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AN EVALUATION AND CONTROL
SIMULATION OF A PACKAGING
PRODUCTION SYSTEM

By

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ABSTRACT

AN EVALUATION AND CONTROL SIMULATION OF A PACKAGING PRODUCTION SYSTEM

By

Kevin Mason Kajiya

This thesis has been designed to provide a simulated experience in the control and evaluation of a packaging production process. In order to simulate the complex relationships and randomness found in a real life environment this simulation has been programmed onto a computer. The model was designed as a gaming simulation where the players are evaluated on the total cost to produce their product. The areas the simulation deals with are packaging, materials management, specifications, quality and production control. The program is set up to simulate most types of product lines through a simple modification of its data.

ACKNOWLEDGMENTS

I would like to thank Dr. Hugh Lockhart for his help and assistance throughout the completion of this thesis. Sincere appreciation must also be extended to Mrs. Elizabeth Anderson (Mrs. A.), the Faculty and Staff of the School of Packaging, and Ms. M. Haines for their support during this ordeal. Most importantly I would like to thank my parents, Tetsuro and Bessie, for their encouragement and guidance throughout my life.

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CHAPTER I

INTRODUCTION

As the field of packaging moves towards a "State-of-the-Art"¹, the people working in it tend to be drawn into very specific and concentrated areas. This thesis was designed to interrupt the process of specialization by providing packaging students with a broader perspective of their interface with other departments.

In order to accomplish this broadening effect it has been necessary to place students in a simulated corporate environment. Within the corporate environment students have been given the total responsibility for the management of packaging, purchasing, production, quality, and inventory control. The students' goal during the simulation is to maximize the profit they can generate. The simulation has been set up so that other students will also be competing to obtain the same goals.

¹Joseph F. Hanlon, Handbook of Package Engineering (New York: McGraw-Hill, 1971), pp 1-3.

CHAPTER II

PROBLEM STATEMENT AND MODEL

Packaging engineers working in an industrial environment do not always deal with projects that relate to the fundamental sciences. In many cases, the packaging engineer is involved with more business related areas such as procurement, processing, manufacturing, shipping, and marketing. For this reason it would seem logical that the preparation for a career in packaging be based on an education which has a very broad foundation.²

The diversity in the course work necessary to produce an individual who can relate to both the sciences and the arts requires some type of mechanism which can clearly identify an interface between the two. The problem, therefore, is to create a simulation model that will aid students in understanding some of the complex relationships that exist within a corporate environment.

Although there are many different types of simulation models available, each is geared for a very specific use. The model which was best suited to simulate the desired decision making process originates in the Mechanistic School of thought regarding educational simulation models. Adherents of this school believe that simulations must conform to a specific list of criteria. They propose that

²Hanlon, pp 1-9.

computer models fit ideally into this scheme. The model chosen for this study can be described as a decision making game which is programmed on a computer. This model fits the requirements of the Mechanistic School and, in creating this model, the author used the following criteria proposed by the Mechanistic School:

1. Examine the environment to be simulated;
2. Reduce the environment to a desired miniature;
3. Define the parameters and variables within the miniature;
4. Create a model which utilizes the defined parameters and variables;
5. Validate the model as a representation of real-life;³

STEP 1. EXAMINATION OF THE ENVIRONMENT TO BE SIMULATED

The program developed for this thesis was designed to simulate the operations within a large manufacturing organization characterized by a fairly stable and continuous demand. A survey (Chapter III, Page 7) of different pharmaceutical companies was done to provide the groundwork for the paper. A specific pharmaceutical company was then chosen for an indepth examination. This examination focused on the interfaces among the following functions: purchasing, inventory control, marketing, quality control, production, and packaging.

STEP 2. THE MINIATURE

Since the purpose of the simulation was to provide a broad overview, it was not necessary to study all of the specific responsibilities of the workers within the identified departments. Instead, the study isolates the procedures that the different departments used for handling

³Omotosho Ogunniyi, The Methodology of Educational Simulation and Design of a Simulated Instructional Model for Occupational Education (Michigan: Michigan State University, 1969), pp. 32-41.

specific situations. The frequency of occurrence for each of the noted situations was recorded and used in reproducing the object system.

STEP 3. DEFINITIONS OF THE PARAMETERS AND VARIABLES

For a detailed list and definition of the parameters and variables used in the model, see the sections in the systems manual concerned with the variables and data. (Chapter IV, Page 20)

STEP 4. THE MODEL

The model created is described in detail in Chapter VI, Page 14.

STEP 5. MODEL VALIDATION

The validation of the model is covered in Chapter III, Page 6.

IMPLEMENTATION

The final portion of this chapter will discuss the implementation of the simulation model. A typical simulation game should include: (1) a briefing session, (2) time to play the game, (3) a closing, debriefing session.⁴

BRIEFING SESSION

The briefing session should provide time for the students to familiarize themselves with the objectives of the simulation.⁵ Because of the complex structure of the Michigan State University Computer Science Department, it is highly recommended that there be two briefing sessions, one to hand out the user's manual, and another to discuss the procedure to use the computer. During the first session, a brief introduction to the simulation should be presented. This introduction

⁴Ogunniyi, p. 40.

⁵John G. H. Carlson and Michael J. Misshauk, Introduction to Gaming Management Decision Simulations (New York: Wiley, 1972), p. 4.

should stress to students that the simulation is only an exercise and will have no effect on their course grade. The time spent on this session should be kept to a minimum. The second session should provide the students with answers to any questions that they might have concerning their operation and the goals by which they are to be evaluated. This session might last 10 to 20 minutes.

PLAYING THE GAME

After the briefing sessions have been completed the user starts the simulation exercise. Each user is responsible for the preparation and follow through of the steps outlined in Chapter V, Page 182.

Nothing is really required of the program administrator (the teacher of the course) at this time. If there are any questions or problems he or she should act as an umpire for the situation. It is essential that the interaction between the user and the program administrator be kept to a minimum. If too much advice is given to participants, their decisions may be influenced on a subconscious level.⁶

DEBRIEFING SESSION

At the end of the game, a period of 10 to 20 minutes should be reserved for a debriefing session. This is the time when the student should relate some of the difficulties encountered during the simulation. This debriefing also creates a different type of learning environment in which the administrator may provide insights that might have been overlooked by the user.⁷

⁶Richard F. Barton, A Primer on Simulation and Gaming (New Jersey: Prentice-Hall, 1970), pp. 60 and 61.

⁷Carlson and Misshauk, p. 4.

CHAPTER III

MODEL VALIDATION

The validity of a model is recognized when the model manipulates a set of defined parameters in a way that recreates an object system.⁸ In order to verify that the model recreates the object system, one must examine the parameters and the way they are manipulated.

PARAMETERS

This section will examine the two classes of parameters used in the simulation model. The first class of parameters represents the product information. This information is gathered each time a different product line is to be simulated. Since the product information is provided by the manufacturing company being simulated, it is reasonable to assume that the data is valid. A complete list of the different product parameters is provided in Chapter IV, Page 20.

The second class of parameters dictates how often the user is exposed to the different problems (subroutines). The limits for these parameters have been determined by a survey of pharmaceutical companies across the U. S. A portion of the survey is provided on the following page (Table 3.1, Page 7). A test program was created to prove that the simulation model calls on the situations in a manner consistent with the parameters surveyed. The test program was based on the same equations and formulas used in the simulation model. The output from the test program is provided in Table 3.2, Page 8.

⁸ Barton, pp. 38 and 39.

INDUSTRY SURVEY

The information reported below was drawn from an industry survey. The information relates to the frequency of different situations occurring.

Table 3.1
SURVEY INFORMATION

		FREQUENTLY	OFF & ON	INFREQUENTLY	NO RESPONSE or NO	% ASSIGNED *
1.	How often are your specs reviewed?	17	5	2	4	10
2.	How often has a trucker's strike affected incoming vendor shipments?	3	2	10	13	1/2
3.	How often has a truck accident resulted in a loss of one of your incoming shipments?	—	—	4	24	1/2
4.	How often do your vendors lie about delivery dates?	14	7	7	—	10
5.	How often does your company take a physical inventory?	1	25	1	1	5
6.	Have you ever received the wrong parts from your vendor?	2	4	17	5	2
7.	How many lift truck accidents occur in your plant?	4	3	7	14	2
8.	Have you ever had a fire in your warehouse?	—	—	7	21	1

1 %

* Note: The percent that was assigned to each situation was based on a minimum of 1 %.

Table 3.2

TEST FOR VALIDATION

WEEK	PRODUCTION	BOTTLES	CAPS	LABELS
1	SUB R=16	SUB R=12	SUB R=12	SUB R=12
2	SUB R=12	SUB R=12	SUB R=12	SUB R=12
3	SUB R=12	SUB R=12	SUB R=12	SUB R=12
4	SUB R=12	SUB R=12	SUB R=12	SUB R=12
5	SUB R=12	SUB R=12	SUB R=12	SUB R=12
6	SUB R=12	SUB R=12	SUB R=12	SUB R=12
7	SUB R=12	SUB R=12	SUB R=12	SUB R=12
8	SUB R=12	SUB R=12	SUB R=12	SUB R=12
9	SUB R=12	SUB R=12	SUB R=12	SUB R=12
10	SUB R=12	SUB R=12	SUB R=12	SUB R=12
11	SUB R=12	SUB R=12	SUB R=12	SUB R=12
12	SUB R=12	SUB R=12	SUB R=12	SUB R=12
13	SUB R=12	SUB R=12	SUB R=12	SUB R=12
14	SUB R=12	SUB R=12	SUB R=12	SUB R=12
15	SUB R=12	SUB R=12	SUB R=12	SUB R=12
16	SUB R=12	SUB R=12	SUB R=12	SUB R=12
17	SUB R=12	SUB R=12	SUB R=12	SUB R=12
18	SUB R=12	SUB R=12	SUB R=12	SUB R=12
19	SUB R=12	SUB R=12	SUB R=12	SUB R=12
20	SUB R=12	SUB R=12	SUB R=12	SUB R=12
21	SUB R=12	SUB R=12	SUB R=12	SUB R=12
22	SUB R=12	SUB R=12	SUB R=12	SUB R=12
23	SUB R=12	SUB R=12	SUB R=12	SUB R=12
24	SUB R=12	SUB R=12	SUB R=12	SUB R=12
25	SUB R=12	SUB R=12	SUB R=12	SUB R=12
26	SUB R=12	SUB R=12	SUB R=12	SUB R=12
27	SUB R=12	SUB R=12	SUB R=12	SUB R=12
28	SUB R=12	SUB R=12	SUB R=12	SUB R=12
29	SUB R=12	SUB R=12	SUB R=12	SUB R=12
30	SUB R=12	SUB R=12	SUB R=12	SUB R=12
31	SUB R=12	SUB R=12	SUB R=12	SUB R=12
32	SUB R=12	SUB R=12	SUB R=12	SUB R=12
33	SUB R=12	SUB R=12	SUB R=12	SUB R=12
34	SUB R=12	SUB R=12	SUB R=12	SUB R=12
35	SUB R=12	SUB R=12	SUB R=12	SUB R=12
36	SUB R=12	SUB R=12	SUB R=12	SUB R=12
37	SUB R=12	SUB R=12	SUB R=12	SUB R=12
38	SUB R=12	SUB R=12	SUB R=12	SUB R=12
39	SUB R=12	SUB R=12	SUB R=12	SUB R=12
40	SUB R=12	SUB R=12	SUB R=12	SUB R=12
41	SUB R=12	SUB R=12	SUB R=12	SUB R=12
42	SUB R=12	SUB R=12	SUB R=12	SUB R=12
43	SUB R=12	SUB R=12	SUB R=12	SUB R=12
44	SUB R=12	SUB R=12	SUB R=12	SUB R=12
45	SUB R=12	SUB R=12	SUB R=12	SUB R=12
46	SUB R=12	SUB R=12	SUB R=12	SUB R=12
47	SUB R=12	SUB R=12	SUB R=12	SUB R=12
48	SUB R=12	SUB R=12	SUB R=12	SUB R=12
49	SUB R=12	SUB R=12	SUB R=12	SUB R=12
50	SUB R=12	SUB R=12	SUB R=12	SUB R=12

MANIPULATION OF THE PARAMETERS

The actual calculations for the manipulation of the parameters were based on the principles and formulas found in the list of referenced sources. It is the belief of the author that a complex examination of those formulas used in the model would be irrelevant to this chapter; therefore, I would like to note that the formulas are described in detail in Chapter IV, Page 21. The actual proof that the parameters were manipulated in the correct manner can be seen in the computer proof models (Chapter VI, Page 233).

CHAPTER IV

SYSTEMS MANUAL FOR AN EVALUATION AND CONTROL SIMULATION OF A PACKAGING PRODUCTION SYSTEM

By

Kevin Mason Kajiya

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INTRODUCTION

This manual was designed to be used as a control mechanism for the program "THSKMK". "THSKMK" is the programmed simulation model developed for the Masters thesis entitled "AN EVALUATION AND CONTROL SIMULATION OF A PACKAGING PRODUCTION SYSTEM".

NOTE: Any changes or modifications to this program should be placed on file at Michigan State University's School of Packaging.

DISCUSSION

The following section describes the options and subroutines that are contained within the simulation model.

This program was developed to provide packaging students with background information concerning packaging's interrelationship with production, quality control, purchasing, and materials management. The program operates as a control device that calls on different subroutines to simulate different activities. The following is a detailed description of the program.

THE MAIN PROGRAM (THSKMK)

The program "THSKMK" contains three different operating styles. These styles are as follows:

1. The first style is designed to provide students with practice exercises. Any of the subroutine exercises may be called and executed.
2. The second style will execute a series of specified (by the program administrator) incidents to provide each user with the same simulation. This style should be used when the users are evaluated against the performance of others.
3. The final style is set up to provide two types of random simulations where any of the events may take place.
 - TYPE A. This simulation will randomly select each of the different exercises (the user will be exposed to all of the different subroutines).
 - TYPE B. This simulation is set-up to randomly select exercises in a proportional relationship with their real occurrence in industry.

SUBROUTINES FOR PROGRAM IMPLEMENTATION AND CONTROLSET3

The subroutine "SET3" reads in information and calculates the values that belong in the materials requirements planning schedule.

ROUTE

This subroutine reads in information indicating which exercises should be called for a particular item, and when the week arrives, the information is reiterated so that the subroutine corresponding to the proper exercise may be called. This sequence makes up the guided simulation mode of the program (style 2).

CCALL

This subroutine calls the other subroutines as directed by the units "THSKMK" and "ROUTE".

MRP

The basic function of the subroutine "MRP" is to print out and update the information used in the materials requirements planning schedule. In addition, the routine implements alternatives corresponding to the way the user decides to handle possible strike situations.

MRP2

This subroutine allows the user to release, cancel, and expedite orders.

EVAL

This unit totals and prints out all of the costs incurred during the simulation.

SUBROUTINES FOR SUPPLY EXERCISESSPEC

This exercise provides the user with an opportunity to evaluate and revise different part specifications. Positive or negative feedback is returned after the user's responses have been evaluated.

TRUCK

This subroutine indicates that an incoming shipment of parts has either been destroyed or delayed in a truck accident or strike. (No evaluation is called for.)

VENQC

In this subroutine the user must input decisions concerning his or her evaluation of the incoming quality control problems. If the decision is not the optimal method of handling the sampled lot, the user is charged an amount which corresponds to the severity of the final results obtained.

WRONGQ

This routine indicates to the user that the received shipment contains the incorrect amount of parts. (No evaluation is called for.)

VENSTK

This subroutine informs the user that he or she may be affected when his or her vendor's workers threaten to go on strike. A decision is required indicating the way the user would like to handle the situation, i.e. buy from another supplier.

VENLIE

This routine indicates that a scheduled receipt will be arriving late. The late receipt has been caused by a sales representative

SUBROUTINES FOR SUPPLY EXERCISES (cont'd.)VENLIE (cont'd.)

providing false information concerning part delivery dates. (No evaluation is called for.)

WRGSHP

This unit informs the user that his company has received another company's parts. This error creates a two week delay of the scheduled shipment. (No evaluation is called for.)

GOVREG

This subroutine informs the user that the specified parts being used do not conform to a new Federal regulation. In the future, the user will have to order a different item as a replacement for the old part. (No evaluation is called for.)

PHYINV

This unit informs the user that a physical inventory has revealed an incorrect balance of a part. (No evaluation is called for.)

FRKLFT

This exercise informs the user that a loss of half of the items on a pallet load has occurred during a fork lift accident. (No evaluation is called for.)

FIRE

This routine reports the loss of two pallet loads of parts during a fire in the warehouse. (No evaluation is called for.)

OK

This unit simulates a smooth operation.

SUBROUTINES FOR LINE EXERCISESLINDWN

This subroutine calculates and reports the down times for the packaging line. (No evaluation is called for.)

YRSTK

This routine informs the user about the possibility of a strike by his own workers. An evaluation of the way the user would like to handle the situation is necessary.

LINEQC

This routine requires the user to evaluate production quality control problems. Decisions are made by the user and feedback is given concerning the evaluation of the decisions.

EXTRA

This subroutine reserves space for other production exercises that are unique to the product.

FUNCTIONRND

This function generates random numbers for the different subroutines.

NOTE: The table on the following page provides a detailed list of the different subroutines. This table also indicates the origin of the subroutine's initial access.

Table 4.1

ACCESS OF THE SUBROUTINES

SUBROUTINE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
THSKK 1-1 1	X	X	X	X																				X
SET3 2-1 2				X																				
ROUTE 2-2 3				X																				
CCALL 2-3 4																								
MAP 2-4 5					X																			X
MAP2 2-5 6						X																		
EVAL 2-6 7							X																	
SPEC 3-1 8								X																
TRUCK 3-2 9									X															X
VENQC 3-3 10										X														X
WRONGQ 3-4 11											X													X
VENSTK 3-5 12												X												
VENLIE 3-6 13													X											
LAGSHIP 3-7 14														X										
GOVREG 3-8 15															X									
PHYINV 3-9 16																X								X
FRKFT 3-10 17																	X							
FIRE 3-11 18																		X						
OK 3-12 19																			X					
LINDAM 3-13 20																				X				
YRSTK 3-14 21																					X			
LINEQC 3-15 22																						X		
EXTRA 3-16 23																							X	

* #24 is the function called RND

VARIABLES

This section contains a list and definition of most of the variables used in the simulation model. The variables are broken up into the following categories:

1. Product information
2. Schedule (MRP) information
3. Cost information
4. Variables passed in common*

* The word common refers to a standard fortran programming command. The variables passed in common are variables passed to all of the subroutines.

PRODUCT INFORMATION

<u>VARIABLE NAME</u>	<u>EQUIVALENT</u>	<u>FIELD LENGTH</u>	<u>NOTES</u>
MRPD (1, ITEM) =	PART NAME	A10	
MRPD (2, ITEM) =	PART NUMBER	14	
MRPD (3, ITEM) =	DATE (WEEK)	16	
MRPD (4, ITEM) =	VENDOR 1	A10	
MRPD (5, ITEM) =	VENDOR 2	A10	
MRPD (6, ITEM) =	VENDOR 3	A10	
MRPD (7, ITEM) =	VENDOR 4	A10	
MRPD (8, ITEM) =	ORDER QUANTITY	16	
MRPD (9, ITEM) =	LEAD TIME	11	IN WEEKS
MRPD (10, ITEM) =	SCRAP FACTOR	12	NORMAL %
MRPD (11, ITEM) =	SAFETY STOCK	17	
MRPD (12, ITEM) =	PUBLIC WAREHOUSE 1	17	
MRPD (13, ITEM) =	NUMBER REQ/UNIT	13	
MRPD (14, ITEM) =	NUMBER/PALLET LOAD	17	
MRPD (15, ITEM) =	BEG. INVENTORY	17	IONH(X,Y)
MRPD (16, ITEM) =	PUBLIC WAREHOUSE 2	17	
CITM(9) =	ITEM COST	F7.5	

SCHEDULE INFORMATION

MRPC(1, ITEM, WEEK) =	(SCHEDULED REQUIREMENTS, THE ITEM, THE WEEK)
MRPC(2, ITEM, WEEK) =	(SCHEDULED RECEIPTS , THE ITEM, THE WEEK)
MRPC(3, ITEM, WEEK) =	(ON HAND INVENTORIES , THE ITEM, THE WEEK)
MRPC(4, ITEM, WEEK) =	(PLANNED ORDERS , THE ITEM, THE WEEK)
MRPC(5, ITEM, WEEK) =	(RESCHEDULED RECEIPTS , THE ITEM, THE WEEK)

COST INFORMATION

TCOTPO(ITEM) = TOTAL COSTS TO PLACE ORDERS (TOTAL FOR ALL WEEKS)
 COTPO = TOTAL COST TO PLACE ORDERS IN AN INDIVIDUAL WEEK
 COTPI = % COST TO PLACE AN ORDER ($\% \times \text{CITM}(y) \times \text{QUAN. PURCH}$)

 TCOTCO(ITEM) = TOTAL COSTS TO CANCEL ALL ORDERS
 COTCO = TOTAL COSTS TO CANCEL THIS WEEK'S ORDERS
 COTL2 = % COST BASE TO CANCEL AN ORDER

 TCOTE0(ITEM) = TOTAL COSTS TO EXPEDITE ALL ORDERS
 COTE0 = TOTAL COST FOR EXPEDITING ORDERS DURING THE WEEK
 COTE3 = % COST BASE TO EXPEDITE AN ORDER

 COST1(ITEM) = TCOTPO(ITEM)+TCOTCO(ITEM)+TCOTE0(ITEM)

 TCOTH1(ITEM) = TOTAL COST TO HOLD INVENTORIES
 COTH1 = COST TO HOLD INVENTORY FOR ONE WEEK
 COTH4 = % COST TO HOLD INVENTORY (UNIQUE TO MANY INDUSTRIES)

 TCOTL0(ITEM) = TOTAL COST OF LATE OR LOST ORDERS
 COTL0 = TOTAL COST FOR LOSSES DURING A WEEK
 COTL5 = % COST FOR EACH LOST ORDER

 TCOTEX(ITEM) = TOTAL EXTRA COSTS INCURRED FOR AN ITEM
 COTEX = TOTAL EXTRA COSTS FOR A WEEK
 COTE6 = % EXTRA COST FOR A PARTICULAR INCIDENT

COST INFORMATION (cont'd.)

$TOTCI(ITEM) = COST1(ITEM) + COST2(ITEM) + TCOTH1(ITEM)$

$PURCH(ITEM) = \text{TOTAL COST TO PURCHASE (FOR ALL WEEKS)}$

$TPURCH = \text{TOTAL COST TO PURCHASE ALL ITEMS}$

$TCTI = \text{TOTAL OF ALL COSTS}$

$ISALE = \text{TOTAL NUMBER OF UNITS SOLD}$

$SALE = \text{TOTAL SALES FOR UNITS SOLD}$

$PROFIT = TCTI - SALE$

NOTE: ALL VARIABLES THAT HAVE "(ITEM)" AFTER THEM ARE BASED PER/UNIT.

VARIABLES PASSED IN COMMON

MRPC(5,50,9)	INFORMATION FOR MRP SCHEDULE
MRPD(16,9)	PRODUCT INFORMATION
IONH(9)	ON-HAND INVENTORY BALANCE
STKP(10)	PROBABILITY OF VENDOR'S WORKERS GOING ON STRIKE
NUMQ(9)	SPECIAL ORDERS FOR COVERAGE OF VENDOR'S STRIKE
ICSP(10)	1 MEANS SPEC. IS OK, 2 MEANS SPEC HAS AN ERROR IN IT
ISPEC(10)	THE NUMBER OF THE SPECIFICATION
NCSP(10)	AREA OF THE ERROR IN THE SPECIFICATION
ICHECK(10)	1 MEANS QC LOT SHOULD BE OK, 2 MEANS LOT SHOULD BE REJECTED.
IQC(10)	QUALITY CONTROL PROBLEM NUMBER
ICH(9)	THE METHOD THE USER WOULD LIKE TO USE TO HANDLE THE POSSIBLE STRIKE BY HIS VENDOR'S WORKERS
IWKST(9)	THE WEEK OF THE POSSIBLE STRIKE
IWK(9)	SPECIAL ORDERS TO HANDLE VENDOR STRIKE
TIMIN(9)	NUMBER OF PASSES THROUGH SUBROUTINE "EXTRA"
SUBR	THE NUMBER OF THE SUBROUTINE TO BE CALLED
ISTOP	SIGNAL TO STOP THE SIMULATION RUN
IWEEK	THE CURRENT WEEK
NQV	NUMBER OF PASSES THROUGH SUBROUTINE "SET3"
NTIMES	NUMBER OF WEEKS THE SIMULATION IS SCHEDULED TO RUN
NITEM2	THE NUMBER OF PARTS FOR THE PRODUCT + 1
ITYPE	THE TYPE OF SIMULATION TO BE RUN

VARIABLES PASSED IN COMMON (cont'd)

ITEM	THE NUMBER OF THE PART BEING SIMULATED
FLIP	PART OF THE CALCULATION FOR SCRAP USAGE
LOP	PART OF THE CALCULATION FOR SCRAP USAGE
ACT	THE ACTUAL SCRAP %
COSTS	SEE THE SECTION FOR COST INFORMATION (PAGE 22)
ISPE	THE CONTROL VARIABLE FOR THE TYPE OF SPECIFICATION RUN
NINE(9)	NUMBER OF PASSES THROUGH THE SUBROUTINE EXTRA
SIGACT(23,9)	SIGNAL THAT A SUBROUTINE HAS BEEN FOR A GIVEN ITEM 1. REPRESENTS THAT IT HAS BEEN CALLED 2. MEANS THAT IT HAS YET TO BE CALLED
NC	INDICATOR OF A POSITIVE OR NEGATIVE DIFFERENCE IN THE QUANTITY SHIPPED vs. THE QUANTITY ORDERED 1= POSITIVE DIFFERENCE 0= NEGATIVE DIFFERENCE NC ALSO CONTROLS WHICH TRUCK EXERCISE IS TO BE RUN
NSL	% FIGURE FOR INCORRECT NUMBER OF UNITS RECEIVED
Z	INDICATOR OF A HIGHER OR LOWER INVENTORY
Y	% AMOUNT OF HIGHER OR LOWER INVENTORY
NPLC	NUMBER OF PLACES THAT ARE USED FOR THE SCHEDULE INFORMATION
RRPD(9)	HOLD OVER FOR DATA IN MRPD(11,ITEM)
SSPD(9)	HOLD OVER FOR DATA IN MRPD(11,ITEM)
ICHIQ2(2)	IF QC PROBLEMS CONTAIN ACCEPTABLE OR REJECTABLE LOTS
IMJR(2)	IF QC PROBLEMS CONTAIN MAJOR OR MINOR DEFECTS
IQCSMP	SIZE OF THE SAMPLED LOT (PRODUCTION QC PROBLEMS)
PBP	% OF BAD PARTS DISCOVERED

VARIABLES PASSED IN COMMON (cont'd)

XX	% OF PRODUCTION TIME
IADJ	DECISION IF LINE IS TO BE ADJUSTED
CITM(9)	SEE COST INFORMATION
OVERHD	OVERHEAD ASSIGNED TO FINISHED PRODUCT
ISALE	SEE COST INFORMATION
SALE	" " " "
PURCH(9)	" " " "
IWKS2	THE WEEK FOR THE PLANT WORKERS STRIKE
IWWW	THE NUMBER OF ORDER QUANTITIES FOR STRIKE PROTECTION
IUNION	IF THE COMPANY IS UNIONIZED OR NOT
IGRV1(4)	TYPE OF WORKER GRIEVANCE
IGRV2(4)	TYPE OF WORKER GRIEVANCE CONTINUED
NGRV	NUMBER INDICATING THE TYPE OF GRIEVANCE
ITRIKE	DECISION OF WORKERS TO STRIKE
STKP9	% FOR THE STRIKE POSSIBILITY
STCST(4,2)	COST TO SETTLE GRIEVANCE
IHSTK	USER'S CHOICE OF METHOD TO HANDLE THE STRIKE
IEX	NUMBER OF TIMES THE SIMULATION IS RUN
IMN(10)	IF THE INCOMING QC PROBLEMS CONTAIN MAJOR OR MINOR DEFECTS

DATA

This section provides the definitions and formats for the remaining variables necessary for the operation of the program.

DATA

TAPE 70 MAIN PROGRAM 'THSKMK'

<u>FORMAT #</u>	<u>VARIABLE & FORMAT</u>
2998	IRF 11
2004	UPLIM(16),WWRLIM(16) 2F4.2
2998	*NPLC 11
2997	*ICHIQ2(2) 211 *IMJR(2)
2995	PBP F4.2 XX
2000	*IUNION 11
2994	IGRV1(4) 4A10 IGRV2(4)
2993	STCST(4,2) 4F7.2

TAPE 70 SUBROUTINE ROUTE

<u>FORMAT #</u>	<u>VARIABLE & FORMAT</u>
1000	*WK,SUBR,ITEME 12,12 ,12 UP' TO 1,000 CARDS , ,12 ← A CARD WITH AN 11 ON IT STOPS THE READING OPERATION

* THIS IS DATA THAT MUST CHANGE WHEN SIMULATING ANOTHER PRODUCT LINE

DATA (cont'd)

TAPE 70 SUBROUTINE MRP

FORMAT # VARIABLE & FORMAT

2000 SEQA(8)
 2(4A7)

2001 SEQB(8)
 2(4A4)

TAPE 14 MAIN PROGRAM 'THSKMK'

FORMAT # VARIABLE & FORMAT

2003 CCTRND
 F4.2

2010 NC, NSL, Y, Z
 11, 11 ,F3.1, 11

2007 *NITEMS,NQV,NTIMES,FLIP,LOP ,ACT ,ISPE
 11 ,11 ,12 ,11 ,11 ,F4.2 ,12

2005 STKP(10)
 10F3.2

2999 *ICSP(10),ISPEC(10)
 1011 ,1012

2006 *NCSP(10)
 1011

2008 *ICHECK(10)
 1011

*IMN(10)

2019 *IQC(10)
 1012

2009 IWKST(9)
 912

IWK(9)

* THIS IS DATA THAT MUST CHANGE WHEN SIMULATING ANOTHER PRODUCT LINE

DATA (cont'd)

TAPE 14

SUBROUTINE SET3

FORMAT #VARIABLE

2051

*COTP1,COTL2,COTE3,COTH4,COTC5,COTE6
6(F4,2,1X)

2050

STP
A10

*MFCAS (2 TYPES)

2001

17

1900

7X,17

2002

*MRPD(1,ITEM),MRPD(2,ITEM),MRPD(3,ITEM),MRPD(4,ITEM),
A10,1X 14,1X ,16,1X A10,1X
MRPD(5,ITEM),MRPD(6,ITEM),MRPD(7,ITEM),MRPD(8,ITEM),
A10,1X ,A10,1X ,A10,1X ,16,2X
MRPD(9,ITEM),MRPD(10,ITEM),MRPD(11,ITEM),MRPD(12,ITEM),
11,1X ,12,1X ,17,1X ,17,1X
MRPD(13,ITEM),MRPD(14,ITEM),MRPD(15,ITEM),MRPD(16,ITEM)
13,1X ,17,1X ,17,1X ,17

2004

*CITM(9)
F7.5

2000

*WK,CFCAS,SIG
12,14 ,A10

,

,A10

← STOP IS THE SIGNAL TO STOP READING

2000

*WK,SCRR,SIG
12,14 ,A10

,

,A10

← STOP IS THE SIGNAL TO STOP READING

* THIS IS DATA THAT MUST CHANGE WHEN SIMULATING ANOTHER PRODUCT LINE

DATA DEFINITIONSTAPE 70

IRF	THE TYPE OF RANDOM SIMULATION DESIRED 1= TYPE A, 2= TYPE B
UPLIM(X)	UPPER LIMIT FOR EACH % (CONTROL FOR RANDOM SIMULATION B)
WWRLIM(X)	LOWER LIMIT FOR EACH % (CONTROL FOR RANDOM SIMULATION B)
NPLC*	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
ICHIQ2(X)*	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
IMJR(X)*	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
PBP	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
XX	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
IUNION*	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
IGRV1(X)	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
IGRV2(X)	" " " " " "
STCST(X,Y)	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
WK *	THE WEEK TO CALL A CERTAIN SUBROUTINE
SUBR *	THE SUBROUTINE THAT SHOULD BE CALLED
ITEME *	THE ITEM THAT THE SUBROUTINE SHOULD BE CALLED FOR
SEQA(X)	THE TITLES FOR THE MRP SCHEDULE (LONG FORM)
SEQB(X)	THE TITLES FOR THE MRP SCHEDULE (SHORT FORM)

* THIS IS DATA THAT MUST CHANGE WHEN SIMULATING ANOTHER PRODUCT LINE

DATA DEFINITIONS (cont'd)TAPE 14

CCTRND	IF CCTRND GREATER THAN CTRND THE PROGRAM WILL CALL THE SUBROUTINE OK
NC	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
NSL	" " " " " " "
Y	" " " " " " "
Z	" " " " " " "
NITEMS*	NUMBER OF PARTS TO PRODUCE THE FINAL PRODUCT (PACKAGE)
NTIMES*	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
ISPE*	" " " " " " "
NQV	" " " " " " "
FLIP	" " " " " " "
LOP	" " " " " " "
ACT	" " " " " " "
STKP(X)	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
ICSP(X)*	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
ISPEC(X)*	" " " " " " "
NCSP(X)*	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
ICHECK(X)*	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
IMN(X)*	" " " " " " "
IQC(X)*	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
IWKST(X)	SEE SECTION TITLED; VARIABLES (COMMON), PAGE 24
IWK(X)	" " " " " " "
COTP1*	SEE SECTION TITLED; VARIABLES (COST INFORMATION), PAGE 22
COTL2*	" " " " " " "
COTE3*	" " " " " " "
COTH4*	" " " " " " "
COTC5*	" " " " " " "
COTE6*	" " " " " " "
STP	VARIABLE TO BE COMPARED TO SIG IN ORDER TO DECIDE WHETHER OR NOT TO KEEP READING CARDS

* THIS IS DATA THAT MUST CHANGE WHEN SIMULATING ANOTHER PRODUCT LINE

DATA DEFINITIONS (cont'd)TAPE 14

MFCAST* MARKETING FORECAST (AVG)
 MRPD(16, ITEM)* SEE SECTION TITLED; VARIABLES (PRODUCT INFORMATION)
 CITM(X)* " " " " " "
 WK* THE WEEK OF A SPECIAL MARKETING FORECAST
 CFCAST* THE SIZE OF THE SPECIAL MARKETING FORECAST
 SIG* THE SIGNAL THAT THERE ARE NO MORE SPECIAL MARKETING
 FORECASTS (STOP)
 WK* THE WEEK OF A PRESCHEDULED RECEIPT (BY SPECIFIC PART)
 SCRR* THE SIZE OF THE PRESCHEDULED RECEIPT (" " ")
 SIG* THE SIGNAL THAT THERE ARE NO MORE SPECIAL SCHEDULED
 RECEIPTS (STOP)

* THIS IS DATA THAT MUST CHANGE WHEN SIMULATING ANOTHER PRODUCT LINE

PROGRAM FLOWCHART

The following section includes a graphic flowchart which will aid the program manager during future modifications of the program.

FLOWCHARTING SYMBOLS

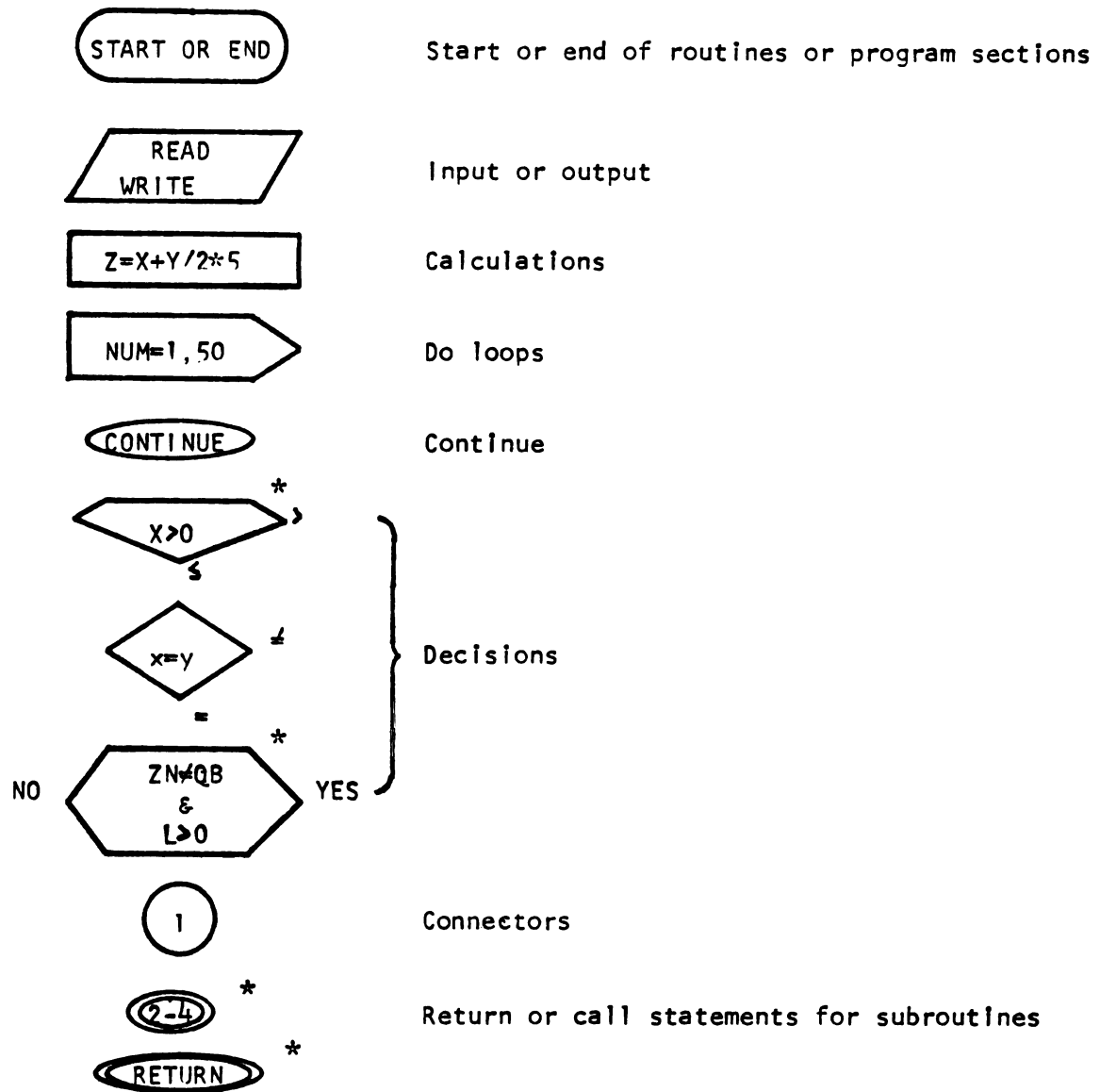


Figure 4.1. Flowcharting symbols

* Modified or unique flowcharting symbols

PROGRAM & SUBROUTINES

<u>NAME</u>	<u>CLASS</u>	<u>CLASS #</u>	<u>CODE**</u>	<u>FUNCTION</u>	<u>PAGE</u>	<u>MANUAL PAGE</u>
MAIN	PROGRAM	1 - 1	---	CHOICE OF SIMULATION TYPE	37	26
SET3	SUBROUTINE	2 - 1	---	SET MRP SCHEDULE DATA	41	30
ROUTE	" "	2 - 2	---	SET UP ROUTE TO FOLLOW	46	35
CCALL	" "	2 - 3	---	CALL SIMULATION SITUATION	48	37
MRP	" "	2 - 4	---	UPDATE AND PRINT SCHEDULE	50	39
MRP2	" "	2 - 5	---	MODIFICATIONS TO SCHEDULE	59	48
EVAL	" "	2 - 6	---	PRINT OUT COST EVALUATIONS	63	52
SPEC	" "	3 - 1	a 1	CHANGES IN SPECIFICATIONS	65	54
TRUCK	" "	3 - 2	a 2	TRUCK ACCIDENT OR STRIKE	67	56
VENQC	" "	3 - 3	a 3	INCOMING QUALITY CONTROL	68	57
WRONGQ	" "	3 - 4	a 4	WRONG QUANTITY OF PARTS	72	61
VENSTK	" "	3 - 5	a 5	VENDOR'S WORKERS ON STRIKE	73	62
VENLIE	" "	3 - 6	a 6	LIES ABOUT DELIVERY DATES	74	63
WRGSH	" "	3 - 7	a 7	ANOTHER COMPANY'S SHIPMENT	75	64
GOVREG	" "	3 - 8	a 8	PARTS DO NOT MEET FED. REG.	75	64
PHYINV	" "	3 - 9	b 1	INCORRECT AMOUNT OF INV.	76	65
FRKLFT	" "	3 - 10	b 2	FORKLIFT ACCIDENT, WAREHOUSE	77	66
FIRE	" "	3 - 11	b 3	FIRE IN WAREHOUSE	77	66
OK	" "	3 - 12	b 4	SMOOTH OPERATION	88	77
LINDWN	" "	3 - 13	c 1	PRODUCTION DOWN TIME	78	67
YRSTK	" "	3 - 14	c 2	PLANT WORKERS, POSSIBLE STRIKE	79	68
LINEQC	" "	3 - 15	c 3	QC INSPECTION, FINISHED PARTS	81	70
EXTRA	" "	3 - 16	c 4	OTHER PRODUCTION PROBLEMS	87	76
RND	FUNCTION	4 - 1	---	GENERATES RANDOM NUMBERS	88	77

* CLASS # INDICATES:

1. program -----		x-y ← number within class
2. subroutine control-----		
3. subroutine exercise-----		
4. function -----		

** CODES INDICATE :

a. vendor supply situation-----		z n ← number within class
b. warehousing problem ----		
c. production problem -----		

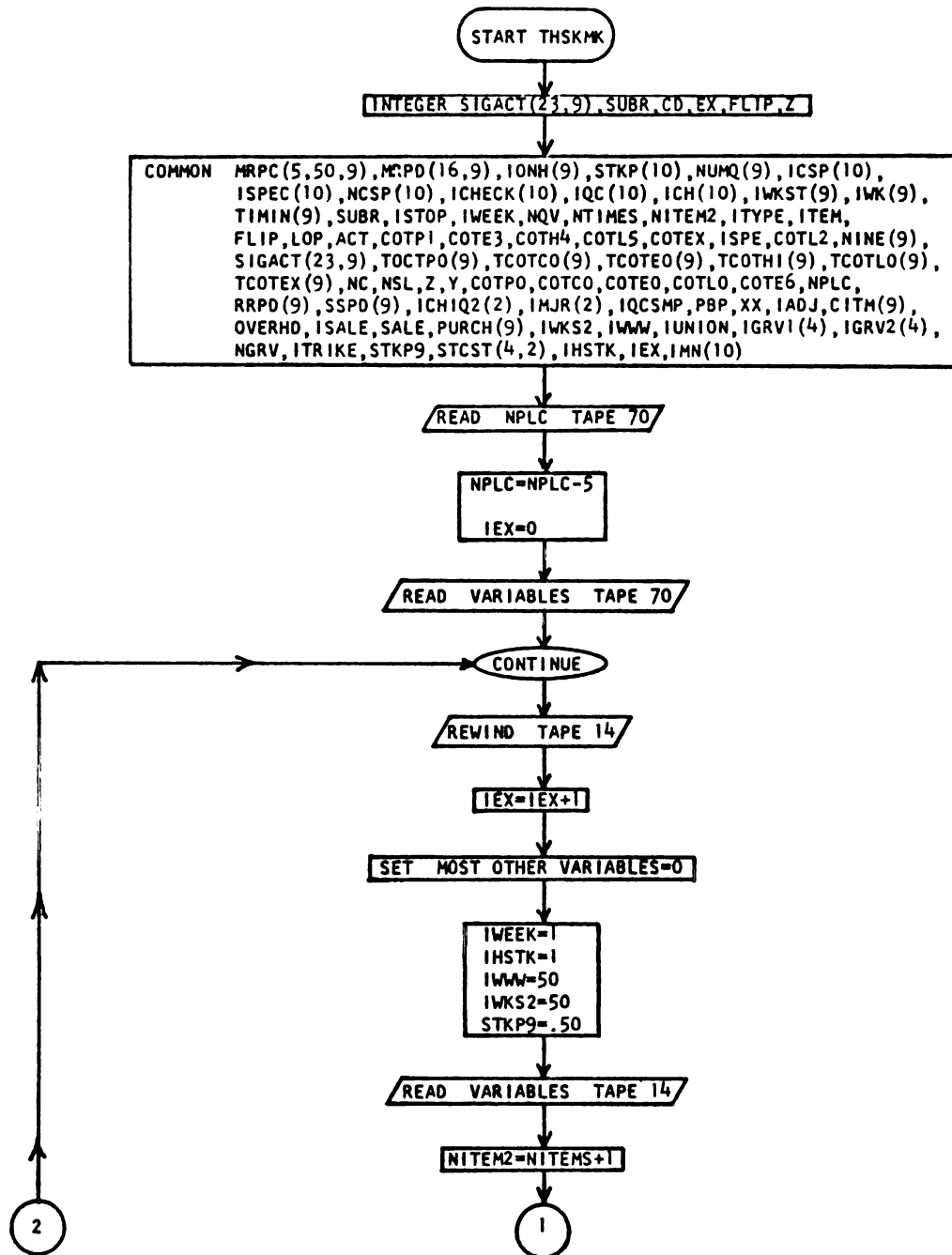


Figure 4.2. Flowchart diagram of model.

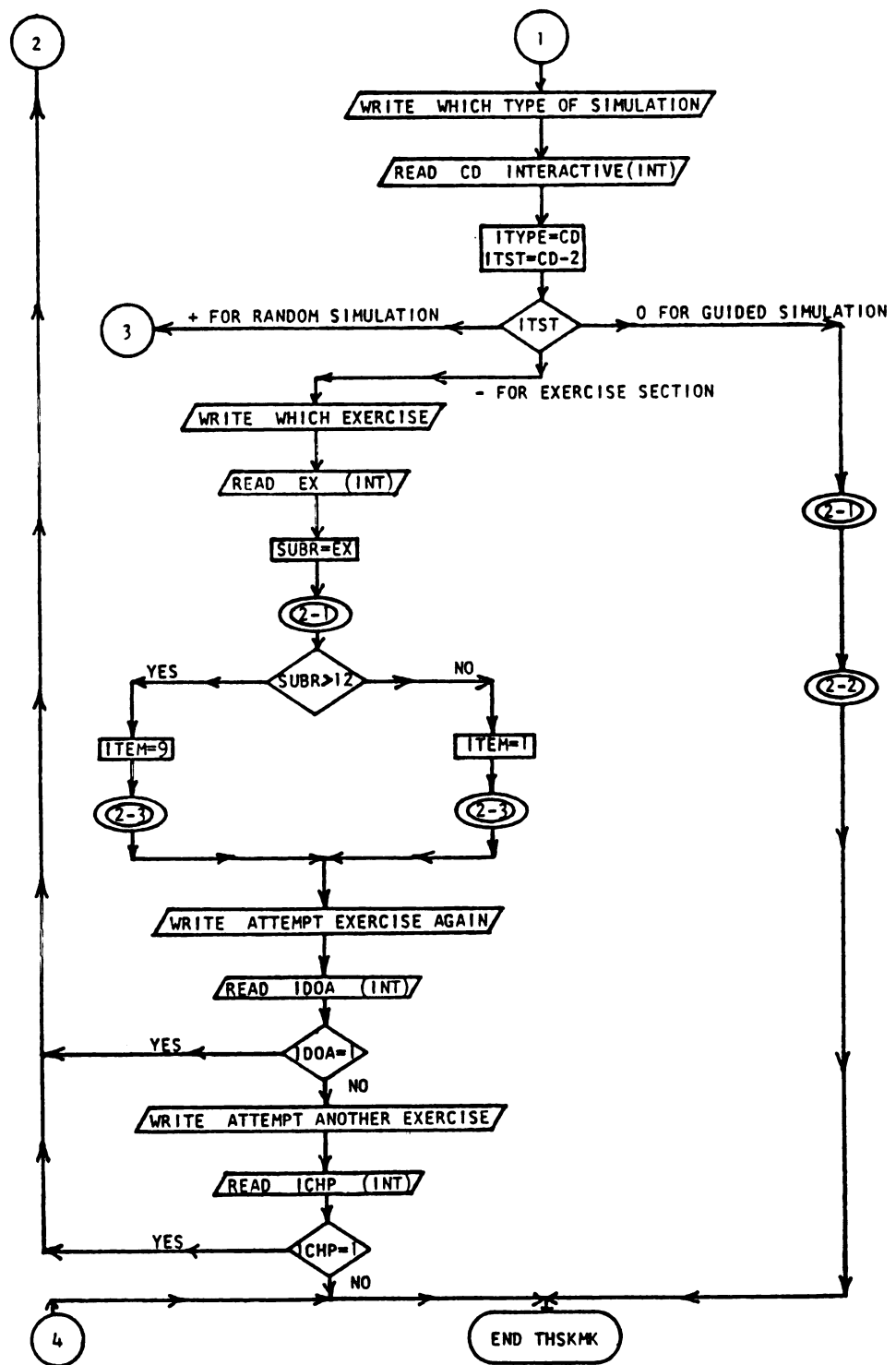


Figure 4.2. (cont'd.).

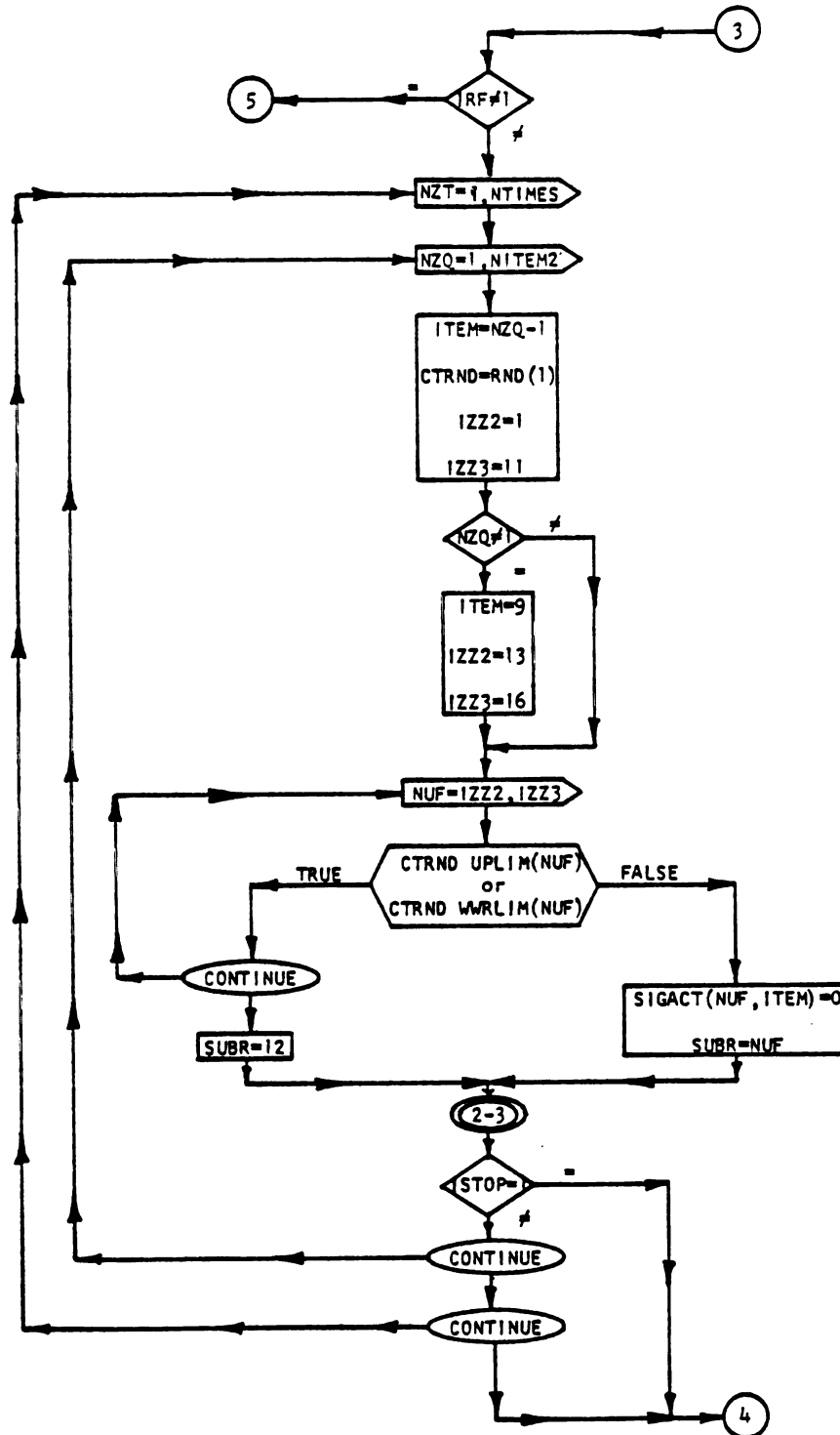


Figure 4.2. (cont'd.).

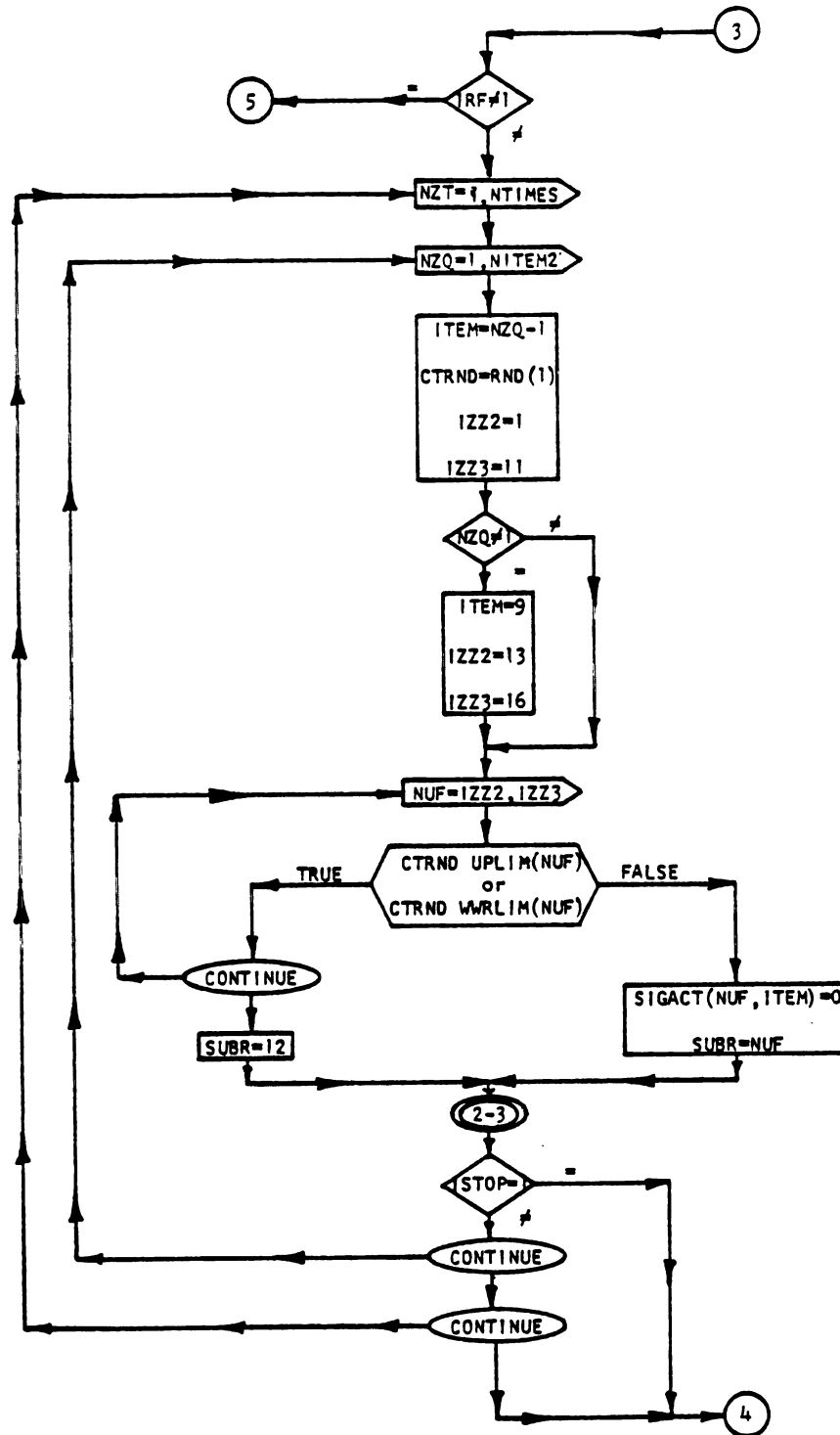


Figure 4.2. (cont'd.).

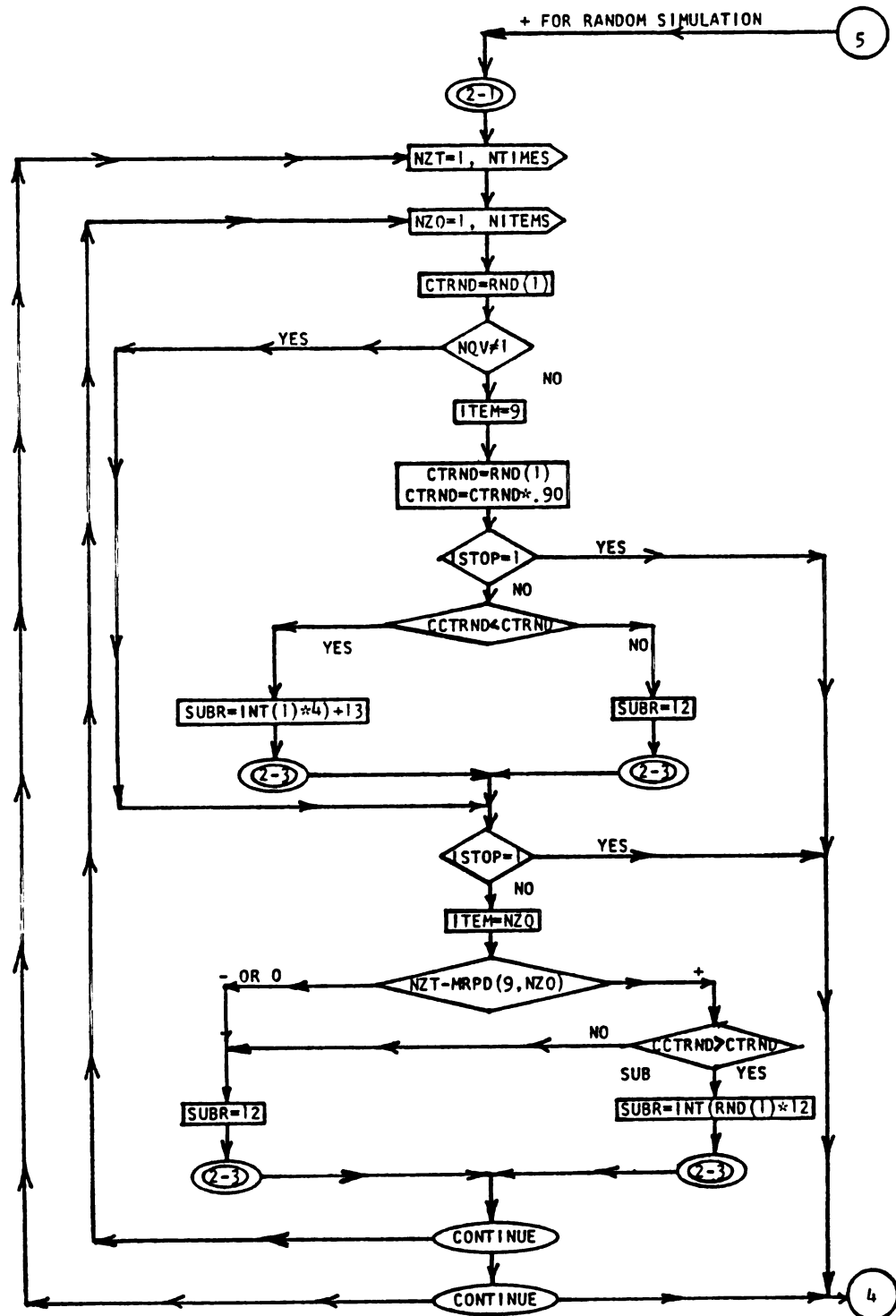


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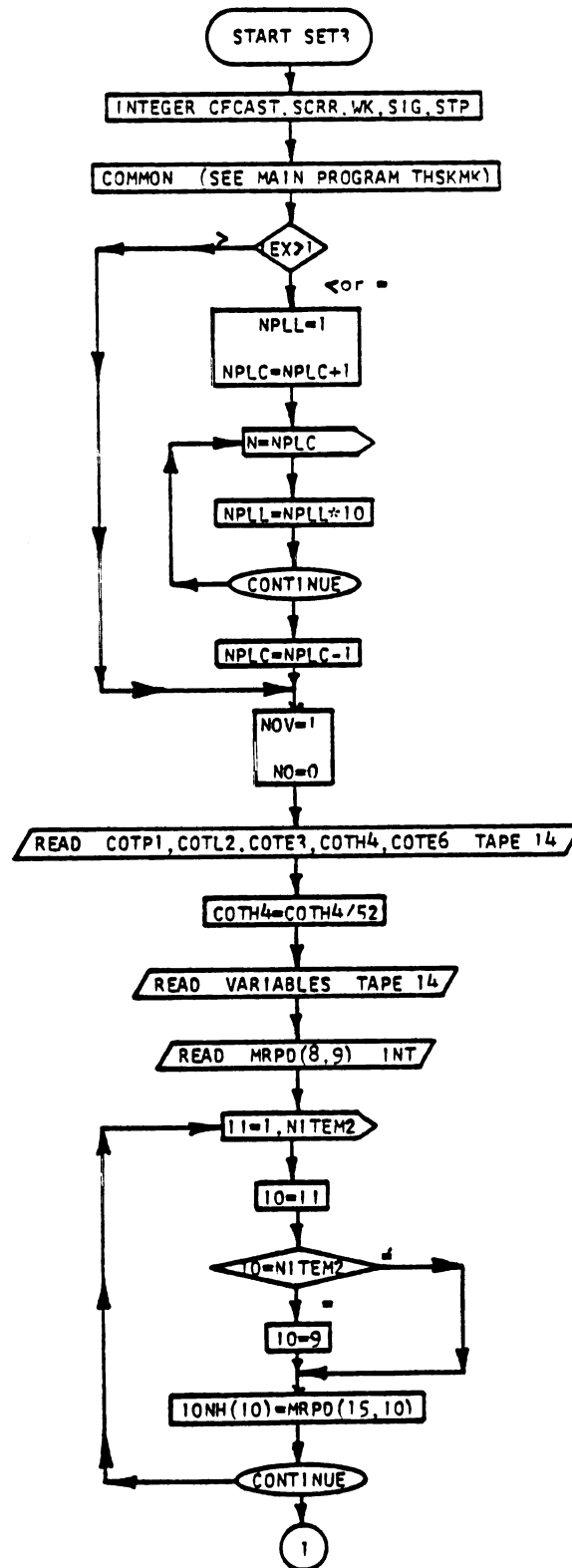


Figure 4.2. (cont'd.).

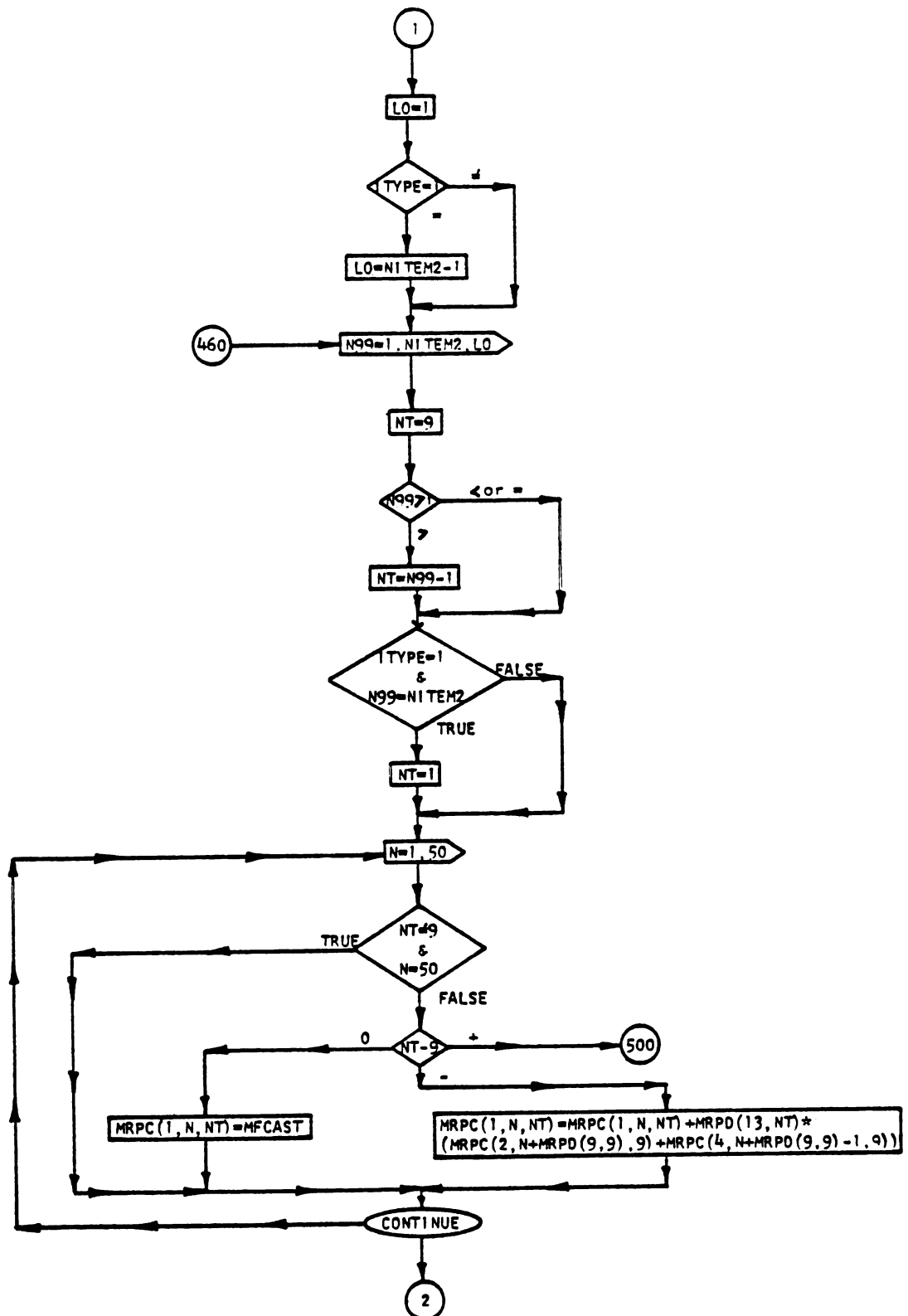


Figure 4.2. (cont'd.).

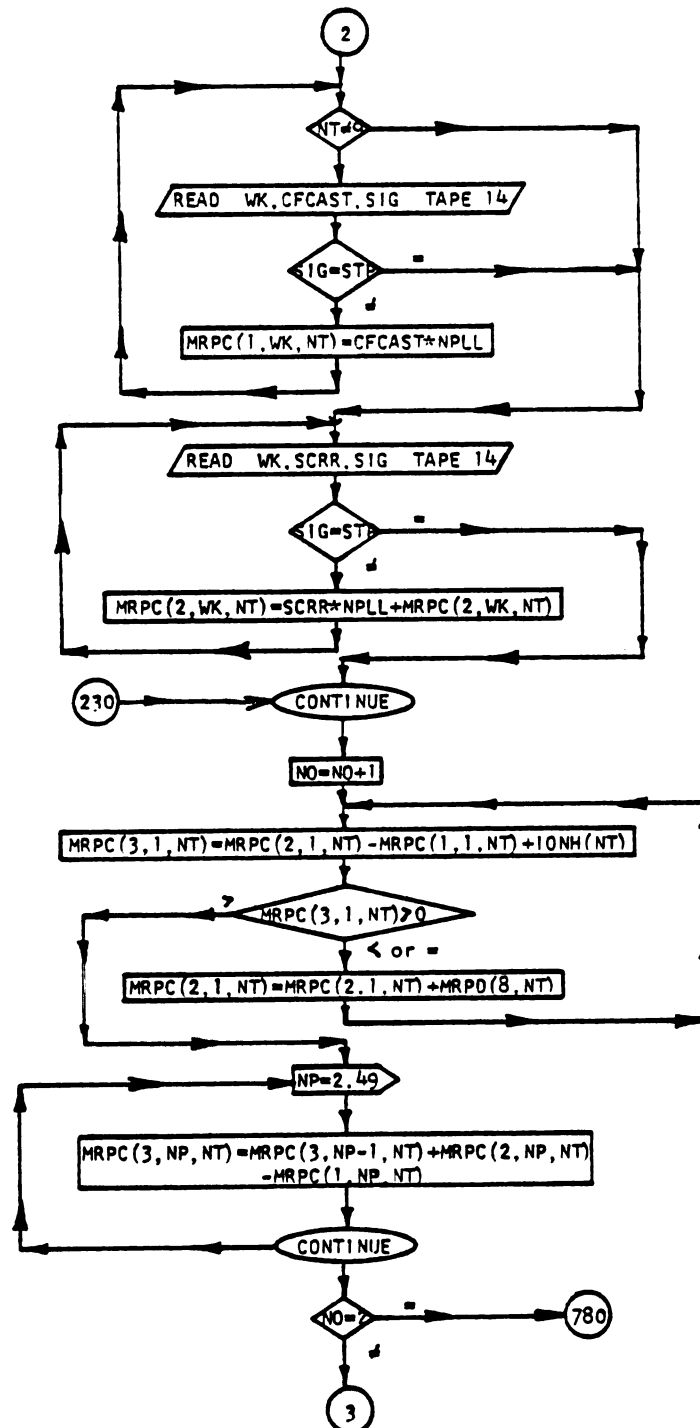


Figure 4.2. (cont'd.).

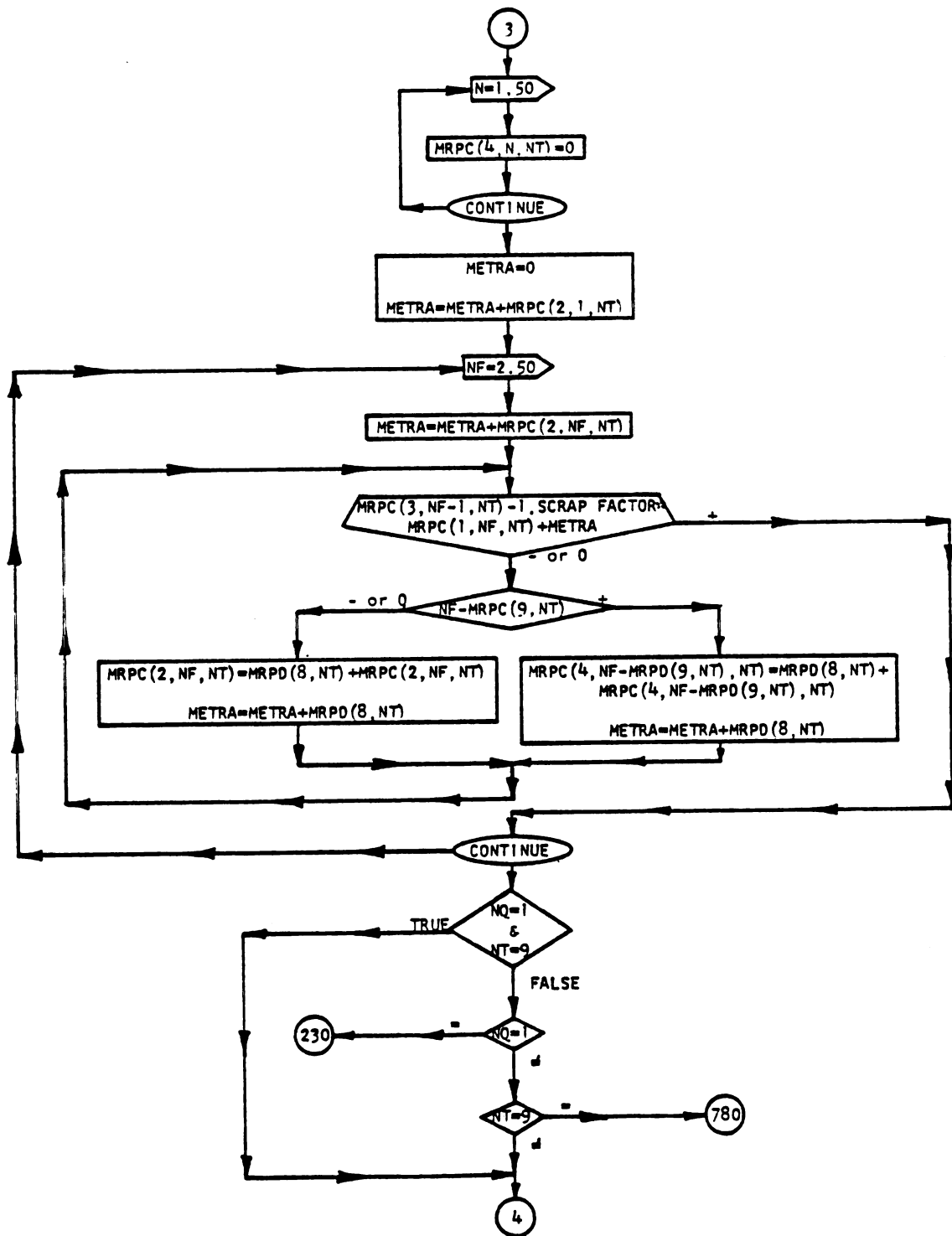


Figure 4.2. (cont'd.).

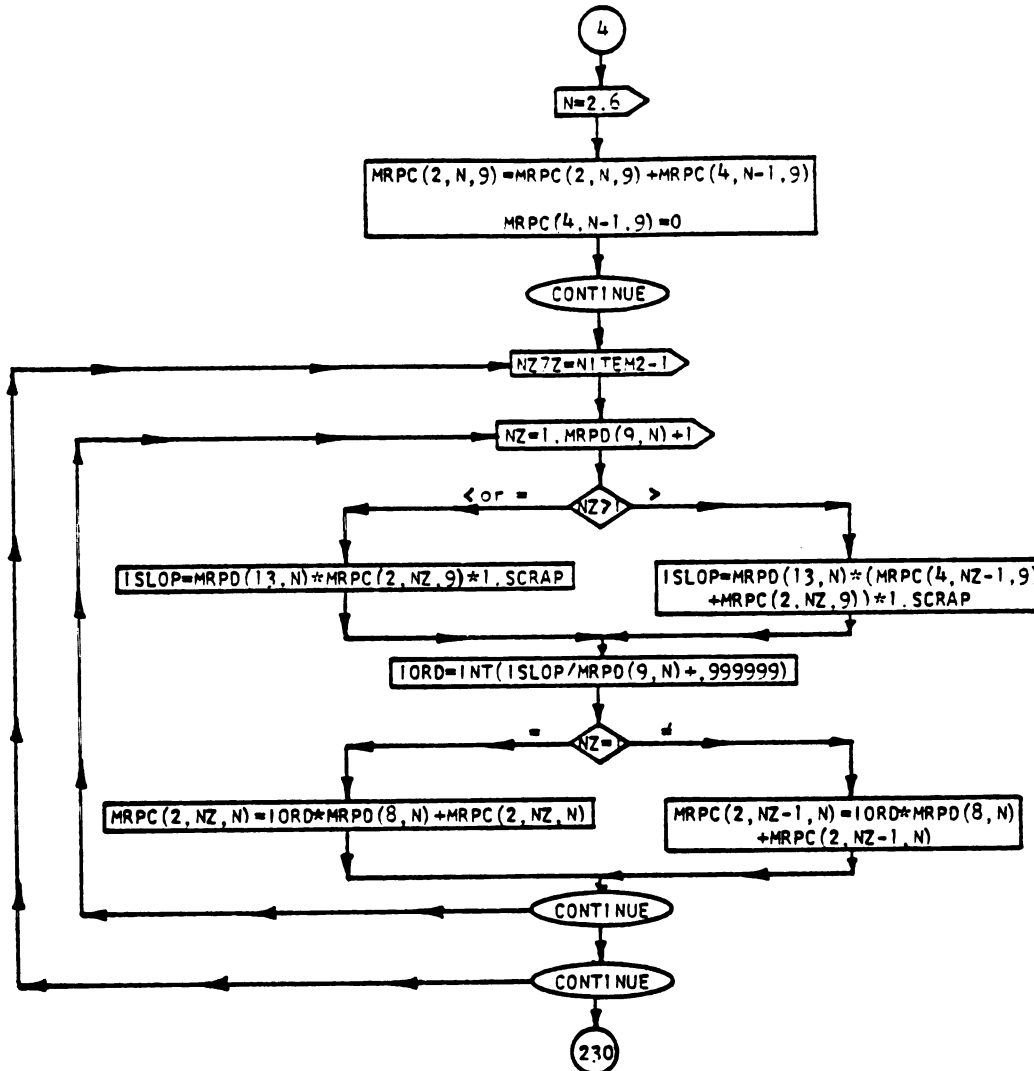


Figure 4.2. (cont'd.).

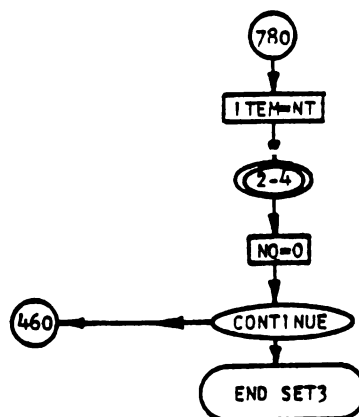


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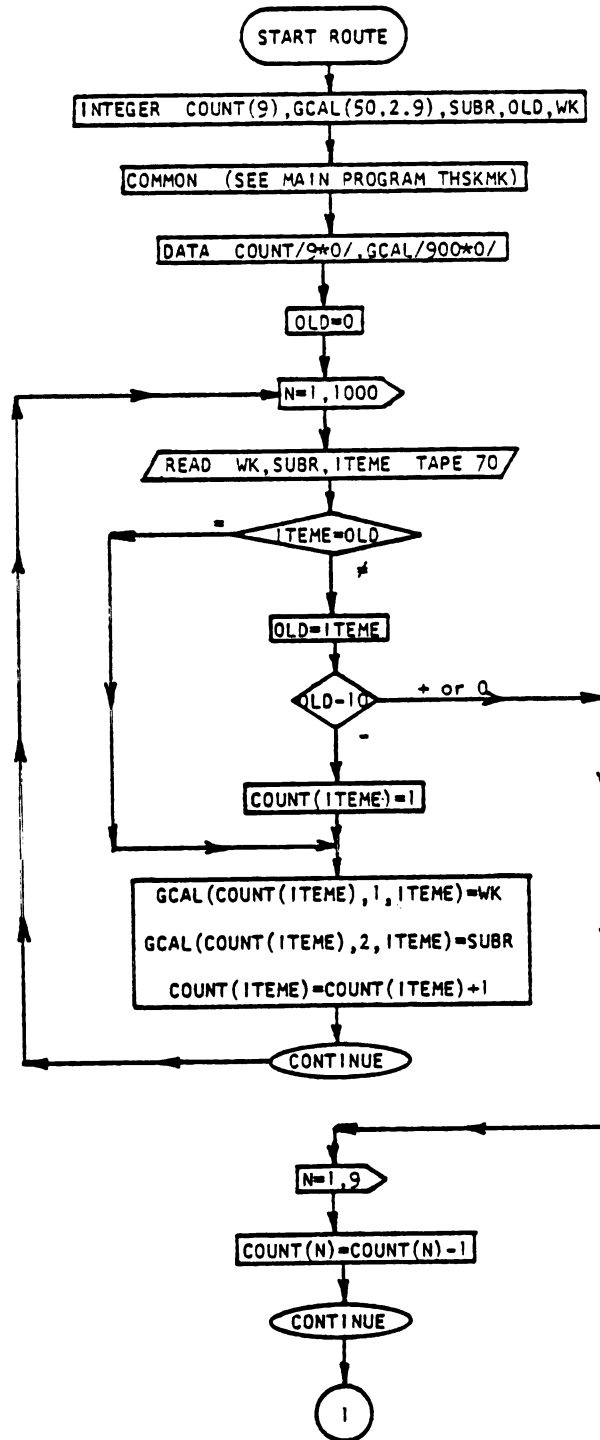


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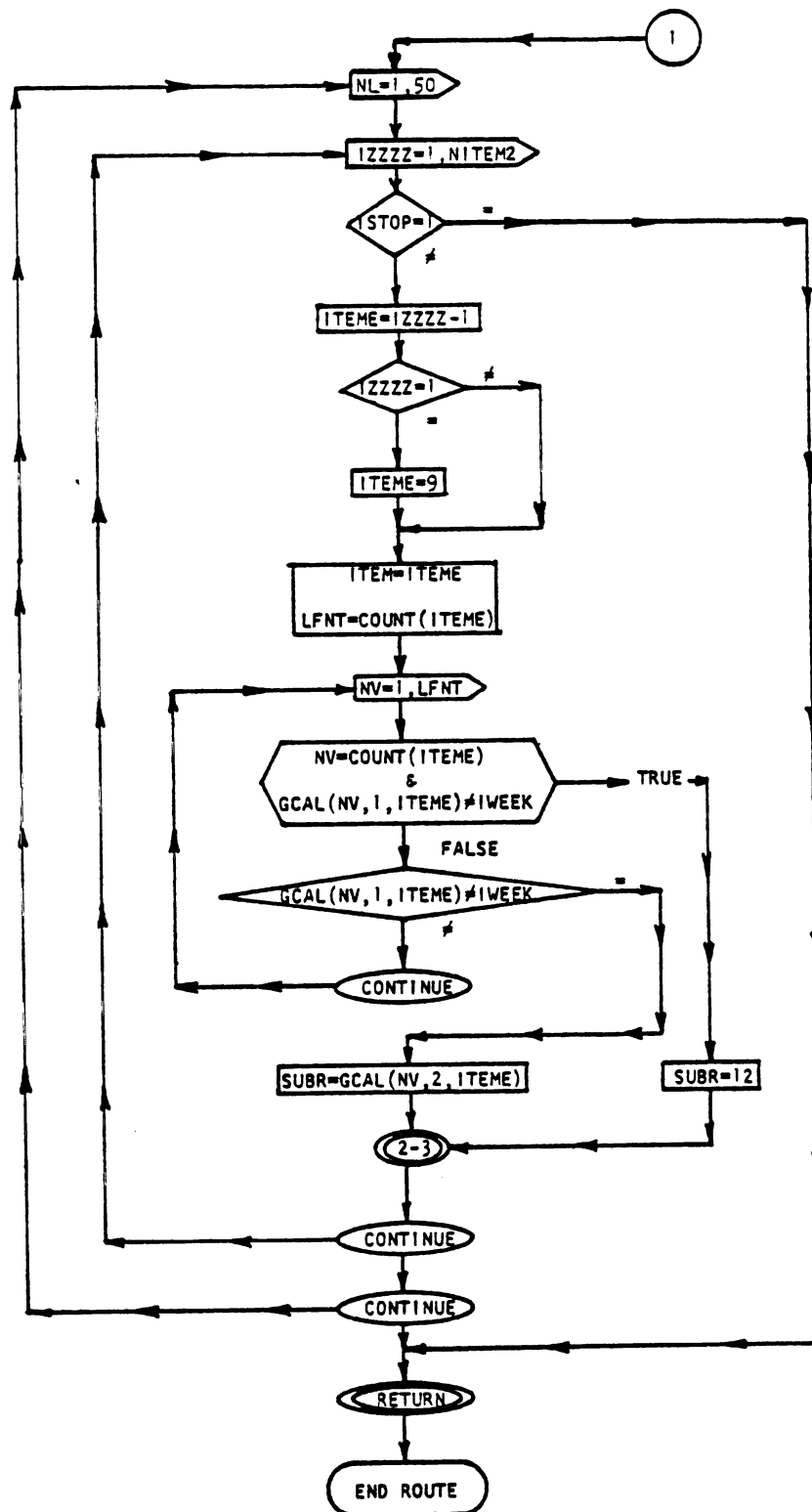


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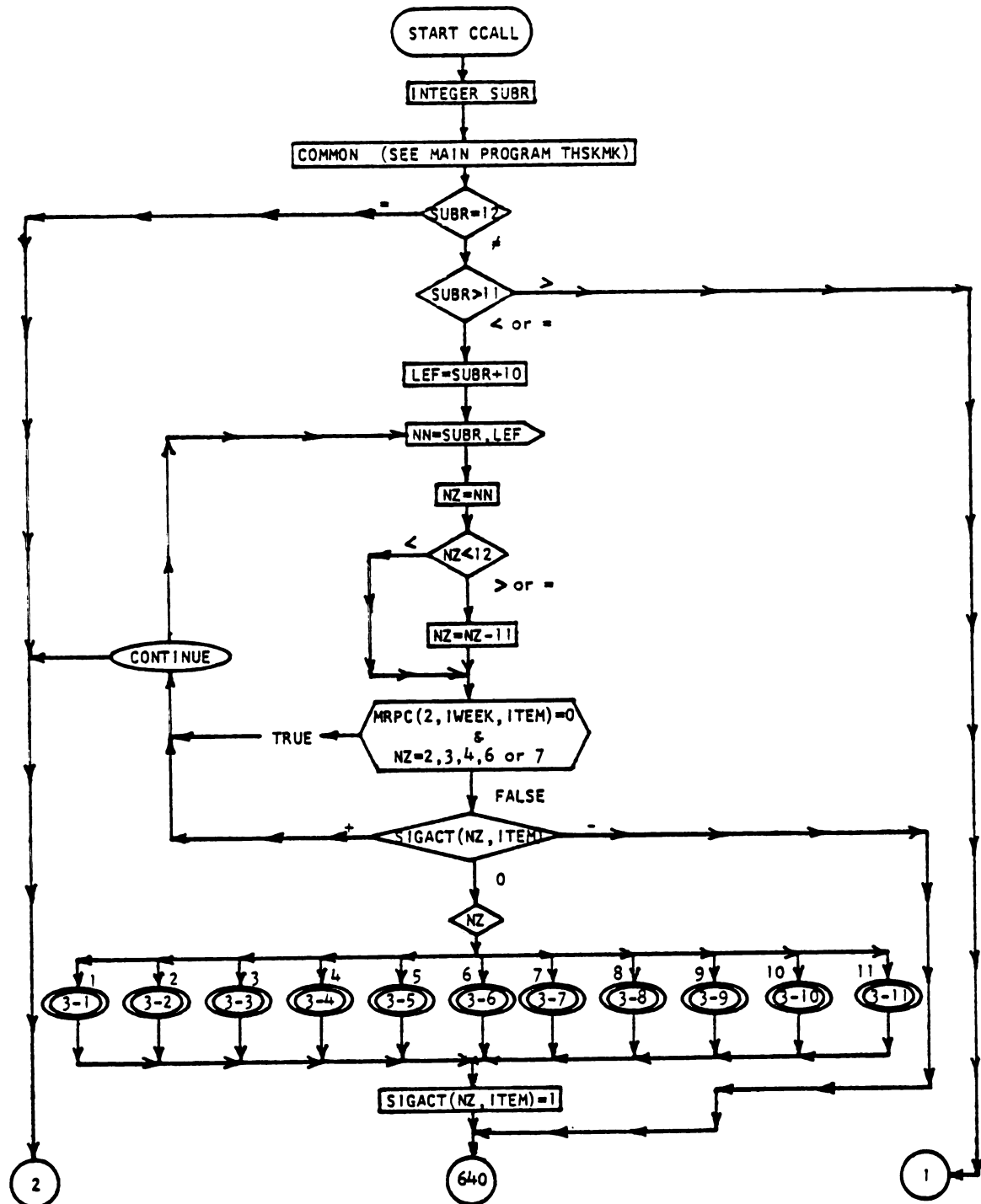


Figure 4.2. (cont'd.).

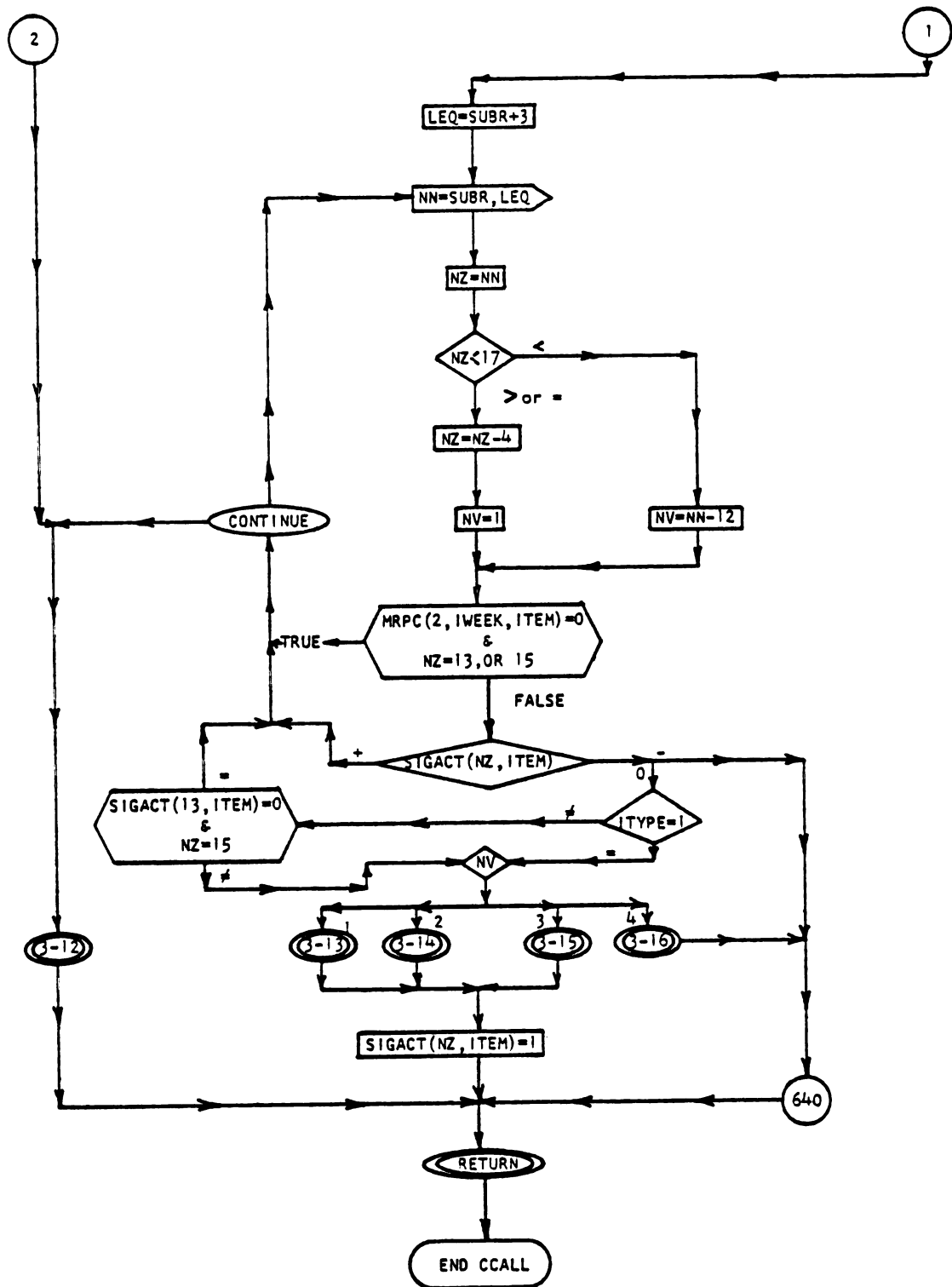


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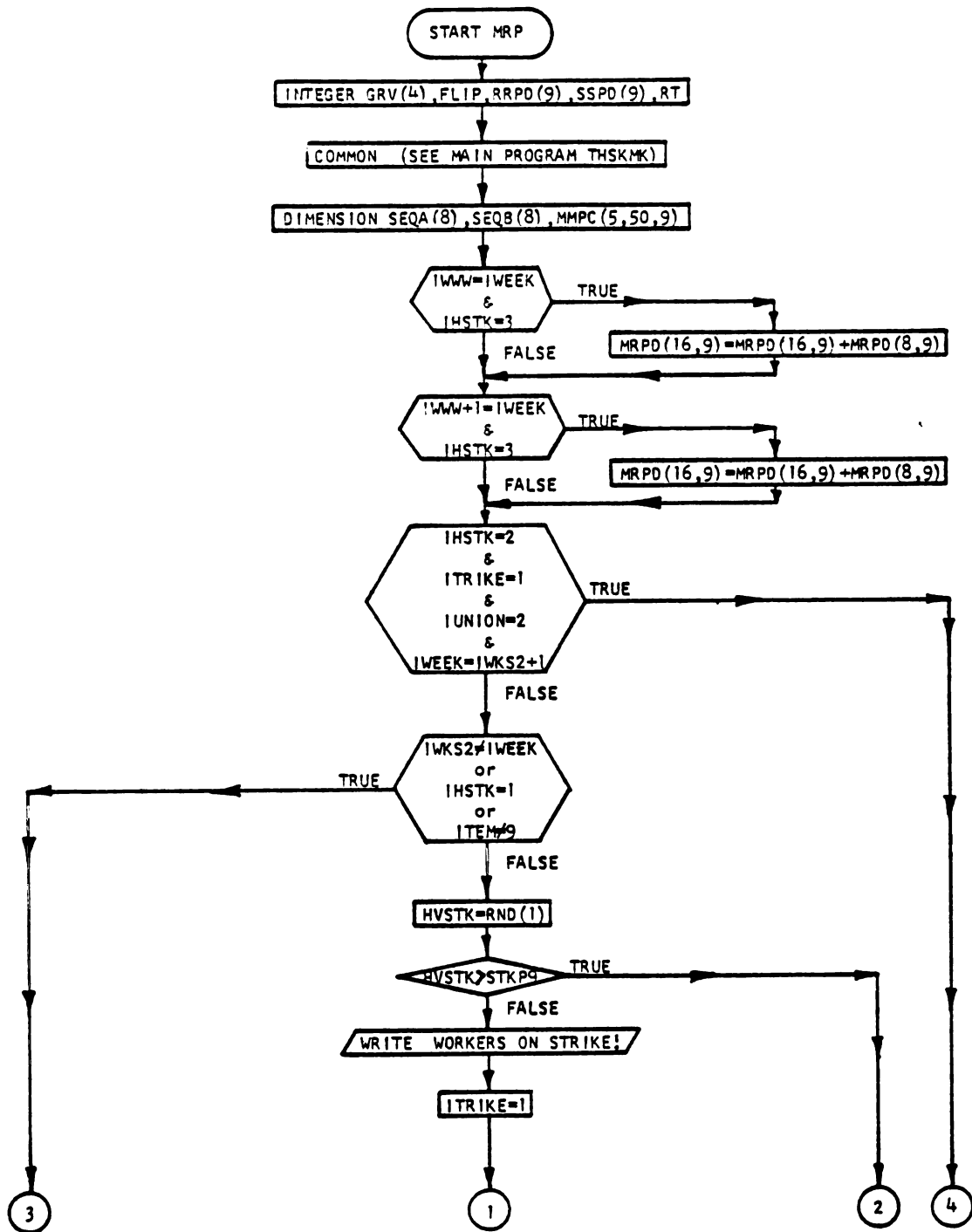


Figure 4.2. (cont'd.).

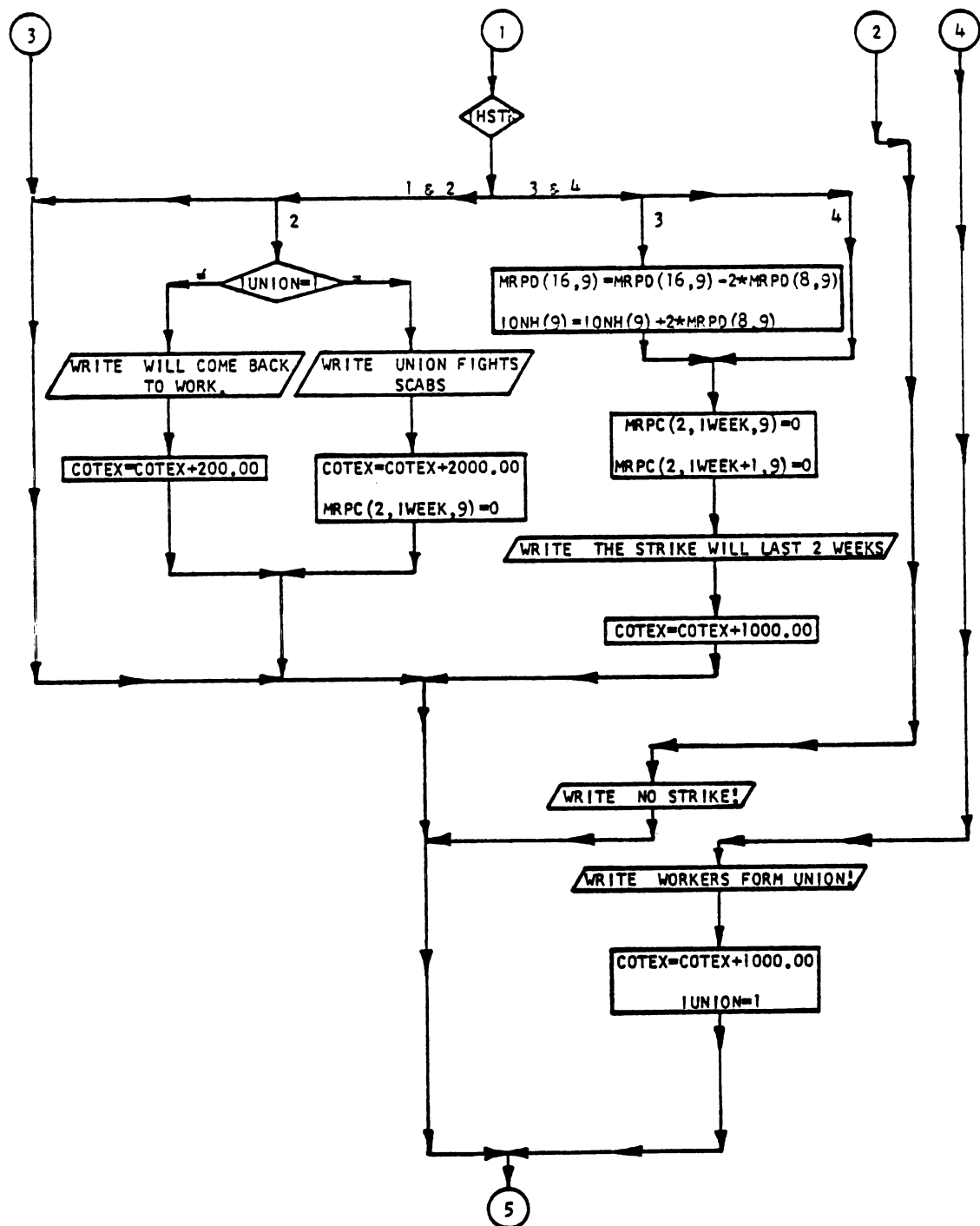


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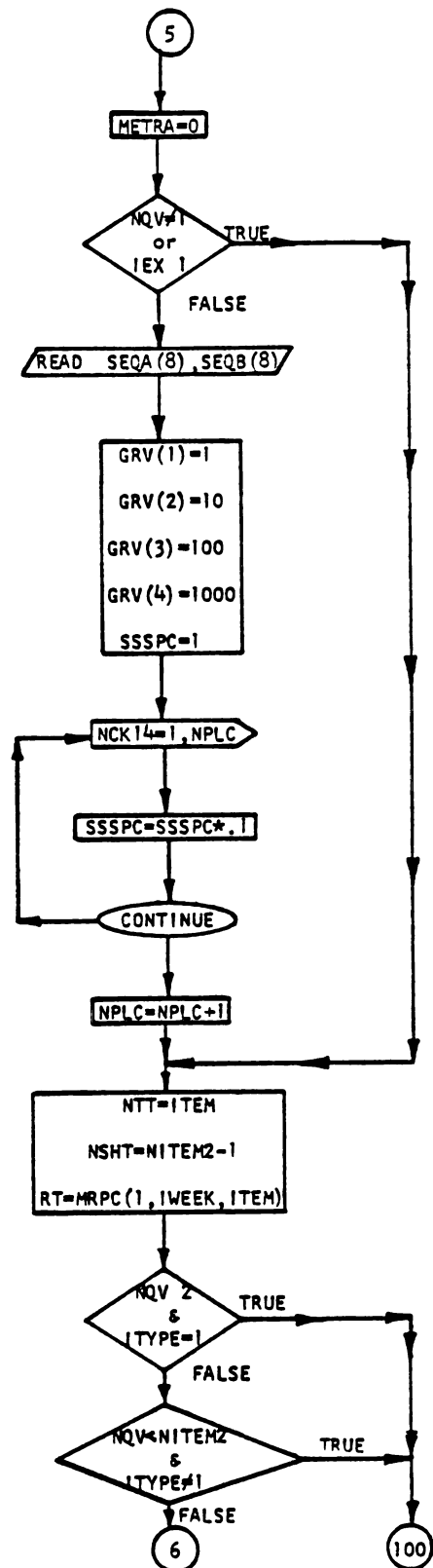


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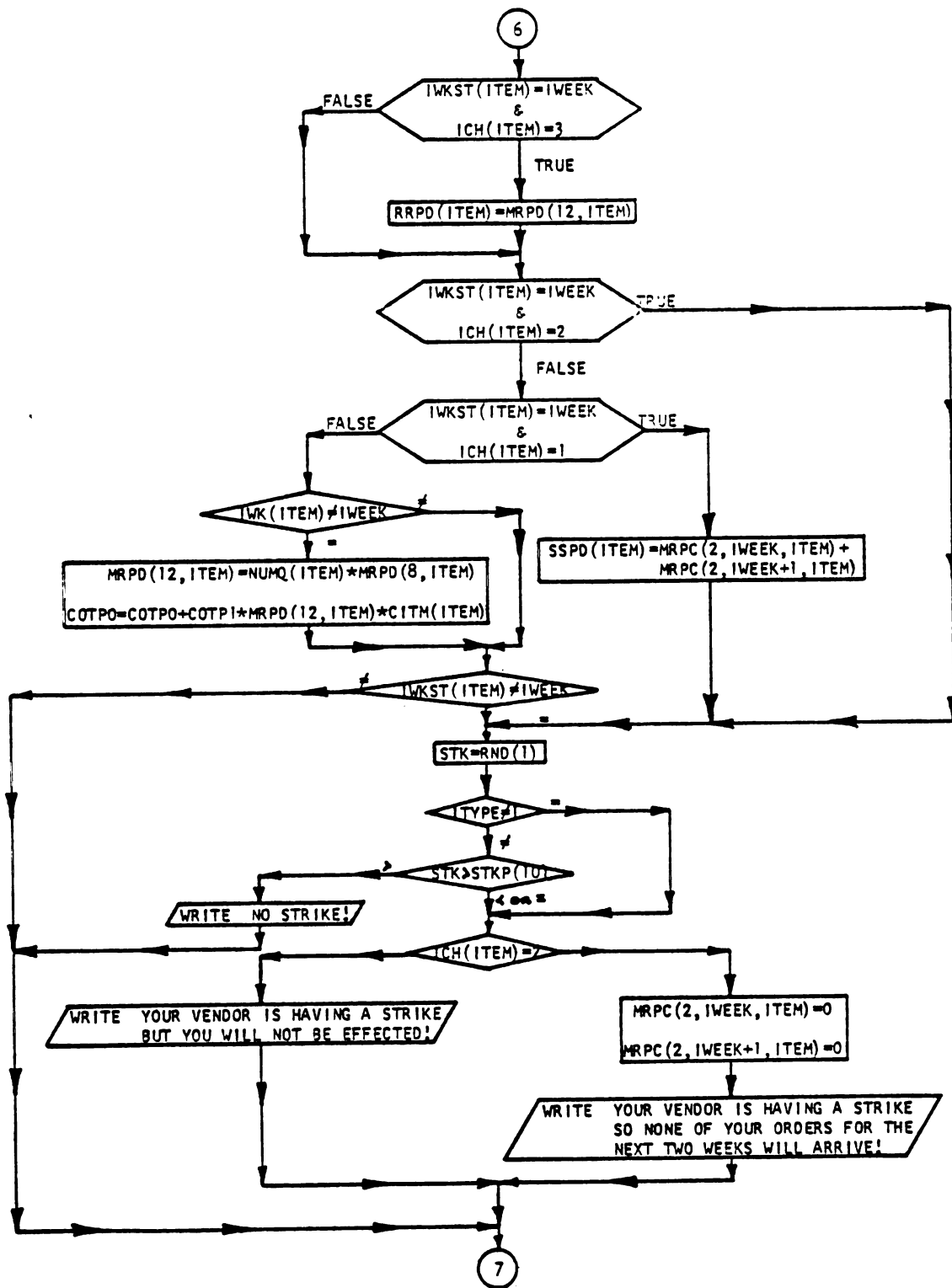


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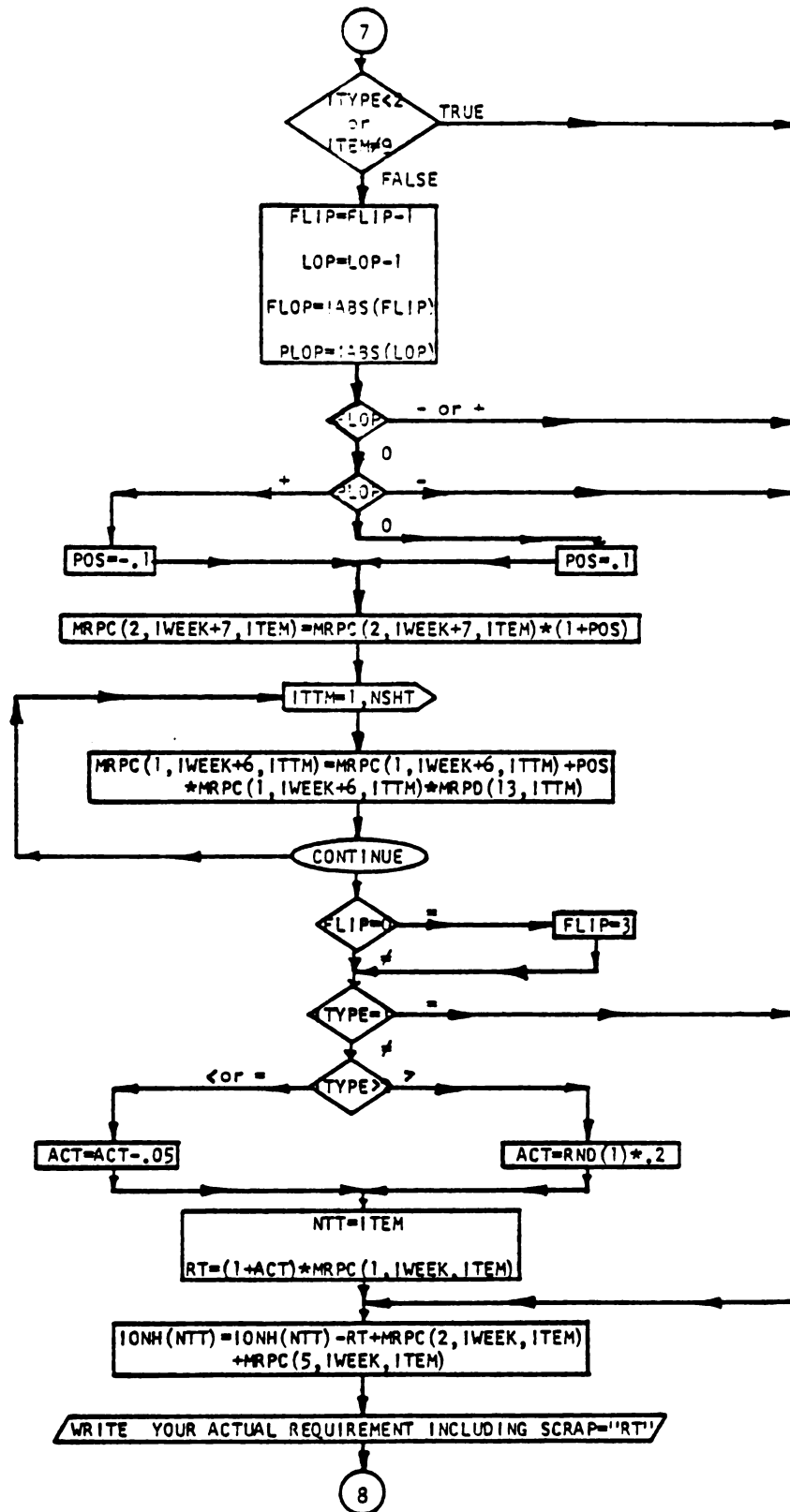


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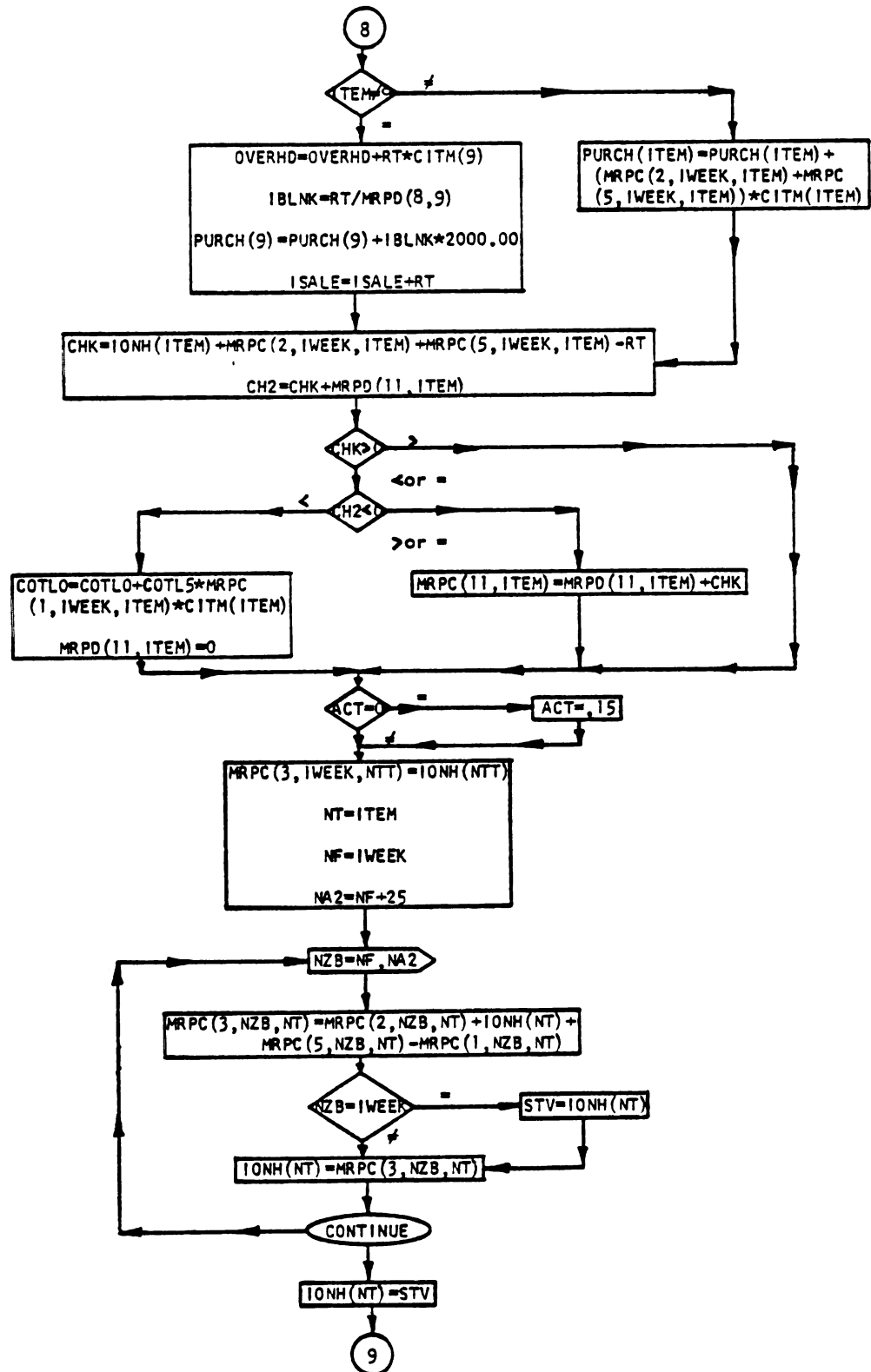


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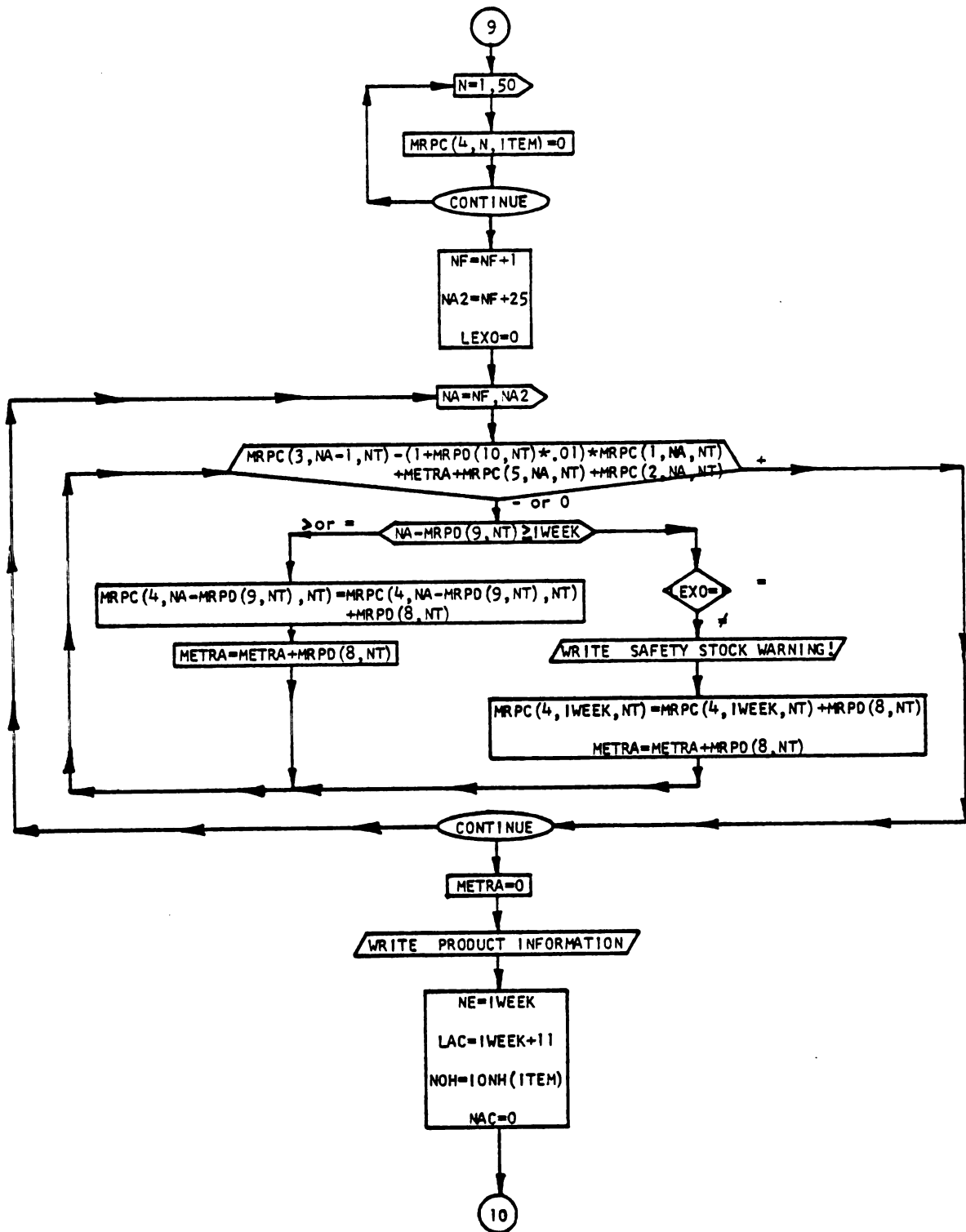


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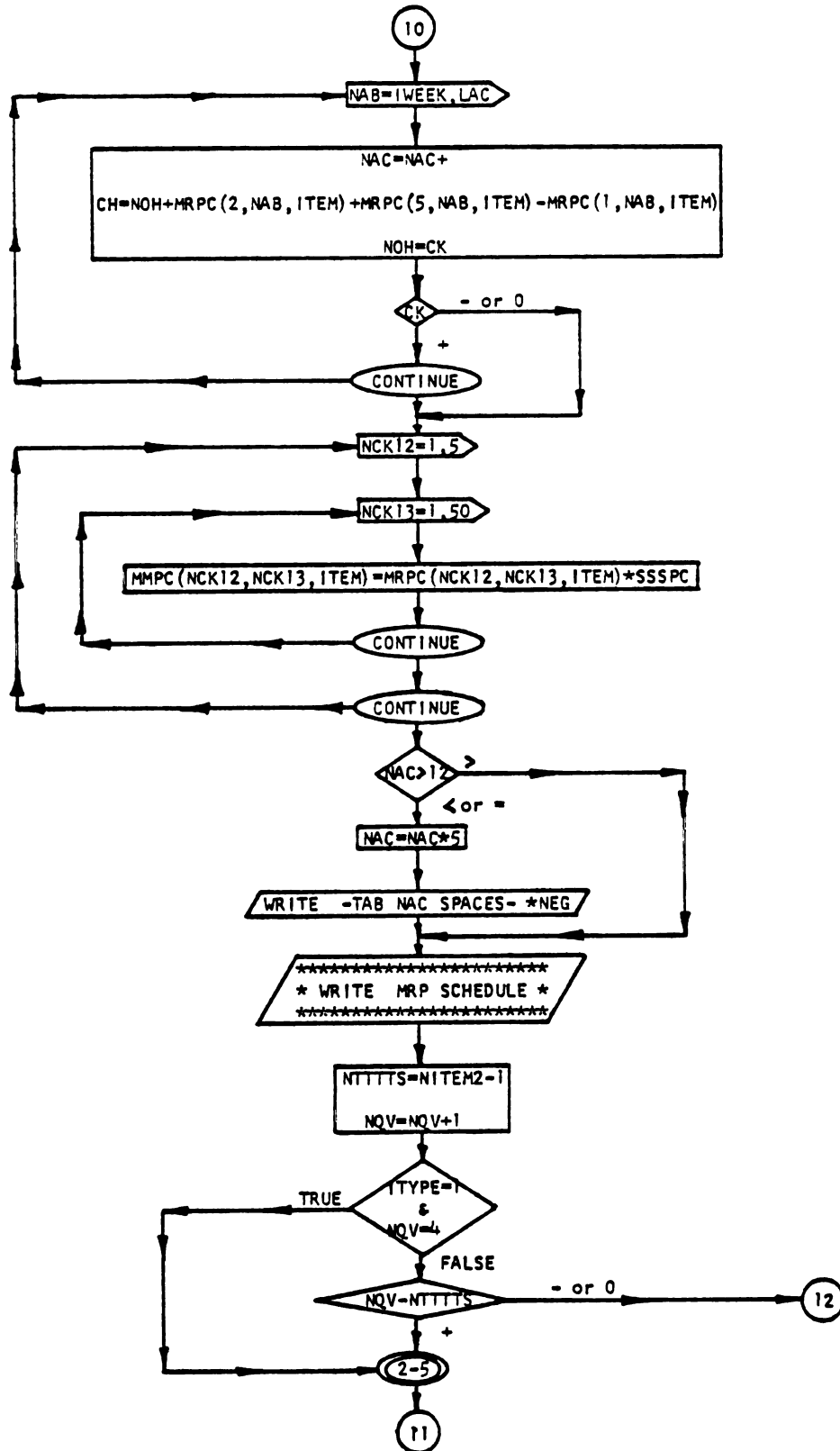


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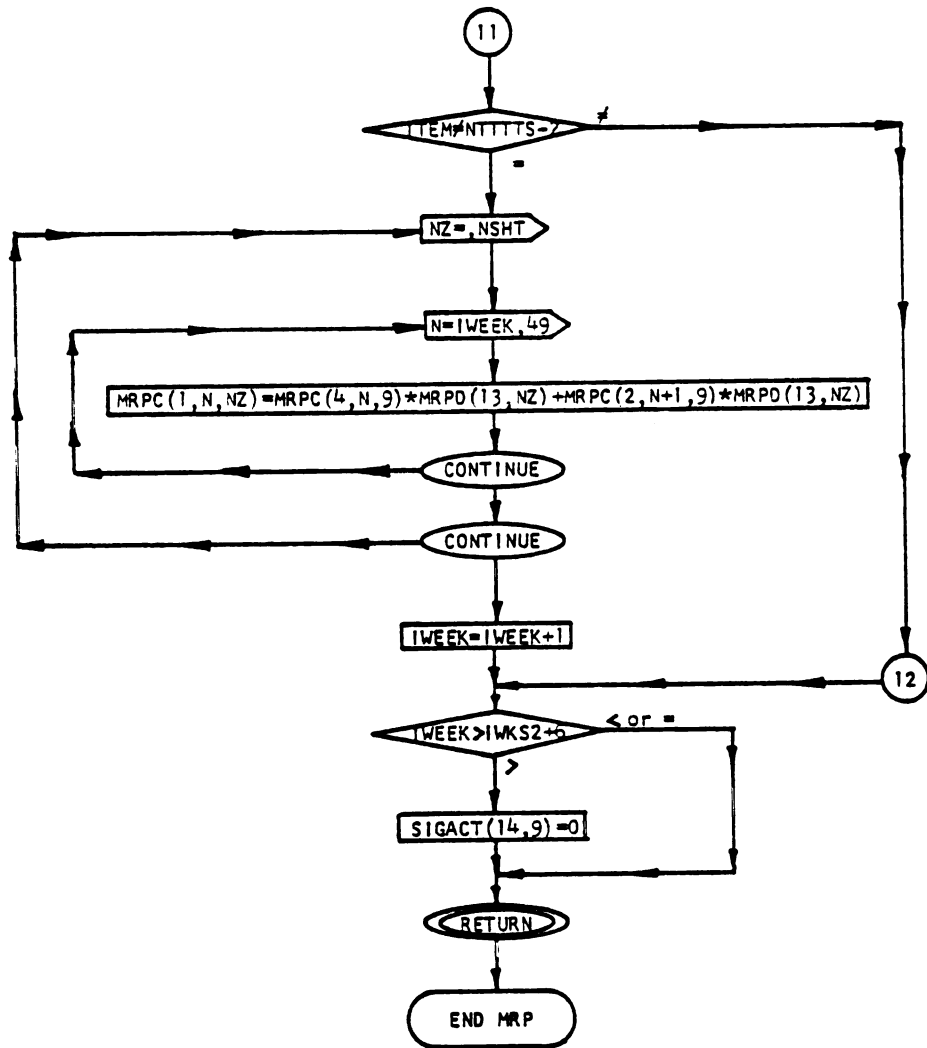


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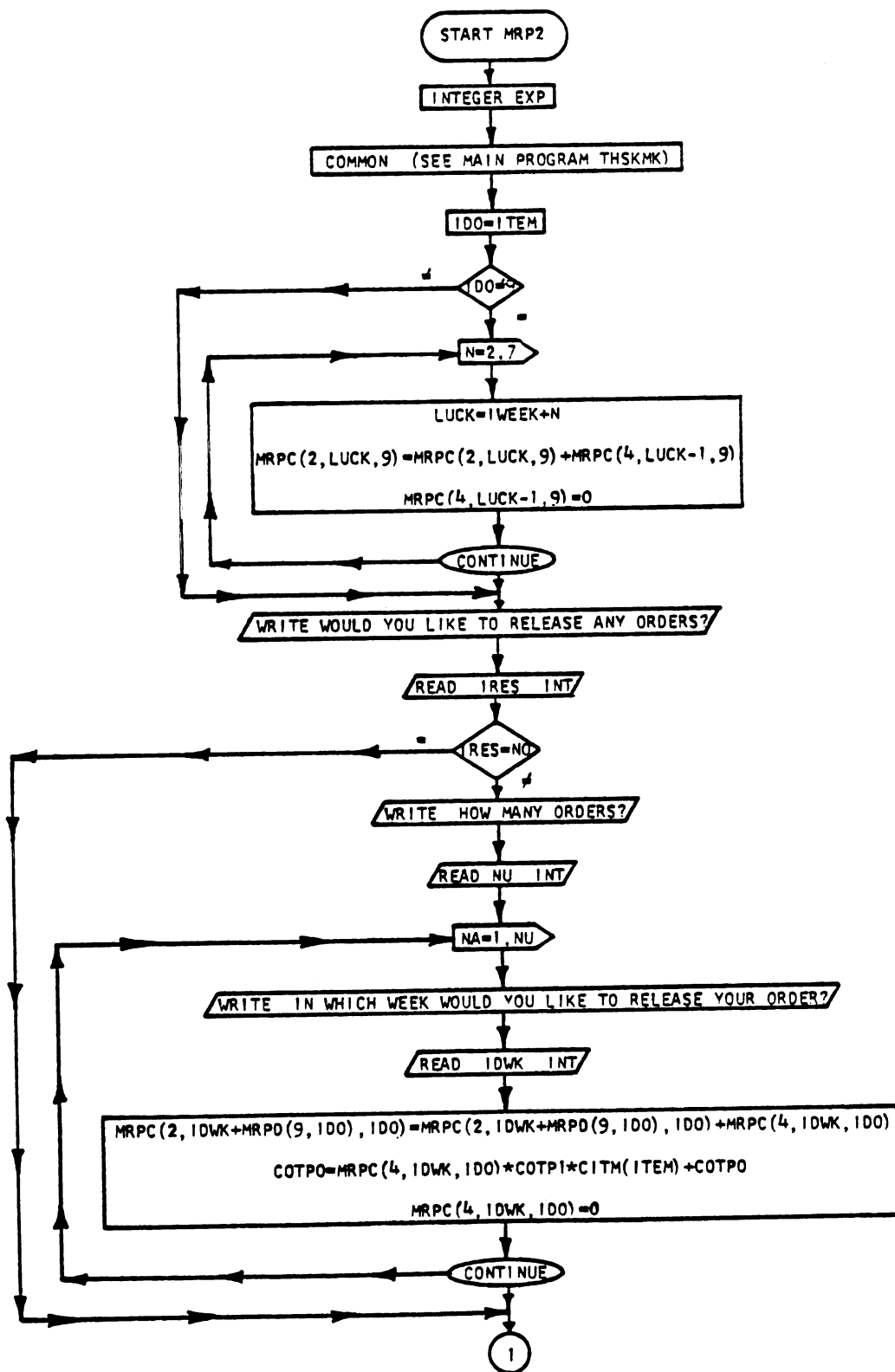


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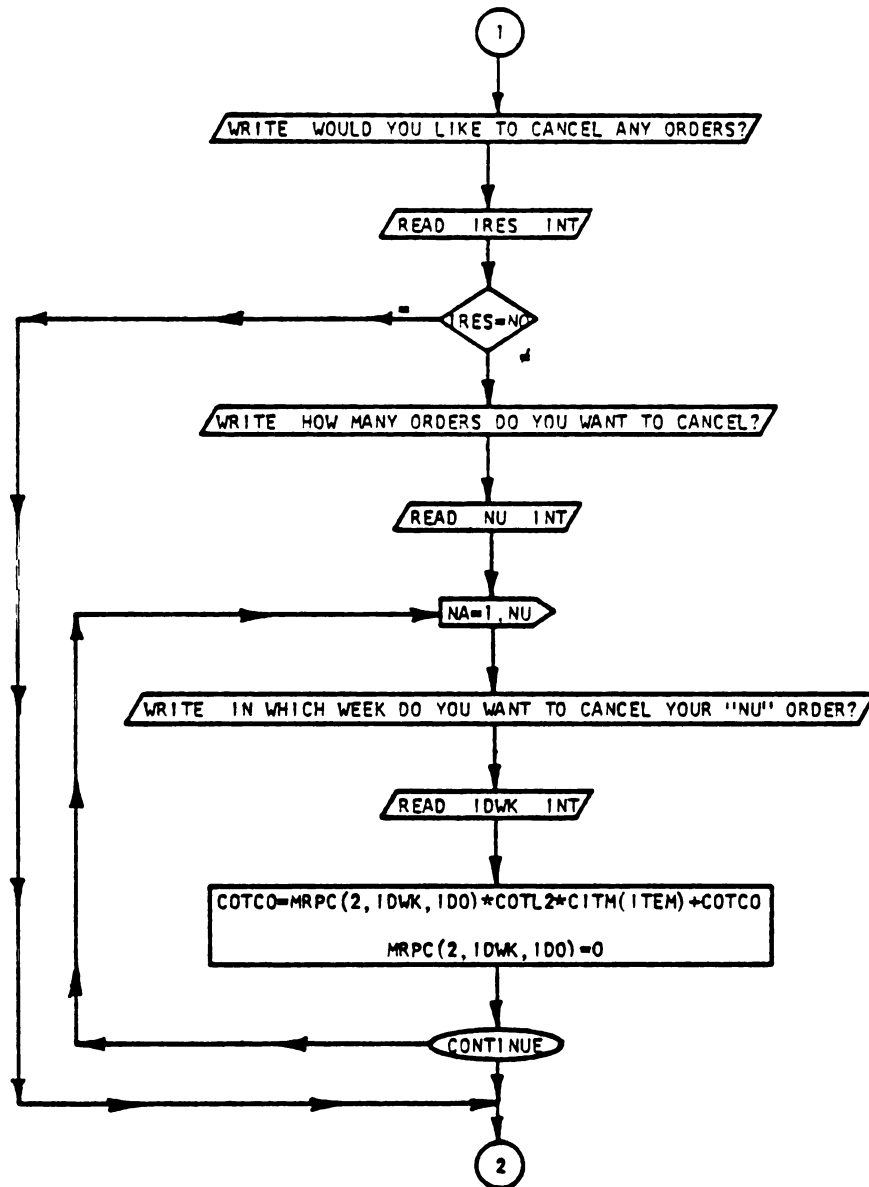


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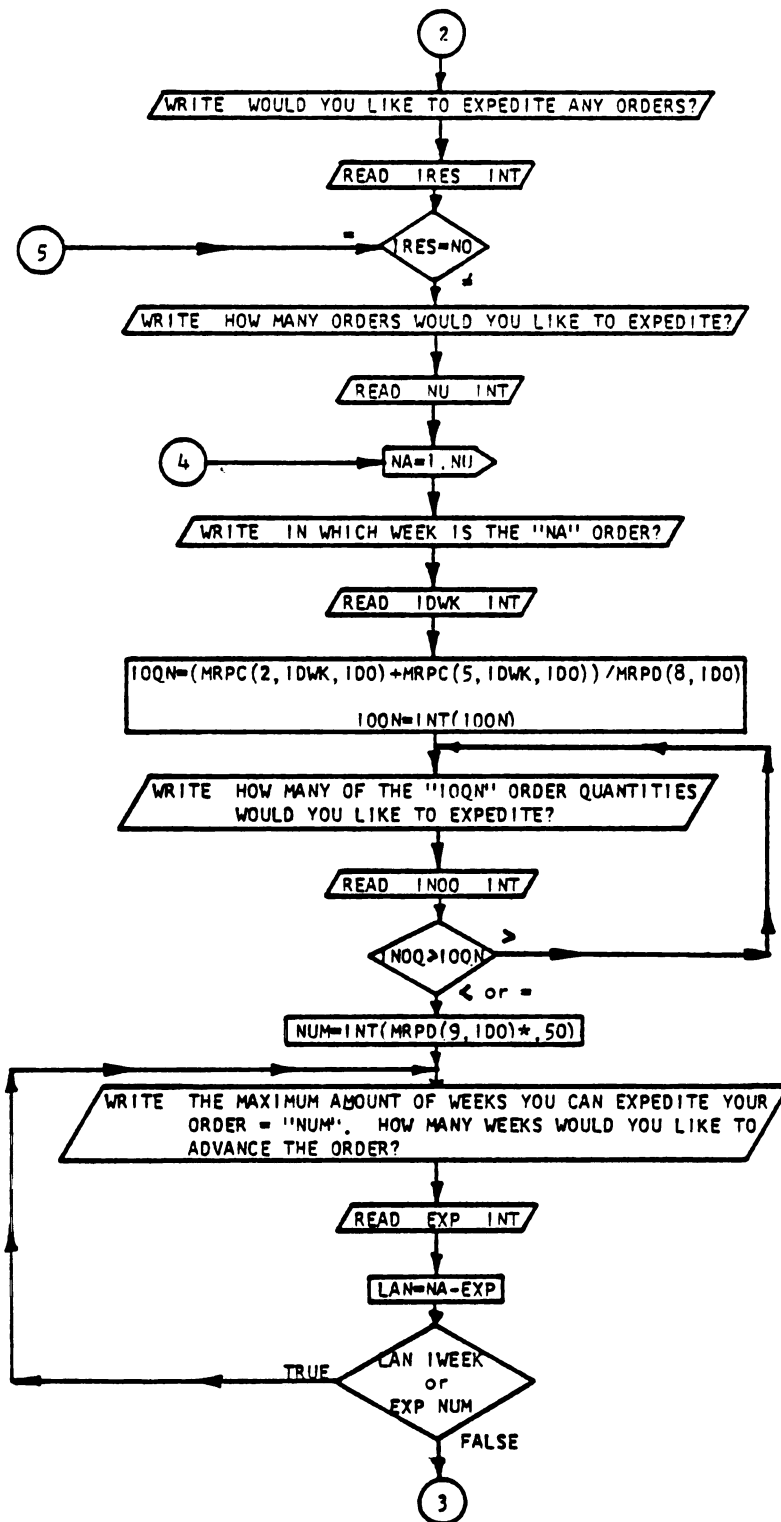


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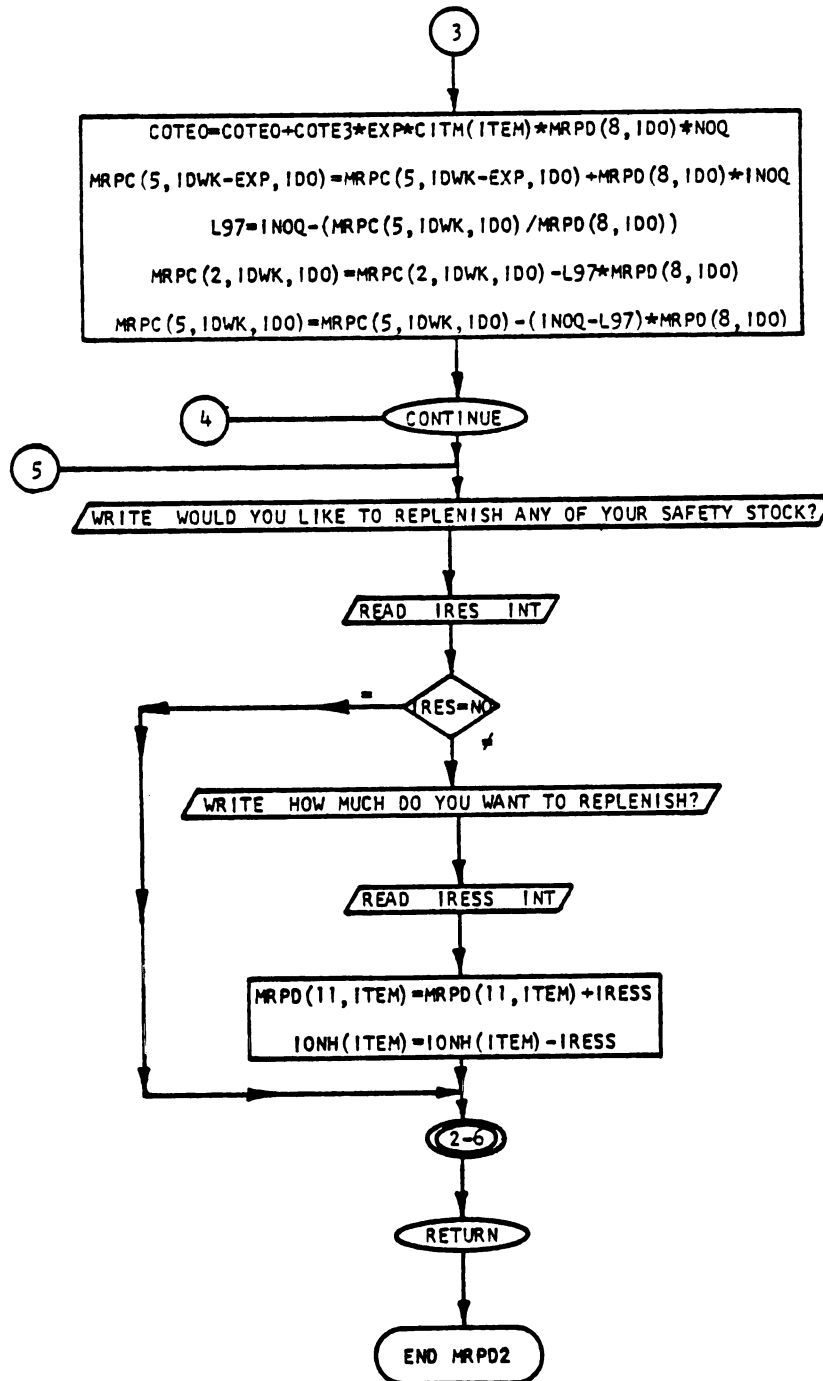


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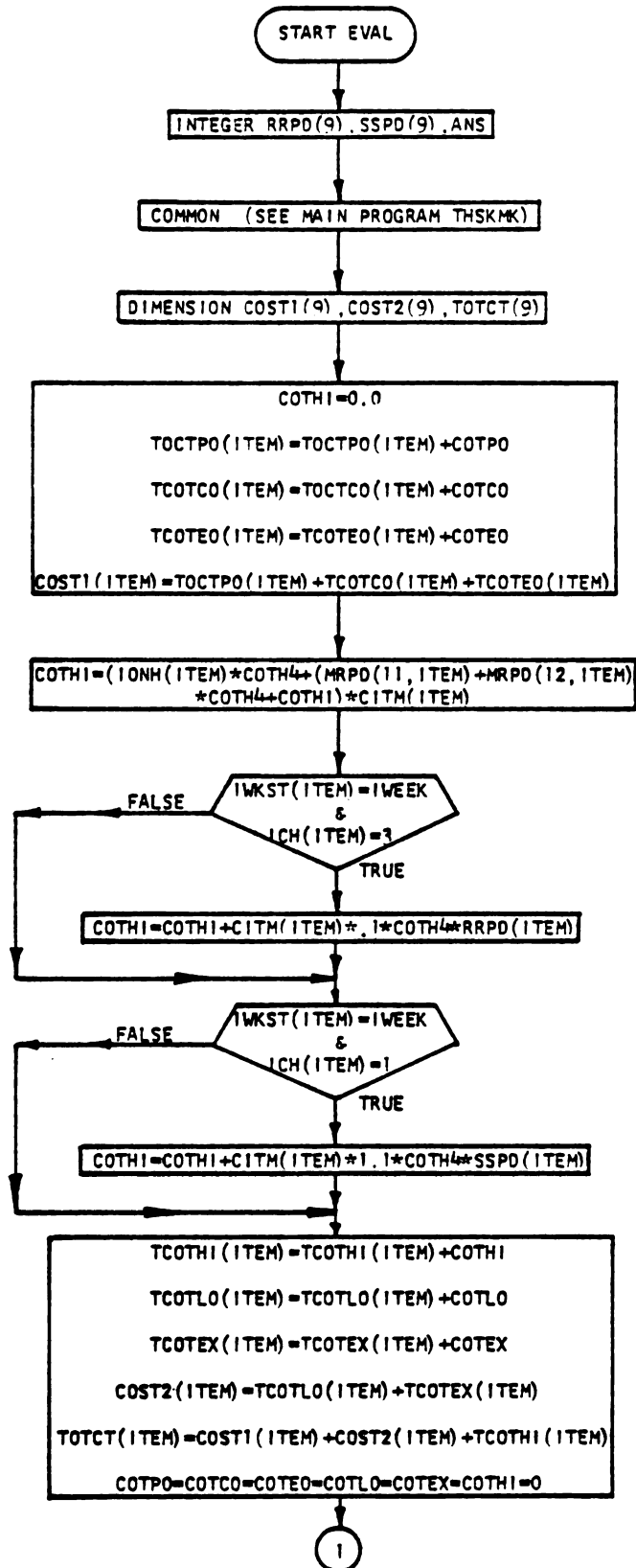


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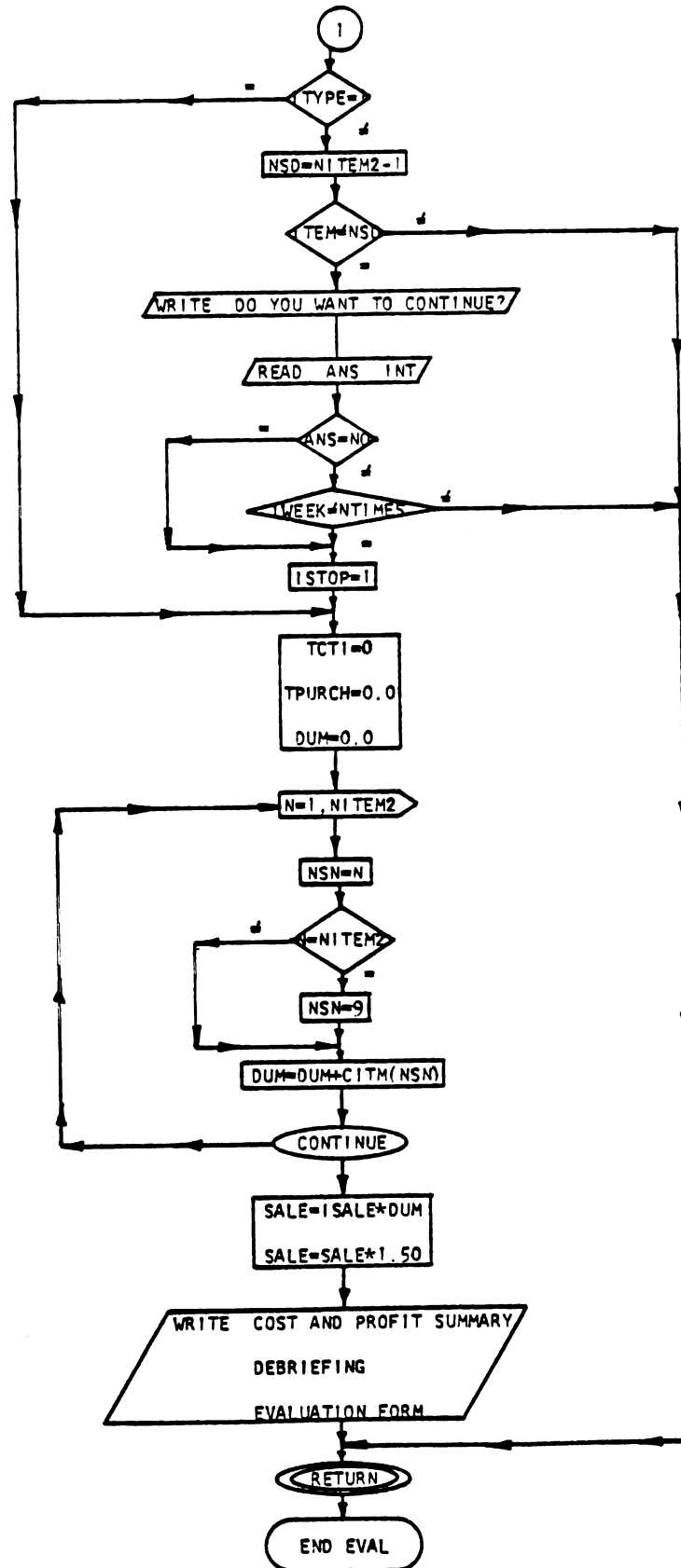


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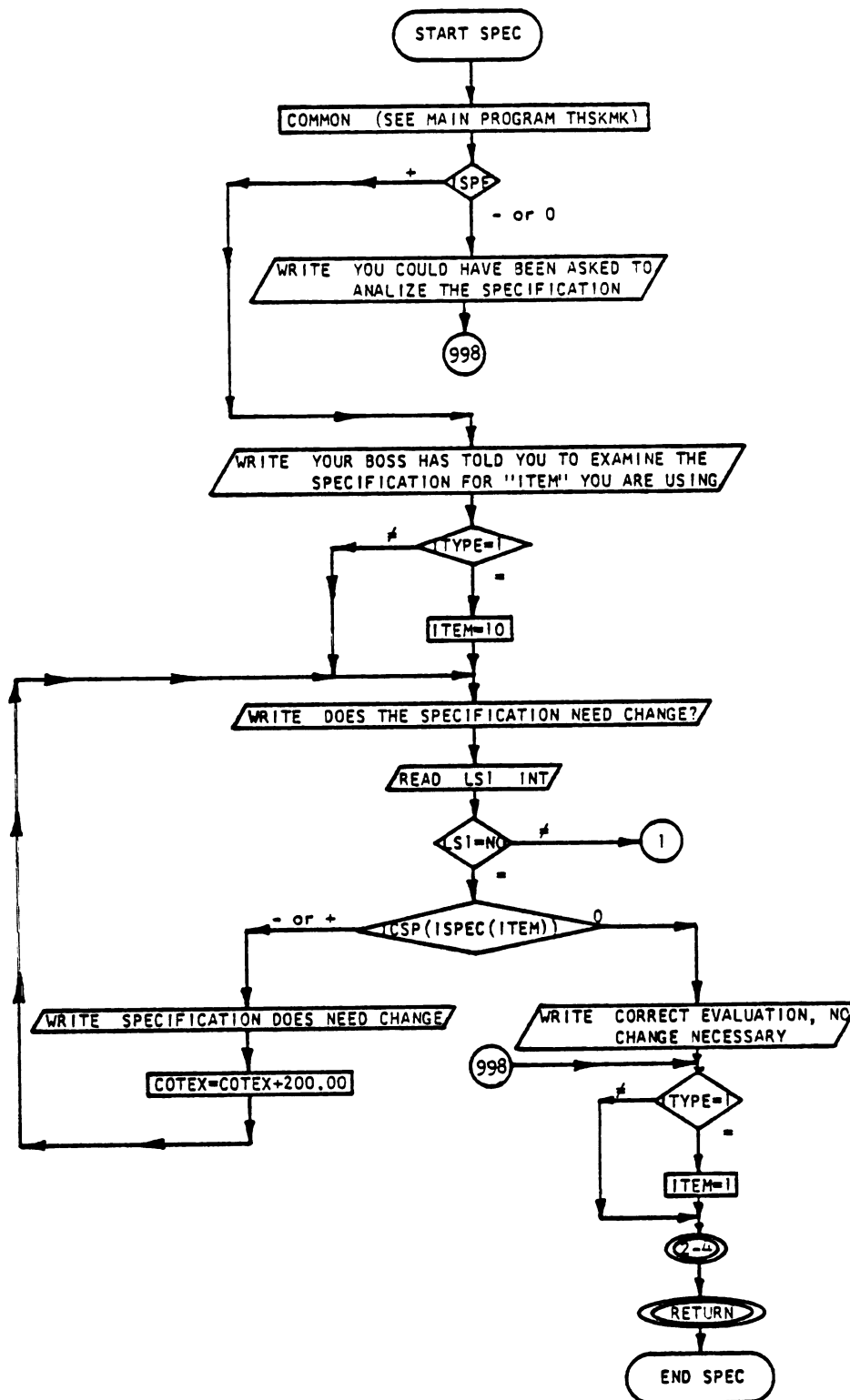


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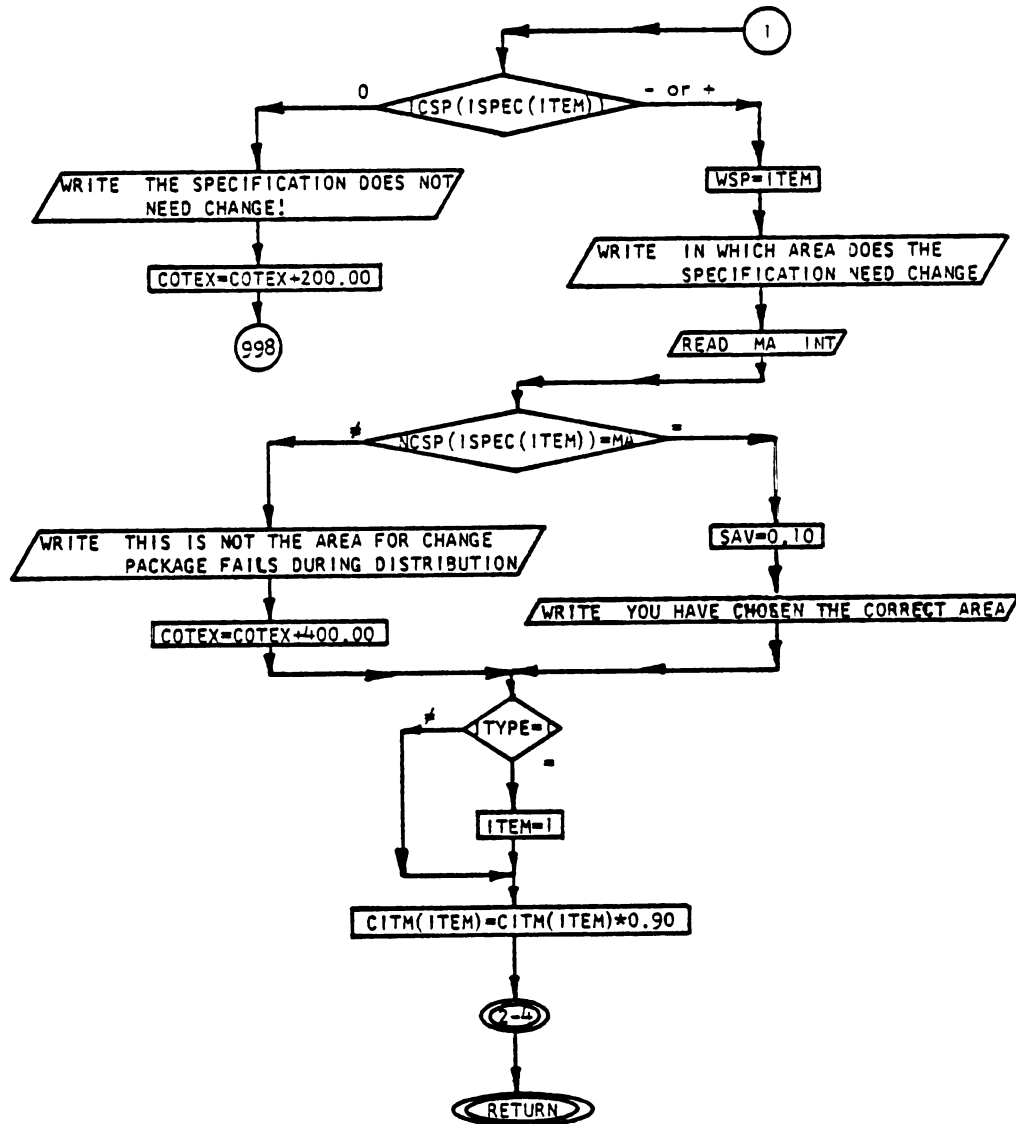


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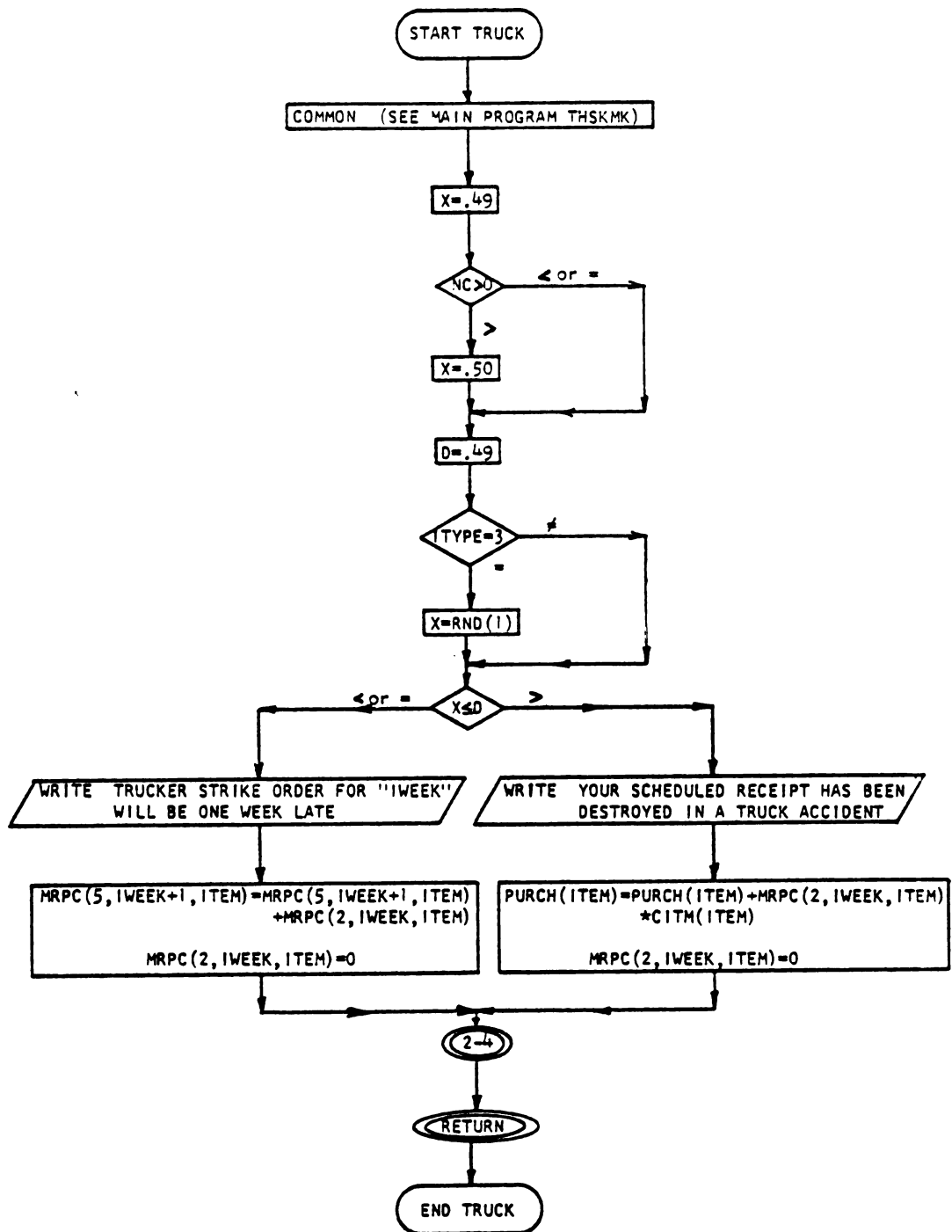


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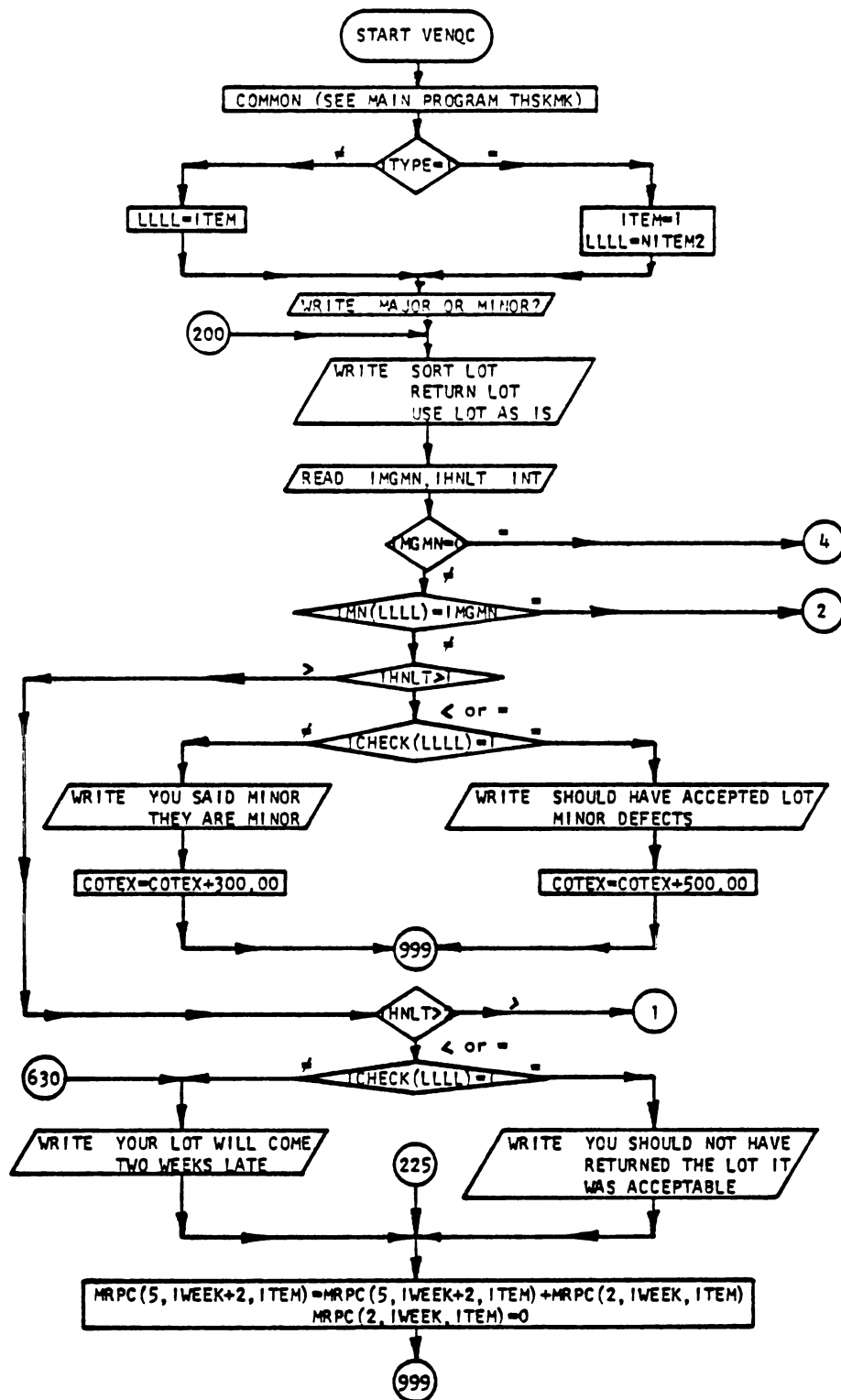


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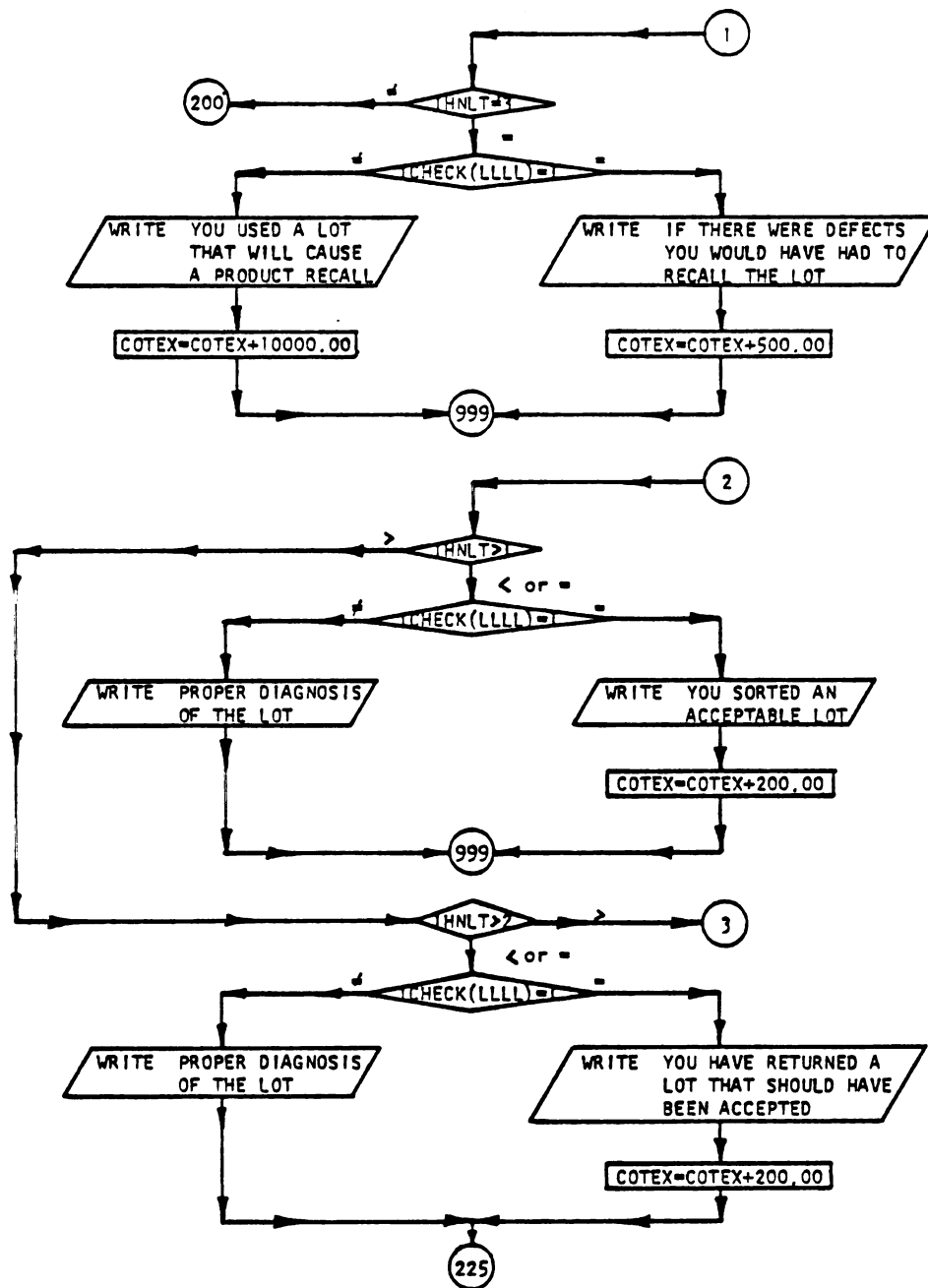


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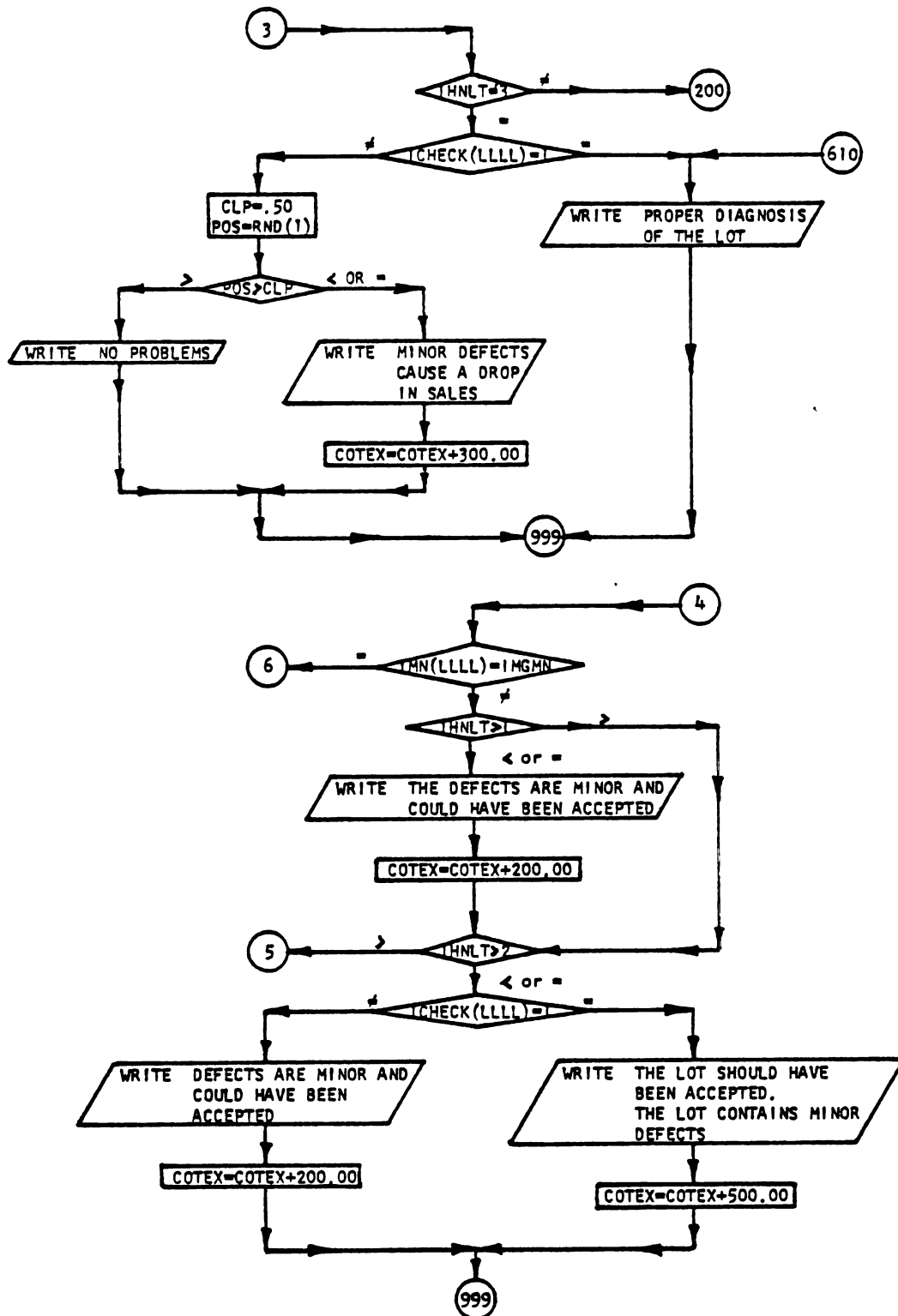


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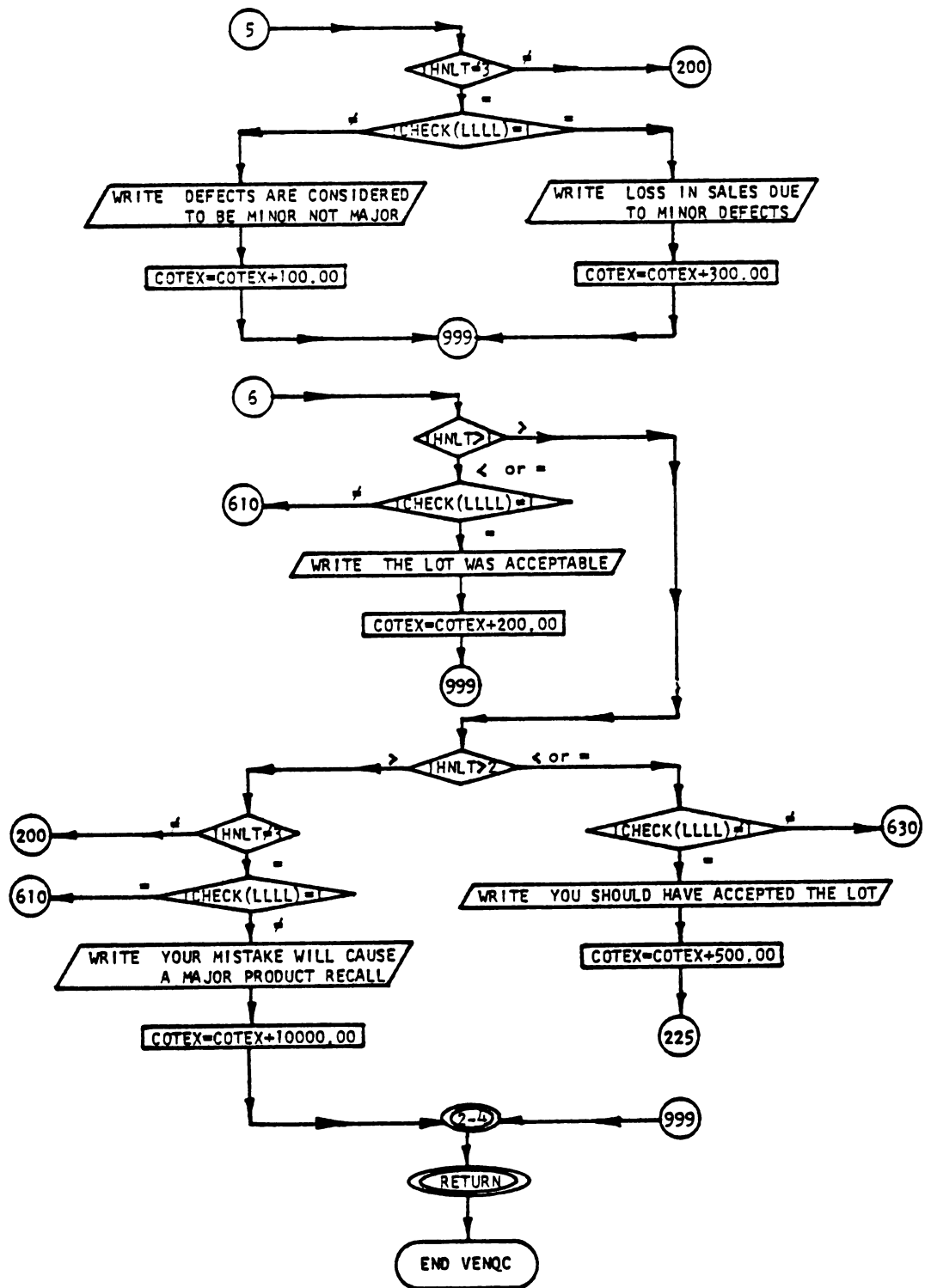


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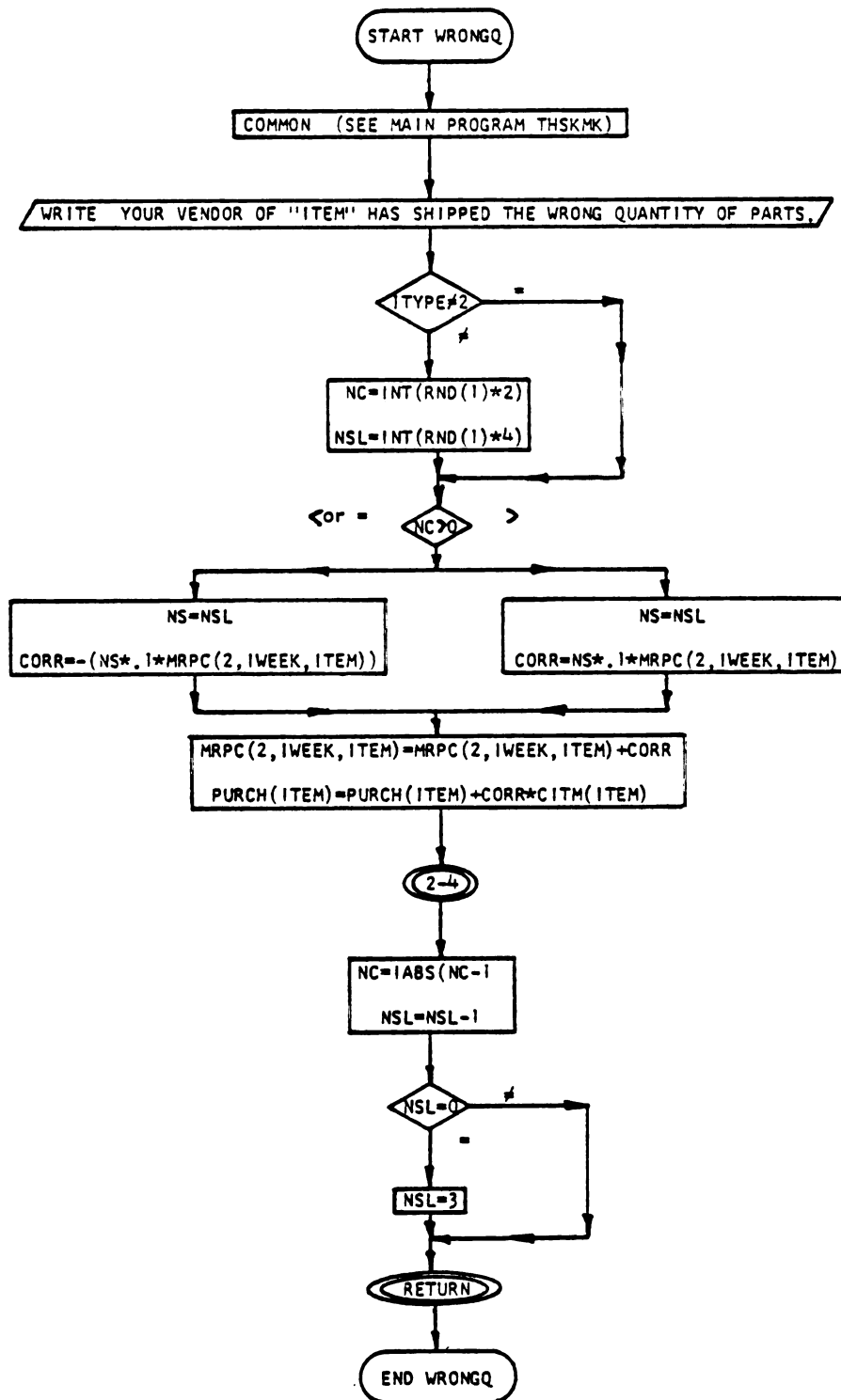


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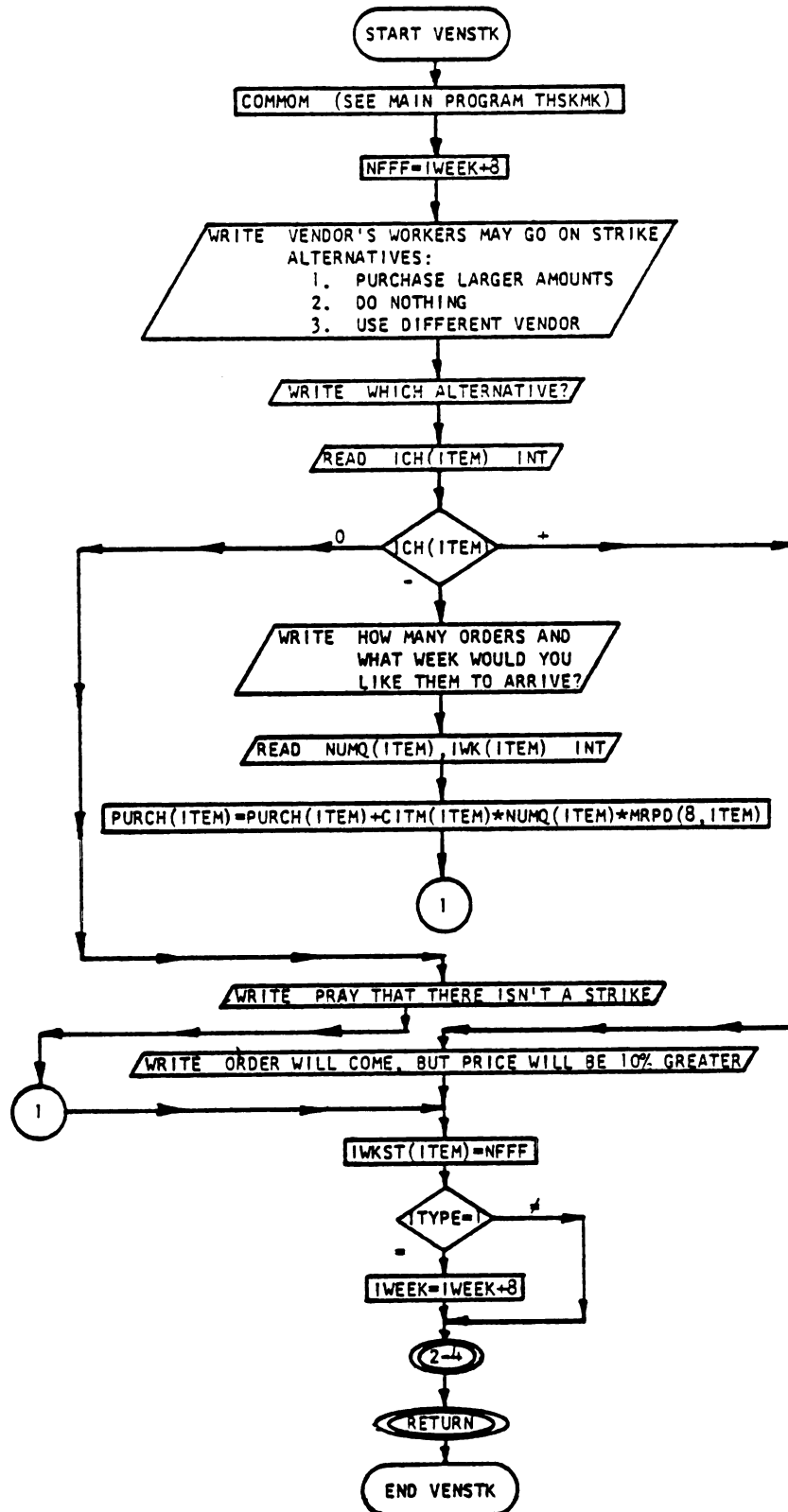


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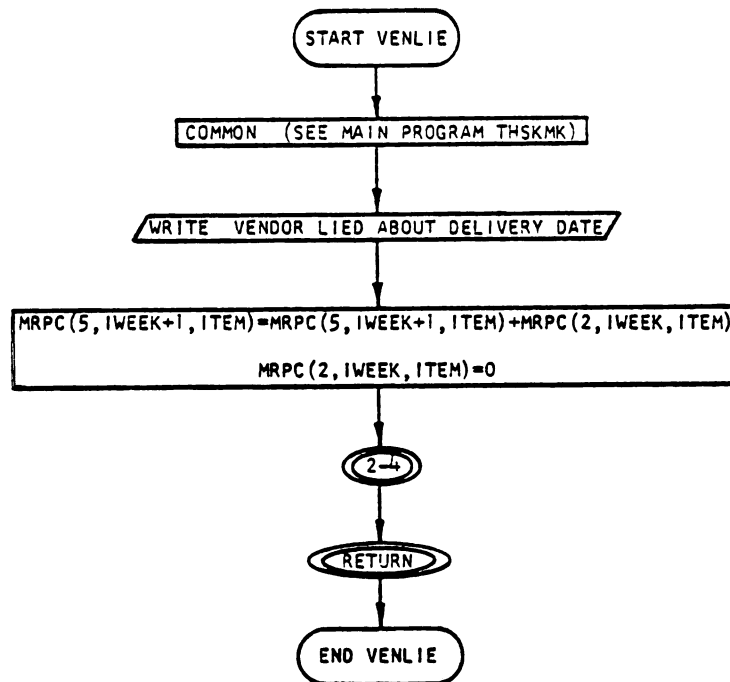


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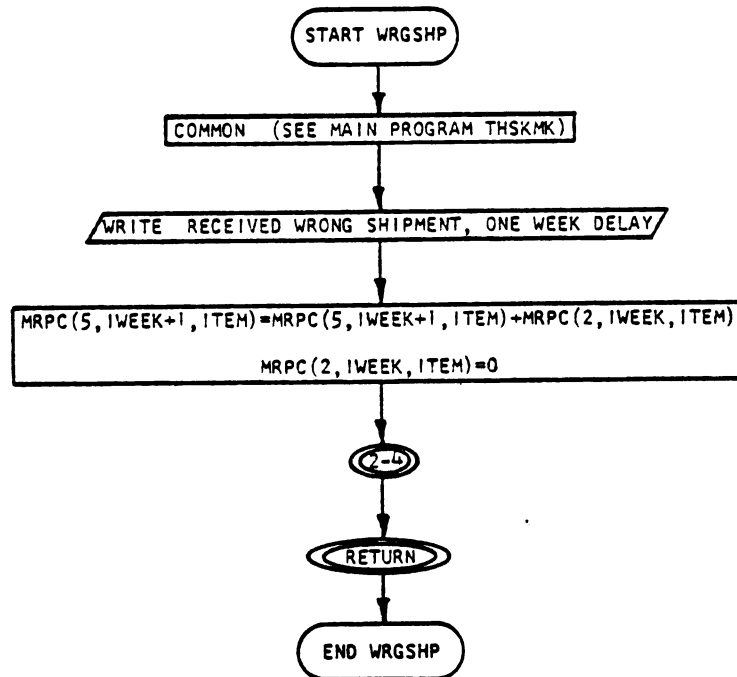


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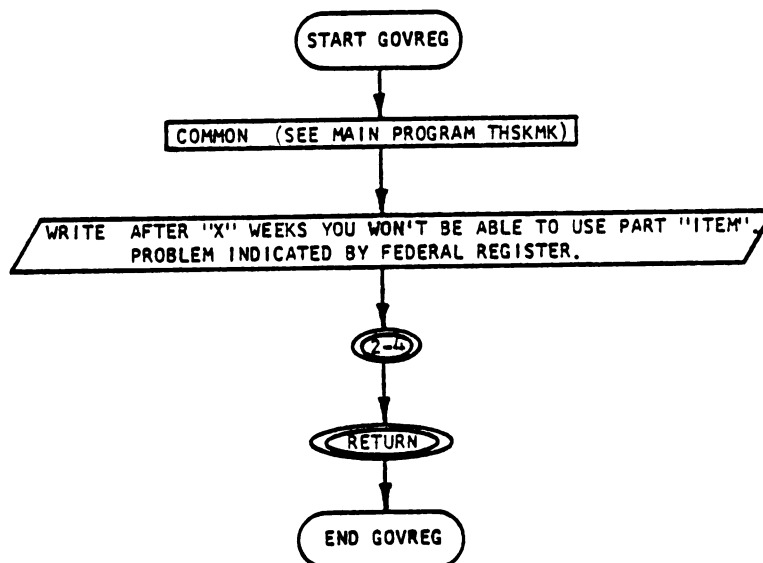


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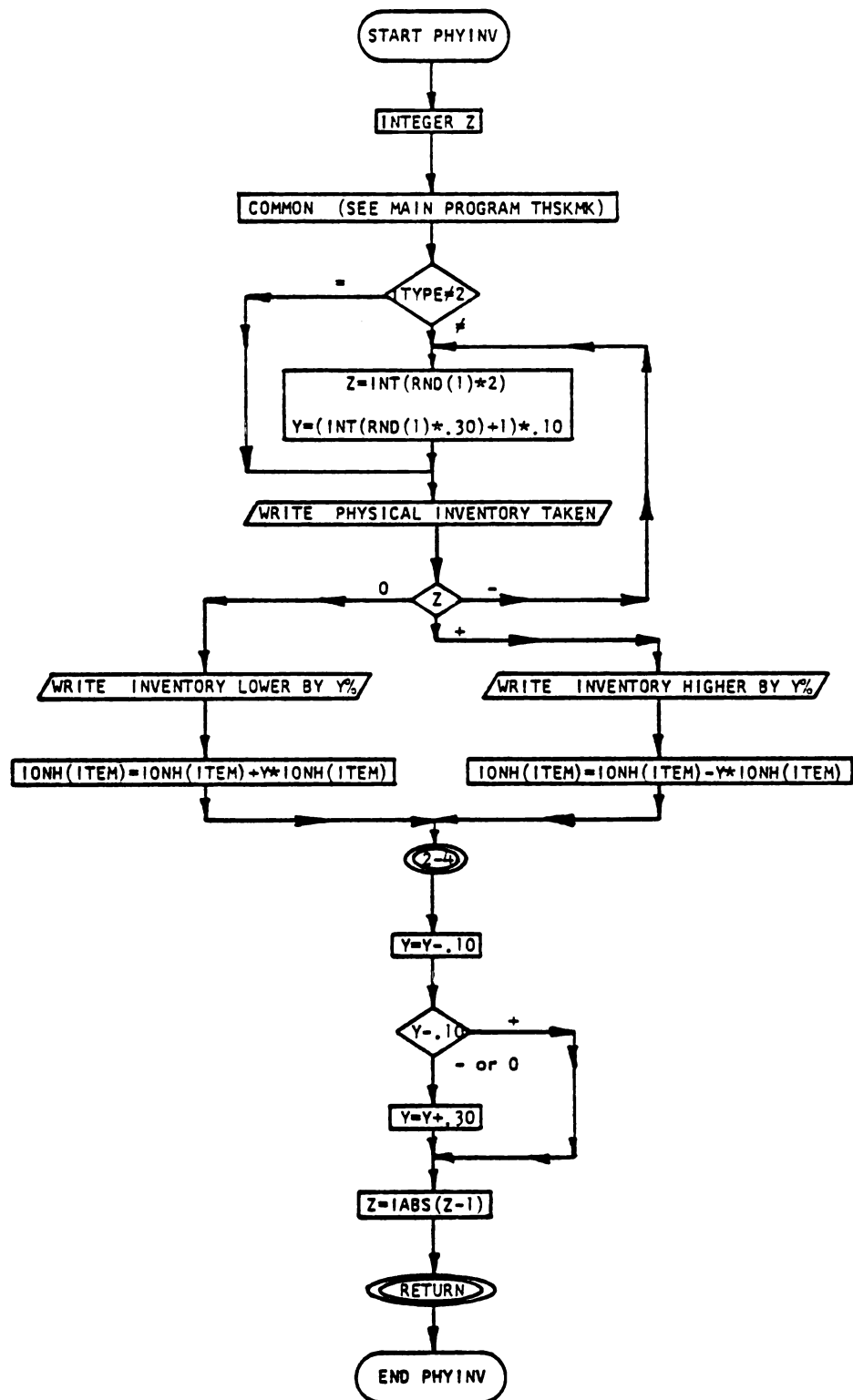


Figure 4.2. (cont'd.).

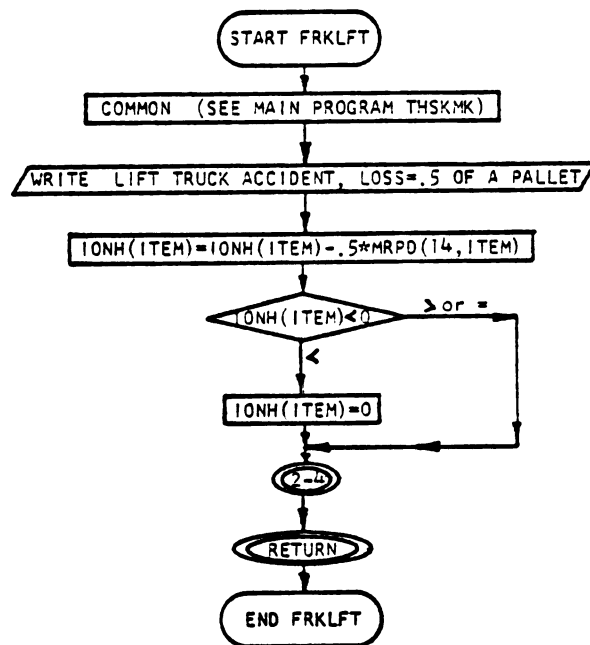


Figure 4.2. (cont'd.).

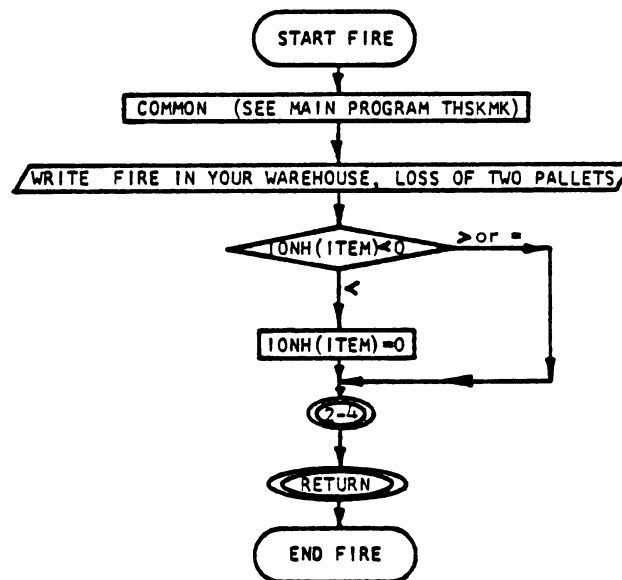


Figure 4.2. (cont'd.).

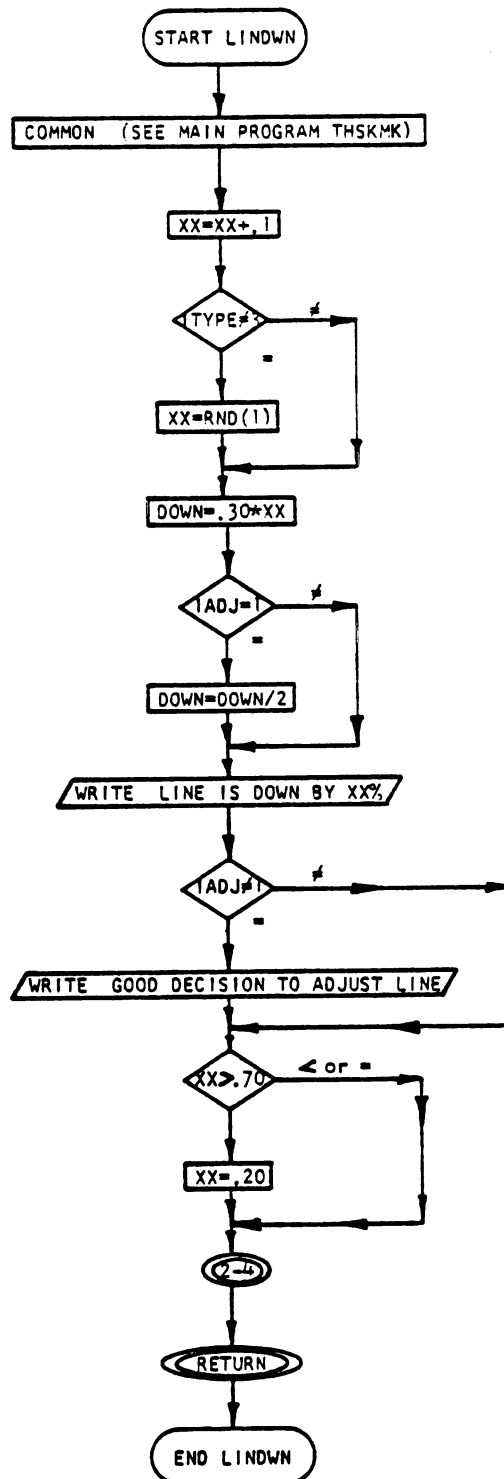


Figure 4.2. (cont'd.).

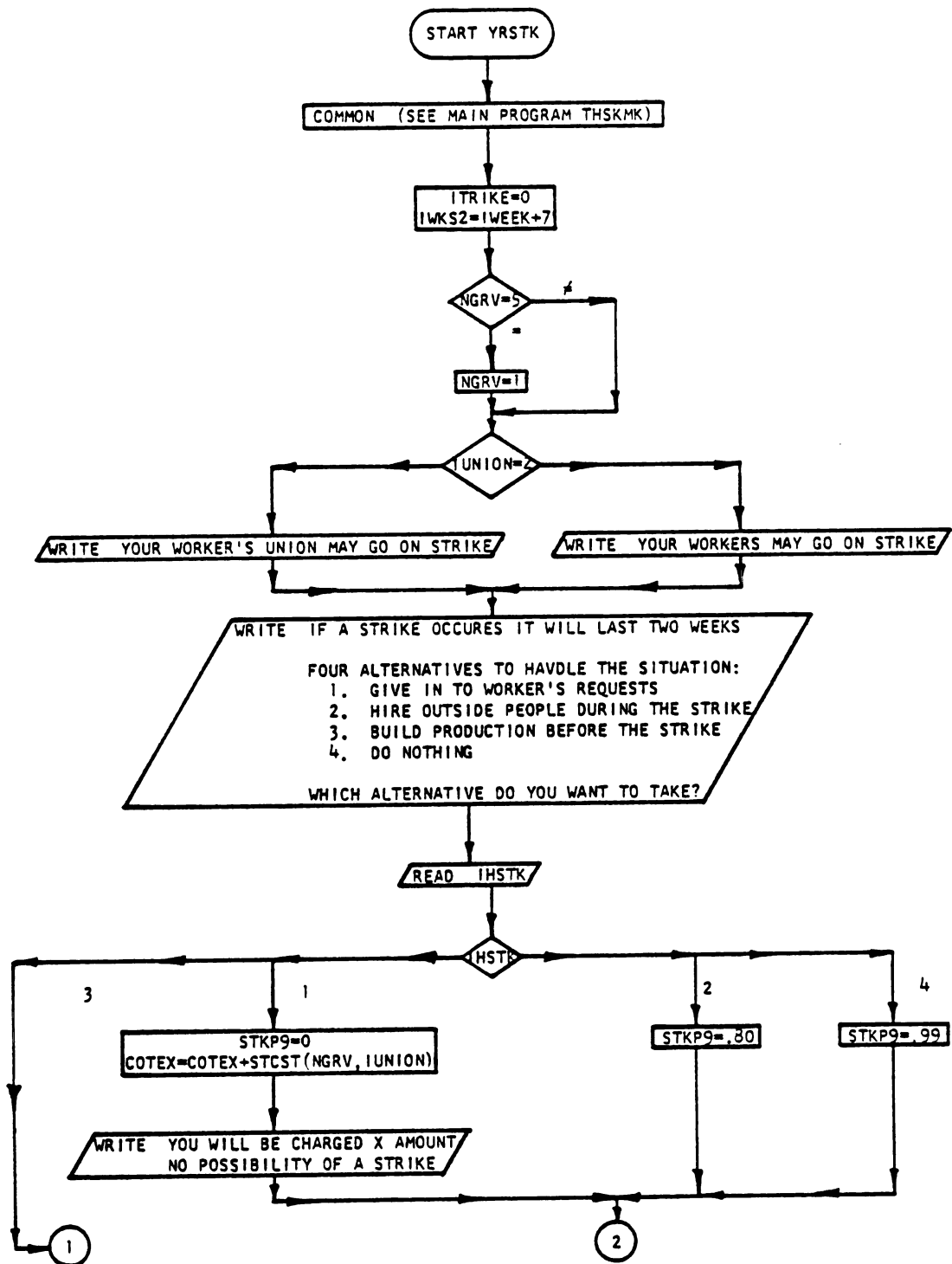


Figure 4.2. (cont'd.).

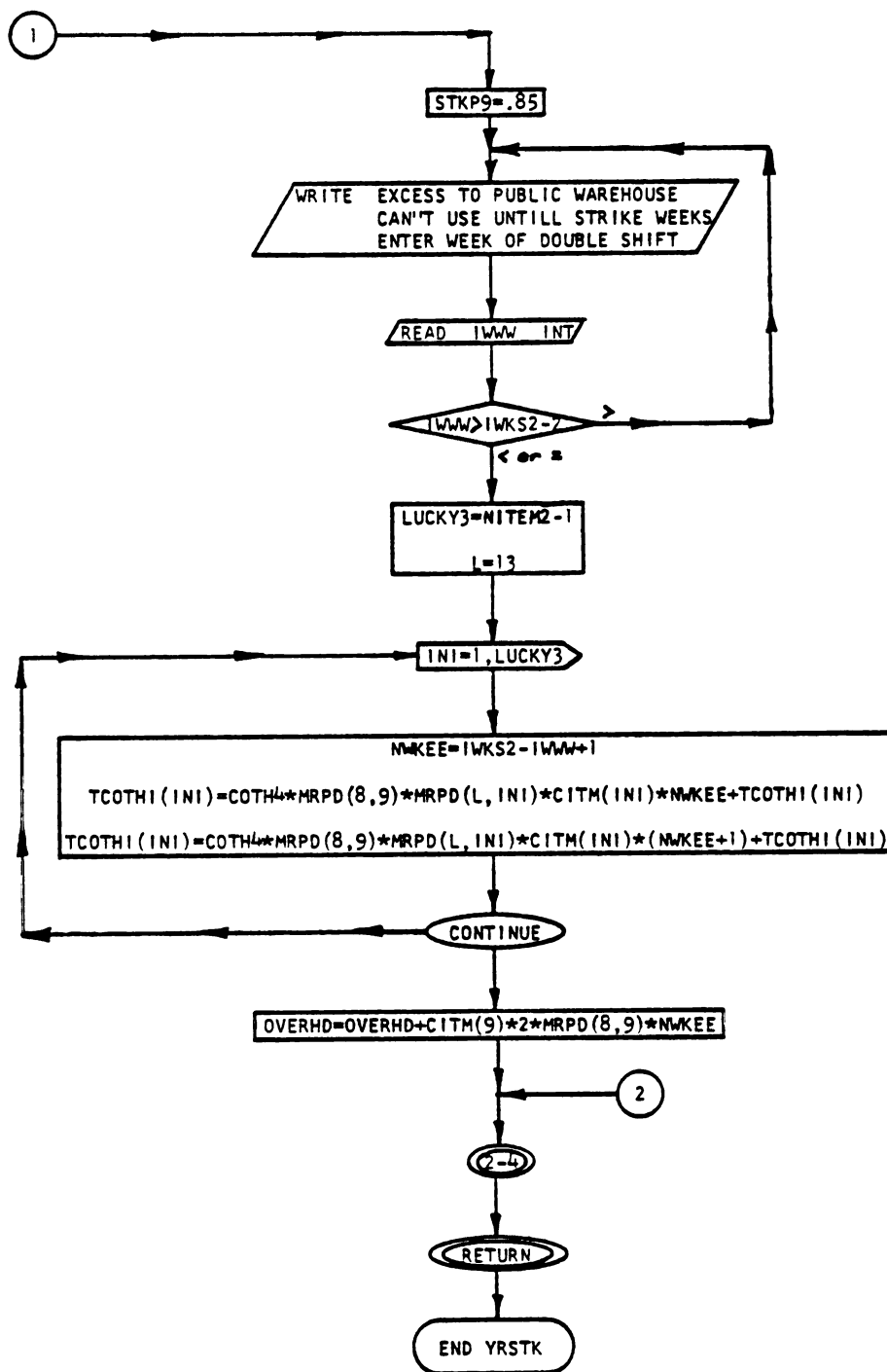


Figure 4.2. (cont'd.).

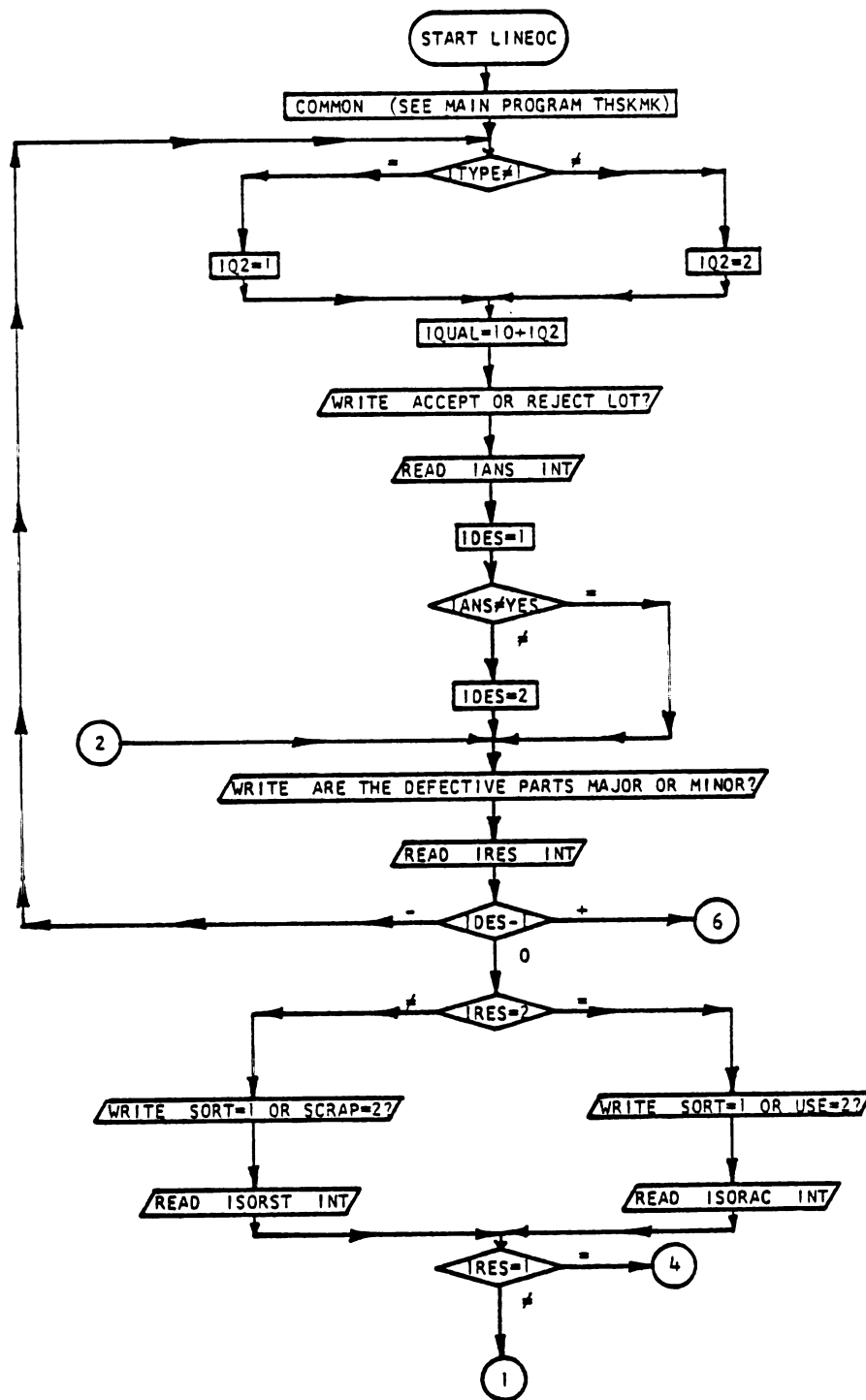


Figure 4.2. (cont'd.).

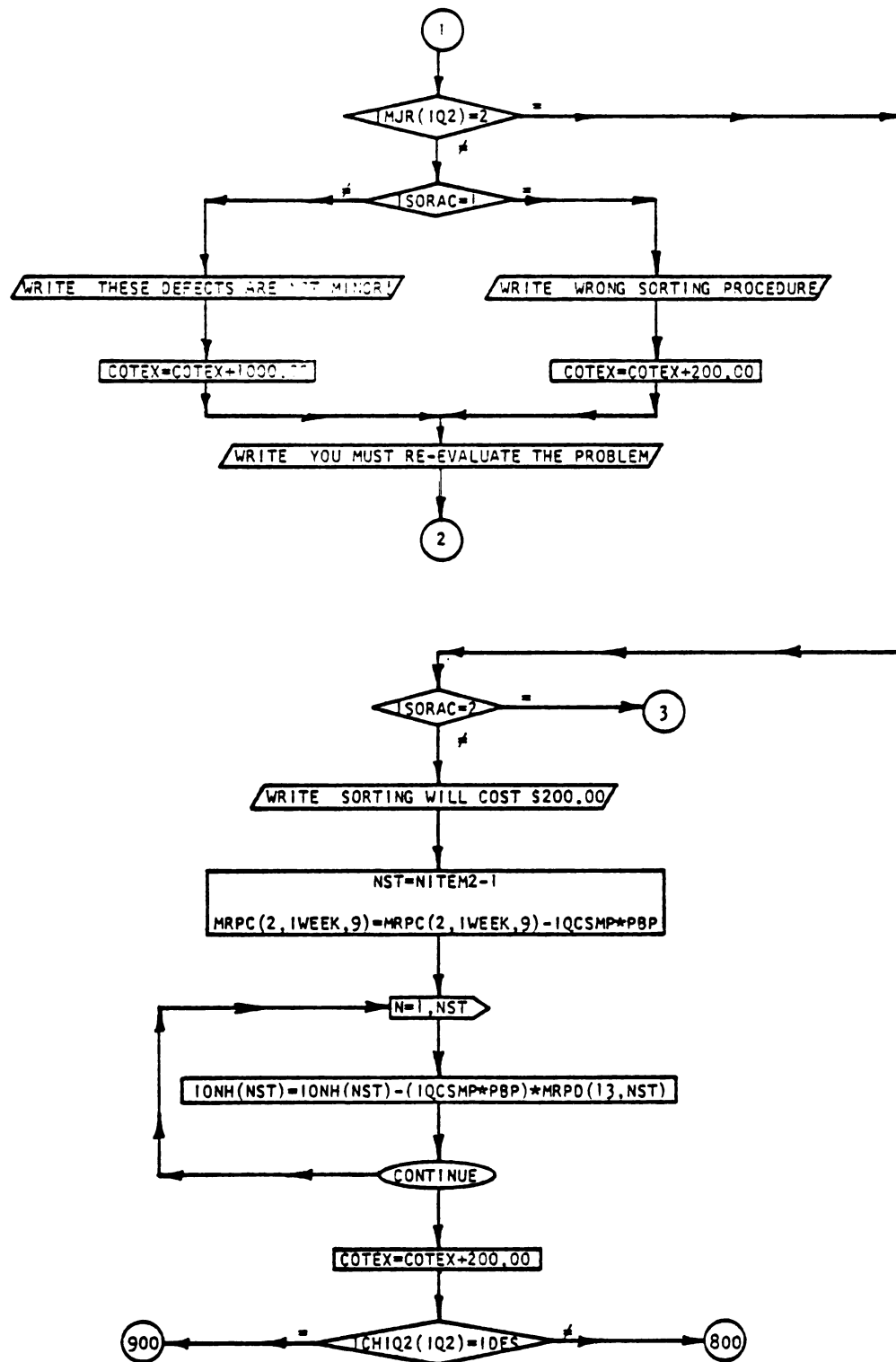


Figure 4.2. (cont'd.).

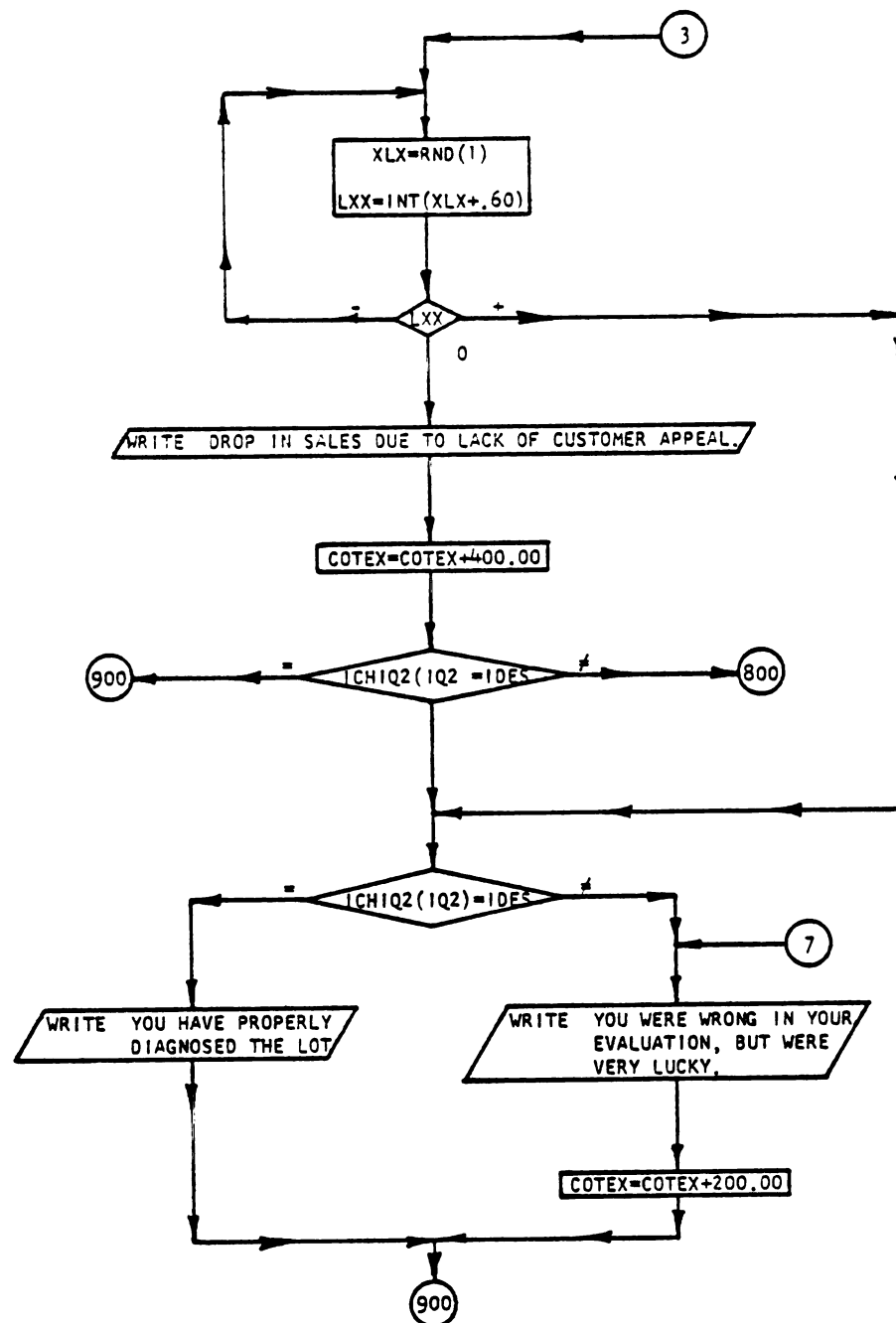


Figure 4.2. (cont'd.).

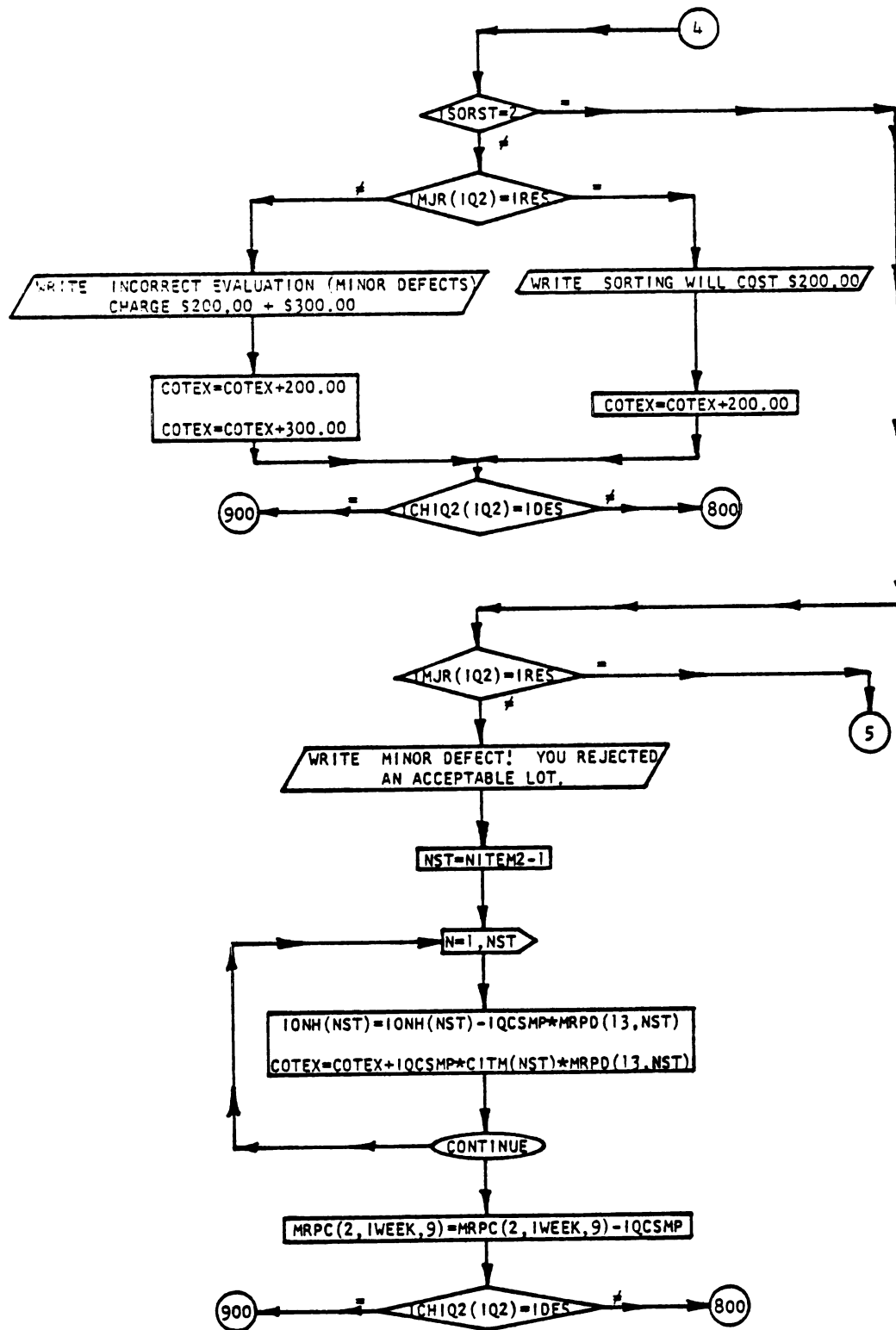


Figure 4.2. (cont'd.).

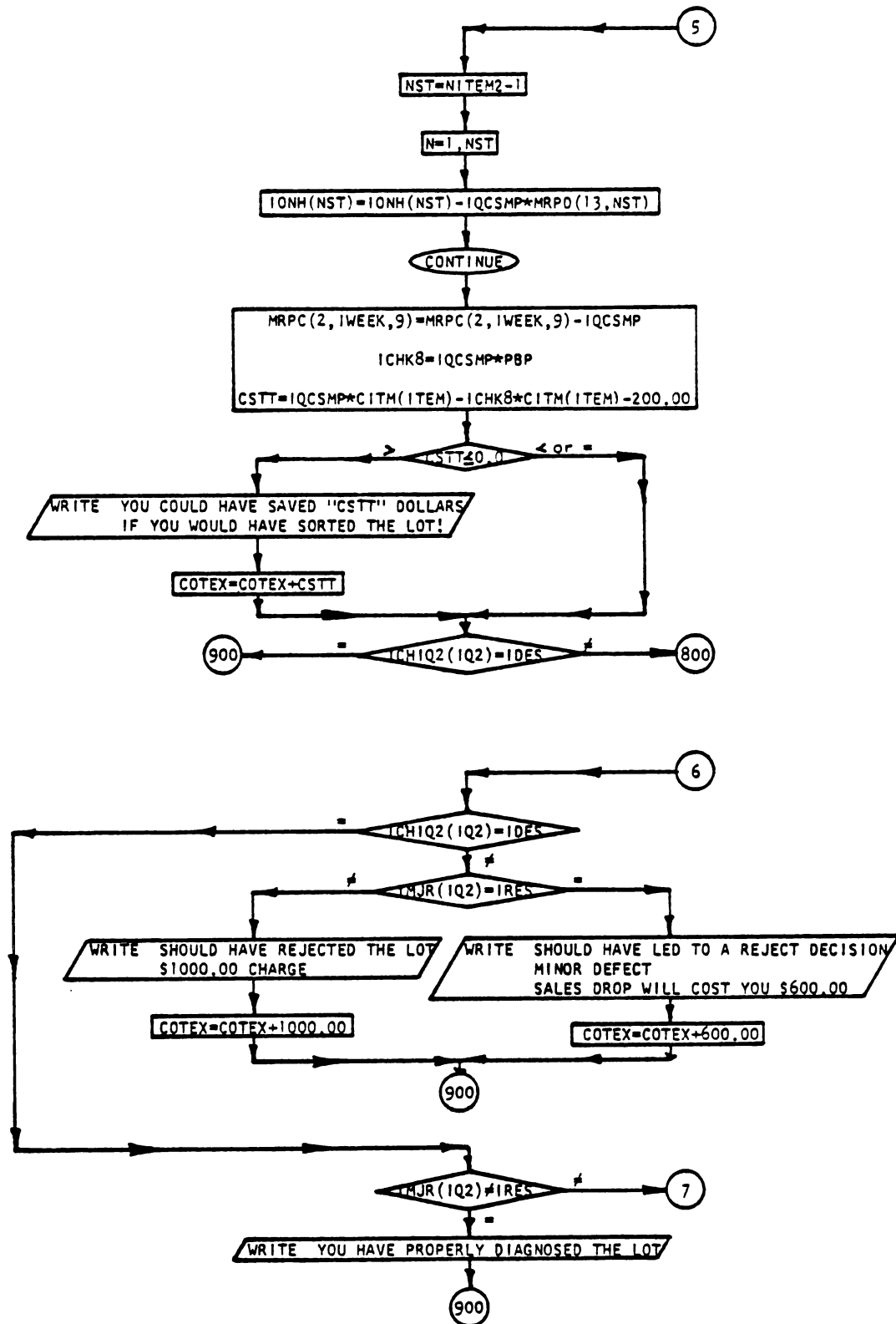


Figure 4.2. (cont'd.).

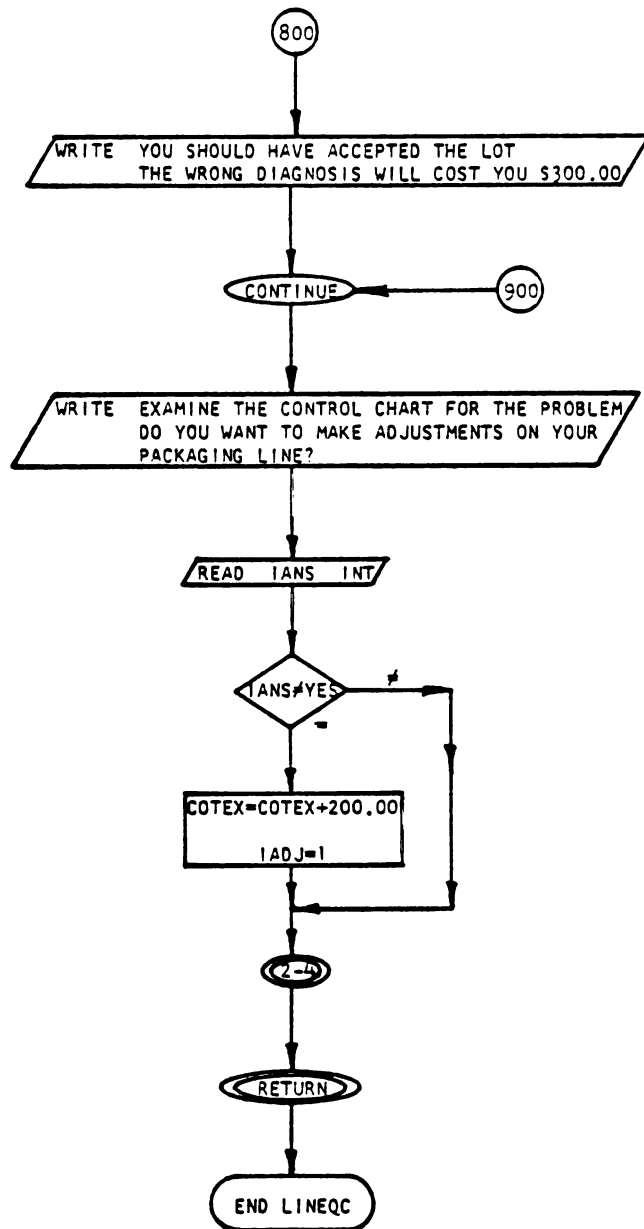


Figure 4.2. (cont'd.).

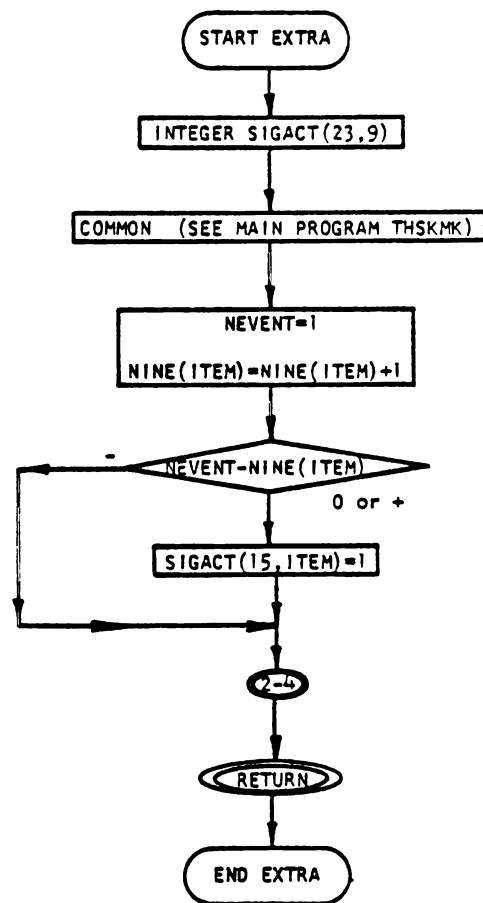


Figure 4.2. (cont'd.).

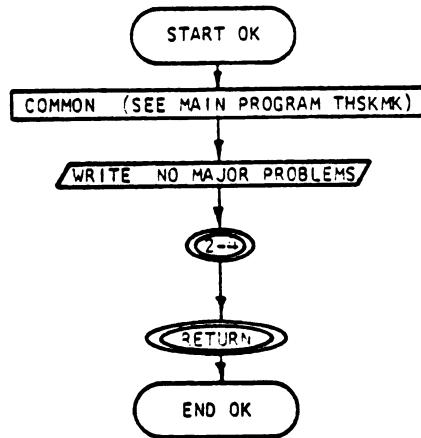


Figure 4.2. (cont'd.).

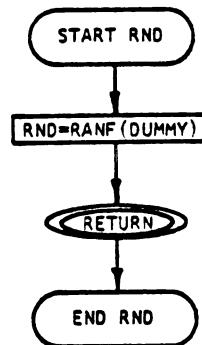


Figure 4.2. (cont'd.).

PROGRAM

The following section contains a complete hard copy listing of the program and all of its subroutines.

NOTE: THE COMPUTER PROGRAM 'THSKMK' WAS WRITTEN IN FORTRAN VI FOR MICHIGAN STATE UNIVERSITY'S CYBER 70 COMPUTER. CHANGES IN THE FORTRAN PROGRAM MAY BE NECESSARY WHEN USING THE PROGRAM ON A DIFFERENT SYSTEM.

PROGRAM & SUBROUTINES					MANUAL	
NAME	CLASS	CLASS #	CODE	FUNCTION	PAGE	PAGE
MAIN	PROGRAM	1 - 1	---	CHOICE OF SIMULATION TYPE	91	80
SET3	SUBROUTINE	2 - 1	---	SET MRP SCHEDULE DATA	94	83
ROUTE	" "	2 - 2	---	SET UP ROUTE TO FOLLOW	97	86
CCALL	" "	2 - 3	---	CALL SIMULATION SITUATION	98	87
MRP	" "	2 - 4	---	UPDATE AND PRINT SCHEDULE	100	89
MRP2	" "	2 - 5	---	MODIFICATIONS TO SCHEDULE	105	94
EVAL	" "	2 - 6	---	PRINT OUT COST EVALUATIONS	107	96
SPEC	" "	3 - 1	a 1	CHANGES IN SPECIFICATIONS	109	98
TRUCK	" "	3 - 2	a 2	TRUCK ACCIDENT OR STRIKE	111	100
VENQC	" "	3 - 3	a 3	INCOMING QUALITY CONTROL	112	101
WRONGQ	" "	3 - 4	a 4	WRONG QUANTITY OF PARTS	115	104
VENSTK	" "	3 - 5	a 5	VENDOR'S WORKERS ON STRIKE	116	105
VENLIE	" "	3 - 6	a 6	LIES ABOUT DELIVERY DATES	117	106
WRGSHP	" "	3 - 7	a 7	ANOTHER COMPANY'S SHIPMENT	117	106
GOVREG	" "	3 - 8	a 8	PARTS DO NOT MEET FED. REG.	118	107
PHYINV	" "	3 - 9	b 1	INCORRECT AMOUNT OF INV.	119	108
FRKLFT	" "	3 - 10	b 2	FORKLIFT ACCIDENT, WAREHOUSE	120	109
FIRE	" "	3 - 11	b 3	FIRE IN WAREHOUSE	121	110
OK	" "	3 - 12	b 4	SMOOTH OPERATION	121	110
LINDWN	" "	3 - 13	c 1	PRODUCTION DOWN TIME	122	111
YRSTK	" "	3 - 14	c 2	PLANT WORKERS, POSSIBLE STRIKE	123	112
LINEQC	" "	3 - 15	c 3	QC INSPECTION, FINISHED PARTS	125	114
EXTRA	" "	3 - 16	c 4	OTHER PRODUCTION PROBLEMS	128	117
RND	FUNCTION	4 - 1	---	GENERATES RANDOM NUMBERS	128	117

* CLASS # INDICATES:

1. program -----
2. subroutine control-----
3. subroutine exercise-----
4. function -----

x-y ← number within class

** CODES INDICATE :

- a. vendor supply situation-----
- b. warehousing problem ---
- c. production problem ----

z n ← number within class

Table 4.2

PROGRAM MODEL LISTING

PROGRAM THSKMK

```

PROGRAM THSKMK(INPUT,TAPE60=INPUT,OUTPUT=/700,TAPE61=OUTPUT,TAPE70
C,TAPE14)
C      MAIN      1-1
C      INTEGER SIGACT(23,9),SUBR,CD,EX,FLIP,Z,RPPD(9),SSPD(9)
COMMON MRFC(5,5),MRFD(16,9),IONH(6),STKP(10),NUMQ(9),ICSP(10),I
CSP(10),NCSP(10),ICHECK(10),IC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
C),SUBR,ISTOP,IWEEK,NV,NTIMES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
C1,COTE3,CCTH4,COTLS,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TOCTPO(9
C),TCOTCO(9),TCOTEG(6),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
CPO,COTCO,COTEN,COTLO,COTE6,NPLC,RRPD(9),SSPD(9),ICHIQ2(2),IMJR(2),
CICCSMP,PBP,XX,IADJ,CITM(9),OVERMD,ISALE,SALE,PURCH(9),IWK52,IWWW,I
CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKPA,STCST(4,2),IHSTK,IEX,IMN
C(10)
C      DIMENSION UPLIM(16),WWRLIM(16)
C
C      ***** INITIALIZE MOST VARIABLES *****
C
C      READS VARIABLES FROM TAPE 70
C      READ(70,2998)IRF
DO 10 N=1,16
C      READ(70,2994)UPLIM(N),WWRLIM(N)
2004 FORMAT(2F4.2)
C      CONTINUE
2998 READ(70,2998)NPLC
C      FORMAT(11)
NPLC=NPLC-5
C      IEX=0
2997 READ(70,2997)ICHIQ2(1),ICHIQ2(2)
C      FORMAT(2I11)
2996 READ(70,2996)IMJR(1),IMJP(2)
C      READ(70,2996)ICCSMP
2996 FORMAT(16)
C      READ(70,2995)PBP
2995 FORMAT(F4.2)
C      READ(70,2995)XX
C      READ(70,2994)IUNION
C      READ(70,2994)((IGRV1(N)),N=1,4)
C      READ(70,2994)((IGRV2(N)),N=1,4)
2994 FORMAT(4A10)
C      READ(70,2993)STCST(1,1),STCST(1,2)
C      READ(70,2993)STCST(2,1),STCST(2,2)
C      READ(70,2993)STCST(3,1),STCST(3,2)
C      READ(70,2993)STCST(4,1),STCST(4,2)
2993 FORMAT(2F7.2)
C      ***** CONTROL SENT TO THIS STATEMENT *****
C      ***** WHEN OPERATOR EXERCISES REPEAT OPT. ***
C      2 CONTINUE
C      REWIND 14
C      IEX=IEX+1
C
C      ASSINS ZERO TO MOST VARIABLES
C      DO 110 NX1=1,9
C      DO 105 NX2=1,30
C      DO 100 NX3=1,0
C      MRPC(NX1,NX2,NX3)=0
C      100 CONTINUE
C      105 CONTINUE
C      110 CONTINUE
C
C      SETS MRPC(ARRAY)=0
C      DO 120 NX1=1,9
C      PURCH(NX1)=0.0
C      NUMQ(NX1)=0
C      ICH(NX1)=0
C      NINE(NX1)=0
C      TIMIN(NX1)=0
C      TOCTPO(NX1)=0
C      TCOTCO(NX1)=0
C      TCOTEG(NX1)=0
C      TCOTHI(NX1)=0
C      TCOTLO(NX1)=0
C      TCOTEX(NX1)=0
C      RRPD(NX1)=0
C      SSPD(NX1)=0
C      120 CONTINUE
C      READ(14,2003)CCTPND
2003 FORMAT(F4.2)

```

Table 4.2. (cont'd.).

PROGRAM THSKMK

```

DO 130 NX1=1,23
DO 125 NX2=1,9
SIGACT(MX1,NX2)=0
125 CONTINUE
130 CONTINUE
COTED=0.0
COTCO=0.0
COTPO=0.0
COTLO=0.0
COTEX=0.0
IWWW=50
STKPS=50
TWKS2=50
TADJ=3
NGPV=2
ITRIKE=0
IHSTK=1
OVERHD=0.0
SALE=0.0
ISALE=0
ISTOP=0
IWEK=1

C READS VARIABLES FROM TAPE 14
2010 READ(14,2010) NC,NSLY,Z
      FORMAT(11,11,F3.1,I1)
      READ(14,2007) NITEMS,NQV,NTIMES,FLIP,LOP,ACT,ISPE
2007 FORMAT(11,11,I2,I1,F1,F4.2,I1)
      READ(14,2005) ((STKF(N)),N=1,10)
2005 FORMAT(10(F4.2))
      READ(14,2009) ((ICSP(N)),N=1,10),((ISPEC(N)),N=1,10)
2009 FORMAT(10I1,10I2)
2006 FORMAT(10(I1))
      READ(14,2006) ((NCSP(N)),N=1,10)
      READ(14,2008) ((ICHECK(N)),N=1,10)
2008 FORMAT(10I1)
      READ(14,2008) ((IMN(N)),N=1,10)
      READ(14,2019) ((IQC(N)),N=1,10)
2019 FORMAT(10I2)
      READ(14,2009) ((IWKST(N)),N=1,9)
2009 FORMAT(9I2)
      READ(14,2009) ((IWK(N)),N=1,9)
      NITEM2=NITEMS+1

C
C ***** STARTS MAIN PROGRAM *****
C
1 CONTINUE
WRITE(61,1005)
1005 FORMAT(*1,*WHICH TYPE OF SIMULATION WOULD YOU LIKE TO TRY? INPUT
C = 1 FOR EXERCISE, INPUT = 2 FOR A GUIDED SIMULATION, OR INPUT =
C 3 FOR A RANDOM SIMULATION.*)
202 READ(60,2002) CD
      ITYPE=CD
C ITYPE IS THE TYPE OF SIMULATION YOU WOULD LIKE TO RUN
2000 FORMAT(I1)
210 ITST=CD-2
C ITST IS ITYPE REDUCED FOR 220 IF STATEMENT -1,0,1
220 IF(ITST)230,370,650
C THIS IS THE EXERCISE PORTION
230 WRITE(61,1001)
1001 FORMAT(*1,*WHICH EXERCISE WOULD YOU LIKE TO ATTEMPT. INPUT THE N
C NUMBER OF THE EXERCISE. FOR 10 INPUT 10, FOR 1 INPUT 01. INPUT=*)
240 READ(60,2001) EX
C THIS IS THE NUMBER OF THE EX YOU WOULD LIKE TO ATTEM
2001 FORMAT(I2)
      SUBR=EX
C THE NUMBER OF THE EXERCISE IS THE SUBROUTINE
255 CONTINUE
CALL SET3
C THIS IS THE PRODUCTION EXERCISES
IF(SUBR.GT.12)GO TO 200
ITEM=1
C ITEM IS THE PART IN QUESTION
260 CALL CCALL
370 GO TO 300
200 CONTINUE
C THIS IS THE ITEM EXERCISE
ITEM=9

```

Table 4.2. (cont'd.).

PROGRAM THSKMK

```

C      ITEM 0 IS THE ACTUAL PRODUCTION SCHEDULE
280 CALL CCALL
300 CONTINUE
WRITE(61,1004)
1004 FORMAT(*=*,*IF YOU WOULD LIKE TO ATTEMPT THIS EXERCISE AGAIN INPUT
C THE NUMBER 1, OTHERWISE INPUT THE NUMBER 0*)
READ(60,2002)IDOA
IF(IDOA.EQ.1)GO TO 2
330 CONTINUE
340 WRITE(61,1002)
1002 FORMAT(*=*,*IF YOU WOULD LIKE TO ATTEMPT ANOTHER EXERCISE INPUT TH
C E NUMBER 1, OTHERWISE ENTER THE NUMBER 0.*)
350 READ(60,2002)ICHP
2002 FORMAT(I1)
360 IF(ICHP)999,999,2
C      THIS ENDS THE EXERCISE PORTION OF THE PROGRAM
C      THIS IS THE GUIDED SIMULATION SECTION
370 CALL SET3
CALL ROUTE
416 GO TO 999
650 CONTINUE
C      THIS IS THE RANDOM SIMULATION SECTION
CALL SET3
IF(IRF.NE.1)GO TO 902
C      THIS IS THE RANDOM SIMULATION TYPE A.
DO 901 NZT=1,NTIMES
DO 900 NZQ=1,NITEMS
CTRND=RND(1)
IF(NZQ.NE.1)GO TO 680
ITEM=9
CTRND=RND(1)
CTRND=CTRND*.90
IF(ISTOP.EQ.1)GO TO 999
IF(CCTRND.GT.CTRND)GO TO 670
SUBR=12
CALL CCALL
GO TO 680
670 CONTINUE
SUBR=INT(RND(1)*4)+13
CALL CCALL
680 CONTINUE
IF(ISTOP.EQ.1)GO TO 999
ITEM=NZQ
IF(CCTRND.GT.CTRND)GO TO 677
SUBR=12
688 CALL CCALL
GO TO 900
677 SUBR=INT(RND(1)*12)
400 CALL CCALL
C      ***** THIS ENDS THE SECTION YOU WOULD REMOVE *****
900 CONTINUE
901 CONTINUE
GO TO 999
902 CONTINUE
C      ***** REAL WORLD RANDOM SIMULATION *****
DO 904 NZT=1,NTIMES
DO 903 NZQ=1,NITEM2
ITEM=NZQ-1
IF(NZQ.EQ.1)ITEM=9
IZZ2=1
IF(ITEM.EQ.9)IZZ2=13
IZZ3=11
IF(ITEM.EQ.9)IZZ3=16
CTRND=RND(1)
DO 905 NUF=IZZ2,IZZ3
IF(CTRND.GE.UPLIM(NUF))GO TO 905
IF(CTRND.LT.WRLIM(NUF))GO TO 905
SIGACT(NUF,ITEM)=0
SUBR=NUF
CALL CCALL
IF(ISTOP.EQ.1)GO TO 999
GO TO 903
905 CONTINUE
SUBR=12
CALL CCALL
IF(ISTOP.EQ.1)GO TO 999
903 CONTINUE
904 CONTINUE
999 CONTINUE
END

```

Table 4.2. (cont'd.).

SUBROUTINE SET3

```

SUBROUTINE SET3
C
C      SET3      2-1
C      INTEGER CFCST,SCRIP,WK,SIG,STP
C      COMMON MRPC(5),SQ(9),MRPD(16),IONH(9),STKP(13),NIM0(9),ICSP(10),I
C      CSPEC(10),NCSP(10),CHECK(10),IQC(10),ICH(9),IWKST(9),IWF(9),TIMIN(
C      C9),SUBR,ISTOP,IWEEK,NQV,NTIMES,NITEM2,ITYPE,ITEM,FLIP,LOF,ACT,COTP
C      C1,COTE3,COTH4,COTL5,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TCOTPO(9
C      C),TCOTCO(9),TCOTED(9),TCOFMI(9),TCOTLO(9),TCOTEX(9),NCNSL,Z,Y,COT
C      CPO,COTCO,COTE6,COTLO,COTE6,NFLC,RRPD(9),SSPD(9),ICHQ2(2),IMJR(2),
C      CIO(SMP,PBP,XX),ADJ,CITM(9),OVERHD,ISALE,SALE,PURCH(9),IWK52,IWW52,
C      CIMION,IGRV(4),IGRV2(4),NGRV,ITRIKE,STKFC,STCST(4,2),IHSTK,IEX,IMN
C      C(10)
C
C      THIS IS SUBROUTINE SET 3
C      THIS SUBROUTINE SETS UP THE DATA FOR SIM MRP FOR ALL
C
C      IF(IEX.GT.1)GO TO 320
C      NFLL=1
C      NPLC=NPLC+1
C      DO 310 N=1,NPLC
C      NPLC=NPLC+10
C      310 CONTINUE
C      NPLC=NPLC-1
C      320 CONTINUE
C      NQV=1
C      NQ=0
C      READ(14,2C51)COTP1,COTL2,COTE3,COTH4,COTL5,COTE6
C      2051 FORMAT(6F4,2)
C      COTH4=COTH4/52
C
C      READS STOP
C      10 READ(14,2C50)STP
C      2050 FORMAT(A1C)
C      IF(ITYPE.EQ.1)GO TO 8
C      READS MARKETING FORECAST
C      READ(14,2C01)MFCST
C      2001 FORMAT(F7)
C      GO TO 9
C      * CONTINUE
C      READ(14,2900)MFCST
C      2900 FORMAT(7Y,17)
C      9 CONTINUE
C      DO 4 I9=1,NITEM2
C      NZ=I9
C      IF(NZ.EQ.NITEM2)NZ=9
C
C      READS PRODUCT AND PRODUCTION INFORMATION
C      READ(14,2C02)(MRPD(NZ2,NZ),N22=1,16)
C      2002 FORMAT(A1C,1X,I4,1X,I6,1X,A10,1X,A10,1X,I6,2X,I1,1X,
C      C I2,1X,I7,1X,I7,1X,I3,1X,I7,1X,I7,1X,I7)
C      4 CONTINUE
C      DO 30C I9=1,NITEM2
C      NZ=I9
C      IF(NZ.EQ.NITEM2)NZ=9
C
C      READS COST AND OVERHEAD INFORMATION
C      READ(14,2C04)CITM(NZ)
C      2004 FORMAT(F7,5)
C      300 CONTINUE
C
C      READS PRODUCTION RATE/ WEEK
C      WRITE(61,1000)
C      1000 FORMAT(*,*,* PLEASE INPUT YOUR REGULAR 40 HOUR WORK WEEK PRODUCTION
C      CN CAPACITY/CASES. 100000=100000 10000=10000 1000=1000000*)
C      READ(60,2003)MRPD(8,9)
C      2003 FORMAT(I6)
C      DO 5 II=1,NITEM2
C      IO=II
C
C      READS ON HAND INVENTORIES
C      IF(IO.EQ.NITEM2)IO=9
C      IONH(IO)=MRPD(15,IO)
C      5 CONTINUE
C      LQ=1
C      IF(ITYPE.EQ.1)LQ=NITEM2-1
C
C      STARTS MAJOR DO LOOP TO FILL IN SCHEDULE INFO
C
C      DO 460 N99=1,NITEM2,LQ
C      NT=0
C      IF(N99.GT.1)NT=N99-1
C      IF(ITYPE.EQ.1.AND.N99.EQ.NITEM2)NT=1
C      ITEM CALCULATED
C      100 DO 120 N=1,50

```

Table 4.2. (cont'd.).

SUBROUTINE SET3

```

      IF (NT.NE.9.AND.N.EQ.50) GO TO 123
      DO LOOP FOR FORECASTS
      C      IF (NT-9) 1 C5, 110, 500
      105 MRPC(1,N,NT)=MRPC(1,N,NT)+MRPC(2,N+MRPD(9,9),9)*MRPD(13,NT)
      MRPC(1,N,NT)=MRPC(1,N,NT)+MRPC(4,N+MRPD(9,9)-1,9)*MRPD(13,NT)
      GO TO 123
      110 MRPC(1,N,NT)=MFCST
      C      ONLY FOR PRODUCTION FORECAST
      120 CONTINUE
      130 CONTINUE
      IF (NT.NE.9) GO TO 180
      C      FOR SPECIAL FORECASTS
      140 READ(14,2 C00) WK, SCFCAST, SIG
      2000 FORMAT(12,I4,A1)
      150 IF (SIG.EQ.STP) GO TO 180
      160 MRPC(1,WK,NT)=SCFCAST*NPLL
      170 GO TO 130
      180 CONTINUE
      C      READS SCHEDULED RECEIPTS
      190 READ(14,2 C00) WK, SCRR, SIG
      200 IF (SIG.EQ.STP) GO TO 230
      210 MRPC(2,WK,NT)=SCRR*NPLL+MRPC(2,WK,NT)
      220 GO TO 180
      230 CONTINUE
      NQ=NQ+1
      240 MRPC(3,1,NT)=MRPC(2,IWEEK,NT)-MRPC(1,IWEEK,NT)+IONH(NT)
      C      ON HAND INV=SCHEDULED REC-REQ+ON HAND INVENTORY
      IF (MRPC(3,1,NT).GT.0) GO TO 250
      MRPC(2,1,NT)=MRPC(2,1,NT)+MRPD(8,NT)
      GO TO 240
      250 DO 265 NP=2,49
      260 MRPC(3,NP,NT)=MRPC(3,NP-1,NT)+MRPC(2,NP,NT)-MRPC(1,NP,NT)
      C      ON HAND INV=ON HAND INV+SCHEDULED REC-REQUIRED
      265 CONTINUE
      IF (NQ.EQ.2) GO TO 780
      DO 718 N=1,50
      718 MRPC(4,N,NT)=0
      CONTINUE
      270 CONTINUE
      METRA=0
      METRA=METRA+MRPC(2,1,NT)
      280 DO 800 NF=2,50
      METRA=METRA+MRPC(2,NF,NT)
      890 IF (MRPC(3,NF-1,NT)-(1+MRPD(10,NT)*.01)*MRPC(1,NF,NT)+METRA) 800,800
      C,850
      C      IF ON HAND INV -1.5 X REQUIRED + ADDED ORDERED
      800 IF (NF-MRPD(9,NT)) 810,810,830
      C      IF WEEK-LEAD TIME
      810 CONTINUE
      METRA=METRA+MRPD(8,NT)
      858 IF (NT.NE.9) GO TO 820
      825 CONTINUE
      MRPC(2,NF,NT)=MRPC(2,NF,NT)+MRPC(8,NT)
      GO TO 890
      820 CONTINUE
      IF (NF.EQ.1) GO TO 825
      MRPC(2,NF-1,NT)=MRPC(2,NF-1,NT)+MRPC(8,NT)
      C      SCH REC FOR WEEK NEEDED=ORDER Q+WEEKS SCHEDULED REC
      C      ADDED ORDER=ADDED ORDER+ORDER Q
      GO TO 890
      830 MRPC(4,NF-MRPD(9,NT),NT)=MRPD(8,NT)+MRPC(4,NF-MRPD(9,NT),NT)
      C      PLANNED ORDER=ORDER Q
      840 METRA=METRA+MRPD(8,NT)
      C      ADDED ORDER=ADDED ORDER + ORDER Q
      GO TO 890
      850 CONTINUE
      860 CONTINUE
      IF (NQ.EQ.1.AND.NT.EQ.9) GO TO 711
      IF (NQ.EQ.1) GO TO 830
      710 IF (NT.NE.9) GO TO 780
      C      THIS AREA TAKES CARE OF ODEPS DURING THE
      C      FROZEN PERIOD
      711 CONTINUE
      DO 740 N=2,6
      MRPC(2,N,9)=MRPC(2,N,9)+MRPC(4,N-1,9)
      IF (N.EQ.6) MRPC(2,7,9)=MRPC(4,6,9)+MRPC(2,7,9)
      IF (N.EQ.6) MRPC(4,N,9)=C

```

Table 4.2. (cont'd.).

SUBROUTINE SET3

```

      MRPC(4,N-1,9)=0
740  CONTINUE
      NZ7Z=NITEM2-1
      DO 730 N=1,NZ7Z
      LUCKY2=MRPD(9,N)+1
      DO 720 NZ=1,LUCKY2
715  IF(NZ.EQ.1) GO TO 716
      ISLOP=MRPD(13,N)*MRPC(2,NZ,9)*(1+MRPD(10,N)*.01)
      GO TO 717
716  ISLOP=MRPD(13,N)*(MRPC(4,NZ-1,9)+MRPC(2,NZ,9))*(1+MRPD(10,N)*.01)
717  IORD=INT(ISLOP/MRPD(8,N)+.9999999)
      IF(NZ.EQ.1) MRPC(2,NZ,4)=IORD*MRPD(9,N)+MRPC(2,NZ,N)
      IF(NZ.EQ.1) GO TO 720
      MRPC(2,NZ-1,N)=IORD*MRPD(8,N)+MRPC(2,NZ-1,N)
720  CONTINUE
730  CONTINUE
      GO TO 230
780  CONTINUE
      ITEM=NT
      IF(ITYPE.EQ.1.AND.ITEM.EQ.1)MRPC(2,1,ITEM)=MFCST
      CALL MRP
      NQ=0
460  CONTINUE
500  RETURN
      END

```

Table 4.2. (cont'd.).

SUBROUTINE ROUTE

```

      SUBROUTINE ROUTE
      C      ROUTE 2-2
      C      INTEGER COUNT(9), GCAL(50,2,9), SUBR, OLD, WK
      C      COMMON MRFC(5,50,9), MRPD(10,5,9), IONH(9), STKP(10), NUMB(9), ICSP(10), T
      C      CSPEC(10), NCSP(10), ICHCK(10), IGC(10), ICH(9), IWKST(9), IWK(9), TIMIN(
      C      CS) SUBR, ISTOP, IWEK, NV, NTIMES, NITE=2, ITYPE, ITEM, FLIP, LOP, ACT, COTP
      C      C1, COTES, COTM4, COTLS, COTEX, ISPE, COTL2, NINE(9), SIGACT(23,9), TOCTPD(9
      C      C), TCOTCO(9), TCOTEN(9), TCOTHI(5), TCOTLO(9), TCOTEX(9), NC, NSL, ZY, COT
      C      CPO, COTCO, COTEO, COTLO, COTE6, NPLC, RRPD(9), SSPD(9), ICHQ2(2), ICHJR(2),
      C      CIOCSMP, PBP, XX, IADJ, CITH(9), OVERHD, ISALE, SALE, PURCH(9), IWKST, IWWW, I
      C      CUNION, IGRV1(4), IGRV2(4), NGRV, ITBIKE, STKFO, STCST(4,2), IMSTK, IEX, IMN
      C      C(12)
      C      DATA COUNT/9*0/, GCAL/900*0/
      C      THIS SUBROUTINE ROUTES THE PEAD IN STEPS TO FOLLOW
      C 100 OLD=0
      C      ITEM NAME RESET
      C 110 DO 200 N=1,1000
      C      READING WEEK, SUBROUTINE TO CALL, ITEM
      C 120 READ(70,200)WK, SUBR, ITEM
      C 2000 FORMAT(I2, I2, I2)
      C 130 IF (ITEM.EQ.OLD) GO TO 140
      C 140 OLD=ITEM
      C      IF (OLD=1) 150, 210, 210
      C 150 COUNT(ITEM)=1
      C 160 CONTINUE
      C 170 GCAL(COUNT(ITEM),1,ITEM)=WK
      C      GCAL SUBROUTINE WEEK TO CHANGE
      C 180 GCAL(COUNT(ITEM),2,ITEM)=SUBR
      C      GCAL SUBROUTINE TO CALL
      C 190 COUNT(ITEM)=COUNT(ITEM)+1
      C      COUNT OF NUMBER OF CHANGES
      C 200 CONTINUE
      C 210 CONTINUE
      C      DO 300 N=1,9
      C      COUNT(N)=COUNT(N)-1
      C 300 CONTINUE
      C      DO 275 NV=1,50
      C      DO 270 IZZZ=1, NITEM2
      C      IF (ISTOP.EQ.1) 60 TO 276
      C      ITEM=IZZZ-1
      C      IF (IZZZ.EQ.1) ITEM=9
      C      ITEM=ITEM
      C      LFNT=COUNT(ITEM)
      C 220 DO 260 NV=1, LFNT
      C      IF (NV.EQ. COUNT(ITEM).AND. GCAL(NV,1,ITEM).NE. IWEK) 60 TO 265
      C      TOP OUT WK WEEK
      C 230 IF (GCAL(NV,1,ITEM).NE. IWEK) 60 TO 260
      C      SUBR=GCAL(NV,2,ITEM)
      C 240 CALL CCALL
      C 250 GO TO 270
      C 265 SUBR=12
      C      SUBROUTINE 12 IS THE OK SUBROUTINE
      C 268 CALL CCALL
      C      GO TO 270
      C 260 CONTINUE
      C 270 CONTINUE
      C 275 CONTINUE
      C 276 CONTINUE
      C 280 RETURN
      C      END

```

Table 4.2. (cont'd.).

SUBROUTINE CCALL

```

C      SUBROUTINE CCALL      2-3
      INTEGER SUBR
      COMMON MRFC(15,50,9),MRPD(16,9),IDNH(9),STKP(10),NUMO(9),ICSP(10),I
C SPEC(10),NCSP(10),CHECK(10),IQC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
C 9),SUBR,ISTOP,IWEEK,NQV,NTIMES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
C 1),COTE3,COTM4,COTL5,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TCCTPO(9
C 1),TCOTCG(9),TCOTED(9),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,2,Y,CCT
C 0,COTCO,COTEJ,COTLO,COTE6,NPLC,RRPD(9),SSPD(9),ICHQ2(2),IMJR(2),
C 10,CMSMP,PBP,XX,IADJ,CITM(9),OVERPD,ISALE,SALE,PURCH(9),IWK$3,IWWW,I
C UNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKP,STCST(4,2),IHSTK,TEX,IMN
C (10)
      THIS SUBROUTINE IS DESIGNED TO CALL ALL THE SITUATIONS
      IF(SUBR.EQ.12)GO TO 18C
      IF(SUBR.GT.11)GO TO 500
      PRODUCTION EXERCISES
      LEF=SUBR+10
      DO 170 NN=SUBR,LEF
      NZ=NN
      IF(NZ.LT.12)GO TO 150
      NZ=NZ-11
      CONTINUE
      IF(MRPC(2,IWEEK,ITEM).EQ.0.AND.NZ.EQ.2)GO TO 170
      IF(MRPC(2,IWEEK,ITEM).EQ.0.AND.NZ.EQ.3)GO TO 170
      IF(MRPC(2,IWEEK,ITEM).EQ.0.AND.NZ.EQ.4)GO TO 170
      IF(MRPC(2,IWEEK,ITEM).EQ.0.AND.NZ.EQ.6)GO TO 170
      IF(MRPC(2,IWEEK,ITEM).EQ.0.AND.NZ.EQ.7)GO TO 170
      IF(SIGACT(NZ,ITEM).999,100,170
      GO TO(230,220,240,260,280,300,320,340,360,380,400)NZ
      160 CONTINUE
      170 CALL OK
      180 GO TO 640
      200 CALL SPEC
      SIGACT(NZ,ITEM)=1
      GO TO 640
      210 CALL TRUCK
      SIGACT(NZ,ITEM)=1
      GO TO 640
      230 CALL VENQC
      SIGACT(NZ,ITEM)=1
      GO TO 640
      250 CALL WRONGO
      SIGACT(NZ,ITEM)=1
      GO TO 640
      270 CALL VENS TK
      SIGACT(NZ,ITEM)=1
      GO TO 640
      290 CALL VENL IE
      SIGACT(NZ,ITEM)=1
      GO TO 640
      310 CALL WRGSH P
      SIGACT(NZ,ITEM)=1
      GO TO 640
      330 CALL GOVREG
      SIGACT(NZ,ITEM)=1
      GO TO 640
      350 CALL PHVIN V
      SIGACT(NZ,ITEM)=1
      GO TO 640
      370 CALL FPKL FT
      SIGACT(NZ,ITEM)=1
      GO TO 640
      390 CALL FIRE
      SIGACT(NZ,ITEM)=1
      GO TO 640
      410 CONTINUE
      500
C      THESE ARE LINE OPERATIONS
      LEQ=SUBR+3
      DO 570 NN=SUBR,LEQ
      NZ=NN
      IF(NZ.LT.17)GO TO 545
      NZ=NZ-4
      NV=1
      GO TO 550
      545 NV=NN-12
      550 CONTINUE
      IF(MRPC(2,IWEEK,ITEM).EQ.0.AND.NZ.EQ.13)GO TO 570

```

Table 4.2. (cont'd.).

SUBROUTINE CCALL

```

      IF(MRPC(2,IWEEK,ITEM).EQ.0.AND.NZ.EQ.15)GO TO 570
      IF(SIGACT(NZ,ITEM))999,560,570
560  IF(ITYPE.EQ.1)GO TO 565
      IF(NZ.EQ.15.AND.SIGACT(13,ITEM).EQ.0)GO TO 570
565  GO TO(590,610,630,660)NV
570  CONTINUE
580  GO TO 180
590  CALL LINDWN
      IF(SIGACT(15,ITEM).EQ.1)SIGACT(NZ,ITEM)=1
600  GO TO 640
610  CALL YRSTK
      SIGACT(NZ,ITEM)=1
620  GO TO 640
630  CALL LINECC
      SIGACT(NZ,ITEM)=1
635  GO TO 640
640  CALL EXTPA
640  CONTINUE
999  CONTINUE
      RETURN
      END

```

Table 4.2. (cont'd.).

SUBROUTINE MRP

```

C      SUBROUTINE MRP
C      MRP      2-4
C      INTEGER GRV(4), FLIP, RRPD(9), SSPB(9), RT
C      DIMENSION SEQA(8), SEQB(8), MRPC(5,50,9)
C      COMMON MRPC(5,50,9), MRPD(16,9), IONH(9), STKP(10), NIIMQ(9), ICSP(10), I
C      CSPEC(10), NCSP(10), ICHCK(10), IAC(10), ICH(9), IWKST(9), IWK(9), TIMIN(
C      C9), SUBR, ISTOP, IWEK, NGV, NTIMES, NITEM, ITYPE, ITEM, FLIP, LOP, ACT, COTP
C      C1, COTEX, COTM4, COTL5, COTEX, I SPE, COTL2, NINE(9), SIGACT(23,9), TOCIPC(9
C      C), TCOTCO(9), TCOTEQ(9), TCOTHI(9), COTLO(9), TCOTEX(9), NC, NSL, Z, Y, COT
C      CPO, COTCO, COTED, COTLO, COTED, NPLC, RRPD(9), SSPD(9), ICHIQ2(2), IMJR(2),
C      CIPC, SMP, PBF, XX, IADJ, CITM(9), OVERHD, ISALE, SALE, PURCH(9), IWK52, IWWW, I
C      CUNION, IGRV1(4), IGRV2(4), NGRV, ITPIKE, STKPS, STCST(4,2), IHSTK, IEX, IAN
C      C(10)
C      THIS IS SUB MRP
C      C
C      C      ***** STARTS STRIKE BY YOUR WORKERS *****
C      IF(IWWW.EQ.IWEK.AND.IHSTK.EQ.3)MRPD(16,9)=MRPD(16,9)+MRPD(8,9)
C      IF(IWWW+1.EQ.IWEK.AND.IHSTK.EQ.3)MRPD(16,9)=MRPD(16,9)+MRPD(8,9)
C      IF(IHSTK.EQ.2.AND.ITPIKE.EQ.1.AND.IUNION.EQ.2.AND.IWEK.EQ.IWK52+1
C      C)GO TO 62
C      IF(IWK52.NE.IWEK.OR.IHSTK.EQ.1.OR.ITEM.NE.9)GO TO 99
C      HVSTK=RND(7)
C      IF(HVSTK.GT.STKF9)GO TO 98
C      WRITE(61,1112)
C      1112 FORMAT(*,*,*YOUR WORKERS HAVE DECIDED TO GO ON STRIKE*)
C      ITPIKE=1
C      GO TO (99,60,70,80)IHSTK
C      60 CONTINUE
C      IF(IUNION.EQ.1)GO TO 65
C      WRITE(61,1111)
C      1101 FORMAT(*,*,*YOUR WORKERS WERE STUNDED THAT YOU HIRED SCABS TO HAND
C      CLE THEIR WORK LOAD. THEY WILL COME BACK TO WORK NEXT WEEK WITHOUT
C      CA SETTLEMENT. YOUR EXTRA CCSTS FOR HIRING THE SCABS WAS $200.00.*
C      C)
C      COTEX=COTEX+200.00
C      GO TO 99
C      62 CONTINUE
C      WRITE(61,1112)
C      1102 FORMAT(*,*,*AFTER LAST WEEKS INCIDENT CONCERNING YOUR WORKERS STRI
C      CKE YOU HAVE BEEN INFORMED THAT THE WORKERS HAVE PETITIONED FOR A U
C      CNION. THEY WILL BECOME UNIONIZED IN 2 WEEKS. THIS ACTION WILL CO
C      CST YOUR COMPANY $1000.00.*)
C      COTEX=COTEX+1000.00
C      IUNION=1
C      GO TO 99
C      65 CONTINUE
C      WRITE(61,1113)
C      1103 FORMAT(*,*,*YOUR WORKERS HAVE VIOLENTLY OPPOSED THE SCABS THAT YOU
C      C HIRED FOR THE STRIKE. ENTRANCE INTO YOUR PLANT BY THE SCABS IS A
C      CLMOST IMPOSSIBLE! THE END RESULT OF THIS IS THAT YOU WILL LOOSE O
C      CNE WEEK OF PRODUCTION. FRANTIC BARGAINING ON YOUR PART WILL LEAD T
C      CO A SETTLEMENT WITHIN THE WEEK. THIS SETTLEMENT WILL COST YOUR CO
C      MPANY $2000.00!*)
C      COTEX=COTEX+2000.00
C      MRPC(2,IWEK,9)=0
C      GO TO 99
C      70 CONTINUE
C      MRPD(16,9)=MRPD(16,9)-2*MRPD(8,9)
C      IONH(9)=IONH(9)+2*MRPD(8,9)
C      80 CONTINUE
C      MRPC(2,IWEK,9)=3
C      MRPC(2,IWEK+1,9)=0
C      85 CONTINUE
C      WRITE(61,1113)
C      1113 FORMAT(*,*,*THE STRIKE WILL LAST FOR TWO WEEKS. TO SETTLE THE STR
C      CKE IT WILL END UP COSTING YOUR COMPANY $1000.00!*)
C      COTEX=COTEX+1000.00
C      GO TO 99
C      9* CONTINUE
C      WRITE(61,1111)
C      1111 FORMAT(*,*,*THERE WILL BE NO STRIKE BY YOUR EMPLOYEES IN THE NEXT
C      CTWO WEEKS!*)
C      99 CONTINUE
C      C
C      C      ***** THIS ENDS STRIKE BY YOUR WORKERS *****
C      C      ***** READS IN HEADINGS *****

```

Table 4.2. (cont'd.).

SUBROUTINE MRP

```

METRA=0
IF(NQV.NE.1)GO TO 509
IF(IEV.GT.1)GO TO 500
READ(70,2000)(SEQA(NLV),NLV=1,4)
READ(70,2000)(SEQB(NLV),NLV=5,8)
2000 FORMAT(4A7)
READ(70,2001)(SEQB(NLV),NLV=1,4)
READ(70,2001)(SEQB(NLV),NLV=5,8)
2001 FORMAT(4A4)
GRV(1)=1
GRV(2)=10
GRV(3)=100
GRV(4)=1000
SSSPC=1
DO 600 NCK14=1,NPLC
SSSPC=SSSPC+.1
600 CONTINUE
NPLC=NPLC+1
509 CONTINUE
NTT=ITEM
NSHT=NITEM2-1
RT=MRPC(1,IWEEK,ITEM)
IF(NQV.LE.2.AND.ITYPE.EQ.1)GO TO 100
IF(NQV.LE.NITEM2.AND.ITYPE.NE.1)GO TO 100
C
C ***** STARTS STRIKE BY VENDORS WOPKERS *****
C
IF(IWKST(ITEM)+0.EQ.IWEEK.AND.ICH(ITEM).EQ.3)RRPD(ITEM)=MRPD(12,IT
CEM)
IF(IWKST(ITEM)+0.EQ.IWEEK.AND.ICH(ITEM).EQ.2)GO TO 518
514 IF(IWKST(ITEM).EQ.IWEEK.AND.ICH(ITEM).EQ.1)GO TO 532
C THIS IS THE EXTRA ORDER
IF(IWK(ITEM).NE.IWEEK)GO TO 516
MRPD(12,ITEM)=NUM6(ITEM)*MRPD(8,ITEM)
COTPO=COTPO+COTP1*MRPD(12,ITEM)+CITM(ITEM)
530 GO TO 540
532 CONTINUE
SSPD(ITEM)=MRPC(2,IWEEK,ITEM)+MRPC(2,IWEEK+1,ITEM)
538 GO TO 518
540 CONTINUE
516 IF(IWKST(ITEM).NE.IWEEK)GO TO 541
518 STK=RND(1)
IF(ITYPE.NE.1)GO TO 520
IF(STK.GT.STKP(10))GO TO 528
GO TO 524
520 IF(STK.GT.STKP(ITEM))GO TO 528
C IF(STK.GT.STKP(ITEM))STRIKE DECISION
524 IF(ICH(ITEM).EQ.2)GO TO 526
WRITE(61,1017)
1017 FORMAT(*,*,*YOUR VENDOR IS HAVING A STRIKE BUT YOU WILL NOT BE EFF
CCTED!*)
GO TO 541
526 MRPC(2,IWEEK+0,ITEM)=0
MRPC(2,IWEEK+1,ITEM)=0
WRITE(61,1114)MRPD(1,ITEM)
1114 FORMAT(*-*,*YOUR VENDOR OF *,A10,* IS EXPERIENCING THE STRIKE HE W
CARNED YOU ABOUT 8 WEEKS AGO. NONE OF THE PARTS YOU ORDERED WILL B
CE COMING IN AT ALL.*)
IF(ICH(ITEM).EQ.3)ICNH(ITEM)=ICNH(ITEM)+MRPD(12,ITEM)
IF(ICH(ITEM).EQ.3)MRPD(12,ITEM)=0
GO TO 541
528 CONTINUE
WRITE(61,1013)MRPD(1,ITEM)
1013 FORMAT(*,*,*THERE WILL BE NO STRIKE FOR THIS WEEK. ALL ORDERS FOR
C *,A10,* WILL ARRIVE AS SCHEDULED.*)
541 CONTINUE
C ***** ENDS STRIKE BY VENDOR'S WORKERS *****
C ***** CHANGE IN SCHED PRODUCTION *****
13 IF(ITYPE.LT.2)GO TO 34
IF(ITEM.NE.9)GO TO 34
12 FLIP=FLIP-1
14 LOP=LOP-1
16 FLOF=IABS(FLIP)
18 PLOP=IABS(LOP)
20 IF(FLOP)34,22,34
22 IF(PLOP)34,24,28
24 CONTINUE

```

Table 4.2. (cont'd.).

SUBROUTINE MRP

```

      MRPC(2,IWEEK+7,ITEM)=MRPC(2,IWEEK+7,ITEM)*1.1
      DO 26 ITM=1,NSHT
      MRPC(1,IWEEK+7-MRPD(9,9),ITM)=MRPC(1,IWEEK+7-MRPD(9,9),ITM)+.1*M
      CRPC(1,IWEEK+7,ITEM)*MRPD(13,ITM)
26    CONTINUE
      GO TO 32
28    CONTINUE
      MRPC(2,IWEEK+7,ITEM)=MRPC(2,IWEEK+7,ITEM)*.9
      DO 29 ITM=1,NSHT
      MRPC(1,IWEEK+7-MRPD(9,9),ITM)=MRPC(1,IWEEK+7-MRPD(9,9),ITM)-.1*M
      CRPC(1,IWEEK+7,ITEM)*MRPD(13,ITM)
29    CONTINUE
30    CONTINUE
32    IF (FLIP.EQ.0) FLIP=3
34    CONTINUE
      IF (ITEM.EQ.9) GO TO 790
      ***** CALCULATES ACTUAL USAGE + SCRAP *****
C 752 IF (ITYPE.EQ.1) GO TO 790
      IF (ITYPE.GT.2) GO TO 770
      756 ACT=ACT+.C5
      GO TO 770
      770 ACT=RND(1)*.2
      775 CONTINUE
      NTT=ITEM
      788 RT=(1+ACT)*MRPC(1,IWEEK,ITEM)
      790 IONH(NTT)=IONH(NTT)-RT+MRPC(2,IWEEK,ITEM)+MRPC(5,IWEEK,ITEM)
      WRITE(61,1019)MRPD(1,ITEM),RT
1019  FORMAT(*-*,*YOUR ACTUAL REQ OF *,A10,* INCLUDING SCRAP EQUALED *,I
      C7)
      IF (ITEM.NE.9) GO TO 791
      OVERHD=CYERHD+RT*CITM(9)
      TBLNK=RT/MPRD(8,9)
      PURCH(9)=PURCH(9)+IBLNK*2000.00
      ISALE=ISALE+RT
      ***** CALCULATES VALUE OF LOST ORDERS *****
C 791 CONTINUE
      IF (ITEM.NE.9) PURCH(ITEM)=(MRPC(2,IWEEK,ITEM)+MRPC(5,IWEEK,ITEM))*C
      CITM(ITEM)+PURCH(ITEM)
      400 CHK=IONH(ITEM)+MRPC(2,IWEEK,ITEM)+MRPC(5,IWEEK,ITEM)-RT
      410 CH2=CHK+MRPD(11,ITEM)
      420 IF (CHK.GT.0) GO TO 490
      430 IF (CH2.LT.0) GO TO 470
      440 MRPD(11,ITEM)=MRPD(11,ITEM)+CHK
      460 GO TO 490
      470 CONTINUE
      475 COTLO=COTLO+COTLS*MRPC(1,IWEEK,ITEM)*CITP(ITEM)
      485 MRPD(11,ITEM)=0
      490 CONTINUE
      450 MRPC(1,IWEEK,ITEM)=0
      MRPC(2,IWEEK,ITEM)=MRPC(5,IWEEK,ITEM)=0
      798 CONTINUE
      794 IF (ACT.EQ.0) ACT=.15
      MRPC(3,IWEEK,NTT)=IONH(NTT)
      795 CONTINUE
      NT=ITEM
      NF=IWEEK
      ***** RECALCULATES ON HAND BALANCES *****
C      NF=IWEEK
      NA2=NF+25
      DO 891 NZB=NF,NA2
      MRPC(3,NZB,NT)=MRPC(2,NZB,NT)+IONH(NT)+MRPC(5,NZB,NT)-MRPC(1,NZB,N
      CT)
      IF (NZB.EQ.IWEEK) STV=IONH(NT)
      IONH(NT)=MRPC(3,NZB,NT)
      891 CONTINUE
      IONH(NT)=STV
      796 CONTINUE
      DO 998 N=1,50
      MRPC(4,N,ITEM)=0
      998 CONTINUE
      NF=NF+1
      NA2=NF+25
      LEX0=0
      ***** PLANS FUTURE ORDERS *****
C      DO 860 NA=NF,NA2
      890 IF (MRPC(3,NA-1,NT)-(1+MRPD(10,NT)*.01)*MRPC(1,NA,NT)+METRA+MRPC(5,
      CNA,NT)+MRPC(2,NA,NT)) 800,800,860

```

Table 4.2. (cont'd.).

SUBROUTINE MRP

```

830 IF((NA-MRPD(9,NT))-GE,IWEEK)60 TO 830
    IF(LEXO.EQ.1)60 TO 811
810 WRITE(61,1015)
1015 FORMAT(*,*,*IF YOUR SAFETY STOCK CANNOT HANDLE THE COMING ORDER, Y
    COW BETTER EXPEDITE AN ORDER VERY QUICKLY OR YOU WILL STOCK OUT!*)
    LEXO=1
811 MRPC(4,IWEEK,NT)=MRPC(4,IWEEK,NT)+MRPD(8,NT)
    METRA=METRA+MRPD(8,NT)
    GO TO 890
830 MRPC(4,NA-MRPD(9,NT),NT)=MRPD(8,NT)+MRPC(4,NA-MRPD(9,NT),NT)
840 METRA=METRA+MRPD(8,NT)
    GO TO 890
860 CONTINUE
    METRA=0

        ***** STARTS WRITING SCHEDULE *****
        ***** PRINTS PRODUCT INFORMATION *****
1000 WRITE(61,1002)
    WRITE(61,1003)MRPD(1,ITEM)
1000 FORMAT(*,*,11X,5HITEM=A10)
210 WRITE(61,1001)MRPD(2,ITEM),MRPD(3,ITEM)
1001 FORMAT(*,*,11X,5HPART=,I4,21X,19H5SPECIFICATION DATE=,I6)
220 WRITE(61,1002)
1002 FORMAT(*,*,*)
230 WRITE(61,1003)MRPD(4,ITEM),MRPD(8,ITEM),MRPD(10,ITEM)
1003 FORMAT(*,*,12X,9HVEENDORS=,A10,6X,8HORDER Q=,I6,* K*,5X,12HSCRAF F
    CACT=,I2,* PERCENT*)
240 WRITE(61,1004)MRPD(5,ITEM)
1004 FORMAT(*,*,10X,A10)
250 WRITE(61,1005)MRPD(6,ITEM),MRPD(9,ITEM),MRPD(11,ITEM)
1005 FORMAT(*,*,10X,A10,6X,9HLEAD TM=,I2,1X,* WEEKS*,2X,12HSAFETY STK=
    C,I7)
260 WRITE(61,1006)MRPD(7,ITEM),MRPD(13,ITEM)
1006 FORMAT(*,*,10X,A10,25X,12HQ REQ/UNIT=,I7)
    WRITE(61,1014)MRPD(12,ITEM),IWKST(ITEM)
1014 FORMAT(*,*,*YOUR STOCKPILE OF *,I7,* WILL BE AVAILABLE IN WEEK *,I
    C2,*,*)
    WRITE(61,1088)MRPD(16,ITEM),IWKS2
1088 FORMAT(*,*,*YOUR SECOND STOCKPILE OF *,I7,* WILL BE AVAILABLE IN W
    CEEK *,I2,*,*)
270 WRITE(61,1002)
275 NE=IWEEK
    LAC=IWEEK+11
    NOM=IONH(ITEM)

        ***** CALCULATES NEG BALANCE *****
    NAC=0
    DO 390 NAB=IWEEK,LAC
    NAC=NAC+1
    CK=NOM+MRPC(2,NAB,ITEM)+MRPC(5,NAB,ITEM)-MRPC(1,NAB,ITEM)
    NOM=CK
    IF(CK)391,391,390
390 CONTINUE
391 CONTINUE

        ***** PUTS MRPC(X,Y,Z) INTO 4 DIGET NUMBER *****
        ***** PUTS 4 DIGET NUMBER INTO MPMP(X,Y,Z) *****
    DO 510 NCK12=1,5
    DO 512 NCK13=1,20
    MPMP(NCK12,NCK13,ITEM)=MRPC(NCK12,NCK13,ITEM)*SSSPC
512 CONTINUE
510 CONTINUE
    METRA=0

        ***** PRINTS NEG INDICATOR *****
    IF(NAC.GT.12)60 TO 280
    NAC=NAC+5
    WRITE(61,1020)NAC+1
1020 FORMAT(*,*,T=,9X,1H*,*NEG*)
        ***** PRINTS FIRST HALF OF SCHEDULE *****
280 WRITE(61,1007)GRV(NPLC),((NE+NS),NS=1,11)
1007 FORMAT(*,*,2X,1H(,I4,1H),8H**CURR*,I2,3H *,I2,3H *,I2,3H *,I2,
    C3H *,I2,4H **,5(I2,3H *),I2,2H *)
285 WRITE(61,1009)
    ISEL=IWEEK+11
    L=1
    NF=L
    IF(ITEM.EQ.9)IQ=NF+4
    IF(ITEM.EQ.9)L=I2

```

Table 4.2. (cont'd.).

SUBROUTINE MRP

```

1008 WRITE(61,1008) SEQA(L), ((MMPC(1,ND,ITEM)),ND=IWEEL,ISELL)
      FORMAT(*,*,1X,A7,2H**,6(I4,1H*),1H*,6(I4,1H*))
      WRITE(61,1009)
      L=2
      NF=L
      IF(ITEM.EQ.9) IQ=NF+4
      IF(ITEM.EQ.9) L=IQ
      WRITE(61,1008) SEQA(L), ((MMPC(2,ND,ITEM)+MMPC(5,ND,ITEM)),ND=IWEEL,
C ISELL)
      WRITE(61,1009)
      L=3
      NF=L
      IF(ITEM.EQ.5) IQ=NF+4
      IF(ITEM.EQ.9) L=IQ
      WRITE(61,1008) SEQA(L), (IABS((MMPC(3,ND,ITEM))),ND=IWEEL,ISELL)
      WRITE(61,1009)
      NE=4
      IQ=NE
      NF=NE
      IF(ITEM.EQ.9) IQ=NF+4
      WRITE(61,1008) SEQA(IQ), (MMPC(NE,ND,ITEM),ND=IWEEL,ISELL)
      WRITE(61,1009)
      1009 FORMAT(*,*,70(1H*))
      305 CONTINUE
      310 WRITE(61,1010)
      1010 FORMAT(*,*,8X,2H**,8X,*FROZEN PERIOD*,8X,2H**)
      320 WRITE(61,1011)
      1011 FORMAT(*,*,8X,33(1H*))
      330 WRITE(61,1002)
C ***** PRINTS SECOND HALF OF SCHEDULE *****
      340 WRITE(61,1012) ((IWEEL+NE),NE=12,24)
      1012 FORMAT(*0*,5X,1H*,13(1X,I2,1X,1H*))
      350 WRITE(61,1009)
      ISELL=ISELL+1
      ISELLS=ISELL+12
      NF=1
      IQ=NF
      IF(ITEM.EQ.9) IQ=NF+4
      360 WRITE(61,1033) SEQA(IQ), (MMPC(NF,ND,ITEM),ND=ISELL,ISELLS)
      1033 FORMAT(*,*,1X,A4,1H*,13(I4,1H*))
      370 WRITE(61,1009)
      NF=2
      IQ=NF
      IF(ITEM.EQ.9) IQ=NF+4
      WRITE(61,1033) SEQA(IQ), ((MMPC(NF,ND,ITEM)+MMPC(5,ND,ITEM)),ND=ISEL
C ISELLS)
      WRITE(61,1009)
      NF=3
      IQ=NF
      IF(ITEM.EQ.9) IQ=NF+4
      WRITE(61,1033) SEQA(IQ), (IABS(MMPC(NF,ND,ITEM))),ND=ISELL,ISELLS)
      WRITE(61,1009)
      NF=4
      IQ=NF
      IF(ITEM.EQ.9) IQ=NF+4
      WRITE(61,1033) SEQA(IQ), (MMPC(NF,ND,ITEM),ND=ISELL,ISELLS)
      WRITE(61,1009)
      WRITE(61,1002)
      1200 FORMAT(*,*,1H*,*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME P
C OSITIVE LATER.*)
      WRITE(61,1002)
C ***** ENDS SCHEDULE PRINT OUT *****
      380 CONTINUE
      NQV=NQV+1
      IF(ITYPE.EQ.1.AND.NQV.EQ.4) GO TO 381
      NTTTT=NTTTT+1
      IF(NQV=NTTTT) 382,382,381
      381 CONTINUE
      CALL MRP2
      999 CONTINUE
      IF(ITEM.NE.NTTTT-2) GO TO 385
      DO 384 NZ=1,N
      DO 383 N=IWEEL,49
      MRP(1,N,NZ)=MRP(4,N,9)*MRPD(13,NZ)+MRP(2,N+1,9)*MRPD(13,NZ)
      383 CONTINUE
      384 CONTINUE
      IWEEL=IWEEL+1
      385 CONTINUE
      IF(IWEEL.GT.IYKS2+6) SIGACT(14,9)=0
      392 CONTINUE
      RETURN
      END

```

Table 4.2. (cont'd.).

SUBROUTINE MRP2

```

C      SUBROUTINE MRP2
C      MRP2      2-5
      INTEGER EXP
      COMMON MRFC(5,50,9),MRPD(16,9),IONH(9),STKP(10),NUMQ(9),ICSP(10),I
      CSPEC(10),NCSP(10),ICHECK(10),IDC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
      C),SUBR,ISTOP,IWEEK,NBY,NTIMES,NITEM,ITYPE,ITEM,FLIP,LOP,ACT,COTP
      C),COTES,COTM4,COTL5,COTEX,ISPE,COTL2,NINE(9),SIGACT(25,9),TOCTPO(9
      C),TCOTCO(9),TCOTED(9),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
      C),COTCO,COTEO,COTLO,COTE6,NPLC,RRPD(9),SSPD(9),ICHQ2(2),IMJR(2),
      C),CQCSMP,PBF,XX,IADJ,CITM(9),OVERHD,SALE,SALEPURCH(9),IWK52,IWWW,I
      C),UNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKFO,STCST(4,2),IHSTK,IEX,IMN
      C(10)

C      THIS IS MRP2 CONTINUED PART OF MRP
      IDO=ITEM
      IF(IDO.NE.9)GO TO R01
      DO 800 N=2,7
      LUCK=IWKST+N
      MRPC(2,LUCK,9)=MRPC(2,LUCK,9)+MRPC(4,LUCK-1,9)
      MRPC(4,LUCK-1,9)=0
      800 CONTINUE
      801 CONTINUE
      100 WRITE(6,1001)
      1001 FORMAT(*,*,*WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS
      C INPUT YES OR NO.*)
      110 READ(60,2001)IRES
      2001 FORMAT(A2)
      120 IF(IRES.EQ.2HNO)GO TO 210
      130 WRITE(6,1002)
      1002 FORMAT(*,*,*HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=01.
      C INPUT=*)
      140 READ(60,2002)NU
      2002 FORMAT(I2)
      150 DO 200 NA=1,NU
      160 WRITE(6,1003)NA
      1003 FORMAT(*,*,*IN WHICH WEEK IS THE *,I2,* ORDER YOU WOULD LIKE TO RE
      CLEASE? 1=10 1=01 ?*)
      170 READ(60,2003)IDWK
      2003 FORMAT(I2)
      180 MRPC(2,IDWK+MRPD(9,IDO),IDO)=MRPC(4,IDWK,IDO)+MRPC(2,IDWK+MRPD(9,I
      C),IDO)
      COTPO=MRPC(4,IDWK,IDO)*COTP1+CITM(ITEM)+COTPO
      191 MRPC(4,IDWK,IDO)=0
      200 CONTINUE
      210 CONTINUE
      300 WRITE(6,1006)
      1006 FORMAT(*,*,*WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YE
      C S OR NO.*)
      310 READ(60,2006)IRES
      2006 FORMAT(A2)
      320 IF(IRES.EQ.2HNO)GO TO 460
      330 WRITE(6,1007)
      1007 FORMAT(*,*,*HOW MANY ORDERS WOULD YOU LIKE TO CANCEL? 10=10 1=01?*)
      C)
      340 READ(60,2007)NU
      2007 FORMAT(I2)
      350 DO 450 NA=1,NU
      360 WRITE(6,1008)NA
      1008 FORMAT(*,*,*IN WHICH WEEK DO YOU WISH TO CANCEL YOUR *,I2,* ORDER
      C? 10=10 1=01?*)
      370 READ(60,2003)IDWK
      COTCO=MRPC(2,IDWK,IDO)*COTL2+CITM(ITEM)+COTCO
      380 MRPC(2,IDWK,IDO)=0
      450 CONTINUE
      460 CONTINUE
      500 WRITE(6,1009)
      1009 FORMAT(*,*,*WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT
      C YES OR NO.*)
      510 READ(60,2006)IRES
      520 IF(IRES.EQ.2HNO)GO TO 730
      530 WRITE(6,1010)
      1010 FORMAT(*,*,*HOW MANY ORDERS WOULD YOU LIKE TO EXPEDITE 10=10 AND
      C 1=01?*)
      540 READ(60,2007)NU
      550 DO 720 NA=1,NU
      560 WRITE(6,1011)NA
      1011 FORMAT(*,*,*IN WHICH WEEK DO YOU WISH TO EXPEDITE YOUR *,I2,* ORD
      C ER? 10=10 1=01 ?*)

```

Table 4.2. (cont'd.).

SUBROUTINE MRP2

```

570 READ(60,2003)IDWK
    IOQN=(MRPC(2,IDWK,IDO)+MRPC(5,IDWK,IDO))/MRPD(8,IDO)
580 WRITE(61,1017)IOQN
1017 FORMAT(*,*,*YOU HAVE *,I2,* ORDER QUANTITIES SCHEDULED TO ARRIVE D
    CURING THIS TIME PERIOD. HOW MANY OF THESE WOULD YOU LIKE TO ADVAN
    CCE? INPUT IC=10 1=01.*)
    READ(60,2003)INQ
    IF(INQ.GT.IOQN)GO TO 590
    C THIS CALCULATES THE MAXIMUM AMOUNT OF WEEKS YOU CAN EXP
    680 NUM=INT(MRPD(9,IDO)*.50)
    190 WRITE(61,1012)NUM
1012 FORMAT(*,*,*THE MAXIMUM AMOUNT OF WEEKS YOU CAN EXPEDITE THE ORDER
    C IS *,I2,* WEEKS. HOW MANY WEEKS WOULD YOU LIKE TO ADVANCE THE RE
    CCEIVAL? INPUT A NUMBER BETWEEN 1-6.*)
    720 READ(60,2008)EXP
    LAN=IDWK-EXP
    IF(LAN.LT.IWEEK)GO TO 190
    IF(EXP.GT.NUM)GO TO 190
2038 FORMAT(I1)
    COTED=COTED+MRPD(8,IDO)*INQ+COTE3*EXP+CITM(ITEM)
    710 MRPC(5,IDWK-EXP,IDO)=MRPC(5,IDWK-EXP,IDO)+MRPD(8,IDO)*INQ
    L97=INQ-(MRPC(5,IDWK,IDO)/MRPD(8,IDO))
    IF(L97.GT.0)MRPC(2,IDWK,IDO)=MRPC(2,IDWK,IDO)-L97*MRPD(8,IDO)
    IF(L97.LT.0)L97=0
    MRPC(5,IDWK,IDO)=MRPC(5,IDWK,IDO)-MRPD(8,IDO)*(INQ-L97)
    IF(MRPC(5,IDWK,IDO).LE.0)MRPC(5,IDWK,IDO)=0
    720 CONTINUE
    730 CONTINUE
    750 CONTINUE
    WRITE(61,1015)MRPD(1,ITEM)
1015 FORMAT(*,*,*WOULD YOU LIKE TO REPLENISH ANY OF YOUR *,A10,* SAFETY
    C STOCK? INPUT YES OR NO.*)
    READ(60,2001)IRES
    IF(IRES.EQ.2HNO)GO TO 760
    WRITE(61,1016)MRPD(1,ITEM)
1016 FORMAT(*,*,*HOW MUCH OF YOUR *,A10,* STOCK WOULD YOU LIKE TO TRANS
    CFER? IE 10000 = ONE HUNDRED THOUSAND. 10000=010000.*)
    READ(60,2100)IRES
2100 FORMAT(I7)
    MRPD(11,ITEM)=MRPD(11,ITEM)+IRES
    IONH(ITEM)=IONH(ITEM)-IRES
    760 CONTINUE
    CALL EVAL
    RETURN
    END

```

Table 4.2. (cont'd.).

SUBROUTINE EVAL

```

      SUBROUTINE EVAL
      EVAL      2-6
      INTEGER RRPD(9),SSPD(9),ANS
      COMMON MRPD(5,50,9),MRPD(10,9),TONH(9),STKP(10),NUMO(9),ICSP(10),I
      CSPEC(10),NCSP(10),ICHECK(10),IC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
      C9),SUBR,ISTOP,IWEEK,NGV,NTIMES,NITEM2,ITYFE,ITEM,FLIP,LOP,ACT,COTP
      C1,COTE3,CCTH4,COTL5,COTEX,ISPE,COTL2,NINF(9),SIGACT(23,9),TCCTPC(9
      C),TCOTCO(9),TCOTEO(9),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
      CPO,CC+CN,COTEO,COTLO,COTE6,NFLC,RRPD(9),SSPD(9),TCH192(2),IMJR(2),I
      CIG,SMF,PRF,XX,IADJ,CITM(9),CVERFD,ISALE,SALE,PURCH(9),IWK52,IWWW,I
      CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIFE,STKPC,STCST(4,2),IHSTK,IEX,IMN
      C(10)
      DIMENSION COST1(9),COST2(9),TOTCT(9)
      C      THIS SUBROUTINE CALCULATES THE DOLLARS SPENT TO KEEP
      C      THE LINE SUPPLIED
      COTHI=0.0
      100 TCCTPO(ITEM)=TCCTFO(ITEM)+COTPO
      C      TOTAL COST TO PLACE ORDERS + THIS WEEKS ORDERS
      110 TCOTCO(ITEM)=TCOTCO(ITEM)+COTCO
      C      TOTAL COST TO CANCEL ORDER + THIS WEEKS CANCELATIONS
      120 TCOTEO(ITEM)=TCOTEO(ITEM)+COTEO
      C      TOTAL COST TO EXPEDITE ORDER + THIS WEEKS EXPEDITICNS
      130 COST1(ITEM)=TCCTPO(ITEM)+TCOTCO(ITEM)+TCOTEO(ITEM)
      C      COST1 IS THE COST FOR MANIPULATING ORDERS
      140 COTHI=IONH(ITEM)*COTH4+(MRPD(11,ITEM)+MRPD(12,ITEM))*COTH4+COTHI
      COTHI=COTHI+CITM(ITEM)
      IF(IWKST(ITEM)+0.EQ.IWEEK.AND.ICH(ITEM).EQ.3)COTHI=COTHI+CITM(ITEM
      C)*1.1*COTH4*RRPD(ITEM)
      IF(IWKST(ITEM)+0.EQ.IWEEK.AND.ICH(ITEM).EQ.1)COTHI=COTHI+CITM(ITEM
      C)*1.1*COTH4*SSPD(ITEM)
      140 TCOTHI(ITEM)=TCOTHI(ITEM)+COTHI
      C      TOTAL COST TO HOLD INVENTORIES + THIS MONTHS COST
      170 TCOTLO(ITEM)=TCOTLO(ITEM)+COTLO
      C      TOTAL COST LOST ORDERS=COST NEW
      180 TCOTEX(ITEM)=TCOTEX(ITEM)+COTEX
      C      TOTAL EXTRA COSTS + EXTRA COSTS
      190 COST2(ITEM)=TCOTLO(ITEM)+TCOTEX(ITEM)
      C
      200 TOTCT(ITEM)=COST1(ITEM)+COST2(ITEM)+TCOTHI(ITEM)
      COTPO=COTCO=COTEO=COTLO=COTEX=CCTHI=0
      205 IF(ITYFE.EQ.1)GO TO 260
      NSD=NITEM2-1
      IF(ITEM.NE.NSD)GO TO 400
      220 WRITE(61,1001)
      1001 FORMAT(+,-,*,DO YOU WANT TO CONTINUE THE SIMULATION FOR ANOTHER WEE
      CK, IF YES = INPUT YES, IF NO = INPUT NO*)
      230 READ(60,201)ANS
      2001 FORMAT(A2)
      240 IF(ANS.EQ.2HNO)GO TO 250
      IF(IWEEK.NE.NTIMES)GO TO 400
      250 ISTOP=1
      260 WRITE(61,1006)
      WRITE(61,1006)
      WRITE(61,1006)
      WRITE(61,1006)
      1006 FORMAT(+,-,*,*)
      270 TCTI=1
      TPURCH=J.C
      DUM=0.0
      DO 50 N=1,NITEM2
      NSN=N
      IF(N.EQ.NITEM2)NSN=9
      DUM=DUM+CITM(NSN)
      50 CONTINUE
      SALE=ISALE*DUM
      SALE=SALE*1.5
      280 DO 350 NN=1,NITEM2
      ITEM=NN
      IF(NQ.EQ.NITEM2)ITEM=9
      300 WRITE(61,1002)MRPD(1,ITEM),TOTCT(ITEM)
      1002 FORMAT(+,-,*,THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR *,A10
      C,*,*,F10.2)
      WRITE(61,1014)PURCH(ITEM)
      1014 FORMAT(+,-,*,TOTAL PURCHASING COST FOR THIS ITEM = $*,F10.2)

```

Table 4.2. (cont'd.).

SUBROUTINE EVAL

```

310 WRITE(61,1003)COST1(ITEM)
1003 FORMAT(*,*,*COST TO MANIPULATE ORDERS =*,F10.2)
320 WRITE(61,1004)COST2(ITEM)
1004 FORMAT(*,*,*COST PENALTIES =*,F10.2)
330 WRITE(61,1005)TCOTH(ITEM)
1005 FORMAT(*,*,*COST TO HOLD INVENTORY =*,F10.2)
IF(ITYPE.EQ.1)GO TO 370
TCTI=TCTI+TOTCT(ITEM)
TPURCH=TPURCH+PURCH(ITEM)
350 CONTINUE
360 WRITE(61,1007)TCTI
1007 FORMAT(*,*,*TOTAL COST TO MAINTAIN ALL INVENTORIES IS EQUAL TO *,4
CH****,1X,*,*,F10.2,1X,4H****)
WRITE(61,1015)TPURCH
1015 FORMAT(*,*,*TOTAL COSTS TO PURCHASE ALL ITEMS IS EQUAL TO *,4
CH****,1X,*,*,F10.2,1X,4H****)
TCTI=TCTI+TPURCH
PROFIT=SALE-TCTI
WRITE(61,1016)SALE
1016 FORMAT(*,*,*SALES DURING THE SIMULATION = *,F10.2)
WRITE(61,1017)PROFIT
1017 FORMAT(*,*,*TOTAL PROFIT = *,F10.2)
C
370 WRITE(61,1008)
1008 FORMAT(*,*,*THIS SIMULATION WAS DESIGNED TO GIVE PACKAGING STUDENT
CS A BROADER VIEW OF THE** WAY PACKAGING INTERFACES WITH OTHER DEP
CARTMENTS.**/* SOME OF THE SITUATIONS THAT YOU WERE FACED WITH ARE
CNOT CONSIDERED TO BE COMMON**/* EVERY DAY PROBLEMS. IN FACT SOME O
CF THE PROBLEMS OCCURE VERY INFREQUENTLY IN**/* A REAL LIFE ENVIRONM
CENT. IT IS FOR THIS REASON YOUR PERFORMANCE DURING THIS**/* SIMULA
TION WILL NOT HAVE ANY DIRECT BEARING ON YOUR COURSE GRADE.**/* IF
C YOU HAVE ANY QUESTIONS CONCERNING PORTIONS OF THIS PROGRAM YOU SH
COULD**/* REFER TO THE THESIS ENTITLED:**/* AN EVALUATION
CAND CONTROL SIMULATION OF A PACKAGING**/*
C PRODUCTION SYSTEM**/* BY**/*
C SCHOOL OF PACKAGING**/* KEVIN KAJIYA**/* MICHIGAN STATE UNIV
CEPSITY**/* JUNE 1980**/*)
WRITE(61,1009)
1009 FORMAT(*,*,*PLEASE TAKE A FEW MINUTES TO FILL OUT THE FOLLOWING EV
CALUATION FORM.**/* THIS FORM SHOULD BE TURNED IN TO THE INSTRUCTOR
COF YOUR COURSE.**/*)
C THANK YOU**/*
C KEVIN KAJIYA**/*
C THE SIMULATION**/* TERM EVALUATION OF
CUCTOR**/* COURSE**/* WHAT IS YOUR OVER-ALL OPINION OF THE
C SIMULATION**/*7777**/* WHAT DID YOU LEARN FROM THE SIMULATION**/*
C**/* PLEASE LIST ANY SPECIFIC WAYS IN WHICH THIS**/* SIMULATI
CON COULD BE IMPROVED.**/* 1.**/* 2.**/* 3.
C**/* 4.**/* WHAT IMPROVEMENTS SHOULD BE MADE ON
C THE USERS MANUAL**/* IF THIS TERMINAL PRINTS - END THSK
CMK- INPUT**/* LOGOUT,T.**/*)
WRITE(61,1006)
400 CONTINUE
RETURN
END

```

Table 4.2. (cont'd.).

SUBROUTINE SPEC

```

C      SUBROUTINE SPEC
C      SPEC      3-1 A-1
COMMON MRFC(5,50,9),MRFD(16,9),IONH(9),STKP(10),NUMP(9),ICSP(10),I
CSPEC(10),NCSP(10),ICHECK(10),IACC(10),ICH(9),IWKST(9),IWR(9),TIMIAT
(9),SUBR,FSTPP,IWEEK,NQV,NTIME,MITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
C1,COTE3,CCTM4,COTLS,CCTEX,ISPE,COTL2,NINF(9),SIGACT(23,9),TOCPO(9
C),TCOTCO(9),TCOTEO(6),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
CPO,COTCO,COTEO,COTLO,COTES,NPLC,RRPD(9),SSPD(9),ICH1Q2(2),IMJR(2),
CIO,CMP,PBP,XX,IADJ,CITM(9),OVERHD,ISALE,SALE,PURCH(9),IWKST,IWW,I
CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKPO,STCST(4,2),IHSTK,IEX,IMN
C(10)
IF(ISPE)2,2,150
2 WRITE(61,1011)MRPD(1,ITEM)
1011 FORMAT(*,*,*MANY TIMES SPECIFICATIONS CAN INDICATE A REQUIRED MEAS
CUREMENT, MATERIAL OR TOLERANCE WHICH REALLY IS NOT NECESSARY. WHE
C ONE OF THESE OVER SPECIFICATIONS OCCURS THE COMPANY USING THE MA
C TERIAL IS CREATING SOME FORM OF WASTE, IE, USUALLY IN THE FORM OF
C A VENDOR CHARGING A HIGHER PRICE. LOOK OVER THE SPECIFICATION FO
C R THE *,A10,* YOU ARE USING. THIS SIMULATION MAY HAVE ASKED YOU T
C O INDICATE THE PROBLEM AREA AS WAS DONE IN THE EXAMPLE -SEE HANDOU
C TS - MARKED SAMPLE OVER SPECIFICATION.*)
GO TO 998
150 CONTINUE
WRITE(61,1014)MRPD(1,ITEM)
1014 FORMAT(*,*,*YOUR BOSS HAS INDICATED THAT TOP MANAGEMENT HAS SET A
C STRICT POLICY CONCERNING COST REDUCTION. AS A RESULT OF THIS POLI
C CY YOU ARE TO REEXAMINE THE SPECIFICATION FOR THE *,A10,* YOU ARE
C CURRENTLY USING. THERE MAY OR MAY NOT BE AN AREA OF OVERSPECIFICA
C TION WITHIN THE SPEC. PULL THE SPEC FROM YOUR BOOKLET AND EXAMINE
C IT FOR POSSIBLE CHANGES.*)
C      MAKE SURE ISPE IS SET TO -1,C,1
IF(ITYPE.EQ.1)ITEM=10
300 CONTINUE
310 WRITE(61,1000)
1000 FORMAT(*,*,* DOES THIS SPECIFICATION NEED MODIFICATION YES OR NO
C *)
520 READ(60,2000)LS1
2000 FORMAT(A2)
330 IF(LS1.EQ.2HNO)GO TO 420
C      USER THINKS CHANGE IS NECESSARY
IF(ICSP(ISPEC(ITEM)))340,331,340
331 WRITE(61,1111)
1111 FORMAT(*,*,*IF YOU REVISE THIS SPECIFICATION YOUR COSTS WILL BECOM
C E HIGHER THAN IS NECESSARY. THIS SPECIFICATION REALLY DOES NOT NE
C CED ANY CHANGE, IT WILL END UP COSTING YOUR COMPANY $210.00 BEFORE
C SOMEONE CAN FIND THE MISTAKE.*)
COTEX=COTEX+200.00
GO TO 998
340 WSP=ITEM
WRITE(61,1001)ISPEC(WSP)
1001 FORMAT(*,*,*IN WHAT AREA DOES SPECIFICATION*,I1,I2,* NEED MODIFICA
C TION ANSWER BY EXAMINING THE SPECIFICATION AND INPUTING THE CORI
C SPONDING NUMBER.*)
350 READ(60,2001)MA
C      THIS IS THE AREA THAT NEEDS MODIFICATION
2001 FORMAT(I1)
360 IF(NCSP(ISPEC(ITEM)).EQ.MA)GO TO 390
C      ICSP IS THE CORRECT CHANGE AREA
370 WRITE(61,1002)MA,ISPEC(ITEM),NCSP(ISPEC(ITEM))
1002 FORMAT(*,*,*CHANGING ITEM *,I1,* ON SPECIFICATION *,A2,* MIGHT HAV
C E SAVED SOME MONEY PUT, THE BEST RESULTS COULD BE AFTAINED BY CHAN
C GING ITEM *,I1)
380 WRITE(61,1003)NCSP(ISPEC(ITEM))
1003 FORMAT(*,*,*YOUR SAVINGS FROM THE SPECIFICATION CHANGE ARE FOUND T
C O BE MINIMAL* AS A MATTER OF FACT YOUR CHANGE MAY HAVE CAUSED YOU
C R PACKAGE TO FAIL DURING DISTRIBUTION! FOR THIS INCORRECT EVALUA
C TION YOU WILL BE CHARGED $400.00. THE CORRECT REVISION IS IN SE
C CTION *,I1,*)
COTEX=COTEX+400.00
GO TO 998
390 CONTINUE
SAV=0.10
400 WRITE(61,1004)SAV
1004 FORMAT(*,*,*YOU HAVE CHOSEN THE CORRECT REVISION YOU CAN CALCULAT
C E THE PARTIAL SAVINGS EFFECT BY MULTIPLYING *,F4.2,* TIMES THE PRO
C DUCT OF THE FORECASTED DEMAND AND THE PRICE FOR THIS ITEM.*)
IF(ITYPE.EQ.1)ITEM=1

```

Table 4.2. (cont'd.).

SUBROUTINE SPEC

```

      CITM(ITEM)=CITM(ITEM)*.90
      CALL MRP
410  RETURN
420  CONTINUE
395  IF(ICSP(ISPEC(ITEM)))430,445,430
430  WRITE(61,1035)
1005 FORMAT(*-*,*YOUR DIAGNOSIS OF THE PROBLEM IS INCORRECT, THIS SPECI
      FICATION DOES NEED CHANGE OR WE WILL HAVE A VERY DIFFICULT TIME BE
      CING ADEQUATELY SUPPLIED AT A REASONABLE PRICE. YOUR ERROR HAS COST
      C YOUR COMPANY $200.00. REPEAT THE PORTION OF THE EXERCISE AS DIRE
      CTED.*)
      COTEX=COTEX+200.00
      GO TO 300
445  WRITE(61,1050)
1050 FORMAT(*-*,*YOU WERE CORRECT THIS SPECIFICATION NEEDS NO MODIFICAT
      CION.*)
998  CONTINUE
      IF(ITYPE.EQ.1)ITEM=1
      CALL MRP
999  RETURN
      END

```

Table 4.2. (cont'd.).

SUBROUTINE TRUCK

```

C      SUBROUTINE TRUCK
C      TRUCK      3-2  A=2
C      COMMON MRPC(5,50,9),MRPD(16,9),IONH(9),STKP(10),NUMQ(9),ICSP(10),I
C      CSPEC(10),NCSP(10),ICHECK(10),IACC(10),ICH(0),IWKST(9),IWK(9),TIMIN(
C      9),SUBR,ISTOP,IWEEK,NQV,NTINES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACT,CGTP
C      C1,COTEX,COTM4,COTL5,COTEX,ISPE,COTL2,NINF(9),SIGACT(23,9),TCFPG(9
C      C),TCOTC(9),TCOTEQ(9),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
C      CPO,COTCO,COTEQ,COTLO,COTE6,NFLC,RRPD(9),SSPA(9),ICHQ2(2),IMJR(2),
C      CTRC,SMP,PBF,XX,IACJ,CITM(9),OVERPD,ISALE,SALE,PURCH(9),IWK52,IWWW,f
C      CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKBP9,STCST(4,2),FHSTK,fex,IWN
C      C(10)
C      THIS PROBLEM AREA DEALS WITH THE POSSIBILITY OF TRUCK
C      DAMAGE OCCURRING OR TRUCKER STRIKES
C      Y=.49
C      IF(NC.GT.C)X=.50
C      D=.49
C 115 IF(ITYPE.EQ.3)GO TO 125
C      EXERCISE INDICATION
C      IF(X.LE.D)GO TO 180
C      SEND BY RANDOM
C      GO TO 140
C 125 CONTINUE
C 120 X=WND(1)
C 130 IF(X.LE.50)GO TO 180
C      THIS PORTION DEALS WITH TRUCK DAMAGE
C 140 WRITE(61,1001)IWEEK
C 1001 FORMAT(*-*,*YOUR SCHEDULED RECEIPT FOR WEEK *,I2,* HAS BEEN DESTRO
C      CYED IN A TRUCK ACCIDENT. ALL OF THE ITEMS IN THIS TRUCK LOAD HAVE
C      BEEN DESTROYED. SINCE IT WAS YOUR TRUCK -FOB DESTINATION- YOU
C      WILL HAVE TO PURCHASE AND SCHEDULE IN A NEW ORDER.*)
C      PURCH(ITEM)=PURCH(ITEM)+MRPC(2,IWEEK,ITEM)*CITM(ITEM)
C 150 MRPC(2,IWEEK,ITEM)=0
C      SCHEDULED RECEIPTS FOR CURRENT WEEK =0
C 160 CALL MRP
C 170 RETURN
C 180 WRITE(61,1002)IWEEK
C 1002 FORMAT(*-*,*DUE TO A TRUCKER STRIKE YOUR SCHEDULED RECEIPT FOR WEE
C      CK *,I2,* WILL BE DELAYED FOR ONE WEEK.*)
C 190 MRPC(5,IWEEK+1,ITEM)=MRPC(2,IWEEK,ITEM)+MRPC(5,IWEEK+1,ITEM)
C 200 MRPC(2,IWEEK,ITEM)=0
C 210 CALL MRP
C 220 RETURN
C 230 END

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Table 4.2. (cont'd.).

SUBROUTINE VENQC

```

C      SUBROUTINE VENQC
C          VENQC      3-3  A-3
C      COMMON MRFC(5,50,9),MRPD(16,9),INNH(9),STKP(10),NUMA(9),ICSP(10),I
C      CSPEC(10),VCSP(10),ICHECK(10),IQC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
C      C9),SUBR,ISTRP,IWEEK,NQVNTIMES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACTCOTP
C      C1,COTEX,COTH4,COTLS,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TOCTPO(9
C      C),TCOTCO(9),TCOTEN(9),TCOTH1(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
C      CPO,COTCO,COTEO,COTLO,COTE6,NPLC,RRPD(9),SSPD(9),ICH1Q2(2),IJR(2),
C      CIRCMP,PBP,XX,IADJ,CITM(9),OVERHD,SALE,SALEPURCH(9),IWK$2,IWWW,I
C      CUNION,IGRV1(4),IGPV2(4),NGRV,ITRIKE,STKPO,STCST(4,2),IWKST,TEX,IAN
C      C(19)
C      THIS SUBROUTINE DEALS WITH INCOMING PARTS NOT MEETING
C      SPECIFICATIONS
C      IF(ITYPE.EQ.1)ITEM=1
C      IF(ITYPE.EQ.1)GO TO 50
C      LLLL=ITEM
C      GO TO 170
C      50 CONTINUE
C      LLLL=10
C      100 CONTINUE
C      WRITE(61,1009)IQC(LLLL)
C      1009 FORMAT(*,*,DOES THE LOT IN THE QUALITY CONTROL PROBLEM *,I2,*,CON
C      TAIN MAJOR OR MINOR DEFECTS,*/,* INPUT 0 IF THE DEFECTS ARE CONSIDERED
C      MAJOR,*/,* INPUT 1 IF THE DEFECTS ARE CONSIDERED MINOR,*/,* INPU
C      T,*)
C      READ(60,2002)IMGMN
C      2002 FORMAT(I1)
C      200 WRITE(61,1010)
C      1010 FORMAT(*,*,YOU HAVE THREE DIFFERENT WAYS TO HANDLE THE SITUATION.
C      C,*/,* THESE ALTERNATIVES ARE:*/,* 1. USE THE LOT AFTER IT HAS BEEN
C      C SORTED. FOR SORTING COSTS SEE TABLE.*/,* 2. SEND THE ORDER BACK
C      C TO YOUR VENDOR. IT WILL TAKE 2 WEEKS BEFORE THE LOT IS RETURNED.
C      C,*/,* 3. TO USE THE LOT AS IS.*/,* INPUT THE NUMBER CORRESPONDING T
C      C O THE WAY YOU WISH TO HANDLE THE LOT. *)
C      READ(60,2002)IHNL
C      IF(IMGMN.EQ.0)GO TO 500
C      IF(IMN(LLLL).EQ.IMGMN)GO TO 300
C      C      THE USER SAYS MINOR BUT REALLY MAJOR
C      IF(IHNL.GT.1)GO TO 220
C      IF(ICHECK(LLLL).EQ.1)GO TO 210
C      WRITE(61,1011)
C      1011 FORMAT(*,*,THE DEFECTS ARE CONSIDERED TO BE MAJOR! YOUR MISTAKE
C      C WILL COST YOU $300.00,*/,* YOU WERE LUCKY THAT THE SORTING PROCEDUR
C      C E PICKED UP THE DEFECTS OR IT COULD HAVE COST YOU AS MUCH $1000.00
C      C,*)
C      COTEX=COTEX+300.00
C      GO TO 999
C      210 CONTINUE
C      WRITE(61,1012)
C      1012 FORMAT(*,*,YOU HAVE SORTED A LOT THAT WAS ACCEPTABLE. FOR THIS E
C      C RROR YOU WILL BE CHARGED THE SORTING COST OF $200.00,*/,* IN ADDITI
C      C ON TO THE $200.00 SORTING CHARGE YOU WILL BE CHARGED $300 FOR IM
C      C PROPERLY DIAGNOSING THE LOT,*/,* THE DEFECTS WERE CONSIDERED TO BE
C      C MAJOR,*)
C      COTEX=COTEX+500.00
C      GO TO 999
C      220 CONTINUE
C      IF(IHNL.GT.2)GO TO 240
C      IF(ICHECK(LLLL).EQ.1)GO TO 230
C      630 WRITE(61,1013)
C      1013 FORMAT(*,*,YOUR LOT WILL ARRIVE IN TWO WEEKS.*/)
C      225 CONTINUE
C      MRPC(5,IWEEK+2,ITEM)=MRPC(5,IWEEK+2,ITEM)+MRPC(2,IWEEK,ITEM)
C      MRPC(2,IWEEK,ITEM)=0
C      GO TO 609
C      230 CONTINUE
C      WRITE(61,1014)
C      1014 FORMAT(*,*,YOU HAVE MADE A GRAVE MISTAKE. THE ORDER YOU SENT BAC
C      C K TO YOUR VENDOR SHOULD HAVE,*/,* BEEN ACCEPTED! YOUR ERROR WILL COS
C      C T YOU $500.00 IN TERMS OF GOOD WILL. THE ORDER WILL RETURN IN TWO
C      C WEEKS.*/)
C      COTEX=COTEX+500.00
C      GO TO 225
C      240 CONTINUE
C      IF(IHNL.EQ.3)GO TO 200
C      IF(ICHECK(LLLL).EQ.1)GO TO 250
C      WRITE(61,1015)

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Table 4.2. (cont'd.).

SUBROUTINE VENQC

```

1015 FORMAT(*-*,*THE LOT YOU HAVE DECIDED TO USE SHOULD HAVE BEEN REJEC
      CTED! THIS LOT ALSO SHOULD HAVE */* BEEN EVALUATED FOR MAJOR DEFEC
      TIS! THIS ERROR WILL COST YOU $10000.00 FOR THE RECALL OF THE LOT*
      C/* YOU WERE LUCKY FOR MANY TIMES A RECALL COULD COST UP TO $100000
      C0.00.*)
      COTEX=COTEX+10000.00
      GO TO 999
250 CONTINUE
      WRITE(61,1016)
1016 FORMAT(*-*,*YOU WERE VERY LUCKY THAT THE LOT HAD ACCEPTABLE PARTS
      CFOR IF THE LOT HAD DEFECTIVE PARTS*/* YOU WOULD HAVE HAD TO RECALL
      C THE LOT. THE PARTS SHOULD HAVE BEEN EVALUATED FOR MAJOR DEFECTS*
      C/* YOUR ERROR WILL COST YOU $500.00*)
      COTEX=COTEX+500.00
      GO TO 999
300 CONTINUE
      C THE USER SAYS MINOR AND IT IS MINOR
      IF(IHNL1.GT.1)GO TO 320
      IF(ICHECK(LLLL).EQ.1)GO TO 310
      WRITE(61,1017)
1017 FORMAT(*-*,*YOU PROPERLY DIAGNOSED THE LOT.*/* YOUR DECISION TO SO
      CRT THE LOT IS DEBATEABLE BUT IT WON'T COST YOU ANYTHING.*)
      GO TO 999
310 CONTINUE
      WRITE(61,1018)
1018 FORMAT(*-*,*YOU WILL BE CHARGED $200.00 FOR SORTING THE LOT.*/* TH
      CIS AMOUNT WILL NOT BE REINBURSED TO YOU FOR THE LOT SHOULD HAVE BE
      CEN */* ACCEPTED.*)
      COTEX=COTEX+200.00
      GO TO 999
320 CONTINUE
      IF(IHNL1.GT.2)GO TO 340
      IF(ICHECK(LLLL).EQ.1)GO TO 330
      WRITE(61,1019)
1019 FORMAT(*-*,*YOU HAVE PROPERLY DIAGNOSED THE LOT. YOUR DECISION TO
      C RETURN THE LOT*/* MIGHT HAVE BEEN UNNECESSARY BUT YOU WILL NOT BE
      C CHARGED FOR YOUR DECISION. THE LOT WILL RETURN*/* IN TWO WEEKS.*)
      GO TO 225
330 CONTINUE
      WRITE(61,1020)
1020 FORMAT(*-*,*YOU SHOULD HAVE ACCEPTED THIS LOT! THE VENDOR IS VERY
      C UPSET THAT YOU RETURNED*/* THE LOT TO HIM. YOUR LOSS OF GOOD WIL
      C L COST YOU $200.00.*/* THE LOT WILL RETURN IN TWO WEEKS.*)
      COTEX=COTEX+200.00
      GO TO 225
340 CONTINUE
      IF(IHNL1.NE.3)GO TO 230
      IF(ICHECK(LLLL).EQ.1)GO TO 350
      CLP=.50
      POS=RND(1)
      IF(POS.GT.CLP)GO TO 360
      WRITE(61,1023)
1023 FORMAT(*-*,*THE LOT PROBABLY SHOULD HAVE BEEN REJECTED BUT YOU WE
      CRE LUCKY IN THAT NO*/* PROBLEMS WERE ENCOUNTERED.*)
      GO TO 999
360 CONTINUE
      WRITE(61,1024)
1024 FORMAT(*-*,*WHEN THE PRODUCTS REACH THE MARKET YOU WILL EXPERIENC
      CE A DROP IN SALES*/* DUE TO A LACK OF CUSTOMER APPEAL. THIS DROP
      C WILL COST YOU $300.00.*)
      COTEX=COTEX+300.00
      GO TO 999
350 CONTINUE
      WRITE(61,1021)
1021 FORMAT(*-*,*YOU HAVE PROPERLY DIAGNOSED THE LOT.*)
      GO TO 999
500 CONTINUE
      IF(IMN(LLLL).EQ.IM6MN)GO TO 600
      C THE USER SAYS MAJOR BUT REALLY MINOR
      IF(IHNL1.GT.1)GO TO 520
      WRITE(61,1025)
1025 FORMAT(*-*,*THE DEFECTS ARE CONSIDERED TO BE MINOR! YOUR EVALUATI
      CON WILL COST YOUR COMPANY*/* THE SORTING CHARGE OF $200.00. THE R
      CEASON YOU HAVE BEEN CHARGED THIS AMOUNT IS THAT IN MANY CASES*/* W
      HERE MINOR DEFECTS ARE INVOLVED THE LOTS CAN BE ACCEPTED WITHOUT S
      ORTING!*)
      COTEX=COTEX+200.00

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Table 4.2. (cont'd.).

SUBROUTINE VENQC

```

      60 TO 999
520  CONTINUE
      IF(IHNL1.GT.2)GO TO 540
      IF(ICHECK(LLLL).EQ.1)GO TO 530
      WRITE(61,1027)
1027  FORMAT(*-*,*YOUR EVALUATION OF THE PROBLEM IS INCORRECT. THE DEFECTS
      ARE CONSIDERED MINOR AND COULD*/* HAVE BEEN ACCEPTED. YOU WILL
      SUFFER AN UN-NECESSARY LOSS OF VENDOR EFFICIENCY THAT WILL*/* COST
      YOU $200.00.*)
      COTEX=COTEX+200.00
      GO TO 999
530  CONTINUE
      WRITE(61,1026)
1026  FORMAT(*-*,*YOU HAVE MADE TWO MISTAKES THE DEFECTS ARE MINOR AND THE
      LOT IS ACCEPTABLE.*/* YOUR EVALUATION HAS CREATED A LOSS OF 600
      CENTS WHICH WILL COST YOU*/* $500.00.*)
      COTEX=COTEX+500.00
      GO TO 999
540  CONTINUE
      IF(IHNL1.NE.3)GO TO 200
      WRITE(61,1028)
1028  FORMAT(*-*,*YOUR DECISION WAS INCORRECT THE LOT HAS DEFECTS IN IT
      WHICH ARE CONSIDERED*/* MINOR! THE RESULT OF ALLOWING THE DEFECTIVE
      PARTS THROUGH WILL COST*/* YOU $300.00 FOR A LOSS IN SALES.*)
      COTEX=COTEX+300.00
      GO TO 999
550  CONTINUE
      IF(ICHECK(LLLL).EQ.1)GO TO 550
      WRITE(61,1029)
1029  FORMAT(*-*,*YOUR DIAGNOSIS WAS INCORRECT THE DEFECTS ARE CONSIDERED
      MINOR! YOU WILL*/* BE CHARGED $100.00 FOR YOUR INCORRECT EVALUA-
      TION.*)
      COTEX=COTEX+100.00
      GO TO 999
600  CONTINUE
      THE USER SAY MAJOR AND IT IS MAJOR
      IF(IHNL1.GT.1)GO TO 620
      IF(ICHECK(LLLL).NE.1)GO TO 610
      WRITE(61,1030)
1030  FORMAT(*-*,*YOU WERE INCORRECT THE PROBLEM CONTAINED A LOT THAT WAS
      NOT ACCEPTABLE! YOU WILL*/* BE CHARGED THE $200.00 SORTING CHARGE.*)
      COTEX=COTEX+200.00
      GO TO 999
620  CONTINUE
      IF(IHNL1.GT.2)GO TO 640
      IF(ICHECK(LLLL).NE.1)GO TO 630
      WRITE(61,1031)
1031  FORMAT(*-*,*YOU HAVE MADE A MISTAKE THAT WILL COST YOU $500.00! THE
      LOT HAD PARTS IN IT*/* THAT SHOULD HAVE BEEN ACCEPTED!*)
      COTEX=COTEX+500.00
      GO TO 225
640  CONTINUE
      IF(IHNL1.NE.3)GO TO 200
      IF(ICHECK(LLLL).EQ.1)GO TO 610
      WRITE(61,1032)
1032  FORMAT(*-*,*YOU HAVE MADE A VERY BIG MISTAKE! THE LOT CONTAINS MA-
      JOR DEFECTS. THE RESULT*/* OF YOUR DECISION WILL BE A RECALL THAT
      WILL END UP COSTING YOU $10000.00!*)
      COTEX=COTEX+10000.00
999  CONTINUE
      CALL MRP
      RETURN
      END

```

Table 4.2. (cont'd.).

SUBROUTINE WRONGQ

```

      SUBROUTINE WRONGQ
C
C      COMMON MRFC(5,50,9), MRPD(16,9), IONH(9), STKP(10), NUMQ(9), ICSP(10), I
C      CSPEC(10), NCSP(10), ICHK(10), IQC(10), ICH(9), IWKST(9), IWK(9), TIMIN(
C      CO), SUBR, ISTOP, IWK, NOV, NTIMES, NITEM2, ITYPE, ITEM, FLIP, LOP, ACT, COTP
C      C1, COTE3, COTH4, COTL5, COTEX, ISPE, COTL2, NINF(9), SIGACT(23,9), TOCTPO(9
C      C), TCOTC(9), TCOTED(9), TCOTHI(9), TCOTLO(9), TCOTEX(9), NC, NSL, Z, Y, COT
C      CP0, COTCO, COFE0, COTLO, COTE6, NPLC, RRPD(9), SSPN(9), ICH1Q2(2), IMJR(2),
C      CIG(SMP, P8F, XX, IADJ, C1TM(9), OVERNO, ISALE, SALE, PURCH(9), IWK52, IWWW, I
C      CUNION, IGRV1(4), IGRV2(4), NGRV, ITRIKE, STKF0, STCST(4,2), IHSTK, IEX, IMN
C      C(10)
C      THIS SUBROUTINE DEALS WITH A SHIPMENT THAT HAS THE
C      WRONG QUANTITY OF PARTS
C      100 WRITE(61,10C1)MRPD(1,ITEM)
C      10C1 FORMAT(*-*,*YOUR VENDOR HAS JUST SHIPPED YOU THE INCORRECT AMOUNT
C      COF *A1C* YOU SHOULD INFORM THE VENDOR OF THE ERROR. IF THE ER
C      ROR IS EITHER POSITIVE OR NEGATIVE THE CORRECT CREDIT OR DEBIT WIL
C      CL BE MADE ON YOUR ACCOUNT.*)
C      IF(ITYPE.NE.2)GO TO 11C
C      CHOOSE NC OR NSL
C      GO TO 13C
C      110 NC=INT(RND(1)*2)
C      NC=1,0 THIS IS TO INDICATE A POSITIVE OR NEG SHIPMEN
C      120 NSL=INT(RND(1)*4)
C      NSL=0,1-3 RANDOM FUNCTION TO CAUSE AN UNUNIFORM STATE
C      130 IF(NC.GT.C)GO TO 160
C      NS=NSL
C      140 CORR=-(NS*.1*MRPC(2,IWEEK,ITEM))
C      150 GO TO 180
C      160 CONTINUE
C      NS=NSL
C      170 CORR=NS*.1*MRPC(2,IWEEK,ITEM)
C      180 CONTINUE
C      MRPC(2,IWEEK,ITEM)=MRPC(2,IWEEK,ITEM)+CORR
C      PURCH(ITEM)=PURCH(ITEM)+CORR+CI1M(ITEM)
C      200 CALL MRP
C      NC=IABS(NC-1)
C      NSL=NSL-1
C      IF(NSL.EQ.0)NSL=3
C      210 RETURN
C      END

```

Table 4.2. (cont'd.).

SUBROUTINE VENSTK

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      SUBROUTINE VENSTK
      COMMON MRFC(5,50,9),MRPD(16,9),IONH(9),STKP(10),NUMB(9),ICSP(10),I
      CSPEC(10),NCSP(10),ICHECK(10),IAC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
      C9),SUBR,ISTOP,IWEEK,NQV,NTIMES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
      C1,COTE3,COT4,COTLS,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TOCfPD(9
      C),TCOTC(6),TCOTED(6),TCOFHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,2,Y,COT
      CPO,COTCO,COTED,COTLO,COT6,NPLC,RRPD(9),SSPD(9),TCHQ2(2),FMIR(2),
      CTOCSMP,F8P,XX,FAOJ,CITM(9),OVERPO,ISALE,SALE,PURCH(9),IWK52,IWWW,1
      CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKPO,STCST(4,2),IHSTK,TEX,IMN
      C(10)
      THIS SUBROUTINE DEALS WITH THE SITUATION WHEN YOUR
      SUPPLIERS PEOPLE GO ON STRIKE
      NFFF=IWEEK+3
      NFFF IS THE WEEK OF THE PRED STRIKE
      100 WRITE(61,1001)MRPD(1,ITEM)
      PART NAME
      1001 FORMAT(*-*,*YOUR SUPPLIER OF *,A10,*S HAS INFORMED YOU THAT HIS WO
      CRKERS MAY EN ON STRIKE 3 WEEKS FROM THE CURRENT DATE. HE SAYS THE
      C POSSIBILITY OF THE STRIKE OCCUPING IS 50-50. HE WILL TRY AND CON
      CTACT YOU AS SOON AS HIS WORKERS UNION INFORMS HIM OF A DECISION.*)
      110 WRITE(61,1002)
      1002 FORMAT(*-*,*YOU HAVE THREE ALTERNATIVES: ONE TO SPECULATE ABOUT T
      CHE STRIKE AND PRE-ORDER LARGER AMOUNTS, TWO TO DO NOTHING AND PRA
      CY THAT THE STRIKE DOESN'T MATERIALIZE, THREE TO MAKE SUBSEQUENT
      CORDERS FROM ANOTHER VENDOR AT AN INCREASED PRICE OF 10 PERCENT CF
      C THE CURRENT PRICE.*)
      POSSIBILITY OF ADDING SEGMENT ON BASIAN ANALYSIS
      120 WRITE(61,1003)
      1003 FORMAT(*-*,*WHICH ALTERNATIVE WOULD YOU LIKE TO CHOOSE INPUT ONE
      C OF THE FOLLOWING NUMBERS 1,2,3 CORRESPONDING TO THE ABOVE ALTER
      CNATIVES.*)
      ICH(ITEM) THE NUMBER OF THE ALTERNATIVE HANDLING STK
      130 READ(60,2003)ICH(ITEM)
      2000 FORMAT(I1)
      140 ICH(ITEM)=ICH(ITEM)-2
      ICH(ITEM) HAS 2 SUBTRACTED FROM IT TO BE CORR LATER
      150 IF(ICH(ITEM))160,190,230
      160 CONTINUE
      170 WRITE(61,1004)MRPD(8,ITEM)
      ORDER QUANTITY
      1004 FORMAT(*-*,*THE STRIKE IS EXPECTED TO LAST FOR TWO WEEKS IF IT BEC
      COMES A REALITY. REMEMBER IF THE STRIKE DOESN'T MATERIALIZE AND YO
      CU DO NOT CANCEL YOUR ORDERS FOR THE DAYS OF THE EXPEDCTED STRIKE
      CYOU WILL RECIEVE AN EXCESSIVE AMOUNT OF PARTS. ANYTHING YOU ORDER
      C NOW WILL BE PLACED IN A STOCK PILE IN A PUBLIC WAREHOUSE AND IS U
      CNUSABLE UNTILL THE STRIKE WEEKS. HOW MANY ORDERS OF *I7,* WOULD Y
      COU LIKE TO PLACE AND WHAT DATE BEFORE THE STRIKE WOULD YOU LIKE TH
      CE ORDERS TO ARRIVE. INPUT - THE NUMBER OF ORDER QUANTITIES AND TH
      CE RECIEVING WEEK. IE. 2 14 --*)
      READ(60,2005)NUMQ(ITEM),IWK(ITEM)
      NUMBER OF ORDER QUANTITIES AND ARRIVAL WEEK
      2005 FORMAT(I1,1X,I2)
      PURCH(ITEM)=PURCH(ITEM)+CITM(ITEM)*NUMQ(ITEM)*MRPD(8,ITEM)
      180 GO TO 999
      190 CONTINUE
      200 WRITE(61,1005)
      1005 FORMAT(*-*,*IF THE STRIKE DOES OCCUPE YOU WILL NOT RE ABLE TO MEET
      C PRODUCTION NEEDS SO BE VERY CAPEFUL. DON'T FORGET TO PRAY.*)
      220 GO TO 999
      230 CONTINUE
      IWKST(ITEM)=THE WEEK OF THE PREDICTED STRIKE
      WRITE(61,1006)
      1006 FORMAT(*-*,*YOUR ORDER WILL COME ON TIME BUT WILL COST YOU 10 PERC
      CENT EXTRA.*)
      999 CONTINUE
      IWKST(ITEM)=NFFF
      ICH(ITEM)=ICH(ITEM)+2
      IF(ITYPE.EQ.1)IWEEK=IWEEK+3
      175 CALL MRP
      RETURN
      END

```

Table 4.2. (cont'd.).

SUBROUTINE VENLIE

```

C      SUBROUTINE VENLIE
C      VENLIE      3-6  A-6
COMMON MRPC(5,50,9),MRPD(16,9),IONH(9),STKP(10),NUMQ(9),ICSP(10),I
CSPEC(10),NCSP(10),ICHECK(10),IC(10),ICH(9),IWKST(9),IWK(9),TIMI(4
C9),SUBR,ISTOP,IWEEK,NQV,NTIMES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
C1,COTE3,COTH4,COTLS,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TQCTPG(9
C),TCOTCO(9),TCOTEQ(9),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
CPD,COTCO,COTEQ,COTLO,COTE3,NPLC,RRPD(9),SSPD(9),ICHQ2(2),IMJR(2),
CIQ(SMP,PBP,XX,IADJ,CITM(9),OVERHD,ISALE,SALE,PURCH(9),IWK$2,IWWW,I
CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKPS,STCST(4,2),IHSTK,fex,IMN
C(10)
C      THIS SUBROUTINE DEALS WITH A TIME WHEN THE VENDOR
C      FEEDS YOU AN OUTRIGHT LIE ABOUT A DELIVERY DATE
100 WRITE(61,1001)
1001 FORMAT(*-*,*AFTER WAITING A DAY FOR A SCHEDULED RECEIPT TO ARRIVE
CYOU HAVE CALLED YOUR VENDOR TO CHECK THE STATUS OF THE ORDER, YOU
CHAVE BEEN INFORMED THAT THE PERSON WHO HANDLED YOUR ACCOUNT HAS JU
CST BEEN FIRED FOR REPEATEDLY PROMISING DELIVERY DATES THAT COULD N
CEVER BE MET. YOUR ORDER WILL AT BEST BE A WEEK LATE, YOUR VEND
COR IS VERY SORRY ABOUT THE DELAY AND WILL TRY TO MAKE IT UP TO YOU
C ON A FUTURE DELIVERY.*)
110 MRPC(5,IWEEK+1,ITEM)=MRPC(5,IWEEK+1,ITEM)+MRPC(2,IWEEK,ITEM)
120 MRPC(2,IWEEK,ITEM)=0
130 CALL MRP
140 RETURN
END

```

Table 4.2. (cont'd.).

SUBROUTINE WRGSHP

```

C      SUBROUTINE WRGSHP
C      WRGSHP      3-7  A-7
COMMON MRPC(5,50,9),MRPD(16,9),IONH(9),STKP(10),NUMQ(9),ICSP(10),I
CSPEC(10),NCSP(10),ICHECK(10),IC(10),ICH(9),IWKST(9),IWK(9),TIMI(4
C9),SUBR,ISTOP,IWEEK,NQV,NTIMES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
C1,COTE3,COTH4,COTLS,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TQCTPG(9
C),TCOTCO(9),TCOTEQ(9),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
CPD,COTCO,COTEQ,COTLO,COTE3,NPLC,RRPD(9),SSPD(9),ICHQ2(2),IMJR(2),
CIQ(SMP,PBP,XX,IADJ,CITM(9),OVERHD,ISALE,SALE,PURCH(9),IWK$2,IWWW,I
CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKPS,STCST(4,2),IHSTK,fex,IMN
C(10)
C      THIS SUBROUTINE DEALS WITH THE SITUATION WHERE YOU
C      HAVE RECEIVED ANOTHER COMPANIES SHIPMENT
100 WRITE(61,1001)MRPD(1,ITEM)
1001 FORMAT(*-*,*YOU HAVE JUST BEEN INFORMED BY YOUR LOADING DOCK THAT
CTHIS WEEKS SHIPMENT OF *,A10,* HAS BEEN MIXED UP WITH A DIFFERENT
CCOMPANIES ORDER. THE ORDER YOU RECEIVED IS NOT USABLE AND MUST BE
CBE EXCHANGED WITH THE OTHER SHIPMENT. THIS EXCHANGE WILL TAKE A W
CEEK.*)
110 MRPC(5,IWEEK+1,ITEM)=MRPC(5,IWEEK+1,ITEM)+MRPC(2,IWEEK,ITEM)
120 MRPC(2,IWEEK,ITEM)=0
130 CALL MRP
140 RETURN
END

```

Table 4.2. (cont'd.).

SUBROUTINE GOVREG

```

C      SUBROUTINE GOVREG
C      GOVREG      3-8  A-8
COMMON MRFC(5,50,9),MRPD(16,9),IONH(9),STKP(10),NUMO(9),ICSP(10),I
CSPEC(10),NCSP(10),ICHECK(10),IC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
C),SUBR,ISTOP,IWEEK,NQV,NTIMES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
C1,COTE3,COT4,COT5,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TOCTPO(9
C),TCOTCO(9),TCOTE0(6),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
CP0,COTCO,COTE0,COTLO,COTE6,NPLC,RRPD(9),SSPD(9),ICH42(2),IMJR(2),
CIQCSMP,PBF,XX,IADJ,CITM(9),OVERHD,ISALE,SALE,PURCH(9),IWK52,IWWW,I
CUNION,I6PV1(4),IGRV2(4),NGRV,ITRIKE,STKPD,STCST(4,2),IHSTK,IEX,IMN
C(10)
C      THIS SUBROUTINE DEALS WITH A CHANGE IN GOV REGS
100 WRITE(61,1001)MRPD(1,ITEM),IWEEK+6,MRPD(1,ITEM)
1001 FORMAT(*-*,*WHILE READING THE FEDERAL REGISTER YOU FOUND A REVISIO
CN INDICATING THAT THE *-A10-* YOU CURRENTLY USE WILL NOT BE LEGAL
C AFTER THE *-12-* WEEK. AFTER THIS DATE YOU WILL USE THE REPLACEM
CENT PART 2782. YOUR JOB WILL BE TO USE UP THE REST OF THE INVENTO
CRY OF *-A10-* BY THIS DATE WITHOUT STOCKING OUT. YOUR SHIPMENT OF
C THE REPLACEMENT PARTS CAN BE SCHEDULED FOR ANY DATE AFTER THE THI
CRD PERIOD FROM NOW. ALL THE PURCHASING INFORMATION IS THE SAME ON
C VENDOR ORDER QUANTITIES, LT, ETC. *-*)
C      THERE IS THE POSSIBILITY OF RUNNING AN INVENTORY CHECK
130 CALL MRF
150 RETURN
END

```

Table 4.2. (cont'd.).

SUBROUTINE PHYINV

```

C      SUBROUTINE PHYINV
C      PHYINV      3-9  B-1
C      INTEGER Z
C      COMMON MRPC(5,50,9),MRPD(16,9),IONH(9),STKP(10),NUMQ(9),ICSP(10),I
C      CSPEC(10),NCSP(10),ICHECK(10),IAC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
C      C9),SUBR,FSTGP,IWEEK,NQV,NTIMES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
C      C1,COTE3,CCTH4,COTL5,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TUCFPO(9
C      C),TCOTCO(9),TCOTEQ(5),TCOTHI(9),TCOTLC(9),TCOTEX(9),NC,NSL,Z,Y,COT
C      CF0,COTCO,CCTEQ,COTLQ,COTE5,NPLC,RRPD(9),SSPD(9),ICHQ2(2),IMJR(2),
C      CIQ(SMP,PBP,XX,IADJ,CITM(9),OVERND,ISALE,SALE,PURCH(9),IWK52,IWW4,I
C      CJUNION,IGRV1(4),IGRV2(4),NGRV,ITWKE,STKP9,STCST(4,2),IHSTK,IEX,IMN
C      C(10)
C      THIS SUBROUTINE DEALS WITH THE EVENTS AFTER A PHYSICAL
C      INVENTORY HAS TAKEN PLACE
C      10 IF(ITYPE.NE.2)GO TO 50
C      Z=1-1
C      Y=.1,.2, OR .3
C      40 GO TO 100
C      50 Z=INT(RND(1)*2)
C      Z=0,1 HIGHER OR LOWER COUNT DECISION
C      60 Y=(INT(RND(1)*3)+1)*.1
C      Y=.1,.2,.3 INDICATES THE AMOUNT ABOVE OR BELOW
C      100 WRITE(6,1001)MRPD(1,ITEM)
C      1001 FORMAT(*-*,*A PHYSICAL INVENTORY OF *-A10,* HAS JUST BEEN COMPLETE
C      CD*)
C      110 IF(Z)50,120,150
C      120 WRITE(6,1002)Y
C      1002 FORMAT(*-*,*THE PHYSICAL INVENTORY HAS REVEALED THAT YOUR INVENTOP
C      CY IS *-F4.2,* PERCENT LOWER THAN YOUR SCHEDULE INDICATES. THIS IN
C      CVENTOPY SCHEDULE WILL BE CORRECTED.*)
C      130 IONH(ITEM)=IONH(ITEM)-Y*IONH(ITEM)
C      140 GO TO 100
C      150 CONTINUE
C      160 WRITE(6,1003)Y
C      1003 FORMAT(*-*,*THE INVENTORY HAS REVEALED THAT YOUR INVENTORY IS *-F4
C      C.2,* PERCENT HIGHER THAN YOUR SCHEDULE INDICATES. THIS INVENTORY
C      CWILL BE INCREASED TO ADJUST FOR THE ERROR.*)
C      170 IONH(ITEM)=IONH(ITEM)+Y*IONH(ITEM)
C      180 CONTINUE
C      190 CALL MRP
C      Y=Y-.1
C      IF(Y-.1)5,5,6
C      5 Y=Y+.3
C      6 CONTINUE
C      Z=IABS(Z-1)
C      200 RETURN
C      END

```

Table 4.2. (cont'd.).

SUBROUTINE FRKLFT

```

      SUBROUTINE FRKLFT
C
      FRKLFT      3-10  8-2
      COMMON MRPC(5,50,9),MRPD(16,9),TOMH(9),STKP(10),NUMQ(9),ICSF(10),I
      CSPEC(10),NCSP(10),ICHECK(10),I6C(10),ICH(9),IWKST(9),IWK(9),TIMIN(
      C9),SUBR,ISTOP,IWEEK,NAV,NTIMES,NITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
      C1,COTE3,COTM4,COTLS,COTEX,ISPE,COTL2,NINF(9),SIGACT(23,9),TCCTPC(9
      C),TCOTCO(9),TCOTED(9),TCOTHI(9),TCOTLO(9),TCCTEX(9),NC,NSL,Z,Y,COT
      C=0,COTCO,COTEO,COTLO,COTE6,NPLC,RRPD(9),SSPD(9),ICHIG2(2),IMJR(2),
      CIQCSMP,PBF,XX,IADJ,CITM(9),OVERHD,ISALE,SALE,PURCH(9),IWK$2,IWWW,I
      CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKP9,STCST(4,2),IHSTK,IEX,IRN
      C(10)
C
      THIS SUBROUTINE DEALS WITH A FORK LIFT ACCIDENT
      100 WRITE(61,10C1)MRPD(1,ITEM)
      10C1 FORMAT(*-+*WHILE DELIVERING A PALLET LOAD OF *-A10* TO ITS STAGI
      CNG AREA A FORKLIFT WENT OUT OF CONTROL. THE DAMAGES THAT FOLLOE
      C INCLUDED HALF OF THE ITEMS ON THE PALLET.*)
      110 IONH(ITEM)=IONH(ITEM)-.5*MRPD(14,ITEM)
      IF(IONH(ITEM).LE.C)IONH(ITEM)=0
C
      MRPD(14,ITEM) PALLET LOAD
      120 CALL MRF
      150 RETURN
      END

```

Table 4.2. (cont'd.).

SUBROUTINE FIRE

```

C      SUBROUTINE FIRE
C      FIRE 3-11 B-7
C      COMMON MRFC(5,50,9),MRPD(16,9),IONH(9),STKP(10),NUMQ(9),ICSP(10),I
C      SPEC(10),NCSP(10),ICHECK(10),IQC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
C      9),SUBR,ISTOP,IWEEK,NQV,NTIMES,MITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
C      C1,COTE3,CCTH4,COTLS,COTEX,ISFE,COTL2,NINF(9),SIGACT(23,9),TOCIPD(9
C      C),TCOTCO(9),TCOTE0(9),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
C      CPO,COTCO,COTE0,COTLO,COTE6,NPLC,RRPD(9),SSPD(9),ICHQ2(2),IMJR(2),
C      CIQ(SMP,PBP,XX,IADJ,CITM(9),OVERNO,ISALE,SALE,PURCH(9),IWK52,IWWW,f
C      CUNION,IGRVf(4),IGRV2(4),NGRV,ITRIKE,STKPO,STCST(4,2),IHSTR,fEX,IAN
C      C(10)
C      THIS SUBROUTINE DEALS WITH THE SITUATION WHERE THERE
C      IS A FIRE IN THE WHEAREHOUSE
1100 WRITE(61,1001)MRPD(1,ITEM)
1001 FORMAT(*-*,*EVEN THOUGH YOU HAVE A WORK PULE CONCERNING EMPLOYEES,
C      CSMOKING IN THE WAREHOUSE A FIRE WAS STARTED WHEN AN EMPLOYEE FAILE
C      CD TO PUT OUT HIS CIGARETTE, LUCKLY THE FIRE WAS EXTINGUISHED RAFI
C      CDLY AND ONLY TWO PALLETS OF *A10,* WERE DESTROYED.*)
110 IONH(ITEM)=IONH(ITEM)-2*MRPD(14,ITEM)
IF(IONH(ITEM).LE.0)IONH(ITEM)=0
150 CALL MRP
160 RETURN
END

```

Table 4.2. (cont'd.).

SUBROUTINE OK

```

C      SUBROUTINE OK
C      OK 3-12 B-4
C      COMMON MRFC(5,50,9),MRPD(16,9),IONH(9),STKP(10),NUMQ(9),ICSP(10),I
C      SPEC(10),NCSP(10),ICHECK(10),IQC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
C      9),SUBR,ISTOP,IWEEK,NQV,NTIMES,MITEM2,ITYPE,ITEM,FLIP,LOP,ACT,COTP
C      C1,COTE3,CCTH4,COTLS,COTEX,ISFE,COTL2,NINF(9),SIGACT(23,9),TOCIPD(9
C      C),TCOTCO(9),TCOTE0(9),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSL,Z,Y,COT
C      CPO,COTCO,COTE0,COTLO,COTE6,NPLC,RRPD(9),SSPD(9),ICHQ2(2),IMJR(2),
C      CIQ(SMP,PBP,XX,IADJ,CITM(9),OVERNO,ISALE,SALE,PURCH(9),IWK52,IWWW,f
C      CUNION,IGRVf(4),IGRV2(4),NGRV,ITRIKE,STKPO,STCST(4,2),IHSTR,fEX,IAN
C      C(10)
C      THIS SUBROUTINE SIMULATES A SMOOTH OPERATION
1100 WRITE(61,1000)
1000 FORMAT(*-*,*FOR THIS PART THERE WERE NO MAJOR PROBLEMS FOR THE WEE
C      CEK.*)
120 CALL MRP
150 RETURN
END

```

Table 4.2. (cont'd.).

SUBROUTINE LINDWN

```

C      SUBROUTINE LINDWN
          LINDWN      3-13  C=1
      COMMON MRPC(5,50,9),MRPD(16,9),IONH(9),STKP(13),NUMQ(9),ICSP(10),I
      CSPEC(10),NCSP(13),ICHECK(13),IAC(10),ICH(9),IWKST(9),IWK(9),TIMIN(
      C9),SIWR,ISTUP,IWEEK,NQV,NTIMES,NITEM2,ITYPE,ITEM,FLI6,LOP,ACT,COTP
      C1,COTE3,COTH4,COTL5,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TCOTPO(9
      C),TCOTC(6),TCOTED(6),TCOTFI(9),TCOTLO(9),TCOTEX(9),NCNSL,Z,Y,COT
      CP0,COTC0,COTE0,COTLO,COTES,NPLC,RRPD(9),SSPD(9),ICHQ2(2),I*JR(2),
      CIOCSMP,P8P,XX,IADJ,CITM(9),OVERHD,ISALE,SALE,PURCH(9),IWK52,IWVW,I
      CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKP9,STCST(4,2),IHSTK,LEX,IMN
      C(10)
          XX=XX+.1
          IF(ITYPE.NE.3)GO TO 10
          XX=RND(1)
      10  CONTINUE
          DOWN=.3C*XX
          IF(IADJ.EQ.1)DOWN=DOWN/2
      100  CONTINUE
          WRITE(6,1000)DOWN
      1000 FORMAT(*-*,*PRODUCTION FOR THIS WEEK HAS BEEN EFFECTED BY BRCKEN P
          CARTS, MACHINE MALFUNCTIONS, AND JAMMED MACHINERY. THESE FACTORS
          CHAVE CAUSED PRODUCTION TO SUFFER BY *F4.2,* TO AVOID SOME OF T
          HESE PROBLEMS IN THE FUTURE YOU SHOULD KEEP AND USE AN ACCURATE CO
          NTROL CART OF ON GOING PRODUCTION!*)
          IF(IADJ.NE.1)GO TO 200
          WRITE(6,1001)
      1001 FORMAT(*-*,*YOUR DECISION TO ADJUST THE MACHINES DURING THE PREVIO
          CUS WEEKS HAS DECREASED YOUR DOWN TIME BY 50.0*%)
      200  CONTINUE
          MRPC(2,IWEEK,9)=MRPC(2,IWEEK,9)*DOWN
          IF(XX.GT.1.0)XX=.20
          CALL MRP
          RETURN
      END

```

Table 4.2. (cont'd.).

SUBROUTINE YRSTK

```

C      SUBROUTINE YRSTK
C      YRSTK      3-14      C-2
COMMON MRPC(5,50,9),MRPD(16,9),IDNH(9),STKP(1),NUMQ(9),ICSP(10),I
CSPEC(10),NCSP(10),ICHECK(10),IGC(10),ICH(9),IWKST(9),IWL(9),TIMT(4
C0),SUBR,ISTOP,IWEEK,NQV,NTIMES,NITEM2,ITYPE,ITEM,FLIF,LOP,ACT,COTP
C1,COT3,COT4,COTLS,COTEX,ISPE,COTL2,NINE(9),SIGACT(23,9),TOCTPU(9
C),TCOTC(9),COTED(9),TCOTHI(9),TCOTLO(9),TCOTEX(9),NC,NSC,Z,Y,COT
CPO,COTCO,COTEO,COTLO,COTES,NPLC,RRPD(9),SSPD(9),TCH1(2,2),IMJR(2),
CIQCSMP,PBP,XX,ADJ,CITM(9),OVERHD,ISALE,SALE,PURCH(9),IWKST,IWWW,
CUNION,IGRV1(4),IGRV2(4),NGRV,ITRIKE,STKPO,STCST(4,2),IHSTK,IEX,IMH
C(11)
ITRIKE=3
IWKST=IWEEK+4
NGRV=NGRV+1
IF(NGRV.E6.5)NGRV=1
IF(IUNION.EQ.2)GO TO 9C
WRITE(61,1000)IWKST,IGRV1(NGRV),IGRV2(NGRV)
1000 FORMAT(*,*,YOUR WORKERS UNION HAS JUST INFORMED YOU THAT THEY MAY
GO ON STRIKE IN WEEK *,I2,*,THEIR GRIEVANCE CONCERNS THE WAY MA
NAGEMENT IS HANDLING THEIR *,2A10,*,*)
GO TO 100
90 WRITE(61,1001)IGRV1(NGRV),IGRV2(NGRV),IWKST
1001 FORMAT(*,*,A GROUP OF WORKERS HAS APPROACHED YOU AND INFORMED YOU
C THAT THEY ARE VERY DISATISFIED WITH THE WAY MANAGEMENT IS HANDLIN
C6 THEIR *,2A10,*,THEY HAVE FOLLOWED THE GRIEVANCE PROCEDURE AND
C WOULD LIKE YOU TO TAKE SOME FORM OF ACTION. FELLOW WORKERS HAVE
CSAID THAT SIMILAR INCIDENTS HAVE LED TO WORKER WALKOUTS WHEN NOT H
CANDLED PROPERLY. IF ONE OF THESE WALKOUTS OCCURES IT WILL MOST LI
CKELY HAPPEN IN WEEK *,I2,*,*)
100 CONTINUE
WRITE(61,1002)
1002 FORMAT(*,*,HISTORICALLY WALKOUTS AND STRIKES OF THIS NATURE HAVE
CLASTED TWO WEEKS. YOU HAVE FOUR ALTEPNATIVE METHODS OF HANDLING T
CME SITUATION. THESE ALTERNATIVES ARE:*)
WRITE(61,1003)
1003 FORMAT(*,*,1. TO USE INCENTIVES WHICH WILL HOPEFULLY ELIMINATE T
CME POSSIBILITY OF A STRIKE. THESE INCENTIVES WILL COST
C THE AMOUNT LISTED IN TABLE 6.*/)
WRITE(61,1004)
1004 FORMAT(*,*,2. PLAN TO HIRE OUTSIDE PEOPLE DURING THE WEEKS OF TH
CE STRIKE.*/)
WRITE(61,1005)
1005 FORMAT(*,*,3. TO BUILD PRODUCTION AND STORE FINISHED INVENTORIES
C IN A PUBLIC WAREHOUSE.*/)
WRITE(61,1006)
1006 FORMAT(*,*,4. TO DO ABSOLUTELY NOTHING AND DISREGARD THE WORKER
CS GRIEVENCE.*/)
WRITE(61,1007)
1007 FORMAT(*,*,INPUT THE NUMBER OF THE WAY TN WHICH YOU WOULD LIKE TO
C HANDLE THE SITUATION.*/)
READ(60,2001)IHSTK
2001 FORMAT(I1)
GO TO(200,300,400,500)IHSTK
200 CONTINUE
STKPO=0
COTEX=COTEX+STCST(NGRV,IUNION)
WRITE(61,1008)
1008 FORMAT(*,*,YOU WILL BE CHARGED THE AMOUNT LISTED IN TABLE 5. THE
CRE IS NO FOSSIBILITY OF YOUR WORKERS WALKING OFF OF THEIR JOBS.*/)
GO TO 999
300 CONTINUE
STKP9=.80
GO TO 999
400 CONTINUE
STKP9=.85
WRITE(61,1009)
1009 FORMAT(*,*,DONT FORGET IF THE STRIKE DOES NOT MATERIALIZE YOU WIL
CL HAVE AN EXCESSIVE AMOUNT OF FINISHED ON HAND INVENTORIES. THE E
CCESS FINISHED INVENTORY MUST GO TO A PUBLIC WAREHOUSE AFTER IT IS
C PRODUCED. THIS INVENTORY WILL NOT BE ACCESSABLE UNTILL THE WEEKS
C OF THE STRIKE!*/)
WRITE(61,1010)
1010 FORMAT(*,*,INPUT THE NUMBER OF THE WEEK IN WHICH YOU WANT TO RUN
C DOUBLE SHIFT. SINCE THE STRIKE WILL GO FOR TWO WEEKS IT WILL BE N
CESSARY TO PLAY IT SAFE AND RUN TWO SHIFTS ON TWO SEPERATE WEEKS.
C THE MINIMUM AMOUNT OF WEEKS BEFORE THE STRIKE THAT YOU CAN HAVE
C THESE DOUBLE SHIFTS IS 3.*/)

```

Table 4.2. (cont'd.).

SUBROUTINE YRSTX

```

540 WRITE(61,1011)
1011 FORMAT(*,*,*WHEN YOU ENTER THE NUMBER OF THE WEEK FOR THE FIRST DO
      CUBLE SHIFT ALL OF THE ORDERING WILL BE TAKEN CARE OF. NONE OF THI
      CS CHANGE WILL SHOW UP ON THE NEXT PRODUCTION SCHEDULE. AFTER THE
      CPRODUCTION OF THESE EXCESS INVENTORIES THEY WILL SHOW UP IN THE AR
      CEA RESERVED FOR THE SECOND PUBLIC WAREHOUSE. IN WHICH WEEK DO YO
      CU WISH TO PLAN YOUR FIRST DOUBLE SHIFT?*)
      READ(60,2003)IWWW
2003 FORMAT(I2)
      IF(IWWW.GT.IWKS2-2)GO TO 540
      L=13
      LUCKY3=NITE*2-1
      DO 530 INI=1,LUCKY3
      NWKEE=IWKS2-IWWW+1
      TCOTHI(INI)=COTH4*MRPD(8,9)*MRPD(L,INI)*CITM(INI)*NWKEE+TCOTHI(INI
      C)
      TCOTHI(INI)=COTH4*MRPD(8,9)*MRPD(8,INI)*CITM(INI)*(NWKEE-1)+TCOTHI
      C(INI)
530 CONTINUE
      OVEPHD=OVERHD+CITM(9)*2*MRPD(8,9)*NWKEE
      GO TO 999
500 CONTINUE
      STKP9=.99
999 CONTINUE
      CALL MRD
      RETURN
      END

```

Table 4.2. (cont'd.).

SUBROUTINE LINEQC

```

SUBROUTINE LINEQC
  LINEQC      3-15, C-3
  COMMON MRFC(5,50,9), MRPD(16,9), IONH(9), STKP(10), NUMO(9), ICSF(10), I
  CSPEC(10), NCSP(10), ICHK(10), IQC(10), ICH(9), IWKST(9), IWK(9), TIMI4(
  C9), SUBR, ISTOP, IWECK, NQV, NTIMES, NITEM2, ITYPE, ITEM, FLIP, LOP, ACT, COTP
  C1, COTE3, COTH4, COTL5, COTEX, ISPE, COTL2, NINE(9), SIGACT(23,9), TQCTPO(9
  C), TQCTC(9), TQCTED(9), TQCTHI(9), TQCTLO(9), TQCTEX(9), NC, NSL, ZY, CNT
  CPO, COTCC, COTED, COTLO, COTE6, NPLC, RRPD(9), SADD(9), ICHIQ2(2), MJR(2),
  CIO, CSMP, PSP, XX, IADJ, CITEM(9), CVERNO, ISALE, SALE, PURCH(9), IWK$2, IWWW, I
  CUNION, IGRV1(4), IGRV2(4), NGRV, ITRIKE, STKPA, STCST(4,2), IHSTK, IEX, IAN
  C(10)
  1 CONTINUE
  IF(ITYPE.NE.1)GO TO 100
  IQ2=1
  GO TO 110
  100 CONTINUE
  IQ2=2
  110 CONTINUE
  IQUAL=10+IQ2
  WRITE(61,1030)TQUAL
  1000 FORMAT(*-*,*ACCORDING TO THE DATA IN THE QUALITY CONTROL PROBLEM *
  C,12,* IS THE LOT ACCEPTABLE OR SHOULD YOU REJECT IT? INPUT YES IF
  C THE LOT IS ACCEPTABLE. INPUT NO IF THE LOT IS DEFECTIVE.*)
  READ(60,2000)IANS
  2000 FORMAT(A2)
  IDES=1
  IF(IANS.NE.2MYE)IDES=2
  115 WRITE(61,1001)
  1001 FORMAT(*-*,*ARE THE DEFECTS CONSIDERED MAJOR OR MINOR. INPUT 1 IF
  C THEY ARE MAJOR. INPUT 2 IF THEY ARE MINOR.*)
  READ(60,2001)IPES
  2001 FORMAT(I1)
  IF(IDES-1)1,120,520
  120 IF(IPES.EQ.2)GO TO 140
  WRITE(61,1002)
  1002 FORMAT(*-*,*DO YOU WISH TO SORT THE LOT OR SCRAP ALL OF THE ITEMS
  C IN THE LOT? INPUT 1 FOR SORT OR INPUT 2 FOR SCRAP.*)
  READ(60,2001)ISORST
  GO TO 150
  140 CONTINUE
  WRITE(61,1003)
  1003 FORMAT(*-*,*DO YOU WISH TO SORT THE LOT OR USE THE LOT WITHOUT SCR
  CTING? SORTING THE LOT WILL COST YOU THE AMOUNT LISTED IN TABLE 4
  C OF YOUR MANUAL. INPUT 1 IF YOU WISH TO SORT THE LOT. INPUT 2 IF
  C YOU WISH TO USE THE LOT WITHOUT SORTING.*)
  READ(60,2001)ISORAC
  150 CONTINUE
  IF(IRES.EQ.1)GO TO 300
  IF(IMJR(IQ2).EQ.2)GO TO 170
  IF(ISORAC.EQ.1)GO TO 160
  WRITE(61,1004)
  1004 FORMAT(*-*,*YOU HAVE MADE A CRITICAL MISTAKE THE DEFECTS ARE CONSI
  CDERED MAJOR IN NATURE! THE LOT YOU LET THROUGH WILL HAVE TO BE RE
  C CALLED. THIS WILL COST YOUR COMPANY $10000.00!*)
  COTEX=COTEX+10000.00
  GO TO 165
  160 CONTINUE
  COTEX=COTEX+200.00+300.00
  WRITE(61,1005)
  1005 FORMAT(*-*,*IN ADDITION TO THE $200.00 SORTING CHARGE YOU WILL BE
  C CHARGED $300.00 FOR THE INCORRECT SORTING PROCEDURES YOU HAVE IMPL
  C EMENTED. THIS IS DUE TO A LESS STRINGENT SORTING PROCESS USUALLY
  C DONE ON NON CRITICAL DEFECTS.*)
  165 WRITE(61,1006)
  1006 FORMAT(*-*,*YOU MUST STILL CONTINUE THIS EXERCISE AS DIRECTED.*)
  GO TO 115
  C THE LOT CONTAINS MINOR DEFECTS
  170 CONTINUE
  IF(ISORAC.EQ.2)GO TO 180
  WRITE(61,1007)
  1007 FORMAT(*-*,*IT WILL COST YOU $200.00 DOLLARS TO SORT THE LOT.*)
  MRPC(2,IWECK,9)=MRPC(2,IWECK,9)-IQCSMP*PPP
  NST=NITEM2-1
  DO 175 N=1,NST
  IONH(NST)=IONH(NST)-(IQCSMP*PPP)*MRPD(13,NST)
  175 CONTINUE
  COTEX=COTEX+200.00

```

Table 4.2. (cont'd.).

SUBROUTINE LINEQC

```

      IF(ICHIQ2(IQ2).EQ.IDES)GO TO 90C
      GO TO 800
C      MARKETING PROBLEMS DUE TO MINOR DEFECTS
180  CONTINUE
      XLX=RND(1)
      LXX=INT(XLX+.63)
      IF(LXX)18C,190,20C
190  CONTINUE
      WRITE(61,1008)
1008 FORMAT(*-*,*YOUR YOUR CHOICE TO LET THE PRODUCTS THROUGH WITHOUT S
      ORTING WILL EVENTUALLY CAUSE A DROP IN SALES. THIS IS DUE TO THE
      LOSS OF CUSTOMER APPEAL FROM YOUR PRODUCT DUE TO BLEMISHES. MARKE
      CTING HAS FIGURED OUT THE COST TO YOUR COMPANY IS ROUGHLY $400.00.*
      C)
      COTEX=COTEX+400.00
      IF(ICHIQ2(IQ2).EQ.IDES)GO TO 90C
      GO TO 800
200  CONTINUE
      IF(ICHIQ2(IQ2).EQ.IDES)GO TO 21C
201  WRITE(61,1009)
1009 FORMAT(*-*,*YOU WERE PARTIALLY LUCKY FOR NO EXTRA COSTS FOR MANIPU
      LATIONS WERE INCURRED. UNFORTUNATELY YOUR DIAGNOSIS OF THE QUALIT
      Y CONTROL PROBLEM WAS INCORRECT. IT IS POSSIBLE THAT A WRONG AND
      CA LOT OF LUCK MIGHT WORK OUT BUT IN MANY CASES IT WON'T. FOR YOU
      OR INCORRECT EVALUATION OF THE PROBLEM YOU WILL BE CHARGED $200.00.
      C*)
      COTEX=COTEX+200.00
      GO TO 900
210  CONTINUE
      WRITE(61,1010)
1010 FORMAT(*-*,*YOU HAVE PROPERLY DIAGNOSED THE LOT!*)
      GO TO 900
200  CONTINUE
      IF(ISCRST.EQ.2)GO TO 35C
      IF(IMJR(IQ2).EQ.IRES)GO TO 310
      WRITE(61,1011)
1011 FORMAT(*-*,*YOU WILL BE CHARGED $200.00 TO SORT THE LOT. YOUR IN
      CORRECT DIAGNOSIS OF THE DEFECTIVES WILL ALSO COST YOU A FEE. THE
      C DEFECTIVE UNITS WERE OF A MINOR NATURE. SINCE YOU HAVE IMPROPERL
      Y DIAGNOSED THIS LOT IT IS ASSUMED YOU WILL DO THE SAME ON OTHER
      QUALITY CONTROL PROBLEMS. THIS CREATES A WASTE OF ESSENTIAL PERSONNEL
      FOR SORTING OPERATIONS AND WILL COST YOU AN ADDITIONAL $300.
      C00.00*)
      COTEX=COTEX+200.00
      COTEX=COTEX+300.00
      IF(ICHIQ2(IQ2).EQ.IDES)GO TO 90C
      GO TO 800
310  WRITE(61,1012)
1012 FORMAT(*-*,*THE SORTING OPERATION WILL COST YOU $200.00.*)
      COTEX=COTEX+200.00
      IF(ICHIQ2(IQ2).EQ.IDES)GO TO 90C
      GO TO 800
350  CONTINUE
      IF(IMJR(IQ2).EQ.IRES)GO TO 400
      WRITE(61,1013)
1013 FORMAT(*-*,*THIS DEFECT IS CONSIDERED TO BE OF A MINOR NATURE. FO
      R IMPROPERLY DIAGNOSING THE LOT YOU WILL BE CHARGED THE COST OF
      C THE FINISHED ITEMS. THIS ACTION IS BASED ON THE FACT THAT MANY TI
      CMES MINOR DEFECTS HAVE NO EFFECT ON THE VALUE OF A PRODUCT.*)
      NST=NITEM-1
      DO 360 N=1,NST
      IONH(NST)=IONH(NST)-IQCSMP*MRPD(13,NST)
      COTEX=COTEX+IQCSMP*CITM(NST)*MRPD(13,NST)
360  CONTINUE
      MRPC(2,IWEEK,9)=MRPC(2,IWEEK,9)-IQCSMP
      IF(ICHIQ2(IQ2).EQ.IDES)GO TO 900
      GO TO 800
400  CONTINUE
      NST=NITEM-1
      DO 430 N=1,NST
      IONH(NST)=IONH(NST)-IQCSMP*MRPD(13,NST)
430  CONTINUE
      MRPC(2,IWEEK,9)=MRPC(2,IWEEK,9)-IQCSMP
      ICHK8=IQCSMP*PBP
      CSTT=IQCSMP*CITM(ITEM)-ICLK8*CITM(ITEM)-200.00
      IF(CSTT.LE.0.0)GO TO 440
      WRITE(61,1014)CSTT

```

Table 4.2. (cont'd.).

SUBROUTINE LINE4C

```

1014 FORMAT(*-*,*YOU WILL BE CHARGED $*,F10.2,* FOR THE COST SAVINGS YO
    CU PASSED UP FROM NOT SORTING THE ORDER.*)
    COTEX=COTEX+CSTT
440 CONTINUE
    IF(ICH(IQ2).EQ.IDES)GO TO 90C
    GO TO 820
500 CONTINUE
    IF(ICH(IQ2).EQ.IDES)GO TO 550
    IF(IMJR(IQ2).EQ.IRES)GO TO 525
    WRITE(61,1015)
1015 FORMAT(*-*,*THE QUALITY CONTROL PROBLEM SHOULD HAVE LED YOU TO REJ
    CECT THE LOT. FOR YOUR IMPROPER DIAGNOSIS OF THE PROBLEM YOU WILL
    BE CHARGED $1000.00. IN MANY CASES A RECALL OF THE PRODUCT WOULD
    HAVE BEEN NECESSARY, IF THIS WERE THE CASE IT WOULD COST A GREAT
    DEAL MORE!*)
    COTEX=COTEX+1000.00
    GO TO 900
525 CONTINUE
    WRITE(61,1016)
1016 FORMAT(*-*,*THE QUALITY CONTROL PROBLEM SHOULD HAVE LED YOU TO A R
    EJECT DECISION. THE MINOR DEFECT WILL EVENTUALLY CAUSE A DROP IN
    YOUR COMPANIES MARKET STANDINGS. THIS DROP WILL COST YOU $600.00
    C!*)
    COTEX=COTEX+600.00
    GO TO 900
550 CONTINUE
    IF(IMJR(IQ2).NE.IRES)GO TO 201
    WRITE(61,1017)
1017 FORMAT(*-*,*YOU HAVE PROPERLY DIAGNOSED THE LOT.*)
    GO TO 920
800 CONTINUE
    WRITE(61,1050)
1050 FORMAT(*-*,*GIVEN THE INFORMATION PROVIDED IN THE QUALITY CONTROL
    PROBLEM YOU SHOULD HAVE ACCEPTED THE LOT. FOR YOUR IMPROPER DIAGN
    OSIS YOU WILL BE CHARGED AN ADDITIONAL $300.00.*)
900 CONTINUE
    WRITE(61,1060)EQUAL
1060 FORMAT(*-*,*EXAMINE THE CONTROL CHART YOU HAVE DRAWN FOR THE QUALI
    TY CONTROL PROBLEM * I2 * YOU HAVE THE OPTION OF MAKING SOME FIN
    CE ADJUSTMENTS ON YOUR LINE MACHINERY. THESE ADJUSTMENTS WILL COST
    YOU $200.00 IF YOU IMPLEMENT THE PROGRAM. IF YOU WISH TO MAKE TH
    CE ADJUSTMENTS INPUT YES, IF YOU WOULD LIKE TO FOR GO THE ADJUSTMEN
    TS INPUT NO.*)
    READ(60,2000)IANS
    IF(IANS.NE.2)MYE)GO TO 999
    COTEX=COTEX+200.00
    IADJ=1
999 CONTINUE
    CALL MRP
    RETURN
    END

```

Table 4.2. (cont'd.).

SUBROUTINE EXTRA

```

C      SUBROUTINE EXTRA          3-16  C-4
      INTEGER SIGACT(23,9)
      COMMON MRFC(5,50,6), MRFD(16,9), IONH(9), STKP(10), NUMR(9), ICSF(10), I
      CSPEC(10), NCSP(10), ICHCK(10), IAC(10), ICH(9), IWKST(9), IWK(9), TIMIN(
      C9), SUBR, ISTOP, IWEK, NQV, NTIMES, NITEM2, ITYPE, ITEM, FLIP, LOP, ACT, COTP
      C1, COTE3, COTM4, COTL5, COTEX, ISPE, COTL2, NINE(9), SIGACT(23,9), TOCTPO(9
      C), TCOTC(9), TCOTE0(6), TCOTHI(9), TCOTLO(9), TCOTEX(9), NC, NSL, Z, Y, COT
      CPO, COTCO, COTE0, COTLO, COTE6, NPLC, RRPD(9), SSPD(9), ICH1Q2(2), IMJR(2),
      CIGCSMP, PBP, YX, IADJ, CITW(9), OVERAD, ISALE, SALE, PURCH(9), IWK52, IWWW, I
      CUNION, IGRV1(4), IGRV2(4), NGRV, ITRIKE, STKB0, STCST(4,2), IHSTK, IEX, IAN
      C(10)
      WRITE(61,10C1)
1001  FORMAT(*-*,*NO EXTRA PROBLEMS FOR THIS ITEM DURING THIS WEEK*)
      NEVENT=1
      NINE(ITEM)=NINE(ITEM)+1
10   IF(NEVENT-NINE(ITEM))30,20,20
20   SIGACT(15,ITEM)=1
30   CONTINUE
      CALL MRP
      RETURN
      END

```

Table 4.2. (cont'd.).

FUNCTION RND

```

FUNCTION RND(DUMMY)
RND=RANF(DUMMY)
RETURN
END

```

DATA CHANGES

This section contains empty data sheets that will aid the program manager during the modification of the program to simulate different product lines. These empty sheets SHOULD NOT be removed from this manual!*

The last part of the section contains two examples of data packs used for the simulation of different product lines. These copies should be used as guidelines during the modification of the simulation.

* These data sheets should be duplicated for use.

PRODUCT LINE _____

INFORMATION	PRODUCTION					
PART #						
SPEC DATE						
VENDOR 1						
VENDOR 2						
VENDOR 3						
VENDOR 4						
ORDER QUAN.						
LEAD TIME						
SCRAP FACT.						
QUAN/UNIT						
QUAN/PALLET						
BEG INV						
DOWN TIME						
SALES PRICE						
FIXED COST						
OVERHEAD						

MARKETING FORECAST

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

____ UNION ____ NON-UNION

OTHER NOTES:

Figure 4.3. Empty product information sheet

GENERAL INFORMATION

_____ NUMBER OF DIGITS (this number should be the largest
 number of integer places for either the order
 quantity or the on-hand inventory)

PRODUCTION QC PROBLEMS

(simulation) _____ MAJOR _____ MINOR, _____ SIZE OF SAMPLED LOT

_____ ACCEPT LOT _____ REJECT LOT

(exercise) _____ MAJOR _____ MINOR

_____ ACCEPT LOT _____ REJECT LOT

SPECIFICATIONS

_____ NUMBER OF PARTS

<u>SPEC. #</u>	<u>MODIFICATION NEEDED</u>	<u>AREA OF MODIFICATION</u>
1	_____ YES _____ NO	NUMBER _____
2	_____ YES _____ NO	NUMBER _____
3	_____ YES _____ NO	NUMBER _____
4	_____ YES _____ NO	NUMBER _____
5	_____ YES _____ NO	NUMBER _____
6	_____ YES _____ NO	NUMBER _____
7	_____ YES _____ NO	NUMBER _____
8	_____ YES _____ NO	NUMBER _____
9	_____ YES _____ NO	NUMBER _____
10 EXERCISE	_____ YES _____ NO	NUMBER _____

GENERAL INFORMATION (cont'd)INCOMING QC PROBLEMS

<u>PROB #</u>	<u>DECISION</u>		<u>DECISION</u>	
1	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR
2	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR
3	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR
4	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR
5	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR
6	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR
7	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR
8	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR
9	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR
10 exercise	☐ ACCEPT	☐ REJECT	☐ MAJOR	☐ MINOR

PRE-SET SCHEDULED RECEIPTS AND MARKETING FORECASTS

<u>ITEM</u>	<u>QUANTITY</u>	<u>WEEK</u>
1		
2		
3		
4		
5	(UNDER THIS HEADING THERE SHOULD BE AS MANY SCHEDULED	
6	RECEIPTS AS IS NECESSARY)	
7		
etc...		

Table 4.3

COPY OF DATA

[illegible]

Table 4.3 (cont'd)

1	WHICH	RANDOM	SECTION 1	FOR GUIDED	2 FOR REAL LIFE	
0.000.10	LOWER	LIMIT	UPERLIMIT			
0.100.11	LOWER	LIMIT	UPERLIMIT			
0.110.21	LOWER	LIMIT	UPERLIMIT			
0.210.23	LOWER	LIMIT	UPERLIMIT			
0.230.25	LOWER	LIMIT	UPERLIMIT			
0.250.35	LOWER	LIMIT	UPERLIMIT			
0.350.37	LOWER	LIMIT	UPERLIMIT			
0.370.47	LOWER	LIMIT	UPERLIMIT			
0.470.52	LOWER	LIMIT	UPERLIMIT			
0.520.54	LOWER	LIMIT	UPERLIMIT			
0.540.55	LOWER	LIMIT	UPERLIMIT			
0.000.00	LOWER	LIMIT	UPERLIMIT			
0.000.15	LOWER	LIMIT	UPERLIMIT			
0.150.16	LOWER	LIMIT	UPERLIMIT			
0.160.26	LOWER	LIMIT	UPERLIMIT			
0.260.30	LOWER	LIMIT	UPERLIMIT			
8	NUMBER OF PLACES					NPLC
12	PRODUCTION QUALITY CONTROL YES=2 NO=1					ICHIQ2(X)
12	MAJOR CF MINOR DEFECT 1=MAJOR 2=MINOR					IMJR(X)
100000	LOT SIZE FOR QUALITY CONTROL PRODUCTION					IQCSMP
0.05	OF BAD PARTS					PBP
0.30	OF DOWN TIME TO BE MULTIPLIED BY .30					XX
2	UNION=1, NON-UNION=2					IUNION
BENIFITS	PAY	WORKING	COPLANT LAYO			IGRV1(X)
		NCITIONS	FFS			IGRV2(X)
2000.001000.00	INCENTIVE	PAYMENTS	TO PREV STRIKE			STCST(X,Y)
2000.001000.00	INCENTIVE	PAYMENTS	TO PREV STRIKE			STCST(X,Y)
2000.001000.00	INCENTIVE	PAYMENTS	TO PREV STRIKE			STCST(X,Y)
2000.001000.00	INCENTIVE	PAYMENTS	TO PREV STRIKE			STCST(X,Y)
REQUIRESCH	RECPTS	INVPLD	ORD	TITLES FOR SCHEDULE		SEQA(4)
SALES	PRODUCTFIN	INVPLD	PRD	TITLES FOR SCHEDULE		SEQA(8)
REQ	SCH ON	HPLD		TITLES FOR SCHEDULE		SEQB(4)
SALEPROD	ON	HPLD		TITLES FOR SCHEDULE		SEQB(8)
011201	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
020801	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
030301	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
040401	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
011102	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
020202	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
040702	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
011003	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
030103	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
040603	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
040504	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
010904	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
011409	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
021609	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
031509	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
041309	FOR ROUTE	THE WEEK	THE SUBROUTINE	ITEM		WK,SUBR,ITEME
000010	10 IS THE	SIGNAL	TO STOP	READING CARDS		WK,SUBR,ITEME

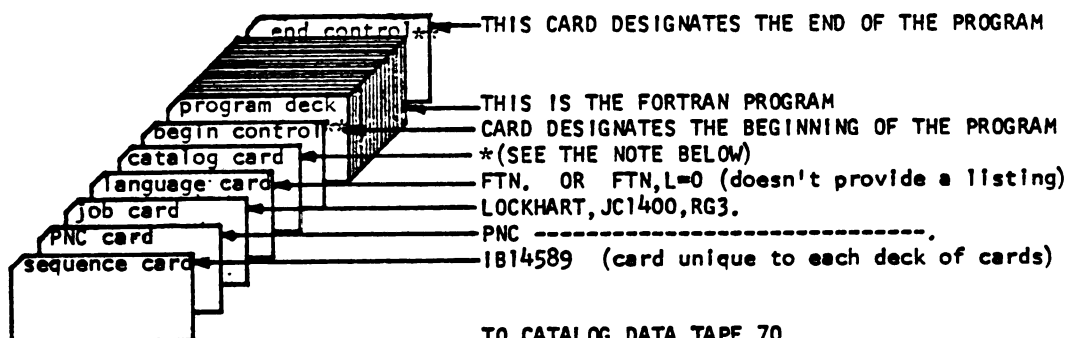
ACCESS & EXECUTION OF PROGRAM

This section includes all of the commands and instructions necessary to load, execute, and purge the program.

The following diagrams illustrate the sequence of the cards for each program deck.

TO CATALOG UNITS AS PERMANENT FILES

TO CATALOG THE MAIN PROGRAM "THSKMK"



TO CATALOG DATA TAPE 70

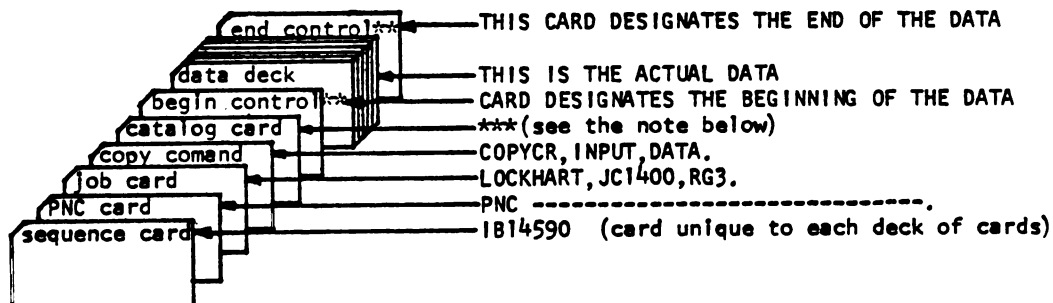


Figure 4.4. Card catalog sequence

TO CATALOG DATA TAPE 14 & EXEC. FILE

This deck is identical to the catalog deck for data tape 70 with the exception of the catalog card and the data. **** (SEE THE NOTE BELOW)

- * CATALOG, LG0, PROJECT 425, RP=999, CN=GETRID, ID=K KAJIYA.
- ** BEGIN CONTROL IS A 789 TYPED ON TOP OF ONE ANOTHER.
END CONTROL IS A 6789 TYPED ON TOP OF ONE ANOTHER.
- *** CATALOG, DATA, KAJ70, RP=999, CN=GETRID, ID=K KAJIYA.
- **** TAPE 14
CATALOG, DATA, KAJ14, RP=999, CN=GETRID, ID=K KAJIYA.
EXEC FILE
CATALOG, PKG425, PROGRAM FOR PKG 425, RP=999, CN=GETRID, ID=K KAJIYA.

TO CATALOG UNITS AS PERMANENT FILES (con'd)

Table 4.4
CATALOG OUTPUT

```

03/31/80 MSU HUSTLER 2 LSD 49.45 03/19/80 CYBER750
17.05.59.1801543
17.06.00.JOB READ- 03/31/80 .17.05.55.
17.06.00.LOCKHART,JC1400,RG3.
17.06.06.LAST ACCESS- 8 17.04 03/31/80
17.06.06.RUNS- 0035 PN DOLLAR BALANCE $00125.96
17.06.06.C00046 CARDS READ VALUE $0000000.06
17.06.06.CP-PP SEC. 008- .000 $ .00
17.06.06.COPYCR,INPUT,DATA.
17.06.07.RP 00000004 000000000123 MAXFL 011300
17.06.07.CP-PP SEC. .012- .255 $ .01
17.06.07.CATALOG,DATA,KAJ14,RP=999,CN=+---*,ID=KK
17.06.07.AJIYA.
17.06.08.FILE CATALOGED AS
17.06.08.DATA - CYCLE 01, KAJ14
17.06.08.MAX FILES 0002 MAX PRUS 0001008.
17.06.08.RP 00000007 000000000135
17.06.08.PP 1.105 SEC.
17.06.08.CP USE .016 SEC VALUES .00
17.06.08.PP USE .793 SEC VALUES .00
17.06.08.CH USE .018 W-H VALUES .00
17.06.08.TOTAL COMPUTE VALUE AT RG3 $ .01
17.07.45..000003 PAGES PRINT. 000031 LINE 3 PRINT. FOR $ 000.05 AT PG2.

```

To complete the cataloging procedure, the card deck must be read in to the computer by a card reader at the Computer Center. (for instructions on the use of the card readers see the appendix)

The above figure is an example of the proper output that should be received when successfully cataloging a permanent file. If the output contains a fortran error message there is some type of fatal error within the program.

NOTE: If the file is to be recataloged you must PURGE the file that was previously created. (for PURGING instructions review the appropriate section on the following page)

TO PURGE A PERMANENT FILE

First you must log on to the computer. The instructions to log on are in the appendix. Once you have logged on, type the following instructions:

1. ATTACH,PKG425,(perm. file name)*,PW=GETRID.
2. THE COMPUTER WILL RETURN THE MESSAGE-
 "ATTACH,PKG425,(perm. file name),PW='-----'."
 "READY"
3. PURGE,PKG425.
4. THE COMPUTER WILL RETURN THE MESSAGE-
 "PURGE,PKG425."
 "READY"
5. YOUR NEXT STEP SHOULD BE TO CHECK THAT THE COMPUTER
 DID IN FACT PURGE THE PERMANENT FILE. TYPE THE FOLLOWING:
 - a. RETURN,PKG425.
 - b. THE COMPUTER WILL RETURN THE MESSAGE-
 "READY"
 - c. ATTACH,PKG425,(perm. file name)
 - d. THE COMPUTER WILL RETURN THE MESSAGE-
 "ATTACH,PKG425."
 "PERM FILE NOT ON SYSTEM"
 "READY"

YOU CAN THEN LOG OUT.

* THIS SHOULD BE THE NAME OF THE PERMANENT FILE (ie. PROJECT 425)

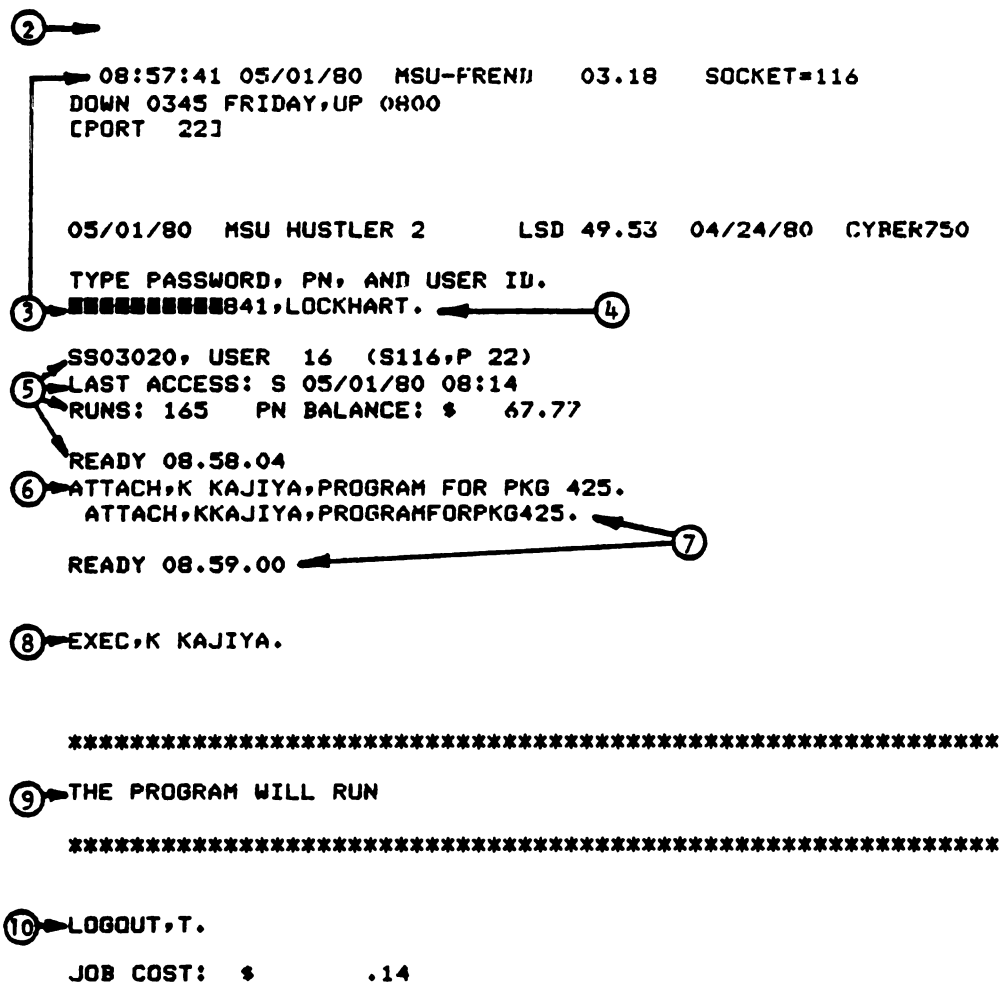
INSTRUCTIONS FOR PROGRAM ACCESS

To access and run the program you should follow the following instructions:

1. Go to a computer terminal and log on (this terminal should be a DECWRITER with a baud rate of 1200).
2. TYPE- TWO CARRIAGE RETURNS (2)
3. COMPUTER PRINTS "TYPE PASSWORD,PN,AND USER ID."
"██████████"
4. On top of these squares (■) you should type the following
"PKGKK,4414841,LOCKHART." (2)
5. COMPUTER PRINTS last access information, then it prints
"READY"
6. TYPE- "ATTACH,(first six letters of your last name),
PROGRAM FOR PKG 425." (2)
7. COMPUTER PRINTS "ATTACH,""",""",PROGRAM FOR PKG 425."
"READY"
8. TYPE- "EXEC,(first six letters of your last name)." (2)
9. AT THIS POINT THE PROGRAM WILL EXECUTE.
10. WHEN YOU ARE DONE TYPE- "LOGOUT,T." (2)

ON THE FOLLOWING PAGE THERE IS AN EXAMPLE OF WHAT THE ACTUAL OUTPUT SHOULD LOOK LIKE.

Table 4.5
LOGGING IN PROCEDURE



INSTRUCTIONS FOR PROGRAM ACCESS (cont'd) .

When the program asks a question, the format should be read VERY CAREFULLY before responding. Answer all of the questions with an appropriate statement or number followed by a carriage return (↵). If the carriage return is not pushed, nothing will happen.

NOTES: IF AN ERROR IS MADE BEFORE THE CARRIAGE RETURN IS DEPRESSED, BACKSPACE TO THE POINT OF THE ERROR AND COMPLETE THE REST OF YOUR RESPONSE. OR, HOLD THE CONTROL BUTTON DOWN, PUSH THE (X) KEY AND THEN RESPOND WITH THE CORRECT ANSWER (start from the beginning of the response).

WHILE RUNNING THE PROGRAM IGNORE ANY BELL SOUNDS.

IF THE OUTPUT CONTAINS A (-1), SEE THE PROGRAM ADMINISTRATOR (COURSE INSTRUCTOR) FOR ASSISTANCE.

IF YOU ENCOUNTER A MAJOR PROBLEM DURING THE SIMULATION PRESS THE 'ESC' KEY. THE TERMINAL SHOULD RESPOND WITH THE MESSAGE 'READY'. LOG OFF THE TERMINAL AND TAKE THE OUTPUT TO THE PROGRAM ADMINISTRATOR FOR ASSISTANCE.

IF YOU ENCOUNTER PROBLEMS OTHER THAN THE ONES DESCRIBED ASK ONE OF THE PEOPLE IN THE INPUT-OUTPUT ROOM AT THE COMPUTER CENTER FOR ASSISTANCE.

SPECIFICATIONS AND QUALITY CONTROL PROBLEMS

The following section contains quality control problems and specifications which should be examined BEFORE the student executes the program.

This section can be modified if different specifications or quality control problems become necessary. If modifications are included the data for the program must be changed. Use the empty data sheets in the section entitled DATA CHANGES (Chapter VI, Pages 129-134) as a guide during the changes.

SPECIFICATIONS

The specifications on the following pages are broken up into six potential problem areas. Before they are used, the program administrator should go through them and correct all questionable areas within the specifications (they should NOT contain any errors). One area can be modified to create some type of error or over specification. This is an option which will provide students with an opportunity to review specifications. If the specification has been changed to create a problem the data corresponding to the specification must reflect the change. 0 (ZERO) indicates that there has been no change, 1 indicates that a change has been made. It will be up to the program administrator to decide how subtle the problem (change) should be.*

Use the examples on the following pages as guidelines when converting the simulation to accomodate different product lines.

- * Examples of different changes can be seen if the specifications on the following pages are compared with revised specifications in Chapter V, Pages 205-213.

REPORT: S097648

ABC CORP.
PACKAGING BILL OF MATERIALS

DESC: THSISOL
SIZE: 24 PINTS

STOCK NUMBER: 33 21

FINISHING SPEC. CODE: 1001
DEPARTMENT: PACKAGING

RUN DATE: 04/25/80

LAST REV: 07/17/79

STOCK NUMBER	DESCRIPTION	QUANTITY	U/
19580	THSISOL	11,880	L
3642	BOTTLE 16oz POLY 28 CT THSISOL	24,000	EA
4123	CAP 28 BLUE METAL P-PEPL LIN	24,000	EA
2324	LABEL 2 27/32 X 1 15/16 DIE CUT	24,000	EA

LABEL INSTRUCTIONS:

BOTTLE LABEL IMP W/"EXP----" AND "LOT----". (ONE LINE) SUPPLY TWO
STICKY BACK RUBBER PLATES STYLE VL 18-RBC F/IMP RESHIPPER "W/"EXP----"
AND "LOT----".

PACKAGING INSTRUCTIONS: LABEL PLACEMENT FROM BOTTOM OF BOTTLE: 1 5/16 IN.
IMPRINT "EXP----" AND "LOT----" ON PRINTED RESHIPPER FOR 24. USE (105 627)
GLUE FOR THE BOTTLE LABEL ADHESIVE. APPLY ORM-D "COPY" TO UPPER RIGHT
HAND CORNER OF THIRD PANEL OF RESHIPPER. POST RESHIPPER STOCK # AND
TITLE ON THE PACKAGING LINE. THE FOLLOWING TESTS MUST BE ACCEPTABLE
BEFORE 1880 APPROVAL IS GIVEN : ASSAY (ALCOHOL), ASSAY (DENATONIUM
BENZOATE), TLC IDENTIFICATION TEST AND METHYL ALCOHOL TEST. SEND 2
RESERVE SAMPLE BOTTLES TO CONTROL SPECS DEPT.

PROOF READER:
PACKAGING DEV:

DATE:
DATE:

LABEL CONTROL:
QUALITY CONTROL:

DATE:
DATE:

Figure 4.5. Specifications

ABC CORP
DIVISION OF MICHIGAN STATE UNIVERSITY

PAGE 1 OF 5 PGS

CONTAINER SPECIFICATION

SPECIFICATION NO.: 22222

ISSUE DATE: 09/04/76

SUPERSEDES: NEW SPEC.

CHANGE: -NONE-

ITEM: BOTTLE

CAPACITY: 16oz./473.184 ml OVERFLOW CAPACITY:
STYLE: MODIFIED ROUNDED SQUARE CONTAINER WEIGHT: 33 grams $\pm$ 1 gram
NECK OR FINISH: 28-400
DIMENSIONS: SEE ATTACHED DRAWING.

MATERIAL: LINEAR POLYETHYLENE (.955 DENSITY) FORTIFLEX PE RESIN
FORMULA No. 855-40H (CELANESE) or (.955 DENSITY)
COLOR: NATURAL No. LC 732 (U.S.I.) or (.955 DENSITY)
DECORATION: NONE No. 388 (O.I.)

PACK FOR SHIPMENT:

RESHIPPER OF 24.

LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER #,
AND SUPPLIER ON EACH CONTAINER.
OTHER INFORMATION:

QUALITY CONTROL REQUIREMENTS: SEE "PACKAGING MATERIALS AND SUPPLIES
ACCEPTANCE STANDARDS". ADDITIONAL
REQUIREMENTS:

SPECIAL INSTRUCTIONS:

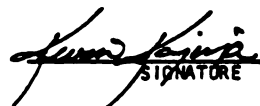

SIGNATURE

Figure 4.5. (cont'd.).

ABC CORP
DIVISION OF MICHIGAN STATE UNIVERSITY

PAGE 2 OF 5 PGS

PACKAGING MATERIAL SPECIFICATION

SPECIFICATION NO: 33333

ISSUE DATE: 03/04/76

SUPERSEDES: NEW SPEC.

CHANGE: -NONE-

CAT NO:

ITEM: RESHIPPER

STYLE: RSC WITH "H" PARTITION

DIMENSIONS: I.D.: 18 1/16"L X 11 3/16"W X 7 1/8"H

MATERIAL: 275# TEST "C" FLUTE. TAPE OR CRUSHED GLUE JOINT.

COLOR: NATURAL

PRINTING: STD. BLACK. PANEL #1: TOP FLAP; "THIS SIDE UP HANDLE WITH CARE" PER ATTACHED PROOF. PANEL #1: "COPY" PER ATTACHED PROOF. BOTTOM FLAP; BOX MAKER'S CERTIFICATE. PANEL #2 "COPY" PER ATTACHED PROOF. PANEL #3: "COPY" PER ATTACHED PROOF. PANEL #4: "COPY" PER ATTACHED PROOF. PANEL #1: BOTTOM FLAP; STOCK No. "33333". (none of the copies are included)

PACK FOR SHIPMENT:

LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER #, QUANTITY AND SUPPLIER ON EACH CONTAINER. FOR FOLDING CARTONS, SHOW QUANTITY: AS QUANTITY PER ROW/ROWS PER LAYER/LAYERS PER CASES AND TOTAL QUANTITY. OTHER INFORMATION:

QUALITY CONTROL REQUIREMENTS: SEE "PACKAGING MATERIALS AND SUPPLIES ACCEPTANCE STANDARDS".
ADDITIONAL REQUIREMENTS:

SPECIAL INSTRUCTIONS: RESHIPPER TO BE ANTI-SLIP COATED (LUDOX)

1

2

3

4

[Signature]
SIGNATURE

Figure 4.5. (cont'd.).

ABC CORP
DIVISION OF MICHIGAN STATE UNIVERSITY

PAGE 3 OF 5 PGS

PACKAGING MATERIAL SPECIFICATION

SPECIFICATION NO: 33333

ISSUE DATE: 03/04/76

SUPERSEDES: NEW SPEC.

CHANGE: NONE

ITEM: "H" PARTITION - CELL

STYLE: FULL HEIGHT

DIMENSIONS: ASSEMBLED CELL SIZE 18"L X 5 1/2"W X 7 1/8"H

MATERIAL: 275# TEST "C" FLUTE

COLOR: NATURAL

PRINTING: NONE

PACK FOR SHIPMENT: ASSEMBLED IN RSC.

LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER #,
QUANTITY AND SUPPLIER ON EACH CONTAINER.
OTHER INFORMATION:

QUALITY CONTROL REQUIREMENTS: SEE "PACKAGING MATERIALS AND SUPPLIES
ACCEPTANCE STANDARDS".
ADDITIONAL REQUIREMENTS:

SPECIAL INSTRUCTIONS:

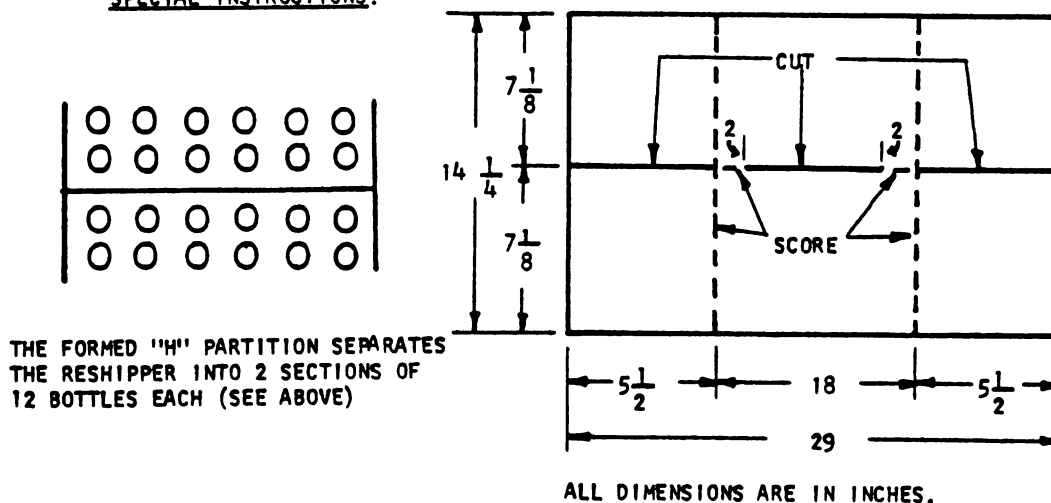


Figure 4.5. (cont'd.).

PACKAGING DEVELOPMENT DIVISION
INCOMING PALLET SPECIFICATION

PAGE 4 OF 5 PGS

STOCK NO: 33 21

CARTONS/LAYER: 6 LAYERS OF 11
1 LAYER OF 10 base

MATERIAL: BOTTLE 16oz POLY 28 CT THESISOL

LAYERS: 7

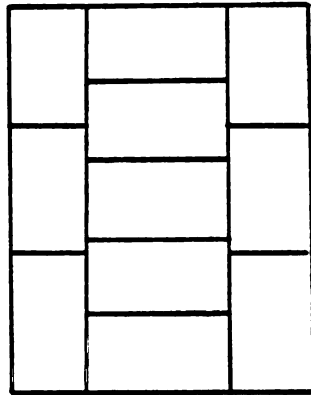
PALLET SIZE: NONE NEEDED (UNITIZED LOAD)

CARTONS/PALLET: 76

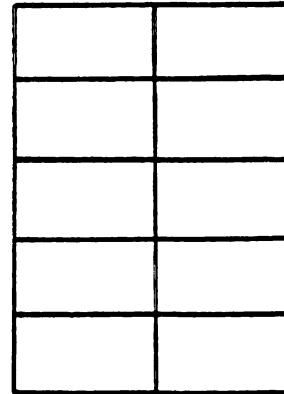
CARTON SIZE: O.D.: 18 7/32"L X 11 11/32"W X 7 9/32"H

OTHER REQUIREMENTS: SPECIAL CORRUGATED SHEET UNDER BASE LAYER (1 REQ)
REGULAR CORRUGATED SHEET ON TOP (1 REQ)
FULL HEIGHT CORNER PADS (4 REQ)
SMALL CORNER PADS FOR BASE ONLY (4 REQ)

TOP VIEW REG. LAYER (6 REQ)



TOP VIEW BASE LAYER (1 REQ)



37"

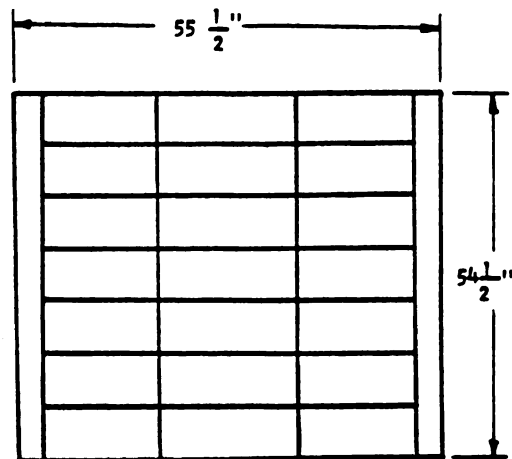
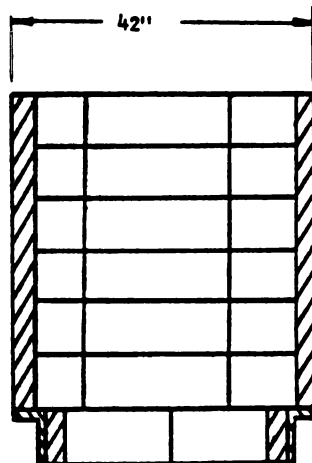


Figure 4.5. (cont'd.).

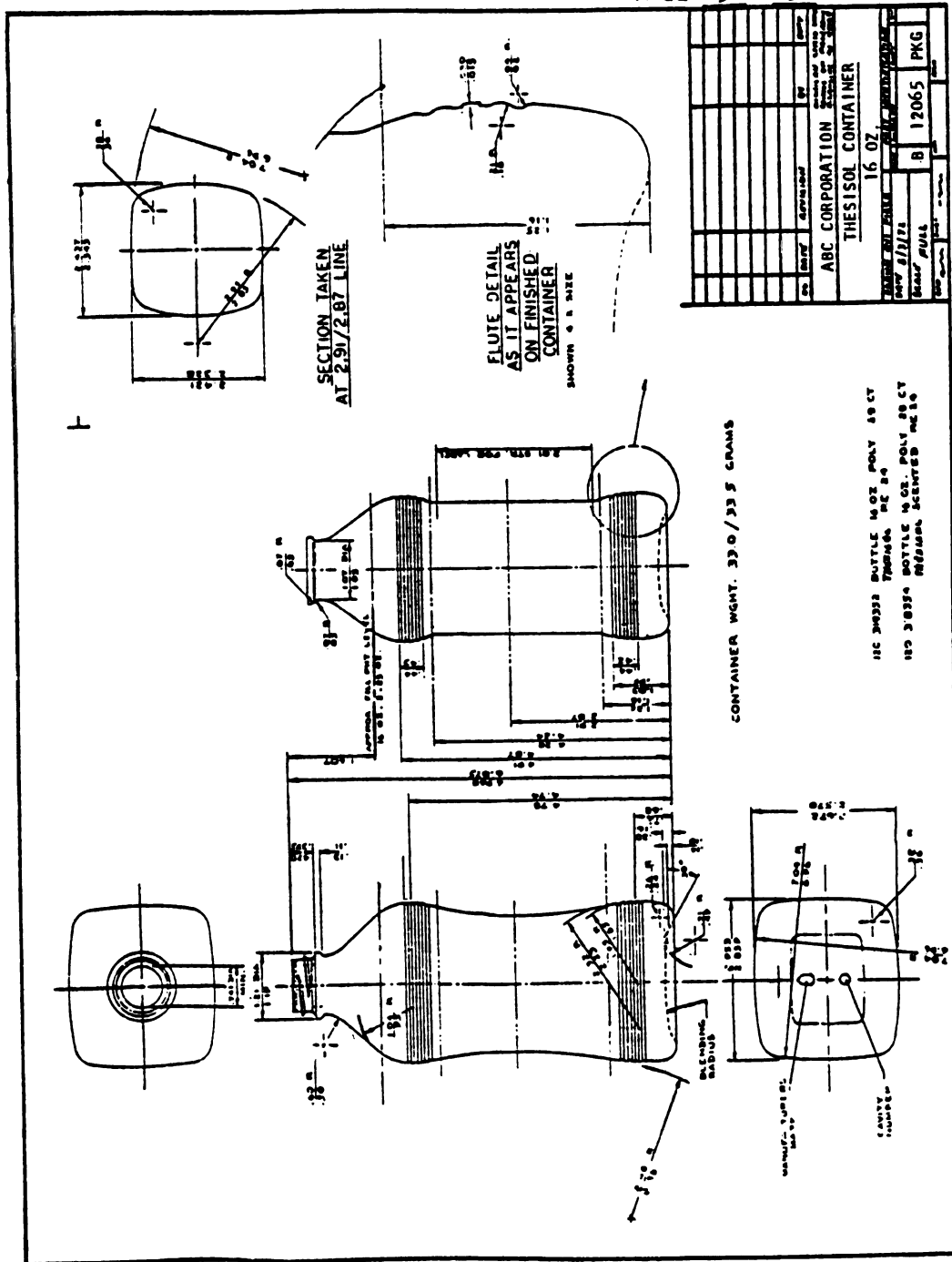


Figure 4.5. (cont'd.).

ABC CORP
DIVISION OF MICHIGAN STATE UNIVERSITY

PAGE 1 OF 2 PGS

CLOSURE SPECIFICATION

SPECIFICATION NO: 44444
ISSUE DATE: 04/10/78
SUPERSEDES: 03/21/75
CHANGE: CORRECT SPEC NO.
FROM 74592 TO ABOVE. 1

ITEM: CAP
SIZE: 28mm
STYLE: CT
DIMENSIONS: .409-.419"H X 1.186-1.221"DIA.
NECK OR FINISH: 28-400

2

MATERIAL: CAP: TINPLATE
LINER: P-PEPL: .035 PULP/PAPER/POLYETHYLENE

COLOR: BLUE

DECORATION:

3

PACK FOR SHIPMENT: 5000/CARTON.

LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER #,
QUANTITY AND SUPPLIER ON EACH CONTAINER.
OTHER INFORMATION:

4

QUALITY CONTROL REQUIREMENTS: SEE "PACKAGING MATERIALS AND SUPPLIES
ACCEPTANCE STANDARDS".
ADDITIONAL REQUIREMENTS:

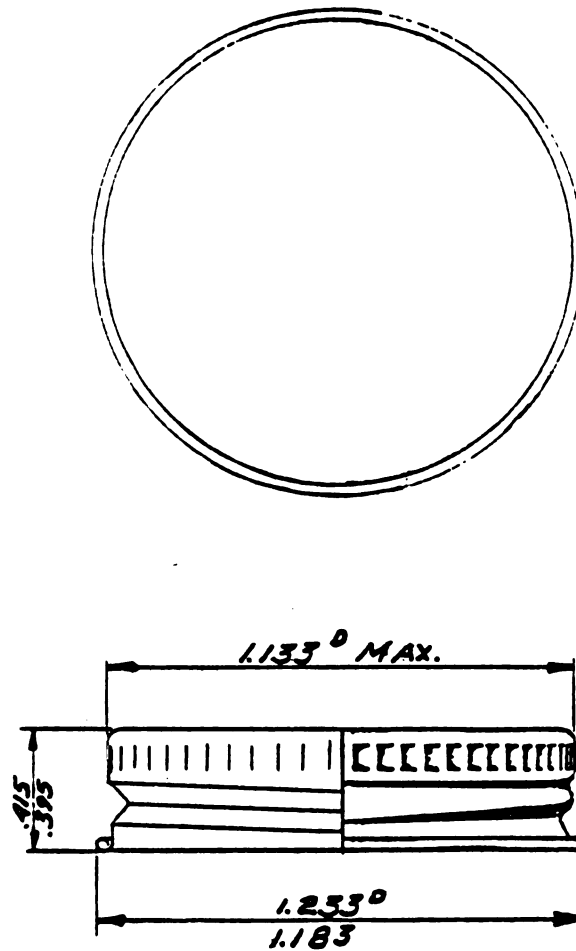
SPECIAL INSTRUCTIONS:

5

6


SIGNATURE

Figure 4.5. (cont'd.).



DIMENSIONS SHOWN MEET WITH INDUSTRY STANDARDS.
RECOMMENDED BY GCM/ COMMITTEE ON CLOSURES

		TITLE 28-900- 6 PITCH FLAT TOP RIVETED METAL CLOSURE.
OWENS-ILLINOIS R- 10000 <u>SWL</u> ①	ASSEMBLY DRAWING 28-900	
DATE <u>3/28/67</u>		A-6736

Figure 4.5. (cont'd.).

COURTESY OF OWENS-ILLINOIS (1967)

ABC CORP		PAGE <u>1</u> OF <u>1</u> PGS	
DIVISION OF MICHIGAN STATE UNIVERSITY			
LABEL SPECIFICATION		SPECIFICATION NO.: 11111	
		LABEL NO: 88 11111	
		ISSUE DATE: 07/18/79	
		SUPERSEDES: 10/17/78	
		CHANGE: PRINTING REGISTRATION	
STOCK NO: 2324			
PRODUCT: THESISOL 24 PINTS			
ITEM: BOTTLE LABEL			
TRADE: DOMESTIC			
STYLE: <u> </u> CUT <u> </u> x OTHER <u> </u> DIE CUT			
<u> </u> ROLL - INDEXING HOLE LOCATION			
(SEE PAGE 2 FOR UNWIND INFO - IF REQ)			
STOCK: <u> </u> x REGULAR LABEL (60# WHITE VARNOSSET DUAL PURPOSE, OR EQUIV.)			
<u> </u> THIN FORM (30# WHITE IMPERIAL BIBLE H.S. OFFSET, " .)			
<u> </u> HEAT SEAL			
<u> </u> OTHER			
DIMENSIONS: 2 27/32"H X 1 15/16"W			
GRAIN: <u> </u> HORIZONTAL <u> </u> VERTICAL			
INK COLOR: BLUE (PMS-280)			
PRINTING REGISTRATION: TOP OF COPY OR TITLE BLOCK TO TOP OF LABEL: 1/8"			
LEFT SIDE TRIM TO COPY OR TITLE BLOCK: 7/32"			
PACK FOR SHIPMENT: IN COMMERCIALY ACCEPTABLE CORRUGATED BOXES, SHOWING LABEL PRINTER'S NAME AND ADDRESS. ATTACH ONE CANCELLED LABEL AND AN ENVELOPE CONTAINING A COPY OF THE REC. TO ONE BOX OF EACH ORDER.			
LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER NUMBER, AND SUPPLIER ON EACH CONTAINER. OTHER INFORMATION:			
QUALITY CONTROL REQ.: SEE "PACKAGING MATERIALS AND SUPPLIES ACCEPTANCE STANDARDS". SUPPLY 2 PRESS SHEETS OF EACH RUN TO THE PRODUCTION QUALITY CONTROL DEPT., ABC CORP. ADDITIONAL REQUIREMENTS:			
SPECIAL INSTRUCTIONS: SUPPLY 4 PLATE PROOFS TO PACKAGING DEVELOPMENT DEPT.			

6

Kevin Kainja
SIGNATURE

Figure 4.5. (cont'd.).

QUALITY CONTROL PROBLEMS

Within this section there are quality control problems in each of the following categories:

Incoming quality control problems corresponding to each part purchased from outside vendors.

One incoming quality control problem to be used for the exercise portion of the simulation. (This problem should relate to the first part listed in the data.)

One processing quality control problem involving the production of the finished inventory.

One processing quality control problem for the exercise portion of the simulation.

QUALITY CONTROL PROBLEM REQUIREMENTS

PROGRAM MANAGER- In setting up the simulation it will be necessary to make up quality control problems in each of the following categories:

INCOMING QUALITY CONTROL PROBLEMS (QC)

Quality control problems containing major or minor defects

Quality control problems with acceptable or rejectable lots

PROCESSING QUALITY CONTROL PROBLEMS

Quality control problems containing major or minor defects

Quality control problems with acceptable or rejectable lots

USER- In running the simulation model it will be necessary to complete and evaluate the following:

INCOMING QUALITY CONTROL PROBLEMS (QC)

DECISION- Is the lot acceptable or should it be rejected?

DECISION- Do the parts have major or minor defects?

CALCULATION- Proof for decision 1.

PROCESSING QUALITY CONTROL PROBLEMS

DECISION- Is the lot acceptable or should it be rejected?

DECISION- Do the parts have major or minor defects?

GRAPH- Draw a control chart for the quality control problem.

DECISION- Should adjustments be made on the production line?

The following pages contain a list of the acceptance criteria for each of the purchased parts.

ABC CORP
QUALITY ASSURANCE PROGRAM

PACKAGING MATERIAL AND SUPPLIES ACCEPTANCE STANDARDS

PLASTIC BOTTLES

SAMPLING PROGRAMS

- I. Visual Inspection- A random sample will be taken following the Military Standard 105-D, General Inspection Level 1 or 11, Single Normal Sampling Plan.
- II. Dimensional Measurements- A random sample of ten bottles will be measured for the appropriate dimensions as listed on the individual specifications.
- III. Leaker Test- A random sample of ten bottles will be tested for leakers by the method specified in this program.
- IV. Flame Treatment Test- A random sample of ten bottles will be tested by the flame treatment test as specified in this program.

ACCEPTABLE QUALITY LEVELS (AQL'S)

Each defect will have its own AQL which is stated on the list of defects. AQL'S between classifications, however, will be interrelated and will be accumulated. For example, Major Defects will be totaled and must pass the higher AQL (1.5%).

DEFINITIONS OF CLASSIFICATIONS:

Critical	A critical defect is any defect which affects the safety, efficacy or legality of the product.
Major A	A Major A defect is any functional defect which will impair production or otherwise render the bottle unusable.
Major B	A Major B defect is a functional defect which will affect shipping, storage, or salability of the product.
Minor	A Minor defect is a non-functional defect which will affect the aesthetic acceptability of the product.

PLASTIC BOTTLES

VISUAL INSPECTION

CRITICAL DEFECTS (AQL 0.0%)

COLOR- Amber bottles must pass light Transmission Requirements of current USP.

Contamination- Foreign material of a chemical nature found on the finish or on the inside of the bottle which will affect the product in any manner (non-compatible grease, etc.).

MAJOR A DEFECTS (AQL 1.0%)

Finish Trim:

False Neck- A neck construction which is additional to the neck finish of the container.

Finish Flash- Excess material due to poor trimming or poor molding.

Bottom Trim:

Flashing- Excess material due to poor trimming or poor molding.

Seamline- Mold mismatch or parting line. A raised line appearing on the surface of a molding and formed at the junction of mold faces (greater than .020")

Choke Neck- Narrowed or constricted opening in the neck of a container affecting the filling operation.

Finish Leakers- Any condition of the finish where the normal closure will not retain the contents of the bottle.

Body Leakers- Any condition of the body in which the contents of the bottle will not be retained (pinholes, parting seams, incomplete bottom).

Wall Thickness- Minimum wall thickness as specified on the individual specifications, measured at the thinnest portion of the bottle.

Foreign Bottle- Any bottle which is foreign to the specification but which can be processed through production.

PLASTIC BOTTLES

VISUAL INSPECTION

MAJOR A DEFECTS (AQL 1.0%) - Continued

Contamination- Foreign material not of chemical nature found on the finish or on the inside of the bottle (bugs, dust, etc.).

Dirty Appearance- Foreign material found on the outside surface of the body of the bottle affecting labeling (grease, dust, etc.).

MAJOR B DEFECT (AQL 1.5%)

Dirty Appearance- Foreign Material found on the outside surface of the body of the bottle affecting salability (dust, dirt, etc.).

Die Lines- Vertical marks on the bottle caused by material build-up on the die parts. (see limit sample)

Flow Marks- Strikes or lines caused by damage to parts. (see limit sample)

Orange Peel- Rough surface of the bottle. (see limit sample)

Foreign Bottle- Any bottle which is foreign to the specification and will not process through production.

Color Variation- Variations in the color of the finished bottle not affecting efficacy or product stability. (see limit sample)

MINOR DEFECTS (AQL 4.0%)

Bubble- A void in the plastic material.

Carbon Specks or Other Inclusions- A portion of black residue from material degradation.

Gel- A small particle of unmelted plastic material which appears as a bead or speck in the finished bottle.

Spider Line- Double Mold Seam- A cloudy streak parallel to the mold seam.

Sink Mark- A shallow depression or dimple on the surface following local internal shrinkage.

PLASTIC BOTTLES

VISUAL INSPECTION

DIMENSIONS:

1. Select 10 bottles randomly from the inspection sample.
2. Check measurements for height, width, and depth.
3. Check for correct finish by applying an appropriate cap.
4. Cut bottle and measure wall thickness where specified on the individual specification.

All measurements must be within the variations specified on the individual specifications.

LEAKER TEST: (Performed on bottles designed for liquid preparations)

1. Select 10 bottles randomly from the inspection sample.
2. Add approximately 25 ml. of Thesitol
3. Cap and invert. Allow to stand 10 minutes.
4. Examine for evidence of leakers.
5. If no leakers are found, the order is acceptable.
6. If two or more bottles leak, the order is unacceptable.
7. If only one leaker is found, re-run the test on an additional 50 bottles randomly selected from the inspection sample.
8. If no additional leakers are found, the order is acceptable.
9. If two or more leakers are found in the 50 bottles tested, the order is unacceptable.

FLAME TREATMENT TEST: (Performed on bottles designed for paper labels)

1. Select 10 bottles randomly from the inspection sample.
2. Spray each bottle with red Poly-Treat-Check Marking Ink.
3. After drying, the ink should not be removed with scotch tape.
4. If 80% of the ink remains after the Scotch Tape Test, the order is acceptable.

ABC CORP
QUALITY ASSURANCE PROGRAM

CAP DEFECTS
A.Q.L.=0.65%

CRITICAL

Foreign Cap (if same size)

MAJOR (GENERAL)

Contaminated or soiled (limit Sample) (Internal- cap or liner)
Damaged Liner or Facing- Any condition that affects sealing
Feathers- Pulp piece large enough to affect sealing (see sample limits)
Foreign Cap (if different size) (Same or different designation)
Liner Not Sealed- Banked or cocked liner (see sample limits)
Loose or Undersize Liner
More Than One Liner
No Liner
Wrong Liner or Wrong Facing

MAJOR (MOLDED CAPS)

Blisters (Internal or External)
Broken or Cracked Cap
Defective Thread (1/4" or more removed)
Excessive Flashing (see limit sample)
Glue on Liner (inside sealing surface)
No Embossing
Poor Molding- Functional
Short Powder (incomplete cap or design- porous appearing condition)

MAJOR (METAL CAPS)

Cracked Thread (Split- light passes)
Dent- (see sample limit)
Defective Bead- Cut out, (see limit sample); Unrolled, if sharp edge
Dirty Appearance - External- (see limit sample)
No Bead
No Knurling
No Threads
Incomplete or Faulty Coverage- Internal or External Coating (see limit sample)
Scored, Scraped or Scratched Coating- Internal or External (see limit sample)
Out of Shape- Malformed or Damaged

CAP DEFECTS (cont'd)MINOR (GENERAL)

Damaged Liner or Facing- Does not affect sealing

MINOR (MOLDED CAPS)

Chipped Rim

Embedded Foreign Material (Discoloration)

Glue on Liner (Not inside sealing surface)

Poor Embossing

Poor Molding- Sticking to mold, etc.

MINOR (METAL CAPS)

Dent- (see limit sample)

Defective Bead- (see limit sample) if not a sharp cutting edge

Dirty Appearance- Internal or External (see limit sample)

Incomplete Coverage- External Coating (see limit sample)

Poor Embossing

Scored, Scraped or Scratched Coating- Internal or External (see limit sample)

NOTE: All threaded caps are to be tested for fit on the proper bottle.
Sample 15 caps per lot.

PRINTING DEFECTS

Foreign Label- CRITICAL
Illegible Lot Number- MAJOR
Missing or Mixed Lot Number- CRITICAL
Missing Color or Registration (one or more colors missing)- MAJOR
Off Registration (placement of copy of register of two or more colors)-
MAJOR OR MINOR
Off Standard Color- MAJOR
Poor Cover Up (Light or dark spots or marks)- MAJOR & MINOR (see limit sample)
Poor Impression- MAJOR & MINOR (see Limit Sample)
Reverse Position of Labels- MAJOR
Streaks or Smudges- MAJOR & MINOR (see limit sample)
Unequal Merging- MAJOR & MINOR (see limit sample)

PAPER DEFECTS

Creased or Folded Labels- MAJOR & MINOR (see limit sample)
 Damaged or Torn Labels- MAJOR & MINOR (see limit sample)
 Dirty Backs- MAJOR & MINOR (see limit sample)
 Improper Direction of Grain (heat seal labels only)- MAJOR
 Improper Paper Weight- MAJOR
 Improper Size of Label (Measurement)- MAJOR
 Off Color Stock- MAJOR

COATING AND ADHESIVE DEFECTS

Absence of Coating (When coating is required)- MAJOR
Improper Color of Coating (Varnish)- MAJOR
Improper or Poor Coating of Adhesive on Heat Seal Label- MAJOR
Improper Type of Coating- MAJOR
Improper Type of Heat Seal Label- MAJOR
Presence of Coating (When coating is not required)- MAJOR

NOTE: MEASURE THE LABEL FOR SIZE AND CHECK SPECIFICATION.

ABC CORP.		
PACKAGING MATERIAL INSPECTION REPORT PACKAGING CONTROL	PART: <i>Bottle</i> VENDOR: <i>M. J. Data</i>	# CONTAINERS: <i>4167</i> # UNITS/CONT.: <i>24</i> # SAMPLED:
DATE:	ASSIN. #: <i>1 (Example)</i>	PROBLEM #: <i>1</i>
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE ☐ REDUCED ☒ SINGLE NO. _____ A.Q.L. _____ ☐ MULTIPLE		
CHARACTERISTIC <i>Excess Flashing → 10[#]</i> <i>DIE LINES → 15[#]</i>	REMARKS ON DEFECTS	
NOTES & CALCULATIONS		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS		
_____ SIGNATURE _____ DATE		

Figure 4.6. Quality control problems.

ABC CORP.		
PACKAGING MATERIAL INSPECTION REPORT PACKAGING CONTROL	PART: <i>Bottle</i>	# CONTAINERS: <i>4,167</i>
	VENDOR: <i>Mch. State</i>	# UNITS/CONT.: <i>29</i>
DATE:	ASSIN. #: <i>2</i>	# SAMPLED:
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE ☐ REDUCED ☒ SINGLE ☐ MULTIPLE NO. _____ A.Q.L. _____		
CHARACTERISTIC <i>SPIDER LINES → 25#</i> <i>CONTAMINATION → 5# →</i>	REMARKS ON DEFECTS <i>(BUGS)</i>	
NOTES & CALCULATIONS		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS _____ DATE _____ SIGNATURE		

Figure 4.6. (cont'd.).

ABC CORP.		
PACKAGING MATERIAL INSPECTION REPORT PACKAGING CONTROL	PART: <u>Caps</u> VENDOR: _____	# CONTAINERS: <u>20</u> # UNITS/CONT.: <u>9,000</u> # SAMPLED: _____
DATE: _____	ASSIN. #: <u>2</u>	PROBLEM #: <u>3</u>
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE ☐ REDUCED NO. _____ A.Q.L. _____ ☒ SINGLE ☐ MULTIPLE		
CHARACTERISTIC <u>BAD BAD FIRST LIMIT SAMPLE → 10th</u>	REMARKS ON DEFECTS	
NOTES & CALCULATIONS		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS _____ DATE _____ SIGNATURE		

Figure 4.6. (cont'd.).

ABC CORP.		
PACKAGING MATERIAL INSPECTION REPORT PACKAGING CONTROL	PART: <i>Labels</i> VENDOR: <i>Mich. State</i>	# CONTAINERS: # UNITS/CONT.: # SAMPLED:
DATE:	ASSIN. #: <i>2</i>	PROBLEM #: <i>4</i>
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE ☒ REDUCED NO. _____ A.Q.L. _____ ☐ SINGLE ☐ MULTIPLE		
CHARACTERISTIC <i>Pkt Stl. color → 10#</i>	REMARKS ON DEFECTS	
NOTES & CALCULATIONS		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS _____ DATE _____ SIGNATURE		

Figure 4.6. (cont'd.).

ABC CORP.										
PACKAGING MATERIAL INSPECTION REPORT PACKAGING CONTROL	PART: <i>Reduction</i> VENDOR: <i>ABC corp.</i>	# CONTAINERS: <i>4.167</i> # UNITS/CONT.: <i>24</i> # SAMPLED: <i>1</i>								
DATE:	ASSIN. #: <i>3 (EXERCISE)</i>	PROBLEM #: <i>5</i>								
ACCEPTANCE SAMPLING TEST										
SIZE OF SAMPLE	☐ REDUCED ☒ SINGLE ☐ MULTIPLE	NO. _____ A.Q.L. <i>40</i>								
CHARACTERISTIC <i>fill level 15.0 oz - 25"</i>	REMARKS ON DEFECTS									
NOTES & CALCULATIONS <i>Control chart information:</i> <table style="margin-left: auto; margin-right: 0;"> <tr><td>$S_p = .049$</td></tr> <tr><td>$\bar{x}_1 = 16.150$</td></tr> <tr><td>$\bar{x}_2 = 18.050$</td></tr> <tr><td>$\bar{x}_3 = 16.150$</td></tr> <tr><td>$\bar{x}_4 = 16.025$</td></tr> <tr><td>$\bar{x}_5 = 18.100$</td></tr> <tr><td>$\bar{x}_6 = 16.175$</td></tr> <tr><td>$\bar{x}_7 = 16.100$</td></tr> </table>			$S_p = .049$	$\bar{x}_1 = 16.150$	$\bar{x}_2 = 18.050$	$\bar{x}_3 = 16.150$	$\bar{x}_4 = 16.025$	$\bar{x}_5 = 18.100$	$\bar{x}_6 = 16.175$	$\bar{x}_7 = 16.100$
$S_p = .049$										
$\bar{x}_1 = 16.150$										
$\bar{x}_2 = 18.050$										
$\bar{x}_3 = 16.150$										
$\bar{x}_4 = 16.025$										
$\bar{x}_5 = 18.100$										
$\bar{x}_6 = 16.175$										
$\bar{x}_7 = 16.100$										
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS										
_____ SIGNATURE _____ DATE										

Figure 4.6. (cont'd.).

ABC CORP.		
PACKAGING MATERIAL INSPECTION REPORT PACKAGING CONTROL	PART: <i>Production</i> VENDOR: <i>Che. corp</i>	# CONTAINERS: <i>4,167</i> # UNITS/CONT.: <i>24</i> # SAMPLED:
DATE:	ASSIN. #: <i>4</i>	PROBLEM #: <i>6</i>
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE ☐ REDUCED ☒ SINGLE NO. _____ A.Q.L. <i>40</i> ☐ MULTIPLE		
CHARACTERISTIC <i>Label - crooked - ° OFF</i>	REMARKS ON DEFECTS <i>MARK 4° → 25°</i>	
NOTES & CALCULATIONS <i>For control chart use the same information in problem 5.</i>		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS		
_____ SIGNATURE _____ DATE		

Figure 4.6. (cont'd.).

TABLES & CHARTS

This section contains charts and tables that are necessary for the User to complete the simulation.

Table 4.6

PREPARATION TABLES FOR THE USER

TABLE 1 Costs to manipulate inventories and orders

MANIPULATION	COST
COST TO PLACE AN ORDER/LOT SIZE	5%
COST TO CANCEL AN ORDER/LOT SIZE	30%
COST TO HOLD INVENTORY/YR.	28%
COST TO EXPEDITE AN ORDER/LOT Q.	20%
COST OF A LOST ORDER/ORDER SIZE	200%

TABLE 2 Product information

	FIN INVENTORY	BOTTLES	CAPS	LABELS
PART #	3321	2222	4444	1111
ORDER Q	11,000 (cases)	250,000	900,000	450,000
LEAD TIME (weeks)	1	6	6	3
QUAN/UNIT (/M)	1	24	24	24
PRICE	---	\$79.00	\$22.80	\$6.90

TABLE 3 COST TO RECALL PRODUCT*

PRODUCTION	DISTRIBUTERS	END USERS
\$500.00	\$10,000.00	\$1,000,000.00

* COST IS DETERMINED BY THE PRODUCT
DISTRIBUTION CHANNEL

Table 4.6. (cont'd.).

TABLE 4 COST TO SORT ORDERS

1. IF THE LOT SHOULD HAVE BEEN REJECTED (DETERMINED BY QC PROBLEM)
2. IF THE LOT SHOULD HAVE BEEN ACCEPTED (DETERMINED BY QC PROBLEM)

	PRODUCTION INVENTORY	INCOMING PARTS
REJECT (situation 1.)	NO CHARGE	NO CHARGE
ACCEPT (situation 2.)	\$200.00	\$200.00

TABLE 5 PRECAUTIONARY STRIKE SETTLEMENT COSTS

GRIEVANCE	UNION COMPANY	NON-UNION COMPANY
1. BENEFIT	\$2000.00	\$1000.00
2. PAY	\$2000.00	\$1000.00
3. WORKING CONDITIONS	\$2000.00	\$1000.00
4. PLANT LAYOFFS	\$2000.00	\$1000.00

PROGRAM OUTPUT

The final section of this manual contains portions of the output received when the program is executed. Review of the output will aid the program administrator in understanding some of the problems encountered by the user.

Table 4.7

PROGRAM OUTPUT 1

ITEM-THSISOL

PART-3321

SPECIFICATION DATE- 42580

VENDORS- IN HOUSE

ORDER Q- 11000 K

SCRAP FACT- 0 PERCENT

LEAD TM- 1 WFEKS SAFETY STK- 15000
Q REQ/UNIT- 1YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 8.

*NEG

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

SALES ** 0* 8* 8* 8* 8* 8** 8* 8* 8* 10* 10* 10*

PRODUCT** 0* 0* 0* 0* 0* 0** 11* 0* 0* 0* 0* 0*

FIN INV** 42* 34* 26* 18* 10* 2** 5* 3* 11* 21* 31* 41*

PIN PRD** 0* 0* 0* 0* 0* 0** 11* 11* 0* 11* 11* 11*

** FROZEN PERIOD **

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *

SALES 10* 8* 8* 8* 8* 8* 8* 8* 8* 8* 8* 8*

PROD 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*

ON H* 51* 59* 67* 75* 83* 91* 99* 107* 115* 123* 131* 139* 147*

PLD * 11* 11* 0* 11* 11* 11* 0* 11* 11* 0* 11* 11* 11*

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

Table 4.7 (cont'd.).

ITEM-BOTTLE
 PART-2222 SPECIFICATION DATE- 90476

VENDORS- 23 ORDER Q-250000 K SCRAP FACT- 2 PERCENT
 34

LEAD TM- 6 WEEKS SAFETY STK- 600000
 Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

*NEG

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

RFQUIRE** 0* 0* 0* 0* 0* 264** 264* 264* 0* 264* 264* 264*

SCH REC** 0* 0* 0* 200* 0* 250** 0* 0* 0* 0* 0* 0*

PTS INV** 200* 200* 200* 400* 400* 386** 122* 142* 142* 406* 670* 934*

PLD ORD** 0* 250* 0* 250* 250* 250** 250* 250* 0* 250* 250* 500*

** FROZEN PERIOD **

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *

REQ * 264* 264* 0* 264* 264* 264* 0* 264* 264* 0* 264* 264* 264*

SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*

ON H*1198*1462*1462*1776*1990*2254*2254*2518*2782*2782*3046*3310*3574*

PLD * 0* 250* 250* 0* 250* 250* 250* 0* 250* 0* 0* 0* 0*

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

Table 4.7 (cont'd.).

ITEM-CAP
 PART-4444 SPECIFICATION DATE- 41078

VENDORS- 2 ORDER R-900000 K SCRAP FACT- 3 PERCENT
 76

LEAD TM- 6 WEEKS SAFETY STK- 300000
 R RFQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

*NEG

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

REQUIRE** 0* 0* 0* 0* 0* 264** 264* 264* 0* 264* 264* 264*

SCH REC** 0* 0* 0*1000* 0* 0** 0* 0* 0* 0* 0* 0*

PTS INV** 150* 150* 150*1150*1150* 884** 622* 358* 358* 94* 170* 434*

FLD ORDA* 0* 0* 0* 0* 0* 0** 0* 0* 0* 900* 0* 0*

** FROZEN PERIOD **

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *

REQ * 264* 264* 0* 264* 264* 264* 0* 264* 264* 0* 264* 264* 264*

SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*

ON H* 698* 962* 962*1226*1490*1754*1754*2018*2282*2282*2546*2810*3074*

PI R * 0* 900* 0* 0* 0* 900* 0* 0* 0* 0* 900* 0* 0*

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

Table 4.7 (cont'd.).

ITEM-LABEL
 PART-1111 SPECIFICATION DATE- 71879

VENDORS- 10 ORDER Q-450000 K SCRAP FACT- 5 PERCENT
 ANY LEAD TM- 3 WEEKS SAFETY STK- 100000
 Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

*NEG

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

RFQUIRE** 0* 0* 0* 0* 0* 264** 264* 264* 0* 264* 264* 264*

SCH REC** 0* 0* 0*1000* 0* 0** 0* 0* 0* 0* 0* 0*

PTS INV** 150* 150* 150*1150*1150* 886** 622* 358* 358* 94* 170* 434*

FLD DRD** 0* 0* 0* 0* 0* 0** 0* 450* 0* 450* 450* 0*

** FROZEN PERIOD **

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *

RFQ * 264* 264* 0* 264* 264* 264* 0* 264* 264* 0* 264* 264* 264*

SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*

ON H* 698* 962* 962*1226*1490*1754*1754*2018*2282*2282*2546*2810*3074*

FLD * 0* 450* 0* 0* 450* 450* 0* 0* 450* 0* 0* 450* 0*

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

Table 4.7 (cont'd.).

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR ROTTIE = \$ 1327.81

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS = \$ 987.50
 COST PENALTIES = \$ 0.00
 COST TO HOLD INVENTORY = \$ 340.31

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR CAP = \$ 321.65

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS = \$ 310.50
 COST PENALTIES = \$ 0.00
 COST TO HOLD INVENTORY = \$ 11.15

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR LABEL = \$ 525.28

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS = \$ 513.00
 COST PENALTIES = \$ 0.00
 COST TO HOLD INVENTORY = \$ 12.28

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR THISISOL = \$ 994.03

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS = \$ 638.00
 COST PENALTIES = \$ 0.00
 COST TO HOLD INVENTORY = \$ 356.03

TOTAL COST TO MAINTAIN ALL INVENTORIES IS EQUAL TO **** \$ 3168.74 ****
 TOTAL COSTS TO PURCHASE ALL ITEMS IS EQUAL TO **** \$ 0.00 ****

SALES DURING THE SIMULATION = \$ 15224.40

Table 4.7 (cont'd.).

THIS SIMULATION WAS DESIGNED TO GIVE PACKAGING STUDENTS A BROADER VIEW OF THE WAY PACKAGING INTERFACES WITH OTHER DEPARTMENTS.

SOME OF THE SITUATIONS THAT YOU WERE FACED WITH ARE NOT CONSIDERED TO BE COMMON EVERY DAY PROBLEMS. IN FACT SOME OF THE PROBLEMS OCCURE VERY INFREQUENTLY IN A REAL LIFE ENVIORNMENT. IT IS FOR THIS REASON YOUR PFKFORMANCE DURING THIS SIMULATION WILL NOT HAVE ANY DIRECT BEARING ON YOUR COURSE GRADE.

IF YOU HAVE ANY QUESTIONS CONCERNING PORTIONS OF THIS PROGRAM YOU SHOULD REFER TO THE THESIS ENTITLED:

AN EVALUATION AND CONTROL SIMULATION OF A PACKAGING
PRODUCTION SYSTEM

BY
KEVIN KAJIYA

SCHOOL OF PACKAGING
MICHIGAN STATE UNIVERSITY

JUNE 1980

PLEASE TAKE A FEW MINUTES TO FILL OUT THE FOLLOWING EVALUATION FORM.
THIS FORM SHOULD BE TURNED IN TO THE INSTRUCTOR OF YOUR COURSE.

THANK YOU
KEVIN KAJIYA

EVALUATION OF THE SIMULATION

----- TERM ----- PROF OR INSTRUCTOR
----- COURSE

WHAT IS YOUR OVER ALL OPINION OF THE SIMULATION?

WHAT DID YOU LEARN FROM THE SIMULATION?

Table 4.7 (cont'd.).

PLEASE LIST ANY SPECIFIC WAYS IN WHICH THIS
SIMULATION COULD BE IMPROVED.

1.

2.

3.

4.

WHAT IMPROVEMENTS SHOULD BE MADE ON THE USERS MANUAL?

IF THIS TERMINAL PRINTS - END THSKMK- INPUT-
LOGOUT,T.

END THSKMK
.510 CP SECONDS EXECUTION TIME

READY 13.45.05
LOGOUT,T.

JOB COST: \$ 3.02

APPENDIX

APPENDIX

This appendix contains copies of two of the "HOW TO:" manuals published by the Michigan State University Computer Laboratory. The two manuals contain more complete information concerning the procedures used in logging in on a public terminal, and the use of a card reader. (See the appendix of this thesis.)

FINAL NOTE

IF THERE ARE ANY QUESTIONS CONCERNING THE USE OR MODIFICATION
OF THIS SIMULATION, CONTACT;

Dr. HUGH LOCKHART, PROFESSOR
MICHIGAN STATE UNIVERSITY
SCHOOL OF PACKAGING
EAST LANSING, MI 48824

or

KEVIN KAJIYA
MICHIGAN STATE UNIVERSITY
SCHOOL OF PACKAGING
EAST LANSING, MI 48824

CHAPTER V

USER'S MANUAL
FOR
AN EVALUATION AND CONTROL
SIMULATION OF A PACKAGING
PRODUCTION SYSTEM

By

Kevin Mason Kajiya

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INTRODUCTION

This manual is to be used as the Users Guide for the simulation model 'THSKMK'. It contains all of the information necessary for the indoctrination, preparation, and access of the simulation model. Read the manual carefully before proceeding to the computer terminal to run the program.

DISCUSSION

"CONGRATULATIONS", you have just received a promotion. Your new job description includes the responsibility for the management of packaging, production control, quality control, purchasing, and inventory management for the product "THSISOL".

During the next few weeks (simulated weeks) you will be faced with different situations that will affect the operation of your company (the ABC corporation). Your job will be to react to the situations by attempting to select an optimal solution to each of the problems (each situation and activity has a cost assigned to it) you encounter. (Since the problem situations have a wide range of results, depending on the solution you choose, there is no one correct answer to any of the problems.)

Other new managers (students) have also been given the same responsibilities (for other product lines). The manager who is most effective in his or her new position will receive another promotion (extra-extra-credit). You will be evaluated on the total profit you can generate. Your objective should then be to maximize profit!

GOOD LUCK IN YOUR NEW POSITION!!!!

PREPARATION

In order to prepare yourself for the simulation program you should follow the instructions on the following page. If you have any questions regarding the simulation ask them during one of the briefing sessions.

STEPS TO COMPLETE THE SIMULATION

1. The first thing you should do is familiarize yourself with each of the following subjects:
 - A. LEAD TIMES
 - B. ECONOMIC ORDER QUANTITIES
 - C. FIXED REORDER POINTS
 - D. FIXED REORDER QUANTITIES
 - E. SAFETY STOCKS
 - F. COST TO HOLD AND MANIPULATE INVENTORIES
 - G. QUALITY CONTROL METHODS
 - H. SPECIFICATIONS
 - I. MATERIALS REQUIREMENTS PLANNING (MRP) SYSTEMS
2. Examine and indicate the section within the specifications which may be over specified or in error.
3. Complete the enclosed quality control problems.
4. Go to the computer center and run the program on a terminal (this terminal should be a decwriter with a baud rate of 1200).
5. Turn in the quality control problems and a complete run of the computer simulation.

On the following pages of this section there is literature concerning the above topics. A list of sources which will provide more complete information on these topics can be obtained from your instructor.

LEAD TIME

Lead time is the average or normal time it takes to receive an order once the order has been given to the purchasing department. For the purpose of this simulation, the time it takes to run quality control checks will be considered a part of the lead time.

ECONOMIC ORDER QUANTITY (EOQ)

The EOQ is the most economical lot size in which to purchase an item. Most methods used to calculate EOQ's use information such as inventory holding costs, costs to process orders (paperwork), unit costs, yearly demands, and transportation costs.

FIXED REORDER POINT

The fixed reorder point is an ordering system where purchasing is carried out at preset time intervals. When a time interval is at hand, the inventory is evaluated and the amount is ordered which will bring the inventory to a given level.

EXAMPLE 1

A person orders pencils for a department once a month. At the end of the month he has 20 pencils left. He has determined (from past experience) that he should have 200

pencils at the beginning of the next period. He calculates the amount he should order as follows:

$$\text{amt. to order} = 200 \text{ pencils} - 20 \text{ pencils (on hand)} + \text{use/day} \times \text{lead time}$$

$$\text{lead time} = 2 \text{ days}$$

$$\text{use/day} = \frac{200 \text{ pencils/day}}{31 \text{ days/month}} = 6.45 \text{ pencils/day or } 7 \text{ pencils/day}$$

$$\begin{aligned} \text{amount to order} &= 200 - 20 + 2 \times 7 \\ \text{" " " " } &= 200 - 20 + 14 \\ \text{" " " " } &= \underline{194 \text{ pencils}} \end{aligned}$$

FIXED ORDER QUANTITY

The fixed order quantity is an ordering system where orders (EOQ's) are placed when a trigger level of inventory is reached. This system requires a calculation which considers average lead times and item usage rates.

EXAMPLE 2

A person orders pens for a department. The order quantity has been determined as a box containing 93 pens. The trigger level is based as follows:

$$\text{use of pens/month} = 93 \text{ pens/month}$$

$$\text{use of pens/day} = \frac{93 \text{ pens/month}}{31 \text{ days/month}} = 3 \text{ pens/day}$$

$$\text{lead time} = 4 \text{ days}$$

$$\begin{aligned} \text{usage during lead time} &= \text{lead time} \times \text{pens/day} \\ \text{" " " " } &= 4 \text{ days} \times 3 \text{ pens/day} \\ \text{" " " " } &= 12 \text{ pens} \end{aligned}$$

When the inventory level of 12 pens is reached, the person will order a box of pens.

SAFETY STOCK

A safety or buffer stock is an amount of inventory left aside to protect a company during sudden shifts in demand, problems in procuring ordered amounts, and unexpected inventory shrinkage (losses). Usually the safety stock is large enough (minimum) to cover for a period equaling the lead time for that item. (This level has been determined optimal for it will allow production to carry on during the shorted period.) A calculation of the safety stock for the pencil example (example 1) might look like the following:

CALCULATION

lead time = 2 days

use per day = 7 pencils/day

safety stock = 2 days x 7 pencils/day

" " = 14 pencils

This means that the actual inventory of pencils would be

34 pencils (20 pencils + 14 pencils) at the reorder point.

NOTE: In many cases the safety stock is physically separated from the actual inventory during storage.

In the case of the simulation the safety stock will not be included as normal inventory (the safety stock balance will be reported separately and under the heading SAFETY STOCK).

COSTS TO HOLD AND MANIPULATE INVENTORIES

The cost to hold inventory is a percent amount of the value of inventories held within a plant. The basis for the percentage

assigned includes the cost to keep up warehouses and the opportunity costs involved in the inventory investment (the opportunity cost might involve the money that could be realized by investing the money spent on inventories in securities, banks, etc...).

Costs to manipulate the inventories would include ordering costs, expediting costs (costs to rush orders), and costs assigned to canceled orders (this cost is assigned due to the loss of a company's good will when canceling orders).

NOTE: Another cost that should be considered is the cost of a lost order. This cost would result when a company does not have enough inventory of finished goods to meet sales.

QUALITY CONTROL METHODS & SPECIFICATIONS

The concepts under these topics are covered in Packaging 425.

MATERIALS REQUIREMENTS PLANNING (MRP)

The general purpose of a MRP system is to report the status of production and inventory requirements for given periods. The format for the reports is a weekly schedule of the requirements for different parts and the finished products (Pages 195 and 196).

FINISHED GOODS

Finished goods are the end product of the production process. Items in the form of finished goods are ready for shipment and sale. One unit is described as a case of the product.

FINISHED GOODS (cont'd.)SALES

Sales are the figures that represent marketing forecasts. These figures are not actual and can vary to become higher or lower. (In most cases the row entitled sales would be referred to as production requirements. A document called the master schedule would dictate the requirements for each of the periods. To simplify, the simulation sales forecasts have been substituted for the production requirements.)

The sales figures in the schedule on page 191 indicate that marketing has forecasted sales to be 21,000 cases/week. In the 8th and 9th week the figures are increased to 40,000 cases to accomodate a sales promotion scheduled for weeks 12 and 13 (distribution takes 4 weeks).

SCHEDULED PRODUCTION

Scheduled production is the second row on the MRP schedule. This row indicates that the finished product will be packaged in the indicated weeks (weeks 2, 3, and 5). Since 30,000 cases/wk have been determined as the production capability of the packaging line, it is also the order quantity for the finished product. These production figures can be moved forward or backwards to accomodate sales requirements for individual periods.

NOTE: Observe the area in the chart labeled the "FROZEN PERIOD".

Moving production within this area is considered costly and should be done only when necessary. The reason for this recommendation is that the requirements of

packaging materials are based on scheduled and planned production. Movement within the frozen period could cause a shortage of packages necessary to meet the shifted requirements.

ON HAND INVENTORY

The on hand inventory represents the predicted quantity of product that should be on hand during a period. The calculation for this row is based on the following:

FOR THE CURRENT WEEK

on hand = amt. in inventory + scheduled production - sales

FOR OTHER WEEKS

on hand = amt. in inventory (from the previous week) +
scheduled production - sales

- NOTES:
1. In week 6 a flag has appeared indicating a negative balance ($14 + 0 - 21 = -7$). This figure is just a warning that if everything goes as scheduled and no production is scheduled six weeks from the current week you will not be able to meet sales.
 2. The safety stock is not considered as a portion of the amount on hand. In other words, the actual inventory at the end of the current week will be 69,000 cases (29,000 cases on hand + 40,000 cases of safety stock) of finished product. Any time there is a problem where sales can not be met through normal production and the use of on hand inventories, the deficit is drawn from the safety stock.

PLANNED PRODUCTION

The planned production is production which has not been ordered (weeks 5, 6, 7, and 8). As long as these orders have not been released, their contribution to the on hand inventories is considered to be zero.

If the planned order of 30,000 cases in week 5 was released, the order would become scheduled production in week 6. The schedule would reflect this transaction by removing the number 30 (planned production row) and adding the quantity 30 to week 6's scheduled production. This would cause the on hand inventory in week 6 to become 23,000 cases (14,000 cases + 30,000 cases - 21,000 cases). The negative flag at the top of column 6 would then be pushed to week 8.

NOTES: All of the above transactions would not be reflected until the next schedule output of the finished product.

All planned orders of production are placed at the end of the week.

PACKAGING MATERIALS

The requirements for the packaging materials are based on the scheduled production and planned production of the finished goods. The computer goes to the bill of materials (this bill reflects the items and the quantity of these items that are necessary to produce a unit of the finished product) and calculates the requirements for each of the components necessary for the production of the units.

EXAMPLE

One unit of finished product requires 24 units of each component part. In week 3 on the production schedule there is a scheduled production of 30,000 cases of finished product. It is necessary to have all of the component parts on hand one week before the scheduled production. Thus, the requirements for the bottles (Page 196) in week 2 becomes 720,000 bottles (30,000 cases x 24 bottles/case = 720,000 bottles).

All of the other pieces of information within the part schedules are computed in the same manner as the information in the production schedule.

- NOTES:
1. The frozen period does not apply to the component parts (packaging materials).
 2. The planned orders are released at the beginning of the week. This means the lead times given for the different component parts include the week of the planned orders.
 3. It is strongly recommended that each person complete the practice exercise in appendix B of this manual.

If more complete information is desired on any of the outlined topics, refer to the reference sources listed in the thesis entitled 'AN EVALUATION AND CONTROL SIMULATION OF A PACKAGING PRODUCTION SYSTEM', by Kevin Kajiya, 1980.

Table 5.1

MRP INSTRUCTION CHART

FINISHED PRODUCT LT- 1 week 30000 order quantity #/per unit: 1
SAFETY STOCK: 40000

(1000)	CURR	1	2	3	4	5	*NEG	6	7	8	9
SALES	21	21	21	21	21	21	21	21	21	40	40
SCHEDULED PRODUCTION	0	0	30	30	0	30	0	0	0	0	0
ON HAND INVENTORY	29	8	17	26	5	14	7	28	68	108	
PLANNED PRODUCTION	0	0	0	0	0	30	30	30	30	30	0
FROZEN PERIOD											

NOTE: THESE ARE NOT ACTUAL REQ. SALES MAY ACTUALLY CHANGE

NOTE: SCHEDULED BY ORDER 0.

NOTE: AMOUNTS THAT SHOULD BE IN THE WAREHOUSE.

AMOUNT
ON HAND
50

29 8 17 26 5 14 23 32 22 12 BALANCE WITH PLANNED ORDERS

SALES: FORCASTED SALES BY MARKETING

SCHEDULED PRODUCTION: PRODUCTION THAT HAS BEEN PLANNED AND SET.

ON HAND INVENTORY: INVENTORY THAT WILL BE ON HAND (does not include planned orders)

PLANNED PRODUCTION: PRODUCTION THAT HAS NOT BEEN SET.

FROZEN PERIOD: PERIOD IN WHICH PRODUCTION IS PRESET AND SHOULD NOT BE CHANGED! (changes within this period will be very expensive)

NOTE: ALL OF THE NUMBERS WITHIN THE CHART ARE ONLY PREDICTIONS. THE ONLY REAL FIGURE THAT YOU CAN DEPEND ON IS THE CURRENT ON HAND BALANCE. (UNLESS A PHYSICAL INVENTORY REVEALS OTHERWISE)

Table 5.1. (cont'd.).

BOTTLES LT- 6 weeks 100000 order quantity #/per finished unit: 24
SAFETY STOCK: 600000

(1000)	CURR	1	2	3	4	5	* NEG 6	7	8	9
REQUIRE- MENTS	0	720	720	0	720	720	720	720	1440	0
SCHEDULED RECEIPTS	0	700	700	200	700	700	0	0	0	0
ON HAND INVENTORY	200	180	160	360	340	320	400	1120	2560	2560
PLANNED ORDERS	0	500	700	1400	0	700	800	700	0	700
FROZEN PERIOD (PRODUCTION)										

NOTE: FIGURES BASED ON REQUIRE-
MENTS (PRODUCTION) x# REQ/
UNIT

AMOUNT
ON HAND
200

200 180 160 360 340 320 100 80 40 40 200 BALANCE WITH PLANNED ORDERS

REQUIREMENTS: THIS DATA IS CALCULATED FROM THE PLANNED PRODUCTION REQUIREMENTS, THE PLANNED ORDERS, AND
THE NUMBER REQUIRED PER PRODUCTION UNIT.

SCHEDULED RECEIPTS: THESE FIGURES REPRESENT PURCHASE ORDERS THAT THE VENDORS HAVE RECEIVED.

ON HAND INVENTORY: PLANNED NUMBER OF UNITS ON HAND BY THE GIVEN DATES. (DOES NOT INCLUDE PLANNED ORDERS.)

PLANNED ORDERS: THESE NUMBERS REPRESENT ORDERS WHICH HAVE NOT BEEN RELEASED TO YOUR VENDORS.

NOTE: ALL OF THE NUMBERS WITHIN THE CHART ARE ONLY PREDICTIONS. THE ONLY REAL INFORMATION THAT YOU CAN
COUNT ON IS THE CURRENT ON HAND BALANCE. (UNLESS A PHYSICAL INVENTORY REVEALS OTHERWISE)

ACCESS

The following pages contain instructions on the access and use of the computer simulation model.

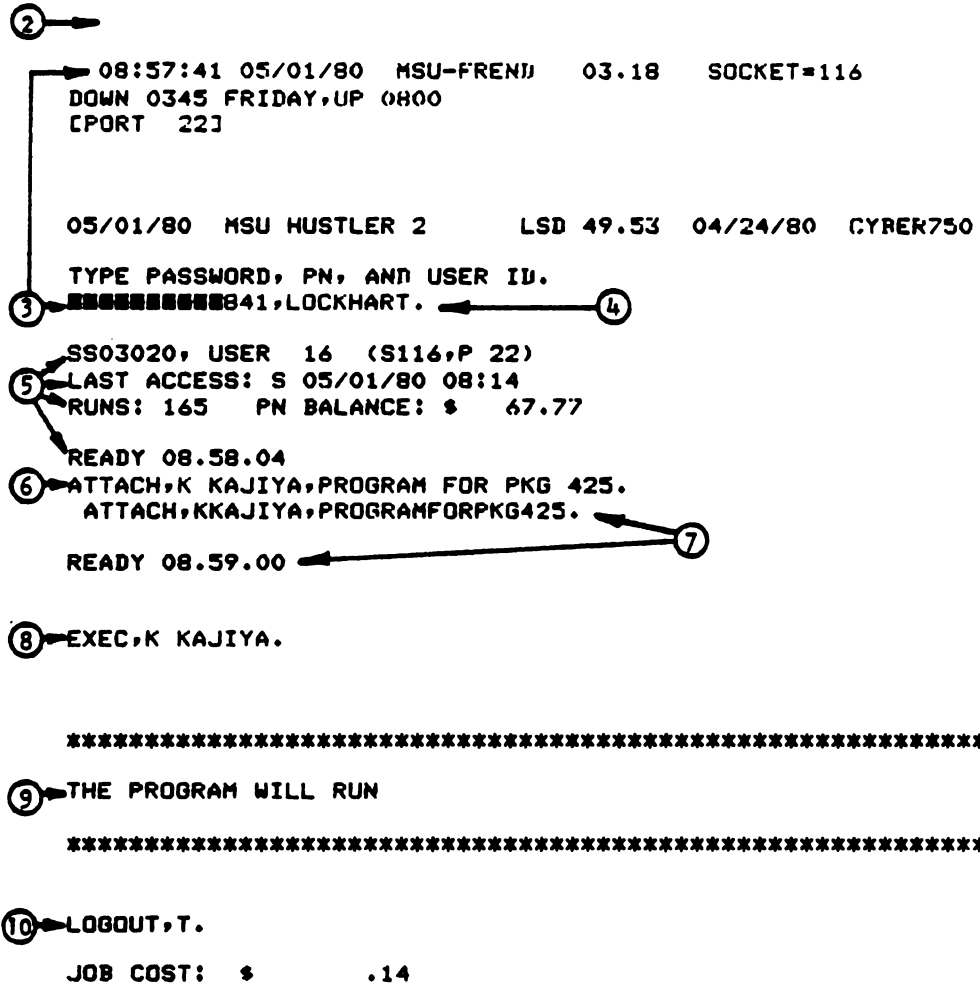
INSTRUCTIONS FOR PROGRAM ACCESS

To access and run the program you should follow the following instructions:

1. Go to a computer terminal and log on (this terminal should be a DECWRITER with a baud rate of 1200).
2. TYPE- TWO CARRIAGE RETURNS (2)
3. COMPUTER PRINTS "TYPE PASSWORD,PN,AND USER ID."
"*****"
4. On top of these squares (2) you should type the following
"PKGKK,4414841,LOCKHART." (2)
5. COMPUTER PRINTS last access information, then it prints
"READY"
6. TYPE- "ATTACH,(first six letters of your last name),
PROGRAM FOR PKG 425." (2)
7. COMPUTER PRINTS "ATTACH,""",PROGRAM FOR PKG 425."
"READY"
8. TYPE- "EXEC,(first six letters of your last name)." (2)
9. AT THIS POINT THE PROGRAM WILL EXECUTE.
10. WHEN YOU ARE DONE TYPE- "LOGOUT,T." (2)

ON THE FOLLOWING PAGE THERE IS AN EXAMPLE OF WHAT THE ACTUAL OUTPUT SHOULD LOOK LIKE.

Table 5.2
LOGGING IN PROCEDURE



INSTRUCTIONS FOR PROGRAM ACCESS (cont'd)

When the program asks a question, the format should be read VERY CAREFULLY before responding. Answer all of the questions with an appropriate statement or number followed by a carriage return (↵). If the carriage return is not pushed, nothing will happen.

NOTES: IF AN ERROR IS MADE BEFORE THE CARRIAGE RETURN IS DEPRESSED, BACKSPACE TO THE POINT OF THE ERROR AND COMPLETE THE REST OF YOUR RESPONSE. OR, HOLD THE CONTROL BUTTON DOWN, PUSH THE (X) KEY AND THEN RESPOND WITH THE CORRECT ANSWER (start from the beginning of the response).

WHILE RUNNING THE PROGRAM IGNORE ANY BELL SOUNDS.

IF THE OUTPUT CONTAINS A (-1), SEE THE PROGRAM ADMINISTRATOR (COURSE INSTRUCTOR) FOR ASSISTANCE.

IF YOU ENCOUNTER A MAJOR PROBLEM DURING THE SIMULATION PRESS THE "ESC" KEY. THE TERMINAL SHOULD RESPOND WITH THE MESSAGE "READY". LOG OFF THE TERMINAL AND TAKE THE OUTPUT TO THE PROGRAM ADMINISTRATOR FOR ASSISTANCE.

IF YOU ENCOUNTER PROBLEMS OTHER THAN THE ONES DESCRIBED ASK ONE OF THE PEOPLE IN THE INPUT-OUTPUT ROOM AT THE COMPUTER CENTER FOR ASSISTANCE.

TABLES & CHARTS

This section contains charts and tables that are necessary for the completion of the simulation. Examine them before going to the computer center to run the program.

Table 5.3

PREPARATION TABLES FOR THE USER

TABLE 1 Costs to manipulate inventories and orders

MANIPULATION	COST
COST TO PLACE AN ORDER/LOT SIZE	5%
COST TO CANCEL AN ORDER/LOT SIZE	30%
COST TO HOLD INVENTORY/YR.	28%
COST TO EXPEDITE AN ORDER/LOT Q.	20%
COST OF A LOST ORDER/ORDER SIZE	200%

TABLE 2 Product information

	FIN INVENTORY	BOTTLES	CAPS	LABELS
PART #	3321	2222	4444	1111
ORDER Q	11,000 (cases)	250,000	900,000	450,000
LEAD TIME (weeks)	1	6	6	3
QUAN/UNIT (/M)	1	24	24	24
PRICE	---	\$79.00	\$22.80	\$6.90

TABLE 3 COST TO RECALL PRODUCT*

PRODUCTION	DISTRIBUTERS	END USERS
\$500.00	\$10,000.00	\$1,000,000.00

* COST IS DETERMINED BY THE PRODUCT
DISTRIBUTION CHANNEL

Table 5.3. (cont'd.).

TABLE 4 COST TO SORT ORDERS

1. IF THE LOT SHOULD HAVE BEEN REJECTED (DETERMINED BY QC PROBLEM)
2. IF THE LOT SHOULD HAVE BEEN ACCEPTED (DETERMINED BY QC PROBLEM)

(SEE NOTE)	PRODUCTION INVENTORY	INCOMING PARTS
REJECT (situation 1.)	NO CHARGE	NO CHARGE
ACCEPT (situation 2.)	\$200.00	\$200.00

TABLE 5 PRECAUTIONARY STRIKE SETTLEMENT COSTS

GRIEVANCE	UNION COMPANY	NON-UNION COMPANY
1. BENEFIT	\$2000.00	\$1000.00
2. PAY	\$2000.00	\$1000.00
3. WORKING CONDITIONS	\$2000.00	\$1000.00
4. PLANT LAYOFFS	\$2000.00	\$1000.00

NOTE: The sorting charge is levied when the sorting operation is carried out on an acceptable lot. (A lot that doesn't need to be sorted.)

SPECIFICATIONS

The specifications on the following pages are broken up into six potential problem areas. Examine the specifications and determine wheather or not they contain errors or over specifications. It is necessary that you complete this exercise before proceeding to the computer center.

NOTE: AT THE TOP OF EACH SPECIFICATION INDICATE THE AREA WHICH THAT CONTAINS THE PROBLEM. IF THERE IS NO PROBLEM WITHIN THE SPECIFICATION WRITE "OK" AT THE TOP.

REPORT: 5097648

ABC CORP.
PACKAGING BILL OF MATERIALS

DESC: THSISOL
SIZE: 24 PINTS

STOCK NUMBER: 33 21

FINISHING SPEC. CODE: 1001
DEPARTMENT: PACKAGING

RUN DATE: 04/25/80
LAST REV: 07/17/79

STOCK NUMBER	DESCRIPTION	QUANTITY	U/
19580	THSISOL	11,880	L
3642	BOTTLE 16oz POLY 28 CT THSISOL	24,000	EA
4123	CAP 28 BLUE METAL P-PEPL LIN	24,000	EA
2324	LABEL 2 27/32 X 1 15/16 DIE CUT	24,000	EA

LABEL INSTRUCTIONS:

BOTTLE LABEL IMP W/"EXP----" AND "LOT----". (ONE LINE) SUPPLY TWO
STICKY BACK RUBBER PLATES STYLE VL 18-RBC F/IMP RESHIPPER "W/"EXP----"
AND "LOT---".

PACKAGING INSTRUCTIONS: LABEL PLACEMENT FROM BOTTOM OF BOTTLE: 1 5/16 IN.
IMPRINT "EXP---" AND "LOT---" ON PRINTED RESHIPPER FOR 24. USE (105 627)
GLUE FOR THE BOTTLE LABEL ADHESIVE. APPLY ORM-D "COPY" TO UPPER RIGHT
HAND CORNER OF THIRD PANEL OF RESHIPPER. POST RESHIPPER STOCK # AND
TITLE ON THE PACKAGING LINE. THE FOLLOWING TESTS MUST BE ACCEPTABLE
BEFORE 1880 APPROVAL IS GIVEN: ASSAY (ALCOHOL), ASSAY (DENATONIUM
BENZOATE), TLC IDENTIFICATION TEST AND METHYL ALCOHOL TEST. SEND 2
RESERVE SAMPLE BOTTLES TO CONTROL SPECS DEPT.

PROOF READER:
PACKAGING DEV:

DATE:
DATE:

LABEL CONTROL:
QUALITY CONTROL:

DATE:
DATE:

Figure 5.1. Specifications

ABC CORP
DIVISION OF MICHIGAN STATE UNIVERSITY

PAGE 1 OF 5 PGS

CONTAINER SPECIFICATION

SPECIFICATION NO.: 22222

ISSUE DATE: 09/04/76

SUPERSEDES: NEW SPEC.

CHANGE: -NONE-

ITEM: BOTTLE

CAPACITY: 16oz./473.184 ml OVERFLOW CAPACITY: 10oz./295.74 ml
STYLE: MODIFIED ROUNDED SQUARE CONTAINER WEIGHT: 33 grams $\pm$ 1 gram
NECK OR FINISH: 28-400
DIMENSIONS: SEE ATTACHED DRAWING.

MATERIAL: LINEAR POLYETHYLENE (.955 DENSITY) FORTIFLEX PE RESIN
FORMULA No. 855-40H (CELANESE) or (.955 DENSITY)
COLOR: NATURAL No. LC 732 (U.S.I.) or (.955 DENSITY)
DECORATION: NONE No. 388 (O.I.)

PACK FOR SHIPMENT: RESHIPPER OF 24.

LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER #,
AND SUPPLIER ON EACH CONTAINER.
OTHER INFORMATION:

QUALITY CONTROL REQUIREMENTS: SEE "PACKAGING MATERIALS AND SUPPLIES
ACCEPTANCE STANDARDS". ADDITIONAL
REQUIREMENTS:

SPECIAL INSTRUCTIONS:


SIGNATURE

Figure 5.1. (cont'd.).

ABC CORP
DIVISION OF MICHIGAN STATE UNIVERSITY

PAGE 2 OF 5 PGS

PACKAGING MATERIAL SPECIFICATION

SPECIFICATION NO: 33333

ISSUE DATE: 03/04/76

SUPERSEDES: NEW SPEC.

CHANGE: -NONE-

CAT NO:

ITEM: RESHIPPER

STYLE: RSC WITH "H" PARTITION

DIMENSIONS: I.D.: 18 1/16"L X 11 3/16"W X 7 1/8"H

MATERIAL: 275# TEST "E" FLUTE. TAPE OR CRUSHED GLUE JOINT.

COLOR: NATURAL

PRINTING: STD. BLACK. PANEL #1: TOP FLAP; "THIS SIDE UP HANDLE WITH CARE" PER ATTACHED PROOF. PANEL #1: "COPY" PER ATTACHED PROOF. BOTTOM FLAP; BOX MAKER'S CERTIFICATE. PANEL #2 "COPY" PER ATTACHED PROOF. PANEL #3: "COPY" PER ATTACHED PROOF. PANEL #4: "COPY" PER ATTACHED PROOF. PANEL #1: BOTTOM FLAP; STOCK No. "33333". (none of the copies are included)

PACK FOR SHIPMENT:

LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER #, QUANTITY AND SUPPLIER ON EACH CONTAINER. FOR FOLDING CARTONS, SHOW QUANTITY: AS QUANTITY PER ROW/ROWS PER LAYER/LAYERS PER CASES AND TOTAL QUANTITY. OTHER INFORMATION:

QUALITY CONTROL REQUIREMENTS: SEE "PACKAGING MATERIALS AND SUPPLIES ACCEPTANCE STANDARDS".
ADDITIONAL REQUIREMENTS:

SPECIAL INSTRUCTIONS: RESHIPPER TO BE ANTI-SLIP COATED (LUFOX)

1

2

3

4

5

6

SIGNATURE

Figure 5.1. (cont'd.).

ABC CORP
DIVISION OF MICHIGAN STATE UNIVERSITY

PAGE 3 OF 5 PGS

PACKAGING MATERIAL SPECIFICATION

SPECIFICATION NO: 33333

ISSUE DATE: 03/04/76

SUPERSEDES: NEW SPEC.

CHANGE: NONE

ITEM: "H" PARTITION - CELL

STYLE: FULL HEIGHT

DIMENSIONS: ASSEMBLED CELL SIZE 18"L X 5 1/2"W X 7 1/8"H

MATERIAL: 275# TEST "C" FLUTE

COLOR: NATURAL

PRINTING: NONE

PACK FOR SHIPMENT: ASSEMBLED IN RSC.

LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER #,
QUANTITY AND SUPPLIER ON EACH CONTAINER.
OTHER INFORMATION:

QUALITY CONTROL REQUIREMENTS: SEE "PACKAGING MATERIALS AND SUPPLIES
ACCEPTANCE STANDARDS".
ADDITIONAL REQUIREMENTS:

SPECIAL INSTRUCTIONS:

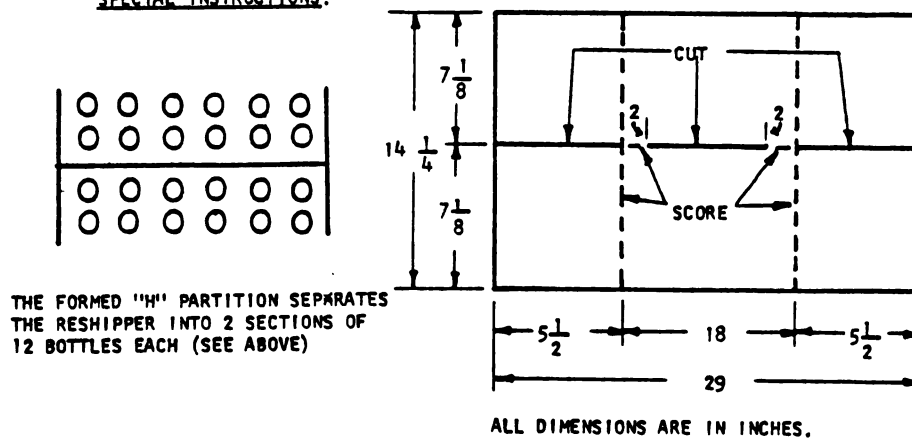


Figure 5.1. (cont'd.).

PACKAGING DEVELOPMENT DIVISION
INCOMING PALLET SPECIFICATION

PAGE 4 OF 5 PGS

STOCK NO: 33 21

CARTONS/LAYER: 6 LAYERS OF 11
1 LAYER OF 10 base

MATERIAL: BOTTLE 16oz POLY 28 CT THESISOL

LAYERS: 7

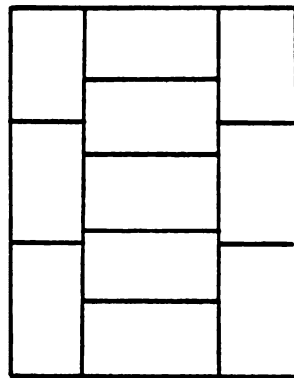
PALLET SIZE: NONE NEEDED (UNITIZED LOAD)

CARTONS/PALLET: 76

CARTON SIZE: O.D.: 18 7/32"L X 11 11/32"W X 7 9/32"H

OTHER REQUIREMENTS: SPECIAL CORRUGATED SHEET UNDER BASE LAYER (1 REQ)
REGULAR CORRUGATED SHEET ON TOP (1 REQ)
FULL HEIGHT CORNER PADS (4 REQ)
SMALL CORNER PADS FOR BASE ONLY (4 REQ)

TOP VIEW REG. LAYER (6 REQ)



TOP VIEW BASE LAYER (1 REQ)

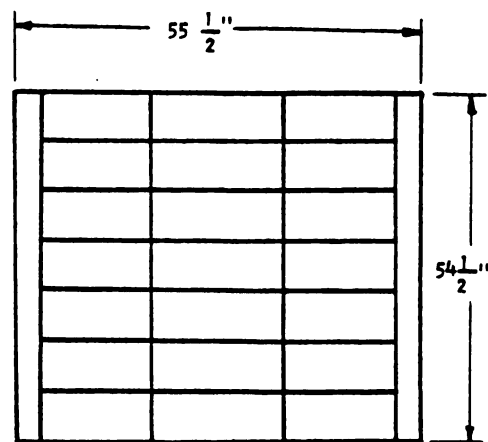
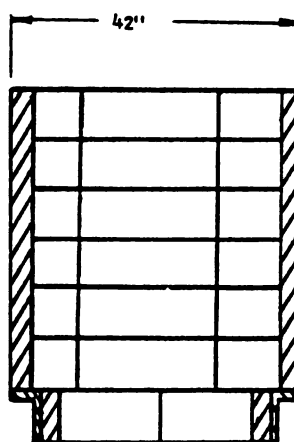
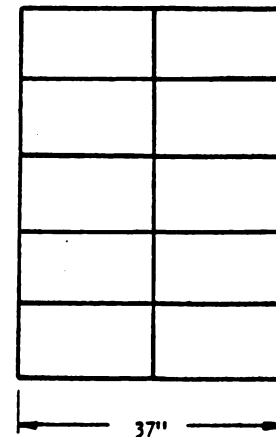


Figure 5.1. (cont'd.).

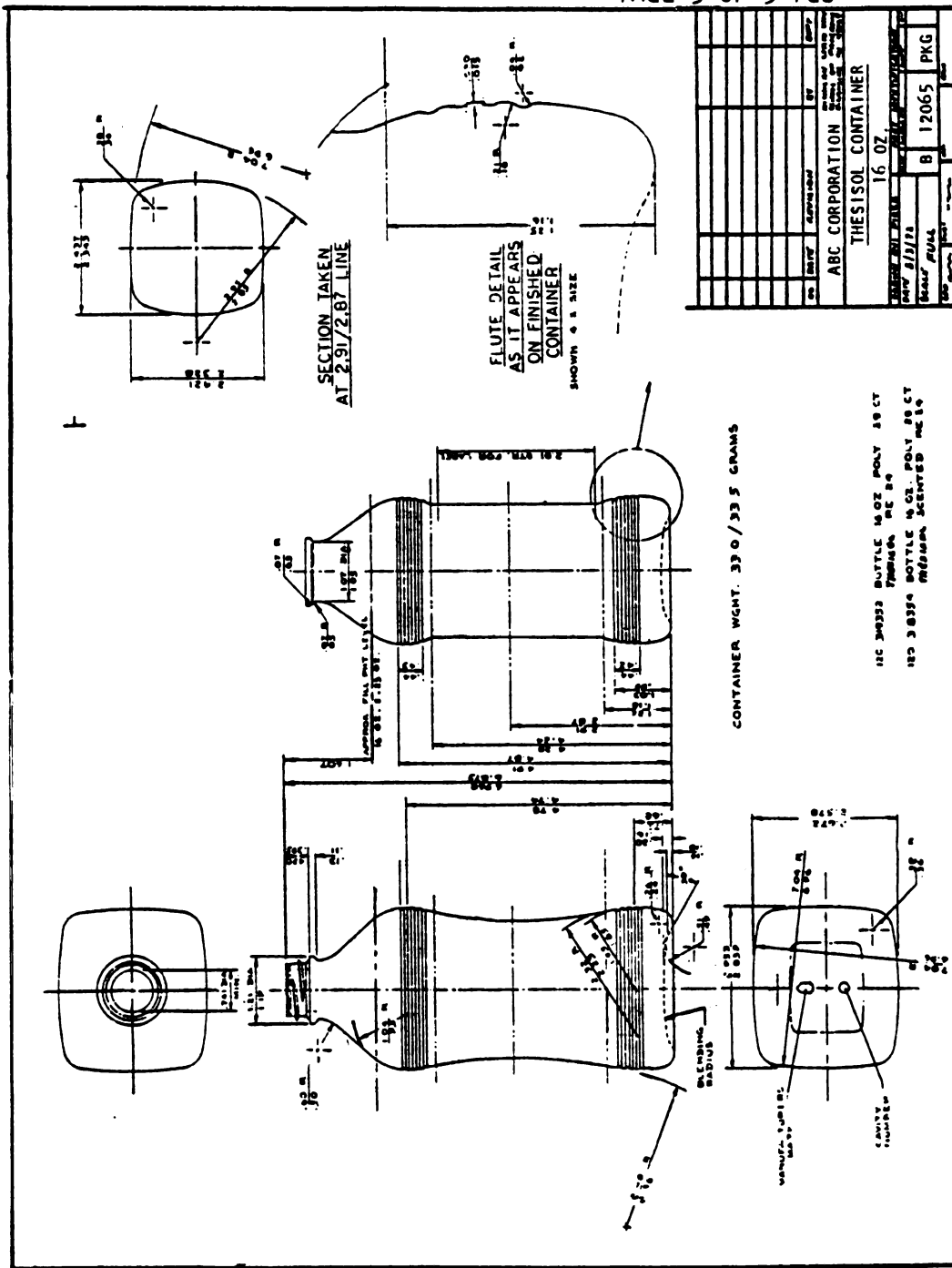


Figure 5.1. (cont'd.).

ABC CORP
DIVISION OF MICHIGAN STATE UNIVERSITY

PAGE 1 OF 2 PGS

CLOSURE SPECIFICATION

SPECIFICATION NO: 44444
ISSUE DATE: 04/10/78
SUPERSEDES: 03/21/75
CHANGE: CORRECT SPEC No.
FROM 74592 TO ABOVE. 1

ITEM: CAP
SIZE: 28mm
STYLE: CT
DIMENSIONS: .409-.419" H X 1.186-1.221" DIA.
NECK OR FINISH: 28-400

2

MATERIAL: CAP: TINPLATE
LINER: P-PEPL: .035 PULP/PAPER/POLYETHYLENE

COLOR: BLUE

DECORATION:

3

PACK FOR SHIPMENT: 25/CARTON.

LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER #,
QUANTITY AND SUPPLIER ON EACH CONTAINER.
OTHER INFORMATION:

4

QUALITY CONTROL REQUIREMENTS: SEE "PACKAGING MATERIALS AND SUPPLIES
ACCEPTANCE STANDARDS".
ADDITIONAL REQUIREMENTS:-

SPECIAL INSTRUCTIONS:

5

6


SIGNATURE

Figure 5.1. (cont'd.).

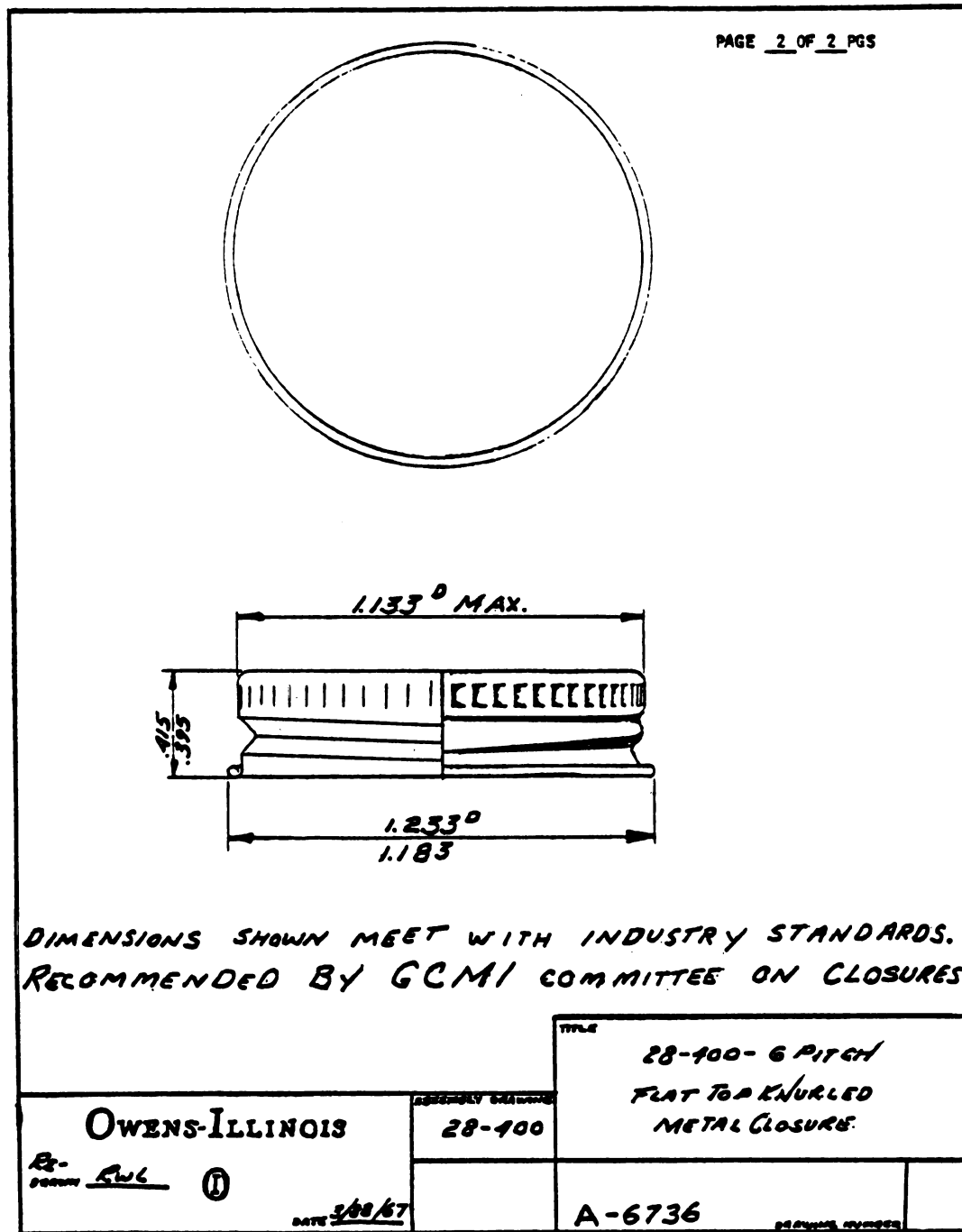


Figure 5.1. (cont'd.).

COURTESY OF OWENS-ILLINOIS (1967)

SPECIFICATION NO.: 11111

LABEL NO: 88 11111

ISSUE DATE: 07/18/79

SUPERSEDES: 10/17/78

CHANGE: PRINTING REGISTRATION

STOCK NO: 2324

PRODUCT: THESISOL 24 PINTS

ITEM: BOTTLE LABEL

TRADE: DOMESTIC

STYLE: X CUT OTHER i.e. die cut.
 ROLL - INDEXING HOLE LOCATION
 (SEE PAGE 2 FOR UNWIND INFO - IF REQ)

STOCK: ☒ REGULAR LABEL (60# WHITE VARNOSSET DUAL PURPOSE, OR EQUIV.)
 THIN FORM (30# WHITE IMPERIAL BIBLE H.S. OFFSET, " .)
 HEAT SEAL _____
 OTHER _____

DIMENSIONS: 2 27/32"H x 1 15/16"W

GRAIN:	HORIZONTAL	VERTICAL
--------	------------	----------

INK COLOR: BLUE (PMS-280)

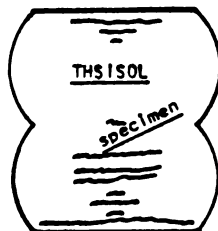
PRINTING REGISTRATION: TOP OF COPY OR TITLE BLOCK TO TOP OF LABEL: 1/8"
LEFT SIDE TRIM TO COPY OR TITLE BLOCK: 7/32"

PACK FOR SHIPMENT: IN COMMERCIALY ACCEPTABLE CORRUGATED BOXES, SHOWING LABEL PRINTER'S NAME AND ADDRESS. ATTACH ONE CANCELLED LABEL AND AN ENVELOPE CONTAINING A COPY OF THE REC. TO ONE BOX OF EACH ORDER.

LABEL FOR SHIPMENT: SHOW ITEM NAME, SPEC NUMBER, PURCHASE ORDER NUMBER, AND SUPPLIER ON EACH CONTAINER. OTHER INFORMATION:

QUALITY CONTROL REQ.: SEE "PACKAGING MATERIALS AND SUPPLIES ACCEPTANCE STANDARDS". SUPPLY 2 PRESS SHEETS OF EACH RUN TO THE PRODUCTION QUALITY CONTROL DEPT., ABC CORP. ADDITIONAL REQUIREMENTS:

SPECIAL INSTRUCTIONS: SUPPLY 4 PLATE PROOFS TO PACKAGING DEVELOPMENT DEPT.



Kura Kajima
SIGNATURE

Figure 5.1. (cont'd.).

QUALITY CONTROL PROBLEMS

This section contains the quality assurance program for the inspection of each of the components used to package "THSISOL". The program should be used when evaluating the quality control problems on pages 223-228.

ABC CORP
QUALITY ASSURANCE PROGRAM

PACKAGING MATERIAL AND SUPPLIES ACCEPTANCE STANDARDS

PLASTIC BOTTLES

SAMPLING PROGRAMS

- I. Visual Inspection- A random sample will be taken following the Military Standard 105-D, General Inspection Level 1 or 11, Single Normal Sampling Plan.
- II. Dimensional Measurements- A random sample of ten bottles will be measured for the appropriate dimensions as listed on the individual specifications.
- III. Leaker Test- A random sample of ten bottles will be tested for leakers by the method specified in this program.
- IV. Flame Treatment Test- A random sample of ten bottles will be tested by the flame treatment test as specified in this program.

ACCEPTABLE QUALITY LEVELS (AQL'S)

Each defect will have its own AQL which is stated on the list of defects. AQL'S between classifications, however, will be interrelated and will be accumulated. For example, Major Defects will be totaled and must pass the higher AQL (1.5%).

DEFINITIONS OF CLASSIFICATIONS:

Critical	A critical defect is any defect which affects the safety, efficacy or legality of the product.
Major A	A Major A defect is any functional defect which will impair production or otherwise render the bottle unusable.
Major B	A Major B defect is a functional defect which will affect shipping, storage, or salability of the product.
Minor	A Minor defect is a non-functional defect which will affect the aesthetic acceptability of the product.

PLASTIC BOTTLES

VISUAL INSPECTION

CRITICAL DEFECTS (AQL 0.0%)

COLOR- Amber bottles must pass light Transmission Requirements of current USP.

Contamination- Foreign material of a chemical nature found on the finish or on the inside of the bottle which will affect the product in any manner (non-compatible grease, etc.).

MAJOR A DEFECTS (AQL 1.0%)

Finish Trim:

False Neck- A neck construction which is additional to the neck finish of the container.

Finish Flash- Excess material due to poor trimming or poor molding.

Bottom Trim:

Flashing- Excess material due to poor trimming or poor molding.

Seamline- Mold mismatch or parting line. A raised line appearing on the surface of a molding and formed at the junction of mold faces (greater than .020")

Choke Neck- Narrowed or constricted opening in the neck of a container affecting the filling operation.

Finish Leakers- Any condition of the finish where the normal closure will not retain the contents of the bottle.

Body Leakers- Any condition of the body in which the contents of the bottle will not be retained (pinholes, parting seams, incomplete bottom).

Wall Thickness- Minimum wall thickness as specified on the individual specifications, measured at the thinnest portion of the bottle.

Foreign Bottle- Any bottle which is foreign to the specification but which can be processed through production.

PLASTIC BOTTLES

VISUAL INSPECTION

MAJOR A DEFECTS (AQL 1.0%) - Continued

Contamination- Foreign material not of chemical nature found on the finish or on the inside of the bottle (bugs, dust, etc.).

Dirty Appearance- Foreign material found on the outside surface of the body of the bottle affecting labeling (grease, dust, etc.).

MAJOR B DEFECT (AQL 1.5%)

Dirty Appearance- Foreign Material found on the outside surface of the body of the bottle affecting salability (dust, dirt, etc.).

Die Lines- Vertical marks on the bottle caused by material build-up on the die parts. (see limit sample)

Flow Marks- Strikes or lines caused by damage to parts. (see limit sample)

Orange Peel- Rough surface of the bottle. (see limit sample)

Foreign Bottle- Any bottle which is foreign to the specification and will not process through production.

Color Variation- Variations in the color of the finished bottle not affecting efficacy or product stability. (see limit sample)

MINOR DEFECTS (AQL 4.0%)

Bubble- A void in the plastic material.

Carbon Specks or Other Inclusions- A portion of black residue from material degradation.

Gel- A small particle of unmelted plastic material which appears as a bead or speck in the finished bottle.

Spider Line- Double Mold Seam- A cloudy streak parallel to the mold seam.

Sink Mark- A shallow depression or dimple on the surface following local internal shrinkage.

PLASTIC BOTTLES

VISUAL INSPECTION

DIMENSIONS:

1. Select 10 bottles randomly from the inspection sample.
2. Check measurements for height, width, and depth.
3. Check for correct finish by applying an appropriate cap.
4. Cut bottle and measure wall thickness where specified on the individual specification.

All measurements must be within the variations specified on the individual specifications.

LEAKER TEST: (Performed on bottles designed for liquid preparations)

1. Select 10 bottles randomly from the inspection sample.
2. Add approximately 25 ml. of Thesisol
3. Cap and invert. Allow to stand 10 minutes.
4. Examine for evidence of leakers.
5. If no leakers are found, the order is acceptable.
6. If two or more bottles leak, the order is unacceptable.
7. If only one leaker is found, re-run the test on an additional 50 bottles randomly selected from the inspection sample.
8. If no additional leakers are found, the order is acceptable.
9. If two or more leakers are found in the 50 bottles tested, the order is unacceptable.

FLAME TREATMENT TEST: (Performed on bottles designed for paper labels)

1. Select 10 bottles randomly from the inspection sample.
2. Spray each bottle with red Poly-Treat-Check Marking Ink.
3. After drying, the ink should not be removed with scotch tape.
4. If 80% of the ink remains after the Scotch Tape Test, the order is acceptable.

ABC CORP
QUALITY ASSURANCE PROGRAM

CAP DEFECTS
A.Q.L.=0.65%

CRITICAL

Foreign Cap (if same size)

MAJOR (GENERAL)

Contaminated or soiled (limit Sample) (Internal- cap or liner)
Damaged Liner or Facing- Any condition that affects sealing
Feathers- Pulp piece large enough to affect sealing (see sample limits)
Foreign Cap (if different size) (Same or different designation)
Liner Not Sealed- Banked or cocked liner (see sample limits)
Loose or Undersize Liner
More Than One Liner
No Liner
Wrong Liner or Wrong Facing

MAJOR (MOLDED CAPS)

Blisters (Internal or External)
Broken or Cracked Cap
Defective Thread (1/4" or more removed)
Excessive Flashing (see limit sample)
Glue on Liner (inside sealing surface)
No Embossing
Poor Molding- Functional
Short Powder (Incomplete cap or design- porous appearing condition)

MAJOR (METAL CAPS)

Cracked Thread (Split- light passes)
Dent- (see sample limit)
Defective Bead- Cut out, (see limit sample); Unrolled, if sharp edge
Dirty Appearance - External- (see limit sample)
No Bead
No Knurling
No Threads
Incomplete or Faulty Coverage- Internal or External Coating (see limit sample)
Scored, Scraped or Scratched Coating- Internal or External (see limit sample)
Out of Shape- Malformed or Damaged

CAP DEFECTS (cont'd)MINOR (GENERAL)

Damaged Liner or Facing- Does not affect sealing

MINOR (MOLDED CAPS)

Chipped Rim
 Embedded Foreign Material (Discoloration)
 Glue on Liner (Not inside sealing surface)
 Poor Embossing
 Poor Molding- Sticking to mold, etc.

MINOR (METAL CAPS)

Dent- (see limit sample)
 Defective Bead- (see limit Sample) if not a sharp cutting edge
 Dirty Appearance- Internal or External (see limit sample)
 Incomplete Coverage- External Coating (see limit sample)
 Poor Embossing
 Scored, Scraped or Scratched Coating- Internal or External (see limit sample)

NOTE: All threaded caps are to be tested for fit on the proper bottle.
 Sample 15 caps per lot.

ABC CORP
QUALITY ASSURANCE PROGRAM

LABEL DEFECTS
A.Q.L.=0.65%

PRINTING DEFECTS

Foreign Label- CRITICAL
 Illegible Lot Number- MAJOR
 Missing or Mixed Lot Number- CRITICAL
 Missing Color or Registration (one or more colors missing)- MAJOR
 Off Registration (placement of copy of register of two or more colors)-
 MAJOR OR MINOR
 Off Standard Color- MAJOR
 Poor Cover Up (Light or dark spots or marks)- MAJOR & MINOR (see limit sample)
 Poor Impression- MAJOR & MINOR (see limit sample)
 Reverse Position of Labels- MAJOR
 Streaks or Smudges- MAJOR & MINOR (see limit sample)
 Unequal Marging- MAJOR & MINOR (see limit sample)

PAPER DEFECTS

Creased or Folded Labels- MAJOR & MINOR (see limit sample)
 Damaged or Torn Labels- MAJOR & MINOR (see limit sample)
 Dirty Backs- MAJOR & MINOR (see limit sample)
 Improper Direction of Grain (heat seal labels only)- MAJOR
 Improper Paper Weight- MAJOR
 Improper Size of Label (Measurement)- MAJOR
 Off Color Stock- MAJOR

COATING AND ADHESIVE DEFECTS

Absence of Coating (When coating is required)- MAJOR
 Improper Color of Coating (Varnish)- MAJOR
 Improper or Poor Coating of Adhesive on Heat Seal Label- MAJOR
 Improper Type of Coating- MAJOR
 Improper Type of Heat Seal Label- MAJOR
 Presence of Coating (When coating is not required)- MAJOR

NOTE: MEASURE THE LABEL FOR SIZE AND CHECK SPECIFICATION.

INCOMING AND PRODUCTION QUALITY CONTROL PROBLEMS

Complete all of the information in the quality control reports. The quality control problems should be filled out using the normal definitions of critical, major, and minor defects. For the production quality control problems a control chart is also required.

IMPORTANT NOTE:

FOR THE PURPOSE OF THE COMPUTER SIMULATION MAJOR DEFECTS ARE CONSIDERED A COMBINATION OF CRITICAL AND MAJOR DEFECTS THAN MUST BE REJECTED. (ie. sent back or sorted) LOTS THAT ARE USEABLE AND CONTAIN MAJOR DEFECTS ARE TO BE REFERRED TO AS IF THEY CONTAINED MINOR DEFECTS.

THIS NOTE ONLY PERTAINS TO THE QUALITY CONTROL PROBLEMS DURING THE TIME YOU ARE LOGGED-ON TO THE COMPUTER TERMINAL!!!

ABC CORP.		
PACKAGING MATERIAL INSPECTION REPORT	PART: <i>Bottle</i>	# CONTAINERS: <i>4167</i>
PACKAGING CONTROL	VENDOR: <i>M. L. Data</i>	# UNITS/CONT: <i>24</i>
DATE:	ASSIN. #: <i>1 (EXAMPLE)</i>	# SAMPLED:
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE	☒ REDUCED ☒ SINGLE ☐ MULTIPLE	NO. _____ A.Q.L. _____
CHARACTERISTIC <i>EXCESS FLASHING → 10th</i> <i>DIE LINES → 13th</i>	REMARKS ON DEFECTS	
NOTES & CALCULATIONS		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS		
_____ SIGNATURE _____ DATE		

Figure 5.2. Quality control problems.

ABC CORP.		
PACKAGING MATERIAL INSPECTION REPORT PACKAGING CONTROL	PART: <i>Bottles</i> VENDOR: <i>Mich. State</i>	# CONTAINERS: <i>4,167</i> # UNITS/CONT.: <i>24</i> # SAMPLED:
DATE:	ASSIN. #: <i>2</i>	PROBLEM #: <i>2</i>
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE ☐ REDUCED NO. _____ A.Q.L. _____ ☒ SINGLE ☐ MULTIPLE		
CHARACTERISTIC <i>SPIDER LINES → 25#</i> <i>CONTAMINATION → 5# →</i>		REMARKS ON DEFECTS <i>(BUGS)</i>
NOTES & CALCULATIONS		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS _____ SIGNATURE _____ DATE		

Figure 5.2. (cont'd.).

ABC CORP.		
PACKAGING MATERIAL	PART: <i>Labels</i>	# CONTAINERS:
INSPECTION REPORT		# UNITS/CONT.:
PACKAGING CONTROL	VENDOR: <i>Mich. State</i>	# SAMPLED:
DATE:	ASSIN. #: <i>2</i>	PROBLEM #: <i>4</i>
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE	☒ REDUCED ☒ SINGLE ☐ MULTIPLE	NO. _____ A.Q.L. _____
CHARACTERISTIC <i>Pkt Std. color → 10th</i>	REMARKS ON DEFECTS	
NOTES & CALCULATIONS		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS _____ SIGNATURE _____ DATE		

Figure 5.2. (cont'd.).

ABC CORP.		
PACKAGING MATERIAL INSPECTION REPORT PACKAGING CONTROL	PART: <i>Production</i> VENDOR: <i>ABC corp.</i>	# CONTAINERS: <i>4.167</i> # UNITS/CONT.: <i>24</i> # SAMPLED: <i>■</i>
DATE:	ASSIN. #: <i>3 (EXERCISE)</i>	PROBLEM #: <i>5</i>
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE ☐ REDUCED ☒ SINGLE ☐ MULTIPLE	NO. _____	A.Q.L. <i>40</i>
CHARACTERISTIC <i>fill level 15.0oz - 25th</i>	REMARKS ON DEFECTS	
NOTES & CALCULATIONS <i>Control chart information: $S_p = .049$</i> $\bar{x}/\text{hour}$ $\bar{x}_1 = 16.150$ $\bar{x}_2 = 16.050$ $\bar{x}_3 = 16.150$ $\bar{x}_4 = 16.025$ $\bar{x}_5 = 16.100$ $\bar{x}_6 = 16.175$ $\bar{x}_7 = 16.100$		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS		
_____ DATE _____ SIGNATURE		

Figure 5.2. (cont'd.).

ABC CORP.		
PACKAGING MATERIAL INSPECTION REPORT PACKAGING CONTROL	PART: <i>Production</i> VENDOR: <i>Chl. corp.</i>	# CONTAINERS: <i>4,167</i> # UNITS/CONT.: <i>24</i> # SAMPLED:
DATE:	ASSIN. #: <i>4</i>	PROBLEM #: <i>6</i>
ACCEPTANCE SAMPLING TEST		
SIZE OF SAMPLE ☐ REDUCED ☒ SINGLE NO. _____ A.Q.L. <i>40</i> ☐ MULTIPLE		
CHARACTERISTIC <i>Label - crooked - ° OFF</i>	REMARKS ON DEFECTS <i>MARK 4° → 25°</i>	
NOTES & CALCULATIONS <i>For control short use the same information in problem 5.</i>		
☐ LOT SHOULD BE ACCEPTED ☐ LOT SHOULD BE REJECTED ☐ LOT CONTAINS MAJOR DEFECTS ☐ LOT CONTAINS MINOR DEFECTS ☐ LOT CONTAINS CRITICAL DEFECTS		
_____ DATE _____ SIGNATURE		

Figure 5.2. (cont'd.).

APPENDICES

APPENDIX A

This appendix contains a copy of one of the "HOW TO;" manuals published by the MICHIGAN STATE UNIVERSITY COMPUTER LABORATORY. The manual contains a complete set of instructions for the procedures involved in logging-in to the computer (from a terminal).

APPENDIX B

This appendix contains a practice problem in the use of materials requirements planning. Complete the problem before using the simulation model (program).

Table 5.4

PRACTICE EXERCISE WITH MRP SCHEDULES

FINISHED PRODUCT LT- 2 weeks 500 order quantity #/per unit: 1
 safety stock: 100

	curr	12	13	14	15	16	17	18	19	20
SALES	300	300	300	300	300	300	300	300	300	300
SCHEDULED PRODUCTION	0	500	0	0	0	0	0	0	0	0
ON HAND INVENTORY										
PLANNED PRODUCTION										
FROZEN PERIOD										

DIRECTIONS: Fill in the above schedule (on hand inventory and planned production).

Include the week of a planned order as part of the lead time.

Table 5.4. (cont'd.).

COMPONENT PART 1		LT- 2 weeks		5,000 order quantity		#/per unit: 20					
				safety stock: 4,000							
		curr	12	13	14	15	16	17	18	19	20
REQUIREMENT											
SCHEDULED RECEIPTS											
ON HAND INVENTORY											
PLANNED ORDERS											

DIRECTIONS: Fill in the above chart.

INFORMATION:

The inventory needed for production should be on hand inventory one week previous to the scheduled production week.

Table 5.4. (cont'd.).

FINISHED PRODUCT		LT- 2 weeks		500 order quantity		#/per unit: 1					
				safety stock: 100							
		curr	13	14	15	16	17	18	19	20	21
SALES											
SCHEDULED PRODUCTION											
ON HAND INVENTORY											
PLANNED PRODUCTION											
		FROZEN PERIOD									

DIRECTIONS: Fill in the above schedule using the data from the previous week.

INFORMATION:

In week 16 an order has been placed for 300 additional units.

Actual sales during week 11 were 250 units.

Table 5.4. (cont'd.).

COMPONENT PART 1 LT- 2 weeks 5,000 order quantity #/per unit: 20
safety stock: 4,000

	curr	13	14	15	16	17	18	19	20	21
REQUIREMENT										
SCHEDULED RECEIPTS										
ON HAND INVENTORY										
PLANNED ORDERS										

DIRECTIONS: Fill in the above chart using the data from the previous week.

CHAPTER VI

PROOF OF THE PROGRAM

The purpose of this chapter is to prove that the program can easily be modified to represent other product lines. Two different product lines are modeled:

1. The first product line is entitled test. This product was used in the development of the computer program 'THSKMK'.
2. The second model was based on a real product, the name of this product has been changed to conceal the identity of the company which provided the necessary information. This product line carries the name Thsisol.

The data for each of the models was based on the different parameters listed on the product information sheets. These data sheets precede each of the hard copy outputs included in the section.

NOTE: The modification of the program to simulate the different product lines involved the change of 24 data cards.

PRODUCT LINE TEST

INFORMATION	PRODUCTION	BOTTLE	CAP	LABEL	CARTON	
PART #	1001	3642	4123	2324	7922	
SPEC DATE	071979	030476	041078	071879	102277	
VENDOR 1	--	23	2	10	46	
VENDOR 2	--	34	76	56	30	
VENDOR 3	--	--	23	--	--	
VENDOR 4	--	--	--	--	--	
ORDER QUAN.	37,000	100,000	500,000	500,000	100,000	
LEAD TIME	1 week	6 weeks	6 weeks	3 weeks	2 weeks	
SCRAP FACT.	--	2%	3%	5%	2%	
QUAN/UNIT	1	24	24	24	24	
QUAN/PALLET	1,563	1563	250,000	500,000	80,000	
BEG INV	50,000	200,000	150,000	150,000	200,000	
DOWN TIME	--	--	--	--	--	
SALES PRICE	1.5 x cost	22.88/M	79.90/M	6.90/M	22.80/M	
FIXED COST	--	--	--	--	--	
OVERHEAD	--	--	--	--	--	

MARKETING FORECAST

$$\text{reg} = 21,000 \times 4 = 84,000$$

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
reg	103/M	122/M	reg	reg	reg	reg	reg	reg	reg	reg	reg

x UNION NON-UNION

OTHER NOTES:

Figure 6.1. Product information sheet model 1.

MODEL I

Table 6.1

PROOF MODEL I

TYPE PASSWORD, FN, AND USER ID.
 ■■■■■■■■■■841-lockhart.

SS28087, USER 2 (S116,P 14)
 LAST ACCESS: S 05/05/80 16:02
 RUNS: 183 FN BALANCE: \$ 48.40

READY 16.13.00
 attach,k kajiya,Program for pkg 425.
 ATTACH,KKAJIYA,PROGRAMFORPKG425.

READY 16.13.22
 exec,k kajiya.
 ATTACH,PKGPF1,PROJECT425.
 ATTACH,TAPE70,KAJ70.
 ATTACH,TAPE14,KAJ14.
 EXEC BEGUN.16.13.37.

WHICH TYPE OF SIMULATION WOULD YOU LIKE TO TRY? INPUT - 1 FOR EXERCISE, INPUT
 - 2 FOR A GUIDED SIMULATION, OR INPUT - 3 FOR A RANDOM SIMULATION.2
 PLEASE INPUT YOUR REGULAR 40 HOUR WORK WEEK PRODUCTION CAPACITY/CASES. 100000=
 100000 10000=010000 1000=001000?037000 .

ITEM-TEST

PART-1001

SPECIFICATION DATE- 71979

VENDORS- IN HOUSE

ORDER Q- 37000 K

SCRAP FACT- 0 PERCENT

LEAD TM- 1 WEEKS

SAFETY STK- 15000

Q REQ/UNIT- 1

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

*NEG

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

SALES ** 21* 21* 21* 21* 21* 21** 21* 40* 40* 40* 21* 21*

PRODUCT** 0* 0* 37* 0* 37* 37** 0* 0* 0* 0* 0* 0*

FIN INV** 29* 8* 24* 3* 19* 35** 14* 26* 66* 106* 127* 148*

PLD PRD** 0* 0* 0* 0* 0* 0** 37* 37* 37* 37* 37* 0*

** FROZEN PERIOD **

Table 6.1. (cont'd.).

```

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
SALE* 21* 21* 21* 21* 21* 21* 21* 21* 21* 21* 21* 21* 21*
*****
PROD* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H* 169* 190* 211* 232* 253* 274* 295* 316* 337* 358* 379* 400* 421*
*****
PLD * 37* 0* 37* 0* 37* 0* 37* 37* 0* 37* 0* 37* 0*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

ITEM-BOTTLE

PART-3642

SPECIFICATION DATE- 30476

VENDORS- 23
34

ORDER Q-100000 K

SCRAP FACT- 2 PERCENT

LEAD TM- 6 WEEKS

SAFETY STK- 600000
Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

*NEG

```

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
REQUIRE** 0* 888* 0* 888* 888* 0** 888* 888* 888* 888* 888* 0*
*****
SCH REC** 0* 900* 0*1100* 900* 0** 0* 0* 0* 0* 0* 0*
*****
PTS INV** 200* 212* 212* 424* 436* 436** 452*1340*2228*3116*4004*4004*
*****
PLD ORD** 0* 0* 0* 300* 900* 0** 900* 0* 800* 0* 900* 0*
*****
** FROZEN PERIOD **
*****

```

Table 6.1. (cont'd.).

```

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 988* 0* 888* 0* 988* 0* 888* 888* 0* 888* 0* 888* 0*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H*4892*4892*5780*5780*6668*6668*7556*8444*8444*9332*9332*****
*****
PLD * 900* 900* 0* 900* 0* 900* 0* 900* 900* 0* 900* 0* 800*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

ITEM-CAP

PART-4123

SPECIFICATION DATE- 4/078

```

VENDORS- 2          ORDER Q-500000 K      SCRAP FACT- 3 PERCENT
          76
          23          LEAD TM- 6 WEEKS    SAFETY STK- 300000
                                   Q REQ/UNIT- 24

```

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

```

*NEG
(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
REQUIRE** 0* 898* 0* 888* 888* 0** 888* 888* 888* 888* 888* 0*
*****
SCH REC** 212* 500* 0*1500* 500* 0** 0* 0* 0* 0* 0* 0*
*****
PTS INV** 362* 26* 26* 586* 198* 198** 690*1578*2466*3354*4242*4242*
*****
PLD ORD** 0* 0* 0*1000* 500* 0**1000* 0*1000* 0*1000* 0*
*****
** FROZEN PERIOD **
*****

```

Table 6.1. (cont'd.).

```

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 888* 0* 888* 0* 888* 0* 888* 888* 0* 888* 0* 888* 0*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
QN H*5130*5130*6018*6018*6906*6906*7794*8682*8682*9570*9570*****
*****
PLD *1000* 500* 0*1000* 0*1000* 0*1000* 500* 0*1000* 0*1000*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

ITEM-LABEL

PART-2324

SPECIFICATION DATE- 71879

VENDORS- 10
56

ORDER Q-500000 K SCRAP FACT- 5 PERCENT
LEAD TM- 3 WEEKS SAFETY STK- 100000
Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

*NEG

```

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
REQUIRE** 0* 888* 0* 888* 888* 0** 888* 888* 888* 888* 888* 0*
*****
SCH REC** 424* 500* 0*1000* 0* 0** 0* 0* 0* 0* 0* 0*
*****
PTS INV** 574* 186* 186* 298* 590* 590**1478*2366*3254*4142*5030*5030*
*****
PLD ORD** 0* 0* 0* 0*1000*1000**1000* 500* 0*1000* 0*1000*
*****
** FROZEN PERIOD **
*****

```

Table 6.1. (cont'd.).

```

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 888* 0* 888* 0* 888* 0* 888* 888* 0* 888* 0* 888* 0*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H*591S*591S*6806*6806*7694*7694*8582*9470*9470*****
*****
PLD * 0*1000* 0*1000* 500* 0*1000* 0*1000* 0*1000* 500* 0*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

ITEM-CARTON

PART-7922

SPECIFICATION, DATE-102277

VENDORS- 46
30

ORDER Q-100000 K SCRAP FACT- 2 PERCENT

LEAD TM- 2 WEEKS SAFETY STK- 200000
Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

```

*NEG
(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
REQUIRE** 0* 888* 0* 888* 888* 0** 888* 888* 888* 888* 0*
*****
SCH REC** 0* 900* 0* 200* 0* 0** 0* 0* 0* 0* 0*
*****
PTS INV** 200* 212* 212* 476*1364*1364**2252*3140*4028*4916*5804*
*****
PLD ORD** 0* 0* 300* 0* 900* 900** 900* 900* 900* 0* 900* 0*
*****
** FROZEN PERIOD **
*****

```

Table 6.1. (cont'd.).

```

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 888* 0* 888* 0* 888* 0* 888* 888* 0* 888* 0* 888* 0*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H*6692*6692*7580*7580*8468*8468*9356*****
*****
PLD * 800* 0* 900* 0* 900* 900* 0* 900* 0* 900* 0* 900* 900*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

A GROUP OF WORKERS HAS APPROACHED YOU AND INFORMED YOU THAT THEY ARE VERY DISATISFIED WITH THE WAY MANAGEMENT IS HANDLING THEIR BENEFITS. THEY HAVE FOLLOWED THE GRIEVANCE PROCEDURE AND WOULD LIKE YOU TO TAKE SOME FORM OF ACTION. FELLOW WORKERS HAVE SAID THAT SIMILAR INCIDENTS HAVE LED TO WORKER WALKOUTS WHEN NOT HANDLED PROPERLY. IF ONE OF THESE WALKOUTS OCCURS IT WILL MOST LIKELY HAPPEN IN WEEK 8.

HISTORICALLY WALKOUTS AND STRIKES OF THIS NATURE HAVE LASTED TWO WEEKS. YOU HAVE FOUR ALTERNATIVE METHODS OF HANDLING THE SITUATION. THESE ALTERNATIVES ARE:

1. TO USE INCENTIVES WHICH WILL HOPEFULLY ELIMINATE THE POSSIBILITY OF A STRIKE. THESE INCENTIVES WILL COST THE AMOUNT LISTED IN TABLE 6.
2. PLAN TO HIRE OUTSIDE PEOPLE DURING THE WEEKS OF THE STRIKE.
3. TO BUILD PRODUCTION AND STORE FINISHED INVENTORIES IN A PUBLIC WAREHOUSE.
4. TO DO ABSOLUTELY NOTHING AND DISREGARD THE WORKERS GRIEVANCE.

INPUT THE NUMBER OF THE WAY IN WHICH YOU WOULD LIKE TO HANDLE THE SITUATION.2

YOUR ACTUAL REQ OF TEST INCLUDING SCRAP EQUALLED 21000

ITEM-TEST

PART-1001

SPECIFICATION DATE- 71979

VENDORS- IN HOUSE

ORDER Q- 37000 K

SCRAP FACT- 0 PERCENT

Table 6.1. (cont'd.).

LEAD TM- 1 WEEKS SAFETY STK- 15000
R RFR/UNIT- 1

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 8.

*NEG

```
(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
SALES ** 0* 21* 21* 21* 21* 21** 21* 40* 40* 40* 21* 21*
*****
PRODUCT** 0* 0* 37* 0* 37* 37** 0* 0* 0* 0* 0* 0*
*****
FIN INV** 29* 8* 24* 3* 19* 35** 14* 26* 66* 106* 127* 148*
*****
PLD PRD** 0* 0* 0* 0* 0* 0** 37* 37* 37* 37* 37* 0*
*****
** FROZEN PERIOD **
*****

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
SALE* 21* 21* 21* 21* 21* 21* 21* 21* 21* 21* 21* 21* 21*
*****
PROD* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H* 169* 190* 211* 232* 253* 274* 295* 316* 337* 358* 379* 400* 421*
*****
PLD * 37* 0* 37* 0* 37* 0* 37* 37* 0* 37* 0* 37* 0*
*****
```

*NEG INDICATES THE FIRST NEGATIVE BAL., MAY BECOME POSITIVE LATER.

WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS INPUT YES OR NO.yes
HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=0101
IN WHICH WEEK IS THE 1 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?07

WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YES OR NO.no

WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT YES OR NO.no

WOULD YOU LIKE TO REPLENISH ANY OF YOUR TEST SAFETY STOCK? INPUT YES OR N
0.no

FOR THIS PART THERE WERE NO MAJOR PROBLEMS FOR THE WEEK.

YOUR ACTUAL REQ OF BOTTLE INCLUDING SCRAP EQUALED 0

Table 6.1. (cont'd.).

ITEM-BOTTLE
 PART-3642 SPECIFICATION DATE- 30476

VENDORS- 23 ORDER Q-100000 K SCRAP FACT- 2 PERCENT
 34

LEAD TM- 6 WEEKS SAFETY STK- 600000
 Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 8.

*NEG
 (1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

 REQUIRE** 0* 888* 0* 888* 888* 0** 888* 888* 888* 888* 888* 0*

 SCH REC** 0* 900* 0*1100* 900* 0** 0* 0* 0* 0* 0* 0*

 PTS INV** 200* 212* 212* 424* 436* 436** 452*1340*2228*3116*4004*4004*

 PLD ORD** 500* 900* 900* 900* 900* 0** 900* 0* 800* 0* 900* 0*

 ** FROZEN PERIOD **

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *

 REQ * 888* 0* 888* 0* 888* 0* 888* 888* 0* 888* 0* 888* 0*

 SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*

 ON H*4892*4892*5780*5780*6668*6668*7556*8444*8444*9332*9332*****

 PLD * 900* 900* 0* 900* 0* 900* 0* 900* 900* 0* 0* 0* 0*

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS INPUT YES OR NO.yes
 HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=0103
 IN WHICH WEEK IS THE 1 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?01
 IN WHICH WEEK IS THE 2 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?02
 IN WHICH WEEK IS THE 3 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?03

WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YES OR NO.no

WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT YES OR NO.no

Table 6.1. (cont'd.).

WOULD YOU LIKE TO REPLENISH ANY OF YOUR BOTTLE SAFETY STOCK? INPUT YES OR N
0.no

EVEN THOUGH YOU HAVE A WORK RULE CONCERNING EMPLOYEES SMOKING IN THE WAREHOUSE A
FIRE WAS STARTED WHEN AN EMPLOYEE FAILED TO PUT OUT HIS CIGARETTE. LUCKLY THE
FIRE WAS EXTINGUISHED RAPIDLY AND ONLY TWO PALLETS OF CAP WERE DESTROYED.

YOUR ACTUAL REQ OF CAP INCLUDING SCRAP EQUALED 0
IF YOUR SAFETY STOCK CANNOT HANDLE THE COMING ORDER YOU BETTER EXPEDITE AN ORDER
VERY QUICKLY OR YOU WILL STOCK OUT!

ITEM-CAP

PART-4123

SPECIFICATION DATE- 41078

VENDORS- 2 ORDER Q-500000 K SCRAP FACT- 3 PERCENT
76
23 LEAD TM- 6 WEEKS SAFETY STK- 300000
Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 8.

*NEG
(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

REQUIRE** 0* 888* 0* 888* 888* 0** 888* 888* 888* 888* 888* 0*

SCH REC** 0* 500* 0*1500* 500* 0** 0* 0* 0* 0* 0* 0*

PTS INV** 212* 176* 176* 436* 48* 48** 840*1728*2616*3504*4392*4392*

PLD ORD**1000*1000*1000*1000* 500* 0**1000* 0*1000* 0*1000* 0*

** FROZEN PERIOD **

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *

RFQ * 888* 0* 888* 0* 888* 0* 888* 888* 0* 888* 0* 888* 0*

SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*

ON H*5280*5280*6168*6168*7056*7056*7944*8832*8832*9720*9720*

PLD * 500*1000* 0*1000* 0*1000* 0*1000* 500* 0* 0* 0* 0*

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

Table 6.1. (cont'd.).

WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS INPUT YES OR NO.yes
 HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=0104
 IN WHICH WEEK IS THE 1 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?01
 IN WHICH WEEK IS THE 2 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?02
 IN WHICH WEEK IS THE 3 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?03
 IN WHICH WEEK IS THE 4 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?04

WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YES OR NO.no

WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT YES OR NO.yes
 HOW MANY ORDERS WOULD YOU LIKE TO EXPEDITE 10=10 AND 1=01?02
 IN WHICH WEEK DO YOU WISH TO EXPEDITE YOUR 1 ORDER? 10=10 1=01 ?04
 YOU HAVE 3 ORDER QUANTITIES SCHEDULED TO ARRIVE DURING THIS TIME PERIOD. HOW M
 ANY OF THESE WOULD YOU LIKE TO ADVANCE? INPUT 10=10 1=01 .01
 THE MAXIMUM AMOUNT OF WEEKS YOU CAN EXPEDITE THE ORDER IS 3 WEEKS. HOW MANY WE
 EKS WOULD YOU LIKE TO ADVANCE THE RECEIVAL? INPUT A NUMBER BETWEEN 1-6 .3
 IN WHICH WEEK DO YOU WISH TO EXPEDITE YOUR 2 ORDER? 10=10 1=01 ?05
 YOU HAVE 1 ORDER QUANTITIES SCHEDULED TO ARRIVE DURING THIS TIME PERIOD. HOW M
 ANY OF THESE WOULD YOU LIKE TO ADVANCE? INPUT 10=10 1=01 .01
 THE MAXIMUM AMOUNT OF WEEKS YOU CAN EXPEDITE THE ORDER IS 3 WEEKS. HOW MANY WE
 EKS WOULD YOU LIKE TO ADVANCE THE RECEIVAL? INPUT A NUMBER BETWEEN 1-6 .2

WOULD YOU LIKE TO REPLENISH ANY OF YOUR CAP SAFETY STOCK? INPUT YES OR N
 0.no

WHILE DELIVERING A PALLET LOAD OF LABEL TO ITS STAGING AREA A FORKLIFT WENT
 OUT OF CONTROL. THE DAMAGES THAT FOLLOWED INCLUDED HALF OF THE ITEMS ON THE PA
 LLET.

YOUR ACTUAL REQ OF LABEL INCLUDING SCRAP EQUALED 0
 IF YOUR SAFETY STOCK CANNOT HANDLE THE COMING ORDER YOU BETTER EXPEDITE AN ORDE
 R VERY QUICKLY OR YOU WILL STOCK OUT!

ITEM-LABEL

PART-2324

SPECIFICATION DATE- 71879

VENDORS- 10
 56

ORDER Q-500000 K SCRAP FACT- 5 PERCENT

LEAD TM- 3 WEEKS SAFETY STK- 100000
 Q RFQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 8.

*NEG

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

 RFQUIRE** 0* 888* 0* 888* 888* 0** 888* 888* 888* 888* 888* 0*

 SCH REC** 0* 500* 0*1000* 0* 0** 0* 0* 0* 0* 0* 0*

Table 6.1. (cont'd.).

```
*****
PTS INU** 424* 36* 36* 148* 740* 740**1628*2516*3404*4292*5180*5180*
*****
PLD ORN** 500* 500* 0*1000*1000* 500**1000*1000* 0*1000* 0*1000*
*****
** FROZEN PERIOD **
*****
```

```
* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 888* 0* 888* 0* 888* 0* 888* 888* 0* 888* 0* 888* 0*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H*6068*6068*6956*6956*7844*7844*8732*9620*9620*****
*****
PLD * 0* 500* 0*1000*1000* 0*1000* 0* 500* 0*1000*1000* 0*
*****
```

*NEG INDICATES THE FIRST NEGATIVE BAI , MAY BECOME POSITIVE LATER.

WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS INPUT YES OR NO.yes
 HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=0103
 IN WHICH WEEK IS THE 1 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?01
 IN WHICH WEEK IS THE 2 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?022
 IN WHICH WEEK IS THE 3 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?04

WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YES OR NO.no

WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT YES OR NO.yes
 HOW MANY ORDERS WOULD YOU LIKE TO EXPEDITE 10=10 AND 1=01?01
 IN WHICH WEEK DO YOU WISH TO EXPEDITE YOUR 1 ORDER? 10=10 1=01 ?04
 YOU HAVE 3 ORDER QUANTITIES SCHEDULED TO ARRIVE DURING THIS TIME PERIOD. HOW M
 ANY OF THESE WOULD YOU LIKE TO ADVANCE? INPUT 10=10 1=01 .01
 THE MAXIMUM AMOUNT OF WEEKS YOU CAN EXPEDITE THE ORDER IS 1 WEEKS. HOW MANY WE
 EKS WOULD YOU LIKE TO ADVANCE THE RECEIVAL? INPUT A NUMBER BETWEEN 1-6 .1

WOULD YOU LIKE TO REPLENISH ANY OF YOUR LABEL SAFETY STOCK? INPUT YES OR N
 O.no

A PHYSICAL INVENTORY OF CARTON HAS JUST BEEN COMPLETED.

THE PHYSICAL INVENTORY HAS REVEALED THAT YOUR INVENTORY IS .10 PERCENT LOWER TH
 AN YOUR SCHEDULE INDICATES. THIS INVENTORY SCHEDULE WILL BE CORRECTED.

YOUR ACTUAL REQ OF CARTON INCLUDING SCRAP EQUALLED 0

ITEM-CARTON

Table 6.1. (cont'd.).

PART-7922

SPECIFICATION DATE-102277

VENDORS- 46
30

ORDER Q-100000 R SCRAP FACT- 2 PERCENT

LEAD TM- 2 WEEKS SAFETY STK- 200000
Q REQ/UNIT- 24YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 8.

*NEG

```

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
RFQUIRE** 0* 888* 0* 888* 888* 0** 888* 888* 888* 888* 888* 0*
*****
SCH REC** 0* 900* 0* 200* 0* 0** 0* 0* 0* 0* 0* 0*
*****
PTS INV** 180* 192* 192* 496*1384*1384**2272*3160*4048*4936*5824*5824*
*****
PLD ORN** 0* 600* 900* 0* 800* 900** 900* 900* 900* 0* 900* 0*
*****
** FROZEN PERIOD **
*****

```

```

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 888* 0* 888* 0* 888* 0* 888* 888* 0* 888* 0* 888* 0*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H*6712*6712*7600*7600*8488*8488*9376*****
*****
PLD * 900* 0* 900* 0* 800* 900* 0* 900* 0* 900* 0* 900* 900*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL., MAY BECOME POSITIVE LATER.

WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS INPUT YES OR NO.yes
 HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=0102
 IN WHICH WEEK IS THE 1 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 702
 IN WHICH WEEK IS THE 2 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 703

WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YES OR NO.no

WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT YES OR NO.no

WOULD YOU LIKE TO REPLENISH ANY OF YOUR CARTON SAFETY STOCK? INPUT YES OR N
0.no

Table 6.1. (cont'd.).

DO YOU WANT TO CONTINUE THE SIMULATION FOR ANOTHER WEEK. IF YES- INPUT YES. IF
NO - INPUT NO

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR BOTTLE = \$ 2729.76

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS =\$ 2631.20
COST PENALTIES =\$ 0.00
COST TO HOLD INVENTORY =\$ 98.56

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR CAP = \$ 55517.80

TOTAL PURCHASING COST FOR THIS ITEM = \$ 16748.00

COST TO MANIPULATE ORDERS =\$ 55300.00
COST PENALTIES =\$ 0.00
COST TO HOLD INVENTORY =\$ 217.80

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR LABEL = \$ 1399.47

TOTAL PURCHASING COST FOR THIS ITEM = \$ 2925.60

COST TO MANIPULATE ORDERS =\$ 1380.00
COST PENALTIES =\$ 0.00
COST TO HOLD INVENTORY =\$ 19.47

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR CARTON = \$ 1756.65

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

Table 6.1. (cont'd.).

COST TO MANIPULATE ORDERS	= \$	1710.00
COST PENALTIES	= \$	0.00
COST TO HOLD INVENTORY	= \$	46.65

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR TEST = \$ 274.83

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS	= \$	0.00
COST PENALTIES	= \$	0.00
COST TO HOLD INVENTORY	= \$	274.83

TOTAL COST TO MAINTAIN ALL INVENTORIES IS EQUAL TO **** \$ 61678.51 ****
 TOTAL COSTS TO PURCHASE ALL ITEMS IS EQUAL TO **** \$ 19673.60 ****

SALES DURING THE SIMULATION = \$ 40684.77

TOTAL PROFIT = \$ -40667.34

THIS SIMULATION WAS DESIGNED TO GIVE PACKAGING STUDENTS A BROADER VIEW OF THE WAY PACKAGING INTERFACES WITH OTHER DEPARTMENTS.

SOME OF THE SITUATIONS THAT YOU WERE FACED WITH ARE NOT CONSIDERED TO BE COMMON EVERY DAY PROBLEMS. IN FACT SOME OF THE PROBLEMS OCCURE VERY INFREQUENTLY IN A REAL LIFE ENVIRONMENT. IT IS FOR THIS REASON YOUR PERFORMANCE DURING THIS SIMULATION WILL NOT HAVE ANY DIRECT BEARING ON YOUR COURSE GRADE.

IF YOU HAVE ANY QUESTIONS CONCERNING PORTIONS OF THIS PROGRAM YOU SHOULD REFER TO THE THESIS ENTITLED:

AN EVALUATION AND CONTROL SIMULATION OF A PACKAGING
 PRODUCTION SYSTEM

BY
 KEVIN KAJIYA

SCHOOL OF PACKAGING
 MICHIGAN STATE UNIVERSITY

JUNE 1980

PLEASE TAKE A FEW MINUTES TO FILL OUT THE FOLLOWING EVALUATION FORM.
 THIS FORM SHOULD BE TURNED IN TO THE INSTRUCTOR OF YOUR COURSE.

THANK YOU
 KEVIN KAJIYA

Table 6.1. (cont'd.).

EVALUATION OF THE SIMULATION

----- TERM ----- PROF OR INSTRUCTOR
----- COURSE

WHAT IS YOUR OVER ALL OPINION OF THE SIMULATION?

WHAT DID YOU LEARN FROM THE SIMULATION?

PLEASE LIST ANY SPECIFIC WAYS IN WHICH THIS
SIMULATION COULD BE IMPROVED.

1.

2.

3.

Table 6.1. (cont'd.).

4.

WHAT IMPROVEMNTS SHOULD BE MADE ON THE USERS MANUAL?

IF THIS TERMINAL PRINTS - END THSKMK- INPUT-
LOGOUT,T.

END THSKMK
.610 CP SECONDS EXECUTION TIME

READY 16.23.04
logout,t.

JOB COST: \$ 3.53

MODEL 11

PRODUCT LINE THISOL

INFORMATION	PRODUCTION	BOTTLE	CAP	LABEL		
PART #	3321	2222	4444	1111		
SPEC DATE	042580	090476	041078	071879		
VENDOR 1	—	23	2	10		
VENDOR 2	—	34	76	ANY		
VENDOR 3	—	—	—	—		
VENDOR 4	—	—	—	—		
ORDER QUAN.	11,000	250,000	900,000	450,000		
LEAD TIME	1 week	6 weeks	6 weeks	3 weeks		
SCRAP FACT.	—	2%	3%	5%		
QUAN/UNIT	1	24	24	24		
QUAN/PALLET	1824	1824	350,000	225,000		
BEG INV	50,000	200,000	150,000	150,000		
DOWN TIME	—	—	—	—		
SALES PRICE	1.5 x COST	79.00/M	22.80/M	6.90/M		
FIXED COST	—	—	—	—		
OVERHEAD	—	—	—	—		

MARKETING FORECAST

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
26/M	28/M	35/M	21/M	29/M	35/M	28/M	34/M	40/M	30/M	23/M	26/M

☒ UNION ☐ NON-UNION

OTHER NOTES:

Figure 6.2. Product information sheet model 2.

Table 6.2

PROOF MODEL 11

13:36:22 05/02/80 MSU-FREND 03.18 SOCKET=116
CPORT 521

05/02/80 +MSU HUSTLER 2 LSD 49.53 04/24/80 CYBER750

TYPE PASSWORD, PN, AND USER ID.
#####841,LOCKHART.

SS13056, USER 45 (S116,P 52)
LAST ACCESS: S 05/02/80 13:35
RUNS: 174 PN BALANCE: \$ 63.78

READY 13.36.35
ATTACH,K KAJIYA,PROGRAM FOR PKG 425.
ATTACH,KKAJIYA,PROGRAMFORPKG425.

READY 13.36.59
EXEC,K KAJIYA.
ATTACH,PKGPF1,PROJFCT425.
ATTACH,TAPE70,KAJ70.
ATTACH,TAPE14,KAJ14.
EXEC BEGUN.13.37.15.

WHICH TYPE OF SIMULATION WOULD YOU LIKE TO TRY? INPUT - 1 FOR EXERCISE, INPUT
- 2 FOR A GUIDED SIMULATION, OR INPUT - 3 FOR A RANDOM SIMULATION.
PLEASE INPUT YOUR REGULAR 40 HOUR WORK WEEK PRODUCTION CAPACITY/CASES. ² 100000=
100000 10000=010000 1000=001000?011000

ITEM-THSTISOL

PART-3321

SPECIFICATION DATE- 42580

VENDORS- IN HOUSE

ORDER Q- 11000 K

SCRAP FACT- 0 PERCENT

LEAD TM- 1 WEEKS

SAFETY STK- 15000

Q REQ/UNIT- 1

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.

YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

Table 6.2. (cont'd.).

```

                                *NFG
(1000)**CIIRR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
SALES **  8*  8*  8*  8*  8*  8** 8*  8*  8* 10* 10* 10*
*****
PRODUCT** 0*  0*  0*  0*  0*  0** 11*  0*  0*  0*  0*  0*
*****
FIN INV** 42* 34* 26* 18* 10* 2** 5*  3* 11* 21* 31* 41*
*****
PLD PRD** 0*  0*  0*  0*  0*  0** 11* 11*  0* 11* 11* 11*
*****
**          FROZEN PERIOD          **
*****

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
SALE* 10*  8*  8*  8*  8*  8*  8*  8*  8*  8*  8*  8*  8*
*****
PROD*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*
*****
ON H* 51* 59* 67* 75* 83* 91* 99* 107* 115* 123* 131* 139* 147*
*****
PLD * 11* 11*  0* 11* 11* 11*  0* 11* 11*  0* 11* 11* 11*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL., MAY BECOME POSITIVE LATER.

ITEM-BOTTLE

PART-2222

SPECIFICATION DATE- 90476

VENDORS- 23
34

ORDER Q-250000 K

SCRAP FACT- 2 PERCENT

LEAD TM- 6 WEEKS

SAFETY STK- 600000

Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

Table 6.2. (cont'd.).

```

                                *NEG
(1000)**CURR*  ? * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
REQUIRE**  0*  0*  0*  0*  0* 264** 264* 264*  0* 264* 264* 264*
*****
SCH REC**   0*  0*  0* 200*  0* 250**  0*  0*  0*  0*  0*  0*
*****
PTS INV** 200* 200* 200* 400* 400* 386** 122* 142* 142* 406* 670* 934*
*****
PLD ORD**   0*  0*  0*  0* 250* 250** 500* 250*  0* 250* 250* 250*
*****
**          FROZEN PERIOD          **
*****

```

```

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 264* 264*  0* 264* 264* 264*  0* 264* 264*  0* 264* 264* 264*
*****
SCH *  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*
*****
ON H*1198*1462*1462*1726*1990*2254*2254*2518*2782*2782*3046*3310*3574*
*****
PLD *  0* 250* 250*  0* 250* 250* 250*  0* 250* 250* 250*  0* 250*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

ITEM-CAP

PART-4444

SPECIFICATION DATE- 41078

VENDORS- 2
76

ORDER R-900000 K SCRAP FACT- 3 PERCENT

LEAD TM- 6 WEEKS SAFETY STK- 300000
R REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

Table 6.2. (cont'd.).

```

*NEG
(1000)**CURR*  ? * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
REQUIRE**  0*  0*  0*  0*  0* 264** 264* 264*  0* 264* 264* 264*
*****
SCH REC**  0*  0*  0*1000* 0* 0** 0* 0* 0* 0* 0* 0*
*****
PTS INV** 150* 150* 150*1150*1150* 884** 622* 358* 358* 94* 170* 434*
*****
PLD ORD**  0*  0*  0*  0*  0* 0** 0* 0* 0* 900*  0*  0*
*****
**          FROZEN PERIOD          **
*****

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 264* 264*  0* 264* 264* 264*  0* 264* 264*  0* 264* 264* 264*
*****
SCH * 0*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*  0*
*****
ON H* 698* 962* 962*1276*1490*1754*1754*2018*2282*2282*2546*2810*3074*
*****
PLD *  0* 900*  0*  0*  0* 900*  0*  0*  0*  0* 900*  0*  0*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

ITEM-LABEL

PART-1111

SPECIFICATION DATE- 71879

VENDORS- 10
ANY

ORDER Q-450000 K SCRAP FACT- 5 PERCENT

LEAD TM- 3 WEEKS SAFETY STK- 100000
Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 50.

Table 6.2. (cont'd.).

```

*NEG
(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
RFQUIRE** 0* 0* 0* 0* 0* 264** 264* 264* 0* 264* 264* 264*
*****
SCH REC** 0* 0* 0*1000* 0* 0** 0* 0* 0* 0* 0* 0*
*****
PTS INV** 150* 150* 150*1150*1150* 886** 622* 358* 358* 94* 170* 434*
*****
PLN ORD** 0* 0* 0* 0* 0* 0** 0* 0* 0* 0* 0* 0*
*****
** FROZEN PFRJND **
*****

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 264* 264* 0* 264* 264* 264* 0* 264* 264* 0* 264* 264* 264*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H* 698* 962* 962*1226*1490*1754*1754*2018*2282*2282*2546*2810*3074*
*****
PLN * 450* 450* 0* 0* 450* 0* 0* 450* 450* 0* 0* 450* 0*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL., MAY BECOME POSITIVE LATER.

A GROUP OF WORKERS HAS APPROACHED YOU AND INFORMED YOU THAT THEY ARE VERY DISATISFIED WITH THE WAY MANAGEMENT IS HANDLING THEIR BENEFITS . THEY HAVE FOLLOWED THE GRIEVANCE PROCEDURE AND WOULD LIKE YOU TO TAKE SOME FORM OF ACTION. FELLOW WORKERS HAVE SAID THAT SIMILAR INCIDENTS HAVE LED TO WORKER WALKOUTS WHEN NOT HANDLED PROPERLY. IF ONE OF THESE WALKOUTS OCCURS IT WILL MOST LIKELY HAPPEN IN WEEK 8.

HISTORICALLY WALKOUTS AND STRIKES OF THIS NATURE HAVE LASTED TWO WEEKS. YOU HAVE FOUR ALTERNATIVE METHODS OF HANDLING THE SITUATION. THESE ALTERNATIVES ARE:

1. TO USE INCENTIVES WHICH WILL HOPEFULLY ELIMINATE THE POSSIBILITY OF A STRIKE. THESE INCENTIVES WILL COST THE AMOUNT LISTED IN TABLE 6.
2. PLAN TO HIRE OUTSIDE PEOPLE DURING THE WEEKS OF THE STRIKE.
3. TO BUILD PRODUCTION AND STORE FINISHED INVENTORIES IN A PUBLIC WAREHOUSE.
4. TO DO ABSOLUTELY NOTHING AND DISREGARD THE WORKERS GRIEVANCE.

INPUT THE NUMBER OF THE WAY IN WHICH YOU WOULD LIKE TO HANDLE THE SITUATION.2

YOUR ACTUAL REQ OF THIS SOL. INCLUDING SCRAP EQUALED 8000

Table 6.2. (cont'd.).

ITEM-THSISOL
 PART-3321 SPECIFICATION DATE- 42580

VENDORS- IN HOUSE ORDER Q- 11000 K SCRAP FACT- 0 PERCENT
 LEAD TM- 1 WFEKS SAFETY STK- 15000
 Q REQ/UNIT- 1

YOUR STOCKPILE OF 0 WILL BE AVAILARLE IN WFEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILARLE IN WFEK R.

*NEG

(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

SALES ** 0* R* R* R* R* R** 8* 8* 8* 10* 10* 10*

PRODUCT** 0* 0* 0* 0* 0* 0** 11* 0* 0* 0* 0* 0*

FIN INV** 42* 34* 24* 18* 10* 2** 5* 3* 11* 21* 31* 41*

PLD PRD** 0* 0* 0* 0* 0* 0** 11* 11* 0* 11* 11* 11*

** FROZEN PERIOD **

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *

SALE* 10* 8* 8* 8* 8* 8* 8* 8* 8* 8* 8* 8*

PRD** 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*

ON H* 51* 59* 67* 75* 83* 91* 99* 107* 115* 123* 131* 139* 147*

PLD * 11* 11* 0* 11* 11* 11* 0* 11* 11* 0* 11* 11* 11*

*NEG INDICATES THE FIRST NEGATVE BAL, MAY BECOME POSITIVE LATER.

Table 6.2. (cont'd.).

WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS INPUT YES OR NO.YES
 HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=0101
 IN WHICH WEEK IS THE 1 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?11

WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YES OR NO.NO

WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT YES OR NO.NO

WOULD YOU LIKE TO REPLENISH ANY OF YOUR THISISOL SAFETY STOCK? INPUT YES OR N
 0.YES
 HOW MUCH OF YOUR THISISOL STOCK WOULD YOU LIKE TO TRANSFER? IE 100000 = ONE
 HUNDRED THOUSAND. 10000=010000.010000

FOR THIS PART THERE WERE NO MAJOR PROBLEMS FOR THE WEEK.

YOUR ACTUAL REQ OF BOTTLE INCLUDING SCRAP EQUALLED 0

ITEM-BOTTLE

PART-2222

SPECIFICATION DATE- 90476

VENDORS- 23
 34

ORDER Q-250000 K SCRAP FACT- 2 PERCENT
 LEAD TM- 6 WEEKS SAFETY STK- 600000
 Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 8.

*NEG
 (1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *

 REQUIRE** 0* 0* 0* 0* 0* 264** 264* 264* 0* 264* 264* 264*

 SCH REC** 0* 0* 0* 200* 0* 250** 0* 0* 0* 0* 0* 0*

 PTS INV** 200* 200* 200* 400* 400* 384** 122* 142* 142* 406* 670* 934*

 PLD ORD** 0* 250* 0* 250* 250* 250** 250* 250* 0* 250* 250* 500*

 ** FROZEN PERIOD **

Table 6.2. (cont'd.).

```

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 264* 264* 0* 264* 264* 264* 0* 264* 264* 0* 264* 264* 264*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H*1198*1462*1462*1726*1990*2254*2254*2518*2782*2782*3046*3310*3574*
*****
PID * 0* 250* 250* 0* 250* 250* 250* 0* 250* 0* 0* 0* 0*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS INPUT YES OR NO.YES
 HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=0101
 IN WHICH WEEK IS THE 1 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?02

WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YES OR NO.NO

WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT YES OR NO.NO

WOULD YOU LIKE TO REPLENISH ANY OF YOUR BOTTLE SAFETY STOCK? INPUT YES OR N
 O.NO

EVEN THOUGH YOU HAVE A WORK RULE CONCERNING EMPLOYEES SMOKING IN THE WAREHOUSE A
 FIRE WAS STARTED WHEN AN EMPLOYEE FAILED TO PUT OUT HIS CIGARETTE. LUCKLY THE
 FIRE WAS EXTINGUISHED RAPIDLY AND ONLY TWO PALETS OF CAP WERE DESTROYED.

YOUR ACTUAL REQ OF CAP INCLUDING SCRAP EQUALLED 0
 IF YOUR SAFETY STOCK CANNOT HANDLE THE COMING ORDER YOU BETTER EXPEDITE AN ORDE
 R VERY QUICKLY OR YOU WILL STOCK OUT!

ITEM-CAP

PART-4444

SPECIFICATION DATE- 41078

VENDORS- 2
 76

ORDER Q-900000 K SCRAP FACT- 3 PERCENT

LEAD TM- 6 WEEKS SAFETY STK- 300000
 Q REQ/UNIT- 24

YOUR STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 0.
 YOUR SECOND STOCKPILE OF 0 WILL BE AVAILABLE IN WEEK 8.

Table 6.2. (cont'd.).

```

*NEG
(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
REQUIRE** 0* 0* 0* 0* 0* 264** 264* 264* 0* 264* 264* 264*
*****
SCH REC** 0* 0* 0*1000* 0* 0** 0* 0* 0* 0* 0* 0*
*****
PTS INU** 0* 0* 0*1000*1000* 736** 472* 20R* 20R* 56* 320* 584*
*****
PLD ORD** 900* 0* 0* 0* 0* 0** 0* 900* 0* 0* 0* 900*
*****
** FROZEN PERIOD **
*****

* 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 264* 264* 0* 264* 264* 264* 0* 264* 264* 0* 264* 264* 264*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H* 848*1112*1112*1376*1640*1904*1904*2168*2432*2432*2696*2960*3224*
*****
PLD * 0* 0* 0* 0* 900* 0* 0* 0* 0* 0* 0* 0* 0*
*****

```

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS INPUT YES OR NO.YES
 HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=0101
 IN WHICH WEEK IS THE 1 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?01

WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YES OR NO.NO

WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT YES OR NO.NO

WOULD YOU LIKE TO REPLENISH ANY OF YOUR CAP SAFETY STOCK? INPUT YES OR N
 O.NO

WHILE DELIVERING A PALLLET LOAD OF LABEL TO ITS STAGING AREA A FORKLIFT WENT
 OUT OF CONTROL. THE DAMAGES THAT FOLLOWED INCLUDED HALF OF THE ITEMS ON THE PA
 LLET.

YOUR ACTUAL REQ OF LABEL INCLUDING SCRAP EQUALLED 0
 IF YOUR SAFETY STOCK CANNOT HANDLE THE COMING ORDER YOU BETTER EXPEDITE AN ORDE
 R VERY QUICKLY OR YOU WILL STOCK OUT!

Table 6.2. (cont'd.).

```

ITEM-LABEL
PART-1111                                SPECIFICATION DATE- 71879

VFNDORS- 10                                ORDER Q-450000 K    SCRAP FACT- 5 PERCENT
ANY                                             LEAD TM- 3 WEEKS  SAFETY STK- 100000
                                                Q REQ/UNIT- 24

YOUR STOCKPILE OF          0 WILL BE AVAILABLE IN WEEK 0.
YOUR SECOND STOCKPILE OF   0 WILL BE AVAILABLE IN WEEK 8.

      *NEG
(1000)**CURR* 2 * 3 * 4 * 5 * 6 ** 7 * 8 * 9 * 10 * 11 * 12 *
*****
REQUIRE** 0* 0* 0* 0* 0* 264** 264* 264* 0* 264* 264* 264*
*****
SCH REC** 0* 0* 0*1000* 0* 0** 0* 0* 0* 0* 0* 0*
*****
PTS INU** 0* 0* 0*1000*1000* 734** 472* 208* 208* 54* 320* 584*
*****
PLD ORD** 450* 0* 0* 0* 0* 0** 0* 0* 450* 0* 450* 0*
*****
**          FROZEN PERIOD          **
*****

      * 13 * 14 * 15 * 16 * 17 * 18 * 19 * 20 * 21 * 22 * 23 * 24 * 25 *
*****
REQ * 264* 264* 0* 264* 264* 264* 0* 264* 264* 0* 264* 264* 264*
*****
SCH * 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0* 0*
*****
ON H* 848*1112*1112*1376*1640*1904*1904*2168*2432*2432*2696*2960*3224*
*****
PLD * 450* 0* 450* 0* 0* 450* 0* 450* 0* 450* 0* 0* 0*
*****

*NEG INDICATES THE FIRST NEGATIVE BAL, MAY BECOME POSITIVE LATER.

WOULD YOU LIKE TO RELEASE ANY OF YOUR PLANNED ORDERS INPUT YFS OR NO.YES
HOW MANY ORDERS WOULD YOU LIKE TO RELEASE? 10=10 1=0101
IN WHICH WEEK IS THE 1 ORDER YOU WOULD LIKE TO RELEASE? 10=10 1=01 ?01

WOULD YOU LIKE TO CANCEL ANY OF YOUR ORDERS INPUT YFS OR NO.NO

WOULD YOU LIKE TO EXPEDITE ANY OF YOUR ORDERS INPUT YES OR NO.NO

WOULD YOU LIKE TO REPLENISH ANY OF YOUR LABEL SAFETY STOCK? INPUT YES OR N
O.NO

```

Table 6.2. (cont'd.).

DO YOU WANT TO CONTINUE THE SIMULATION FOR ANOTHER WEEK. IF YES- INPUT YES, IF
NO - INPUT NONG

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR BOTTLE = \$ 1327.81

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS	= \$	987.50
COST PENALTIES	= \$	0.00
COST TO HOLD INVENTORY	= \$	340.31

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR CAP = \$ 321.65

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS	= \$	310.50
COST PENALTIES	= \$	0.00
COST TO HOLD INVENTORY	= \$	11.15

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR LABEL = \$ 525.28

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS	= \$	513.00
COST PENALTIES	= \$	0.00
COST TO HOLD INVENTORY	= \$	12.28

Table 6.2. (cont'd.).

THE TOTAL COST SPENT TO MAINTAIN INVENTORIES FOR THIS SOL. = \$ 994.03

TOTAL PURCHASING COST FOR THIS ITEM = \$ 0.00

COST TO MANIPULATE ORDERS =\$ 638.00
 COST PENALTIES =\$ 0.00
 COST TO HOLD INVENTORY =\$ 356.03

TOTAL COST TO MAINTAIN ALL INVENTORIES IS EQUAL TO **** \$ 3168.76 ****
 TOTAL COSTS TO PURCHASE ALL ITEMS IS EQUAL TO **** \$ 0.00 ****

SALES DURING THE SIMULATION = \$ 15224.40

TOTAL PROFIT = \$ 12055.64

THIS SIMULATION WAS DESIGNED TO GIVE PACKAGING STUDENTS A BROADER VIEW OF THE WAY PACKAGING INTERFACES WITH OTHER DEPARTMENTS.

SOME OF THE SITUATIONS THAT YOU WERE FACED WITH ARE NOT CONSIDERED TO BE COMMON EVERY DAY PROBLEMS. IN FACT SOME OF THE PROBLEMS OCCURE VERY INFREQUENTLY IN A REAL LIFE ENVIORNMENT. IT IS FOR THIS REASON YOUR PERFORMANCE DURING THIS SIMULATION WILL NOT HAVE ANY DIRECT BEARING ON YOUR COURSE GRADE.

IF YOU HAVE ANY QUESTIONS CONCERNING PORTIONS OF THIS PROGRAM YOU SHOULD REFER TO THE THESIS ENTITLED:

AN EVALUATION AND CONTROL SIMULATION OF A PACKAGING
 PRODUCTION SYSTEM

BY
 KEVIN KAJIYA

SCHOOL OF PACKAGING
 MICHIGAN STATE UNIVERSITY

JUNE 1980

PLEASE TAKE A FEW MINUTES TO FILL OUT THE FOLLOWING EVALUATION FORM.
 THIS FORM SHOULD BE TURNED IN TO THE INSTRUCTOR OF YOUR COURSE.

THANK YOU
 KEVIN KAJIYA

Table 6.2. (cont'd.).

EVALUATION OF THE SIMULATION

----- TERM ----- PROF OR INSTRUCTOR
----- COURSE

WHAT IS YOUR OVER ALL OPINION OF THE SIMULATION?

WHAT DID YOU LEARN FROM THE SIMULATION?

PLEASE LIST ANY SPECIFIC WAYS IN WHICH THIS
SIMULATION COULD BE IMPROVED.

1.

2.

3.

Table 6.2. (cont'd.).

4.

WHAT IMPROVEMENTS SHOULD BE MADE ON THE USER'S MANUAL?

IF THIS TERMINAL PRINTS - END THSKMK- INPUT-
LOGOUT,T.

END THSKMK
.510 CP SECONDS EXECUTION TIME

READY 13.45.05
LOGOUT,T.

JOB COST: \$ 3.02

CHAPTER VII

SUMMARY

In order for packaging students to be effective in the real-world they have to be capable of utilizing the material they learn in college. The educational process will have been wasted if students can't put the information they learn to practical use. The model created for this thesis provides one mechanism to help tie parts of the students' education together while giving them an opportunity to solve some real life problems.

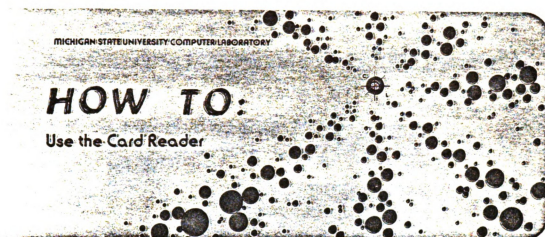
Simulation models cannot completely represent a real life environment, but they can provide some insights which may be useful in dealing with future problems. The model presented for this thesis was designed and tested to simulate the problems described within this text. An examination of the output in Chapter VI will prove that this was accomplished.

If used in the proper manner this simulation model can be a worthwhile tool for both the instructor and the student. My hope, therefore, is that this simulation be used to aid students during their preparation for careers as packaging engineers.

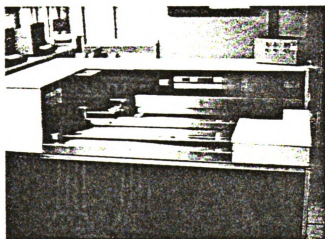
APPENDIX

APPENDIX

This appendix contains copies of two of the "HOW TO;" manuals published by the Michigan State University Computer Laboratory. The two manuals contain more complete information concerning the procedures used in logging in on a public terminal, and the use of a card reader.



The card reader is the device that allows the transfer of data from punched cards into a storage area within the computer. The Central Site in Room 207/208 Computer Center (the I/O Room) houses two self-service card readers; you may read your job into the card reader and receive your cards back immediately.



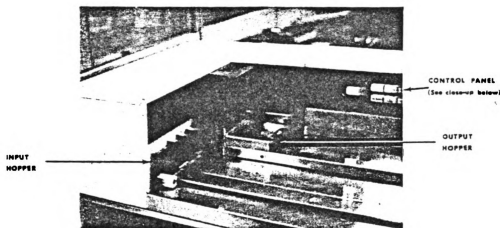
At the entrance to Room 207 you will find a tray marked "Sequence Cards." Take one of these cards and place it at the beginning of your job (in front of your PNC). The sequence card contains a unique 7-character number which will be used to identify your job in its various stages of processing. Use each sequence card only once!

COURTESY OF THE MICHIGAN STATE UNIVERSITY
COMPUTER LABORATORY (1272)

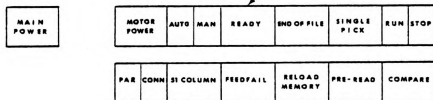
65109a

2

As you stand in front of the card reader, you will find the Input Hopper on the left side of the machine. Pull back the gate and place the cards right side up in the hopper, with the sequence card facing the machine. Replace the gate behind the cards.



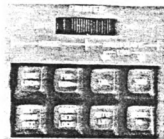
The buttons at the back of the reader have various functions; however, the only button that should concern you now is the READY button. Pressing the READY button causes the reading process to begin. When you press and release READY, the button will light up, and the cards will disappear one by one into the machine (at a rate of 1200 cards per minute), and will reappear in the Output Hopper. When the entire job has been read, the light on the READY button will go out. You may take your cards out of the output hopper.



Sometimes the machine will pause while reading the cards. Be patient: usually the reading process will resume after a moment. If, however, one of the buttons other than READY lights up when the reader pauses, ask a member of the I/O Staff for assistance.

For a Decwriter:
Printer on/off
baud rate - 300
all other buttons

- on
- down
- up



Give the terminal a few seconds to warm up. Type a carriage return or a CTRL-X to display a log-in message.

```
09:28:28 10/05/78 MSU-FREND 01.27 SOCKET= 8 353-8505
[PORT 62]
```

```
10/05/78 MSU HUSTLER 2 LSD 47.01 09/19/78 6500
```

```
TYPE PASSWORD, PN, AND USER ID.
*****
```

You have 5 minutes to supply the requested information. Type your password over the blacked-out spaces, followed by your PN and USER-ID. If you are using a CRT, type the exchange-echo-back character (CTRL-S, hold down the CTRL key then depress S) before entering your password to suppress the display of the password on the terminal screen. Be sure to use commas as delimiters between the password, problem number and user-id. A carriage return must follow each typed line; information is sent to the 6500 only after a carriage return is entered. If you have made an error in entering this information the computer will send a message telling you which item was wrong. You have 3 chances to log in successfully. After 3 unsuccessful attempts, ask for assistance at the I/O Service Window.

Once you have successfully logged in you will receive a message containing information on your account, notice of any abnormal operating conditions and a READY message.

```
SS80002, USER 54 (S 8,P 62)
LAST ACCESS: S 10/03/78 13:43
RUNS: 257 BALANCE: $ 9643.18
```

```
READY 09.31.34
```

You are now ready to enter your job.

When you are finished, you can terminate your interactive session by typing:

```
LOGOUT,T.
```

This will drop all local files and suppress the display of accounting information.

```
logout,t
```

```
JOB COST: $ .54
```

Be sure to log out, otherwise another user can sit down at the terminal and use your account.

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