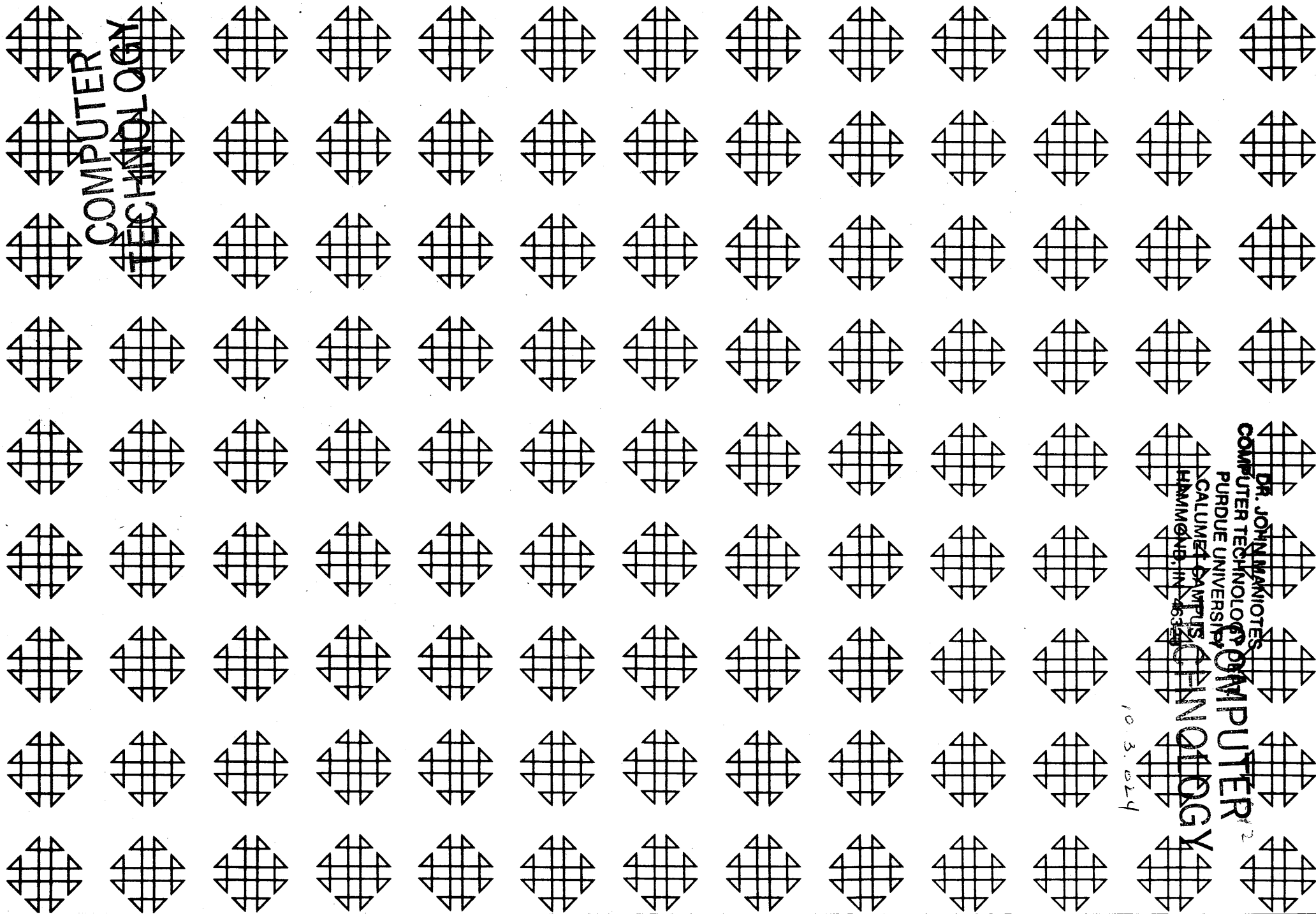


1620 GENERAL PROGRAM LIBRARY

Seasonal Adjustment Program for the IBM 1620 10.3.024



COMPUTER
TECHNOLOGY

DR. JOHN HAMMOTTES
COMPUTER TECHNOLOGY
PURDUE UNIVERSITY
CALUMET CAMPUS
HAMMOND, IN 46324
COMPUTER TECHNOLOGY
10.3.024

DISCLAIMER

Although each program has been tested by its contributor, no warranty, express or implied, is made by the contributor or COMMON, as to the accuracy and functioning of the program and related program material, nor shall the fact of distribution constitute any such warranty, and no responsibility is assumed by the contributor or COMMON, in connection therewith.

COMMON USERS GROUP PROGRAM REVIEW AND EVALUATION

(fill out in typewriter, ink or pencil)

Program No. _____

Date _____

Program Name: _____

1. Does the abstract adequately describe what the program is and what it does? Yes ___ No ___
Comment _____

2. Does the program do what the abstract says? Yes ___ No ___
Comment _____

3. Is the description clear, understandable, and adequate? Yes ___ No ___
Comment _____

4. Are the Operating Instructions understandable and in sufficient detail? Yes ___ No ___
Comment _____
Are the Sense Switch options adequately described (if applicable)? Yes ___ No ___
Are the mnemonic labels identified or sufficiently understandable? Yes ___ No ___
Comment _____

5. Does the source program compile satisfactorily (if applicable)? Yes ___ No ___
Comment _____

6. Does the object program run satisfactorily? Yes ___ No ___
Comment _____

7. Number of test cases run _____. Are any restrictions as to data, size, range, etc. covered adequately in description? Yes ___ No ___
Comment _____

8. Does the Program meet the minimal standards of COMMON? Yes ___ No ___
Comment _____

9. Were all necessary parts of the program received? Yes ___ No ___
Comment _____

10. Please list on the back any suggestions to improve the usefulness of the program. These will be passed onto the author for his consideration.

Please return to:

Mr. Richard L. Pratt
Data Corporation
7500 Old Xenia Pike
Dayton, Ohio 45432

Your Name _____
Company _____
Address _____
Users Group Code _____

THIS REVIEW FORM IS PART OF THE COMMON ORGANIZATION'S PROGRAM REVIEW AND EVALUATION PROCEDURE. NONMEMBERS ARE CORDIALLY INVITED TO PARTICIPATE IN THIS EVALUATION.



Seasonal Adjustment Program for the IBM 1620

DECK KEY

1. 60K Object Deck
2. Example Problem Input Deck
3. Example Problem Output Deck
- * 4. Source Deck

Author: Mr. Sinclair W. Groman
Budget Department
United States Borax & Chemical Corp.
3075 Wilshire Boulevard
Los Angeles, California

* This will be forwarded only when specifically requested.

Modifications or revisions to this program, as they occur, will be announced in the appropriate Catalog of Programs for IBM Data Processing Systems. When such an announcement occurs, users should order a complete new program from the Program Information Department.

July 17, 1963

Program Abstract

 Title (If subroutine state in Title) SEASONAL ADJUSTMENT PROGRAM FOR THE 1620-CMD
Subject Classification 10.3
 Author: Organization: SINCLAIR GROMAN, BUDGET DEPARTMENT, U. S. BORAX AND CHEMICAL CO.

Direct Inquiries to:

 Name SINCLAIR GROMAN Address U.S. BORAX
3075 WILSHIRE BLVD., LOS ANGELES, CALIF. Phone 381-5711 EXT. 335

 Purpose/Description: ADJUST ECONOMIC DATA FOR SEASONAL VARIATIONS - USER IS BETTER ABLE TO UTILIZE HIS RESOURCES TO COMPENSATE FOR SEASONAL VARIATIONS - AIDS IN INTERPRETING ECONOMIC DATA HAVING A SEASONAL PATTERN

 Mathematical Method: PARAMETER CONTROL AND TWELVE MONTH MOVING AVERAGE, LINEAR LEAST SQUARES, AND RATIO SMOOTHING (ITERATIVE).

 Restrictions, Range: UP TO 11 SEQUENTIAL YEARS OF DATA - INPUT IN FORM OF MONTHLY DATA, BI-MONTHLY DATA, OR QUARTERLY DATA - VARIABLES BETWEEN 1 AND 99 MILLION FIRST HALF YEAR AND LAST HALF YEAR OF DATA LOST FOR OUTPUT PURPOSES. OUTPUT VIA PUNCHED CARDS
Storage Requirements: 60K

Equipment Specifications:

 Memory 20K 40K 60K K Automatic Divide: Yes No
 Indirect Addressing: Yes No Other Special Features Required
Card I/O
 Additional Remarks (Include at author's discretion: Language; Fixed/Float; Relocatability) (Optional: Running time; Approximate number of times run successfully; Programming hours) WRITTEN IN FORTRAN II - SUB ROUTINES INCLUDED - 4 MONTHS TO WRITE AND TEST - FULLY TESTED - RUN OVER 100 TIMES - MATH MODEL NOT AS SOPHISTICATED AS SHISKIN METHOD BUT WORKS WITH SINGLE OBJECT DECK PROBABLY FASTER THAN SHISKIN METHOD PER ITERATION ALTHOUGH NEVER COMPARED WITH COMMON DATA. PREDICTS UP TO FOUR YEARS OF SEASONAL FACTORS. WILL NOT COMPUTE CYCLICAL FACTORS AND TREND. BASED ON TRADITIONAL METHOD USED BY THE FEDERAL RESERVE BOARD IN ADJUSTING FOR SEASONAL VARIATIONS

The United States Borax & Chemical Corporation hereby grants permission to International Business Machines Corporation, and in particular to that specific section or group thereof known as "I.B.M. Users Group" to utilize, apply, experiment with, publish and distribute that particular program developed by Mr. Sinclair W. Groman, Budget Department, United States Borax & Chemical Corporation, known as "Seasonal Adjustment Program for the I.B.M. 60 K 1620 Computer"; the aforesaid permission is not intended to transfer any rights of ownership our Corporation may have in and to said program nor to preclude the unrestricted use, and independent distribution use and publication of said program, by United States Borax & Chemical Corporation in whatever manner this Corporation, in its sole discretion, may deem advisable.

Practical use and application of this program together with experimental tests utilizing such program have indicated the validity and beneficial usage of such seasonal adjustment program but, in voluntarily offering the aforesaid program to International Business Machines Corporation, the United States Borax & Chemical Corporation makes no representations or warranties, express or implied by law, respecting the results or effects of the use of this system by I.B.M. or any other party. All risks resulting from or in any way connected with the use thereof are expressly assumed by the user. International Business Machines Corporation accepts this submission subject to this disclaimer and agrees not to hold United States Borax & Chemical Corporation liable for the results or effects of any usage of this program and, moreover, agrees to deliver copy of this disclaimer to all distributees of I.B.M. of this program.

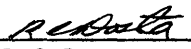

 Mr. R. C. Dosta
 Assistant Treasurer

TABLE OF CONTENTSPREFACE

This seasonal adjustment high-speed computer program is the outgrowth of a more intensive economic, business, and sales forecasting effort undertaken by the Budget Department at U.S. Borax. It was designed primarily to meet the forecasting requirements of U.S. Borax, particularly those of the Budget Department, but its range of applications is quite general.

A conscious effort was made to construct a simplified rather than a sophisticated mathematical model, the computational procedure being based, insofar as possible, on the method used in past years to seasonally adjust the Federal Reserve Board's series of industrial production indexes. Since seasonal variations in economic time series are in fact sociological phenomena which tend to exhibit approximate patterns as opposed to precisely defined mathematical abstractions, the emphasis upon simplification is thought to be justified. Of course, more refined seasonal adjustment programs are available from other sources, but in this instance substantial economies of computer operation were achieved by avoiding the tendency to oversophisticate the computational procedure.

Perhaps one of the major advantages of this seasonal adjustment program is the amount of control which the analyst responsible for the forecasting function exercises over the manner in which the actual seasonal adjustment occurs. The knowledge, skill, experience, and judgement which the analyst possesses about any given economic time series may all be incorporated in the seasonal adjustment procedure. Considerable preliminary analysis must be performed, and provision is made for manual intervention should it become necessary; it follows that the analyst must possess a working knowledge of business, economic, and sales forecasting techniques. The computer, in other words, serves as a high-speed calculating machine capable of communicating with the analyst, but the burden of decision making remains with the analyst. Furthermore, the seasonally adjusted output data is not infallible, and the analyst should not hesitate to modify the results if, in his judgement, such modification is in order. For the reasons enumerated above, this computer program will probably be most useful to those analysts working directly in the forecasting function and who are willing to accept some reasonable balance among control, speed, realism, practicality, and cost. Admittedly, however, the program has its limitations, and those analysts who prefer a more theoretical computational model will probably find that it was not designed to adequately satisfy their particular requirements. In the final analysis, this seasonal adjustment program is a forecasting aid, and it is not intended to be a substitute for experience, knowledge, and skill.

In closing, it is appropriate that mention should be made of the many professional courtesies extended by the Signal Oil and Gas Company and Computerat Incorporated, both of whose main offices are in Los Angeles, and the Los Angeles office of IEM.

| <u>REFERENCE NUMBER</u> | <u>HEADING</u> | <u>PAGE NUMBER</u> |
|-------------------------|--|--------------------|
| 1.0 | INTRODUCTORY COMMENTS AND INITIAL SENSE SWITCHES SETTINGS | 1 |
| 1.1 | INTRODUCTORY COMMENTS | 1 |
| 1.2 | INITIAL SENSE SWITCH SETTINGS | 1 |
| 2.0 | GENERAL DESCRIPTION OF THE SEASONAL ADJUSTMENT PROGRAM . | 2 |
| 2.1 | RAW DATA INPUT | 2 |
| 2.2 | TYPE OF RAW DATA INPUT | 2 |
| 2.3 | NUMBER OF YEARS OF RAW DATA | 2 |
| 2.4 | NUMBER OF YEARS IN WHICH SEASONAL OUTPUT INFORMATION IS AVAILABLE | 2 |
| 2.5 | RAW DATA FORMAT | 2 |
| 2.6 | ORDERING OF RAW DATA INPUT | 3 |
| 2.7 | SEASONAL ADJUSTMENT PROCEDURE | 3 |
| 3.0 | CARD INPUT ROUTINE | 7 |
| 3.1 | PARAMETER ELEMENT | 7 |
| 3.2 | JOB NUMBER ELEMENT | 15 |
| 3.3 | IDENTIFICATION ELEMENT | 15 |
| 3.4 | RAW DATA ELEMENT | 16 |
| 3.5 | CARD INPUT SUMMARY | 17 |
| 4.0 | COMPUTATIONAL PROCEDURE | 17 |
| 4.1 | MOVING AVERAGE AND SEASONAL FACTOR GENERATION ITERATIVE PROCESS ROUTINE | 17 |
| 4.2 | LEAST SQUARES DISPERSION REDUCTION ROUTINE | 21 |
| 4.3 | SEASONAL FACTOR PREDICTION AND SEASONALLY ADJUSTED SALES COMPILATION ROUTINE | 22 |
| 5.0 | PRINTER OUTPUT ROUTINE | 23 |

vi

vii

ECONOMIC TIME SERIES
SEASONAL ADJUSTMENT PROGRAM FOR THE IBM 60K 1620 COMPUTER

1.0 INTRODUCTORY COMMENTS AND INITIAL SENSE SWITCH SETTINGS1.1 INTRODUCTORY COMMENTS

This seasonal adjustment program is designed for the IBM 60K 1620 computer. The hardware floating point equipment, if available, is not used and consequently the program will operate with all 60K 1620 computers. It is true, however, that those computers with hardware floating point equipment will be operating at less than optimum efficiency. This shortcoming, of course, may be corrected by recompiling the FORTRAN II deck to be consistent with the floating point hardware.

The subroutines are included in the object deck and should not, therefore, be input separately. The object deck has been condensed in size by a core dump. While it is true that some small excess core capacity exists, for all practical purposes it may be assumed that the entire 60K capacity is used up by the program.

The computational procedure, although unsophisticated in the mathematical sense, is based on an iterative procedure and should effectively remove seasonal fluctuations from economic time series. This seasonal adjustment program involves the use of a single object deck, and consequently it is possible to seasonally adjust any number of sets of data in consecutive order, without stopping the computer. The program automatically processes one set of data after another, with no manual intervention needed from the operator. Through the use of card input control parameters, a large degree of flexibility is built into the program, enabling it to meet a wide variety of seasonal adjustment needs.

No attempt has been made to seasonally adjust data at the midpoint of the computing unit (month, bi-monthly period, or quarter). While seasonal factors may be predicted several years into the future, seasonally adjusted data may be computed only through the end of the last year containing a full year's data. In most instances, this is the year immediately preceding the current year. Data for the initial half-year and the final half-year will be lost.

In this seasonal adjustment program certain restrictions apply which should be understood prior to seasonally adjusting data. For example, no attempt has been made to compensate for the variation in the number of working or marketing days in the units designating time intervals. Also, the linear least squares technique and a simple ratio smoothing method are used to calculate the seasonal factors. Finally, at most eleven years of raw data may be processed by the program. These restrictions, however, do not seriously impair the usefulness of the program, although they may create obstacles which must be overcome by the application of ingenuity, experience, and judgement.

1.2 INITIAL SENSE SWITCH SETTINGS

Initially, all four sense switches should be set in the off position. Should any of the sense switches be thrown on while the computer is processing a particular time series, as indicated in various sections of this report, all sense switches will be thrown off prior to processing the next time series. A printer output message will in this instance inform the operator to turn off all the sense switches.

| <u>REFERENCE NUMBER</u> | <u>HEADING</u> | <u>PAGE NUMBER</u> |
|-----------------------------|---|------------------------|
| 6.0 | MANUAL INPUT ROUTINE | 29 |
| 6.1 | PARAMETER OUTPUT MESSAGE NO. 1 AND EXECUTE INSTRUCTION MESSAGE FOLLOWED BY A PAUSE | 30 |
| 6.2 | DECISION TO MANUALLY INPUT PARAMETERS | 30 |
| 6.3 | DECISION NOT TO MANUALLY INPUT PARAMETERS | 31 |
| 7.0 | SENSE ROUTINE | 31 |
| 7.1 | TO MANUALLY ABORT THE SEASONAL ADJUSTMENT PROCESS | 32 |
| 7.2 | TO MANUALLY BYPASS SEASONAL OUTPUT | 32 |
| 7.3 | TO MANUALLY ENTER THE MANUAL INPUT ROUTINE | 32 |
| 8.0 | PUNCH OUTPUT ROUTINE | 32 |
| 9.0 | TIME REQUIRED TO OPERATE THE PROGRAM | 40 |
| 10.0 | FLOW DIAGRAM | 42 |
| 10.1 | FLOW SUMMATION | 43 |
| 10.2 | DETAILED FLOW DIAGRAM | 44 |
| 11.0 | FORTRAN II LISTING | 56 |

2.0 GENERAL DESCRIPTION OF THE SEASONAL ADJUSTMENT PROGRAM

2.1 UNIT TIME INCREMENTS OF RAW DATA INPUTS

The seasonal adjustment program is adaptable to the following unit time increments of raw data inputs:

- a. Monthly periods
- b. Bi-monthly periods
- c. Quarterly periods

2.2 TYPE OF RAW DATA INPUT

Any consecutive numerical data from an economic time series for which a seasonal pattern is suspected and which conforms to the unit time intervals specified in 2.1 above may be input.

2.3 NUMBER OF YEARS OF RAW DATA

Up to eleven years of raw data may be input. If seasonally adjusted information is desired for years 1 through N, then raw data for the last half of year zero through the first half of year N + 1 must be input. In other words, up to ten complete years of raw data may be input, and two half-years of raw data must be input, for a maximum of eleven years.

It is recommended that a minimum of five years of raw data be input for satisfactory results. In the event that the seasonal pattern is shifting substantially in a non-linear manner, it is recommended that a maximum of six to eight years of raw data be input. The reason for this is to minimize the weight of the earlier years in the linear least squares computational procedure.

2.4 NUMBER OF YEARS IN WHICH SEASONAL OUTPUT INFORMATION IS AVAILABLE

Input raw data for the last half of year zero and the first half of year N + 1, while processed, is lost for the purposes of seasonal output. Seasonally adjusted data may be computed for years 1 through N, while seasonally predicted data may be computed for years N + 1 through N + 4. N can be as high as 10, that is, up to ten years of seasonally adjusted data may be output, while an additional four years of predicted seasonal factors only may be output.

2.5 RAW DATA INPUT FORMAT

The program is written in floating point FORTRAN II without the hardware floating point option, and the raw data input word format must be in whole number (fixed point) notation with a maximum of eight digit positions. Since nine digits of seasonally adjusted output data are allowed no output format problems will normally occur. However, some caution should be exercised in this respect, because eight digits of input data can conceivably result in more than nine digits of output data under certain exceptional circumstances. In the event that the data for a unit time interval is zero, it is recommended that the integer "1" be substituted so as to avoid the possibility of format errors. If an adjustment is to be made for the variation in the number of working or marketing days in each unit, it will be necessary to input raw data as an average daily rate for each unit. Output data, then, will also be on an average daily rate for each unit.

The format for raw data input has been simplified as much as possible. The reason for this, of course, is that the program is intended for economic and business analysts rather than mathematicians and programmers.

2.6 ORDERING OF RAW DATA INPUT

The output format constrains the ordering of raw data input as follows:

2.6.1 IF UNITS ARE MONTHS

If the unit time intervals are months, there are 12 units to a year with unit 1 always being the first month of the year, and unit 12 always being the last month of the year. The particular initial month for each year depends upon what type of a year is involved (calendar, fiscal, administrative, federal, agricultural, etc.) The initial monthly raw data input is for the month six months previous to month 1 of year 1, and the last monthly raw data input is for the month six months after month 12 of year N, where raw data is input for the complete years 1 through N.

2.6.2 IF UNITS ARE BI-MONTHLY PERIODS

If unit time intervals are bi-monthly periods, there are 6 units to a year with unit 1 always being the first bi-monthly period of the year and unit 6 always being the last bi-monthly period of the year. The particular initial bi-monthly period for each year depends upon what type of year is involved (calendar, fiscal, administrative, federal, agricultural, etc.) The initial bi-monthly period raw data input is for the bi-monthly period three bi-monthly periods previous to bi-monthly period 1 of year 1, and the last bi-monthly period raw data input is for the bi-monthly period three bi-monthly periods after bi-monthly period 6 of year N, where raw data is input for the complete years 1 through N.

2.6.3 IF UNITS ARE QUARTERS

If unit time intervals are quarters there are 4 units to a year with unit 1 always being the first quarter of the year and unit 4 always being the last quarter of the year. The particular initial quarter for each year depends upon what type of year is involved (calendar, fiscal, administrative, federal, agricultural, etc.) The initial quarterly raw data input is for the quarter two quarters previous to quarter 1 of year 1, and the last quarterly raw data input is for the quarter two quarters after quarter 4 of year N, where raw data is input for the complete years 1 through N.

2.7 SEASONAL ADJUSTMENT PROCEDURE

The seasonal adjustment procedure can best be illustrated by a brief description of the program routines.

2.7.1 CARD INPUT ROUTINE

The following types of data are input on cards:

- a. Parameters
- b. Job Number
- c. Identification
- d. Raw Data

2.7.2 MOVING AVERAGE AND SEASONAL FACTOR GENERATION ITERATIVE PROCESS ROUTINE

After the raw data has been read into the computer, an M unit moving average is computed, where M is the number of units into which each year is divided (twelve for months, six for bi-monthly periods, and four for quarters). From the moving average and raw data, approximate seasonal factors are calculated for each unit (monthly period, bi-monthly period, or quarterly period), and linear least square vectors are fitted to the approximate seasonal factors. From the resulting least square vectors, theoretical seasonal factors are generated and smoothed. These smoothed seasonal factors, in conjunction with the raw data, are used to compute a new moving average and a revised moving average halfway between the old moving average and the new moving average. If the new moving average deviates too much from the old moving average, the program will iterate by making another pass through the computational procedure, generating new seasonal factors, a new moving average and a revised moving average. This iterative process continues until the new moving average and old moving average are close enough, or until a predetermined number of passes have been made, when the program will stop computing seasonal factors.

By card input it is possible to control the program so that only one pass will be made through the moving average and seasonal factor generation iterative process routine. In this instance only the initial moving average, initial approximate seasonal factors, initial least square generated seasonal factors, and initial smoothed seasonal factors will be compiled before program control is transferred out of the moving average and seasonal factor generation iterative process routine. This short-cut path is recommended for those instances where low-profit data is being seasonally adjusted, or for those instances where approximate results suffice.

2.7.3 SEASONAL FACTOR PREDICTION AND SEASONALLY ADJUSTED SALES COMPILATION ROUTINE

The seasonal factor prediction and seasonally adjusted sales compilation routine is an optional feature of the seasonal adjustment program. After the seasonal factors have been generated the program will make a conditional branch to one of the following routines:

- a. The seasonal factor prediction and seasonally adjusted sales compilation routine (which is described herein)

- b. The least squares dispersion reduction routine (see 2.7.5 below)
- c. The punch output routine (see 2.7.4 below)

If the branch is made to the seasonal factor prediction and seasonally adjusted sales compilation routine, seasonal factors are normally predicted for years N + 1 through N + 4 by the linear least square vectors generated in 2.7.2 above and seasonally adjusted sales are normally compiled for years 1 through N. The compilation of seasonally adjusted sales may be bypassed by parameter control.

2.7.4 PUNCH OUTPUT ROUTINE

After seasonally adjusted sales have been compiled, the following information is normally punched out:

- a. Seasonal factors, including predicted factors
- b. Least square vectors
- c. Seasonally adjusted sales
- d. Input parameters
- e. Compiled counters content

Once the output information has been punched, control will be transferred back to the beginning of the program and the next set of data, if available, will be processed.

2.7.5 LEAST SQUARES DISPERSION REDUCTION ROUTINE

The least squares dispersion reduction routine is an optional feature of the seasonal adjustment program. After the seasonal factors have been generated and if a card input conditional branch has been made to the least squares dispersion reduction routine (see 2.7.3 above), the program will check the dispersion of the smoothed seasonal factors about each unit least square line. If the dispersion is too great the seasonal factors will be packed halfway to each unit least square line, a new moving average generated, and control transferred to the moving average and seasonal factor generation iterative process routine (see 2.7.2 for further computation).

If the dispersion of the smoothed seasonal factors about the least square line continues to be too great and sufficient passes have been made through the least squares dispersion reduction routine, the program will check to see if the operator shall have the option of manually terminating or continuing the seasonal adjustment procedure. If the operator shall have this option, the program will transfer to the manual input routine (see 2.7.7 below). If the operator shall not have this option, the program will transfer to the moving average and seasonal factor generation

iterative process routine (see 2.7.2) for a final iterative compilation of the moving average and seasonal factors. Then, control will be transferred to the seasonal factor prediction and seasonally adjusted sales compilation routine (see 2.7.3). If, on the other hand, the dispersion of the seasonal factors about the least square line is small enough, the program will transfer directly to the seasonal factor prediction and seasonally adjusted sales compilation routine (2.7.3 above).

2.7.6 SENSE ROUTINE

The sense routine is an optional feature of the seasonal adjustment program. Entry to the sense routine is always made by throwing on sense switch No. 2 during the operation of the program. Entry is made into the sense routine for the following reasons:

- a. To manually abort the seasonal adjustment process
- b. To manually bypass seasonal output
- c. To manually enter the manual input routine

2.7.7 MANUAL INPUT ROUTINE

The manual input routine is an optional feature of the seasonal adjustment program. Entry into the manual input routine may be made in one of two ways:

- a. From the sense routine under certain circumstances (see 2.7.6 above)
- b. When the least squares dispersion reduction routine indicator is on and the dispersion about the unit least square lines remains too great and sufficient passes through the least squares dispersion reduction routine have been made and the operator shall have the option of terminating or continuing the seasonal adjustment procedure (see 2.7.5 above)

The manual input routine will be used in those rare circumstances when, for some reason, it is desired to visually observe the card input parameters in order that the operator may make a decision concerning the continuation or discontinuation of the iterative process. When program control is transferred to the manual input routine the input parameters are printed out on the typewriter, following which a program PAUSE occurs. If sense switch 1 is thrown on the computer will ACCEPT new parameters. After the parameters are correctly inserted from the typewriter, control is transferred to the moving average and seasonal factor generation iterative process routine for further compilation. If sense switch 1 is left in the off position, control is transferred directly to the moving average and seasonal factor generation iterative process routine for one last pass.

2.7.8 PRINTER OUTPUT ROUTINE

As the program processes data the printer will output various types of messages which provide the following information:

- a. Identification of data being processed
- b. Trace the path through the program
- c. Inform the operator of the results of the iterative process
- d. Inform the operator of the dispersion of moving average points and smoothed seasonal factors
- e. Print out parameters, if desired
- f. Inform the operator to make a decision to terminate iteration or to continue iteration
- g. Inform the operator to turn off sense switches before the next set of data can be processed

In general, the printer output provides a real time basis for the operator to visually observe the degree of seasonal adjustment which occurs and to permit the operator to take a flexible course of action while the program is operating, should this become necessary. The courses of action (see 2.7.6 and 2.7.7 above) which the operator may take are the following:

- a. Manually abort the seasonal adjustment process
- b. Bypass seasonal output
- c. Print out parameters
- d. Manually input parameters (continue to iterate) or terminate iteration

3.0 CARD INPUT ROUTINE

The card input routine will be specified in the order that its elements appear in the card input deck and are read into the computer.

3.1 PARAMETER ELEMENT

The card input parameters control the operation of the program, lending to the program a great degree of flexibility and providing for the satisfaction of a large variety of seasonal adjustment requirements. There are 21 parameters, identified as K₁ through K₂₁, input for each set of raw data, six parameters to a card. Consequently, the parameter element consists of four cards. The least significant digit of each parameter will appear in card positions 10, 20, 30, 40, 50, and 60 respectively, with the subscripted order of parameters increasing consecutively from left to right and from parameter card No. 1 to parameter card No. 4.

A description of each parameter follows:

- K1. K1 is the first year for which raw data is input. K1 corresponds to year zero, the last half only of which contains raw data. K1 contains four digit positions and will be punched in card positions 7 - 10 of parameter card No. 1.

Example: 1955

- K2. K2 is the total number of years of raw data input, including the last half of year zero and the first half of year N + 1. K2 is equal to the number of complete years for which raw data is input plus one. One is added to the number of complete years for which raw data is input in order to compensate for the last half of year zero and the first half of year N + 1, which also contain raw data. K2 will be limited to two digit positions, with a maximum magnitude of eleven and a suggested minimum magnitude of five. K2 will be punched in card positions 19-20 of parameter card No. 1.

Example: 08

- K3. K3 is the number of units in a year. When monthly raw data is input, K3 = 12; when bi-monthly raw data is input, K3 = 6; when quarterly raw data is input, K3 = 4. K3 is limited to two digit positions and will be punched in card positions 29-30 of parameter card No. 1.

Example: 06

- K4. K4 is the number of years of predicted seasonal factors. Generally speaking, $0 \leq K_4 \leq 4$. For all practical purposes $K_4 = 0$ or $K_4 = 4$, depending upon whether predicted seasonal factors are or are not desired. K4 will be punched in card position 40 of parameter card No. 1.

Example: 4

- K5. K5 specifies the product of 1000 times the maximum allowable absolute percentage moving average deviation for each pair of points. When the program compares the new moving average with the old moving average, point by point, it calculates the absolute percentage deviation between the two. If this percentage deviation is greater in absolute magnitude than that specified by K5, counter MP1 is incremented by one. K5 is entered into the computer as a whole number and divided by 1000 by the program to obtain the correct percentage. The program is designed to operate optimally when $K_5 \approx 5$, which, when divided by 1000, means the program screens all moving average deviations in excess of one-half of one per cent. However, K5 is not limited to 5, and it may take on any value $0 \leq K_5 \leq 1000$. It is recommended that, for best results, K5 not exceed 20 because when K5 is greater than 20 the program will screen only those moving average deviations in excess of two per cent, that is, counter MP1

will not be incremented if an absolute deviation of less than two per cent is detected. High values of K5 result in speeding up the seasonal adjustment process; low values of K5 result in a more reliable seasonal adjustment process. For practical purposes, a balance between the two must be achieved, and for this reason $5 \leq K_5 \leq 20$ is recommended. K5 is punched in positions 47 - 50 of parameter card No. 1.

Example: 0005

- K6. K6 is the maximum number of moving average passes allowed in the moving average and seasonal factor generation iterative process routine. Each time the program enters this routine from outside the routine the number of passes it makes through the routine may not exceed K6. It may make fewer passes than K6, however, if the seasonal adjustment process meets the specifications of parameters K5, K10 and K12. As a practical matter, K6 should not exceed 10, but it may be anywhere in the range $0 \leq K_6 \leq 1000$. At the conclusion of each pass counter N11 is incremented by one. It should be noted that program control may enter the moving average and seasonal factor generation iterative process routine more than once, and each time entry is so made, K6 specifies the maximum number of allowable passes while program control is in this routine. K6 will be punched in card positions 57 - 60 of parameter card No. 1.

Example: 0004

- K7. In the event that control is transferred from the least squares dispersion reduction routine back to the moving average and seasonal factor generation iterative process routine, K6 takes on the value of K7. A substantial amount of seasonal adjustment will have occurred by the time the transfer of control back to the seasonal factor generation iterative process routine is made, and a reduction in the value of K6 may be appropriate. This facility is built into the program in order to take advantage of these potential savings. While it is possible for K7 to be larger than K6, for practical purposes this possibility may be ignored. If a reduction in K6 is desired, $K_7 < K_6$, while if no reduction in K6 is desired, $K_7 = K_6$. K7 will be punched in card positions 7 - 10 of parameter card No. 2.

Example: 0002

- K8. K8 specifies the product of 1000 times the maximum allowable absolute percentage seasonal factor deviation. If the least squares dispersion reduction routine is being operated, the program will compare, for each unit, every smoothed seasonal factor with the corresponding least square generated seasonal factor for years 1 through N. If this percentage deviation is greater in absolute magnitude than that specified by K8, counter NQ1 is incremented by 1. K8 is entered into the computer as a whole number and divided by 1000 by the program to obtain the correct percentage. The program is designed to operate optimally when $K_8 \approx 5$, which, when divided by 1000, means

the program screens all seasonal factor deviations in excess of one-half of one percent. However, K_8 is not limited to 5, and it may take on any value $0 \leq K_8 \leq 1000$. It is recommended that, for best results, K_8 not exceed 20 because when K_8 is greater than 20 the program will screen only those seasonal factor deviations in excess of two percent, that is, counter NQ1 will not be incremented if an absolute deviation of less than two percent is detected. High values of K_8 result in speeding up the seasonal adjustment process; low values of K_8 result in a more reliable seasonal adjustment process. For practical purposes, a balance between the two must be achieved, and for this reason $5 \leq K_8 \leq 20$ is recommended. K_8 will be punched in card positions 17 - 20 of parameter card No. 2.

Example: 0005

- K9. K_9 specifies the maximum number of allowable passes through the least squares dispersion reduction routine. It is recommended that the range $0 \leq K_9 \leq 5$ apply, although K_9 may be as high as 100. Each time a pass is made, NMI is incremented by one. When no more passes are available, that is, when $NMI = K_9$, control will be transferred to the seasonal factor prediction and seasonally adjusted sales compilation routine after the moving average and seasonal factor generation iterative process routine is operated on for one last time. K_9 will be punched in card positions 28 - 30 of parameter card No. 2.

Example: 003

- K10. K_{10} specifies the maximum number of moving average absolute percentage deviations which may exceed that specified by K_5 and still be acceptable. K_{10} , in other words, indicates the maximum value which counter MPI can be and the seasonal adjustment process remain under control. Every time an excessive moving average absolute percentage deviation is detected, counter MPI is incremented by one. After all moving average magnitude deviations are examined, counter MPI is tested with K_{10} . If the contents of MPI exceed K_{10} , the test fails, that is, too many extreme points have been detected. If the test fails and K_6 exceeds the contents of counter NMI (meaning at least one more pass is available through the moving average and seasonal factor generation iterative process routine) another pass will be made through this routine. If the test is OK, K_{12} is tested. The value of K_{10} will depend upon whether data for months, bi-monthly periods, or quarters is being seasonally adjusted. The suggested formula for determining K_{10} appears below:
- Monthly data:

$$K_{10} = 2(K_2 - 1)$$
, where K_2 = number of years of raw data, including last half of year zero and first half of year $N + 1$.
 - Bi-monthly and quarterly data:

$$K_{10} = K_2 - 1$$
, where K_2 is defined above.

In both instances a few extreme points are recommended, an average of two per year when dealing with monthly data and an average of one per year when dealing with bi-monthly or quarterly data. However, if more accuracy is desired, $K_{10} = 0$ might be considered. For monthly data the range $0 \leq K_{10} \leq 120$ applies; for bi-monthly data the range $0 \leq K_{10} \leq 60$ applies; for quarterly data the range $0 \leq K_{10} \leq 40$ applies. It is probably true that anything greater than the suggested values of K_{10} in a and b above are not very practical. K_{10} will be punched in card positions 37 - 40 of parameter card No. 2.

Example: 0012

If the test summation results are printed on the typewriter, the most recent result of this test will be indicated.

- K11. K_{11} specifies the maximum number of seasonal factor absolute percentage deviations which may exceed that specified by K_8 and still be acceptable. K_{11} , in other words, indicates the maximum value which counter NQ1 can be and the seasonal adjustment process remain under control. Every time an excessive seasonal factor absolute percentage deviation is detected, counter NQ1 is incremented by one. After all seasonal factor magnitude deviations are examined, counter NQ1 is tested with K_{11} . If the contents of NQ1 exceed K_{11} , the test fails, that is, too many extreme points have been detected. If the test fails and K_9 exceeds the contents of NMI (meaning at least one more pass is available through the least squares dispersion reduction routine) another pass will be made through both the moving average and seasonal factor generation iterative process routine and the least square dispersion reduction routine. If the test is OK, K_{13} will be tested. If the test fails and no more passes are available, K_{15} will be tested after the test summation results are printed. The value of K_{11} will depend upon whether data for months, bi-monthly periods, or quarters is being seasonally adjusted. The suggested method for determining K_{11} appears below:

- Monthly data:

$$K_{11} = .2 (K_2 - 1)$$
, where minimum $K_{11} = 1$
- Bi-monthly data and quarterly data:

$$K_{11} = .2 (K_2 - 1)$$
, where minimum $K_{11} = 1$

In each instance at least one extreme point is recommended. However, if more accuracy is desired, $K_{11} = 0$ might be considered. In each instance the range $0 \leq K_{11} \leq 10$ applies. It is probably true that anything greater than the suggested value of K_{11} is not very practical. K_{11} will be punched in card positions 49-50 of parameter card No. 2.

Example: 02

K₁₂. If the test summation results are printed on the typewriter, the most recent result of this test will be indicated. **K₁₂** specifies the maximum allowable sum of the absolute percentages of the moving average deviations. When the program determines the percent deviation between the old moving average and the new moving average, point by point, it squares each deviation to eliminate the sign, multiplies by 1,000,000 to eliminate the decimal point, and then takes the square root. If an absolute deviation is in the neighborhood of .005 (one-half of one percent), the final result of the above calculation will be in the neighborhood of 5. If, on the other hand, an absolute deviation is in the neighborhood of .02 (two percent), the final result of the above calculation will be in the neighborhood of 20. **K₁₂** is used to test the sum of the absolute deviations which have been calculated in the manner indicated above. The following formula for determining **K₁₂** is suggested:

- a. Monthly data:
 $K_{12} = 12K_5 (K_2 - 1)$
- b. Bimonthly data:
 $K_{12} = 6K_5 (K_2 - 1)$
- c. Quarterly data:
 $K_{12} = 4K_5 (K_2 - 1)$

While the range $0 \leq K_5 \leq 100$ applies, it is strongly recommended that **K₅** not be allowed to exceed 20, because values in excess of 20 mean that average absolute deviations in excess of 2% will be accepted.

The sum of the moving average deviations are accumulated in counter FMI. After the deviations are accumulated, counter FMI is tested with **K₁₂**. If the contents of **K₁₂** exceed the counter the test is OK; if not, the test fails. If the test fails and **K₆** exceeds the contents of counter NMI (meaning at least one more pass is available through the moving average and seasonal factor generation iterative process routine) another pass will be made through this routine. If the test is OK, or if no more passes are available, **K₁₈** is tested. **K₁₂** will be punched in card positions 57 - 60 of parameter card No. 2.

Example: 0600

K₁₃. **K₁₃** specifies the maximum allowable sum of the absolute percentages of the seasonal factor deviations. When the program determines the percent deviation between the smoothed seasonal factors and the corresponding least square generated seasonal factors it squares each deviation to eliminate the sign, multiplies by 1,000,000 to eliminate the decimal point, and then takes the square root. If an absolute deviation is in the neighborhood of .005 (one-half of one percent) the final result of the above calculation will be in the neighborhood of 5. If, on the other hand, an absolute deviation is in the neighborhood of .02 (two percent), the final result of the above calculation will be in the neighborhood of 20. **K₁₃** is used to test the sum of the absolute deviations which have been calculated in the manner indicated above. The following formula for determining **K₁₃** is suggested:

- a. Monthly data:
 $K_{13} = K_8 (K_2 - 1),$
- b. Bi-monthly data and quarterly data:
 $K_{13} = K_8 (K_2 - 1),$

While the range $0 \leq K_8 \leq 100$ applies, it is strongly recommended that **K₈** not be allowed to exceed 10, because values in excess of 10 mean that average absolute deviations in excess of 1% be accepted. The sum of the seasonal factor deviations are accumulated in counter FNI. After the deviations are accumulated, counter FNI is tested with **K₁₃**.

If the contents of **K₁₃** exceed the counter the test is OK; if not, the test fails. If the test fails and **K₉** exceeds the contents of NMI (meaning at least one more pass is available through the least squares dispersion reduction routine), another pass will be made through both the moving average and seasonal factor generation iterative process routine and the least square dispersion reduction routine. If the test is OK the program will test **K₁₉**. If the test fails and no more passes are available (NMI exceeds **K₉**), **K₁₅** will be tested after the test summation results are printed. **K₁₃** will be punched in card positions 8 - 10 of parameter card No. 3.

Example: 050

K₁₄. **K₁₄**, the seasonal factor prediction bypass parameter, may assume three values, 0, 1, and 2, but only in the manner specified below with respect to **K₁₇**. Violations of this specification may result in incorrectly punched cards. When **K₁₄** = 0 and **K₁₇** ≠ 0, least square vectors are fitted to the seasonal factors and the program processes data in a normal manner. When **K₁₄** = 1 and **K₁₇** = 2 least square vectors are fitted to the seasonal factors only once, after which program control bypasses the seasonal factor prediction and seasonally adjusted sales compilation routine, transferring control directly to the punch output routine. If **K₁₄** = 2 and **K₁₇** = 0, least square vectors will not be fitted to the seasonal factors and the seasonal factor prediction and seasonally adjusted sales compilation routine is bypassed, program control being transferred directly to the punch output routine. **K₁₄** must be used only in conjunction with **K₁₇** in the manner specified. **K₁₄** will be punched in card position 20 of parameter card No. 3.

Example: 1

K₁₅. **K₁₅** is the manual input switch. After the test summation results have been printed, the program will test **K₁₅**. If **K₁₅** = 0, the program will cycle through the moving average and seasonal factor generation iterative process routine for the last time. If **K₁₅** = 1, the program will enter the sense routine to check for any of the sense switches being turned on. If none of the sense switches are turned on, or if

only sense switch No. 2 is turned on, the program will enter the manual input routine. K15 will be punched in card position 30 of parameter card No. 3.

Example: 1

- K16. K16 is a spare parameter which should always be zero. K16 will be punched in card position 40 of parameter card No. 3.

Example: 0

- K17. K17 is the least squares fit bypass parameter, and it may assume three values, 0, 1, and 2. When K17 = 0 or 2, the program will process data in the manner specified by the description of parameter K14 above. If K17 = 1, seasonal factors are computed once without using least square vectors and then control is transferred directly to the punch output routine without predicting seasonal factors and seasonally adjusting sales. When K17 = 1, K14 should be zero, since K14 will never be tested in this instance. K17 is punched in card position 50 of parameter card No. 3.

Example: 0

- K18. K18 is the dispersion smooth switch, and it may assume three values, 0, 1, and 2. When K18 = 0, the program will bypass the least squares dispersion reduction routine and will directly enter the seasonal factor prediction and seasonally adjusted sales compilation routine. When K18 = 1, the program will enter the least squares dispersion reduction routine. When K18 = 2, the program will bypass the least squares dispersion reduction routine; in addition, the program will also bypass computing seasonally adjusting sales and it will permit only the seasonal factors to be punched out. When K14 is 1 and K17 is 2, or when K14 is 2 and K17 is 0, K18 is always 2, because in these instances only seasonal factors are to be punched. K18 will be punched in card position 60 of parameter card No. 3.

Example: 1

- K19. K19 is the parameter which tests the sum of the combined moving average deviations and the seasonal factor deviations when the dispersion smooth switch K18 = 1. The suggested formula for determining K19 is as follows: $K19 = K12 + K13$.

Counter NP4, which is the sum of the mean $FM1 = FM$ plus the mean $FM1 = FM$, is tested with K19. If K19 exceeds NP4, the test is OK and the program will transfer control to the seasonal factor prediction and the seasonally adjusted sales compilation routine. If the contents of counter NP4 exceed K19, the test fails. If the test fails and K9 exceeds the contents of FM1 (meaning at least one more pass is available through the least squares

dispersion reduction routine), another pass will be made through both the moving average and seasonal factor generation iterative process routine and the least square dispersion reduction routine. If the test fails and no more passes are available (NMI exceeds K9), K15 will be tested after the test summation results are printed. K19 will be punched in card positions 7 - 10 of parameter card No. 4.

Example: 0010

- K20. K20 is the print suppress indicator, and it may be either zero or one. If K20 is zero, all printer output messages are printed. If K20 is one, the job number printer message, both identification printer messages, and the end of data printer message are bypassed. K20 will be punched in card position 20 of parameter card No. 4.

Example: 0

- K21. K21 is a spare parameter which should always be zero. K21 will be punched in card position 30 of parameter card No. 4.

Example: 0

3.2 JOB NUMBER ELEMENT

The job number identifies a particular data batch or run, and it may be used to sort a deck of output cards should they be dropped or mingled with another output deck. The job number will be punched twice on a single card, together with the initial card counter or LO number of one. The job number is composed of three digits, and will be punched in card positions 8 - 10 and again in card positions 63 - 65. The card counter or LO number, which is always one in this instance, will be punched in card position 71.

Example: 8 - 10 63 - 65 71
 001 001 1

3.3 IDENTIFICATION ELEMENT

The purpose of the identification element is to identify the seasonally adjusted data which will be punched on cards. The identification element is composed of two cards, each of which contains up to 39 alphanumerical characters and a card counter or LO number.

- a. Identification card No. 1 will contain alphanumerical information punched in card positions 1 - 39, and card counter or LO number two punched in card position 71. This identification information may be anything deemed to be of value in identifying the data.

Example: 20 MTP PACK BOR MO LB SLS 2

- b. Identification card No. 2 will contain alphanumerical information punched in card positions 1 - 39, and card counter or LO number three punched in card position 71. This identification information may be anything deemed to be of value in identifying the data.

Example: SEAS ADJ FROM 1952 3

3.4 RAW DATA ELEMENT

The raw data element will have three separate formats, depending upon whether monthly, bimonthly, or quarterly data is being input. Under no circumstances will more than 132 months or 66 bimonthly periods or 44 quarters of raw data be input, that is, the program will process at most eleven years of raw data. In addition, it is recommended that a minimum of five years of raw data be input for reliable results. Raw data must be input in consecutively ordered cards, the initial card containing the oldest data and the last card containing the most recent data. Each input data word must be in whole number (fixed point) notation with a maximum of eight digit positions. Data will be punched starting with the last half of year zero and ending with the first half of year $N + 1$. In the event that the data for a unit time interval is zero, it is recommended that the integer "1" be substituted so as to avoid the possibility of format errors (see 4.1.2).

3.4.1 MONTHLY DATA

Each monthly data card must contain exactly six consecutive months of data, with the least significant digit of the data of the initial month being punched in card position 10 and the least significant digit of the data of the most recent month being punched in card position 60. The least significant digits of the data of the intervening consecutive months will be punched in card positions 20, 30, 40, and 50 respectively, beginning with the data of the second oldest month and ending with the data of the second most recent month. In this manner data cards will be consecutively ordered, and the data on each card will also be consecutively ordered, resulting in a consecutively array of raw data from the initial month to the most recent month.

Example:

| | | | | | |
|----------|----------|----------|----------|----------|----------|
| 3 - 10 | 13 - 20 | 23 - 30 | 33 - 40 | 43 - 50 | 53 - 60 |
| 00004126 | 00005283 | 00006718 | 00008874 | 00006112 | 00003009 |

3.4.2 BIMONTHLY PERIOD DATA

Each bimonthly data card must contain exactly three consecutive bimonthly periods of data, followed by three consecutive zeros. The least significant digit of the data of the initial bimonthly period will be punched in card position 10, the least significant digit of the data of the middle bimonthly period will be punched in card position 20, and the least significant digit of the data of the most recent bimonthly period will be punched in card position 30. Zeros will be punched in card positions 40, 50, and 60.

Example:

| | | | | | |
|----------|----------|----------|----|----|----|
| 3 - 10 | 13 - 20 | 23 - 30 | 40 | 50 | 60 |
| 00002215 | 00003342 | 00006952 | 0 | 0 | 0 |

3.4.3 QUARTERLY PERIOD DATA

Each quarterly data card must contain exactly two consecutive quarters of data, followed by four consecutive zeroes. The least significant digit of the data of the initial quarter will be punched in card position 10, and the least significant digit of the data of the most recent quarter will be punched in card position 20. Zeros will be punched in card positions 30, 40, 50, and 60.

| | | | | | | |
|----------|----------|----------|----|----|----|----|
| Example: | 3 - 10 | 13 - 20 | 30 | 40 | 50 | 60 |
| | 00001513 | 00006298 | 0 | 0 | 0 | 0 |

3.5 CARD INPUT SUMMARY

Cards will be input in the following order:

Card 1. Parameter card No. 1 ($K_1 - K_6$)

Card 2. Parameter card No. 2 ($K_7 - K_{12}$)

Card 3. Parameter card No. 3 ($K_{13} - K_{18}$)

Card 4. Parameter card No. 4 ($K_{19} - K_{21}$)

Card 5. Job number card

Card 6. Identification card No. 1

Card 7. Identification card No. 2

Card 8 through last card. Raw data cards in consecutive order, beginning with raw data for last half of year zero and ending with raw data for first half of year $N + 1$.

4.0 COMPUTATIONAL PROCEDURE

4.1 MOVING AVERAGE AND SEASONAL FACTOR GENERATION ITERATIVE PROCESS ROUTINE

4.1.1 MOVING AVERAGE COMPUTATION

Let j be any unit in the time interval. After the input data has been read into the computer, for each unit j the program computes a moving average A_j from the raw data D_j based on a 12-unit period if monthly data is used or a 6-unit period if bi-monthly data is used or a 4-unit period if quarterly data is used. The moving average is computed by the following formula:

$$A = \frac{D(j - M/2) + \dots + D_j + \dots + D((j + M/2) - 1)}{M}$$

Where: M = number of units in a year and j = the unit number. Furthermore, if $N = K_2 - 1$, where N is the number of years, then the following relationship holds: $1 \leq j \leq MN$. This relationship

holds true for all computations. Note that a vector rather than a matrix notation is used to order increasing values of j .

This moving average extracts from the raw data the first estimate of those time series fluctuations attributable to seasonal causes, because each month, bimonthly period, or quarter is given equal weight over a one-year interval.

4.1.2 APPROXIMATE SEASONAL FACTORS

After the initial moving average A_j is computed, the raw data D_j for the last half of year zero and the first half of year $N + 1$ is dropped from the computing model. Hereafter only raw data D_j for years 1 through N will be relevant. For each unit j , approximate seasonal factors $R_j = \frac{D_j}{A_j}$ are computed. These approximate seasonal

factors are ratios which provide an estimate of the variation in an economic time series which may be attributable to seasonal causes. For very small A_j , format errors may occur. In order to avoid very small A_j , substitute the integer "1" for zero whenever zero appears as the raw data input for a unit time interval.

4.1.3 FORMULA LINEAR LEAST SQUARES FIT OF APPROXIMATE SEASONAL FACTORS

Temporarily, j will refer to units, i will refer to years, and the matrix notation will be used for the purposes of illustration only. For each unit j formula linear least square lines are fit to the approximate seasonal factors R_j where the R_j for each unit are ordered by i from year 1 through year $N = K_2 - 1$. The formula unit linear least square lines are computed from the following set of equations:

$$R_{i,j} = Na + b \sum i$$

$$i R_{i,j} = a \sum i + b \sum i^2$$

Where: a = constant term
 b = linear coefficient of independent variable
 i = year number
 j = unit number
 N = maximum year number = number of years

And: $1 \leq j \leq 12$ for months
 $1 \leq j \leq 6$ for bimonthly periods
 $1 \leq j \leq 4$ for quarters

And: $1 \leq i \leq K_2 - 1$
 $R_{i,j}$ = seasonal factor of the i th year for the j th unit

There are twelve, six or four sets of equations depending upon whether monthly, bimonthly, or quarterly data, respectively, is being processed. From these sets of equations twelve, six, or four unit least square formulas of the following form are computed:

$$R_{i,j} = a_j + b_j i$$

Where: $R_{i,j}$ now refers to formula seasonal factors as opposed to approximate seasonal factors.

Although the vector notation of j is used in the program computational procedure, the matrix notation i,j is used here for the purpose of illustration only. The final result is the same in both instances, excepting that the computer operates faster using the vector notation rather than the matrix notation.

4.1.4 GENERATION OF FORMULA SEASONAL FACTORS

Once again the matrix notation rather the vector notation is used for the purpose of illustration only. The formula least square seasonal factors are generated from the following set of equations, where there are as many equations as there are units j .

$$R_{i,j} = a_j + b_j i$$

Since a formula has been computed for each unit it is possible to generate formula seasonal factors for each unit of each year i from year 1 through year $N = K_2 - 1$.

4.1.5 SMOOTHING FORMULA SEASONAL FACTORS

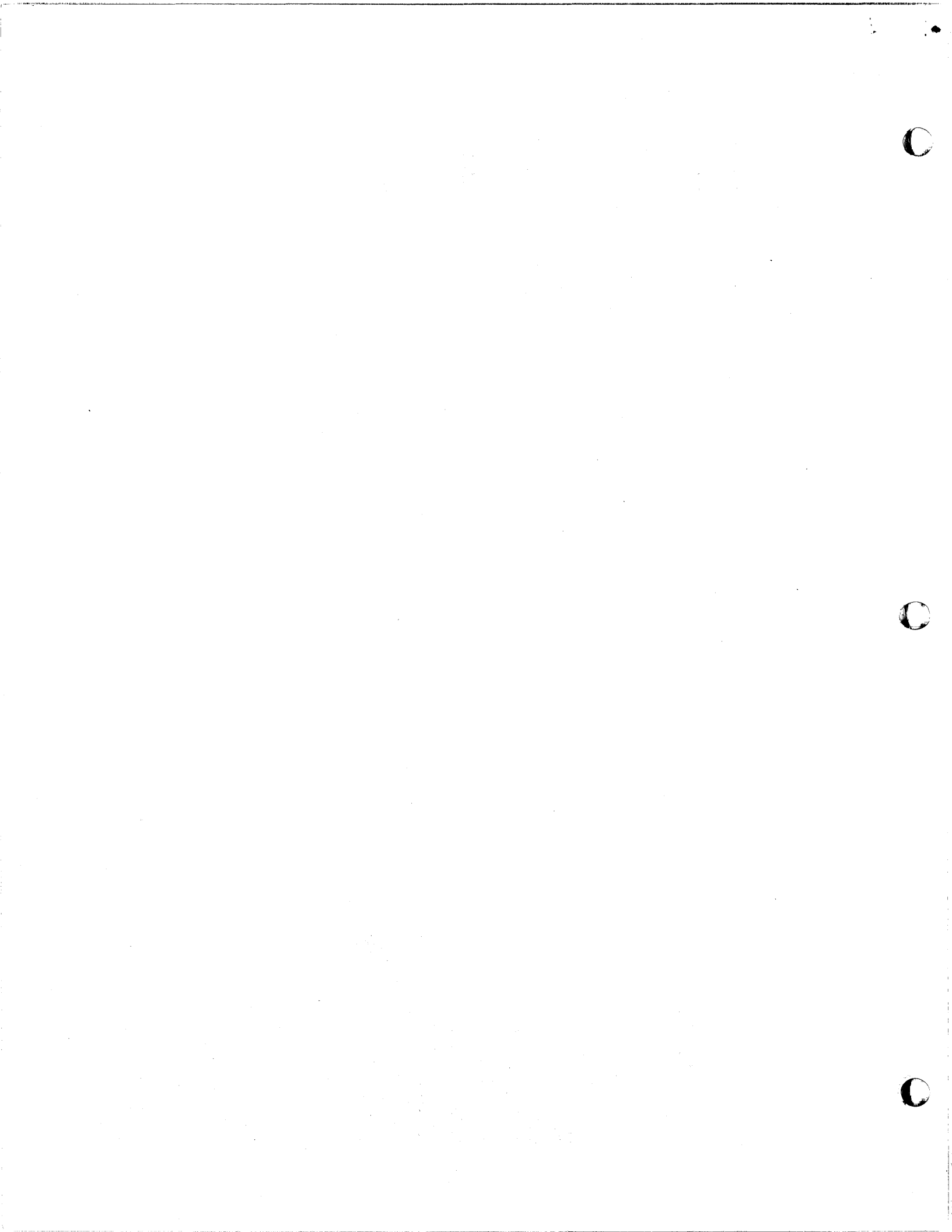
Formula seasonal factors have been generated by unit equations; however, for a given year each seasonal factor should average 1.0. This means, if monthly data is being processed, the sum of the formula seasonal factors for each year should amount to 12.0; if bi-monthly data is being processed, the annual total should be 6.0; if quarterly data is being processed, the annual total should be 4.0. If FK_3 = required sum of the seasonal factors R_i for year i , and ZYR = actual sum for year i , then the smoothing factor for year i , $SZYR$, is found by:

$$SZYR = (FK_3 - ZYR)/ZYR$$

For each year i , the formula seasonal factors R_i may be smoothed, if smoothing is necessary, by the following formula:

$$R_i = R_i + R_i (SZYR)$$

The computational procedure for smoothing seasonal factors is illustrated below (assuming bi-monthly periods):



Year i
Least Square
Generated Seasonal Factors
For Year i

| | |
|--------|--|
| | R_1 |
| Unit 1 | 1.10 |
| Unit 2 | 1.30 |
| Unit 3 | 1.00 |
| Unit 4 | 0.80 |
| Unit 5 | 0.90 |
| Unit 6 | 1.22 |
| | ZYR = 6.32 |
| | FK3 = 6 x 1.00 = 6.00 |
| | SZYR = (FK3 - ZYR)/ZYR = $\frac{6.00 - 6.32}{6.32} = - .051$ |

Year i
Smoothed Seasonal
Factors

$$R_1 = R_i + R_1 (SZYR)$$

| | |
|--------|-----------------------------|
| Unit 1 | 1.10 + 1.10 (- .051) = 1.05 |
| Unit 2 | 1.30 + 1.30 (- .051) = 1.24 |
| Unit 3 | 1.00 + 1.00 (- .051) = 0.95 |
| Unit 4 | 0.80 + 0.80 (- .051) = 0.75 |
| Unit 5 | 0.90 + 0.90 (- .051) = 0.85 |
| Unit 6 | 1.22 + 1.22 (- .051) = 1.16 |
| | Check = 6.00 = FK3 |

4.1.6 COMPUTING THE NEW MOVING AVERAGE

Reverting once again to the vector notation, let j be any unit in the time interval. From the raw data D_j and the smoothed seasonal factors R_j , a new moving average B_j is computed for each unit in the time interval by the following formula: $B_j = \frac{D_j}{R_j}$

4.1.7 COMPUTING THE REVISED MOVING AVERAGE

From the old moving average A_j and the new moving average B_j a revised moving average A_j is computed for each unit in the time interval by the following formula: $A_j = A_j - (A_j - B_j)/2$
Note that A_j now refers to the revised moving average instead of the old moving average. This revised moving average, which is actually the mean of the old and new moving averages, now becomes the basis for further seasonal adjustment computations.

4.2 LEAST SQUARES DISPERSION REDUCTION ROUTINE

Reverting once again to the matrix notation, the program will check the dispersion of the smoothed seasonal factors about the unit least square lines. Given M units and N years, the following table illustrates the smoothing deviations about the unit least square lines:

| Unit | <u>Year 1</u> | | | Deviation of Smoothed R_j as a per cent of Unsmoothed R_j | <u>Year N</u> | | Deviation of Smoothed R_j as a per cent of Unsmoothed R_j |
|------|----------------------------|-------------------|-----------------------------|---|-------------------|-----------------------------|---|
| | For Year $1 \leq i \leq N$ | Smoothing Factor | Smoothed R_j | | Smoothing Factor | Smoothed R_j | |
| 1 | $R_{1,1} = a_1 + b_1(1)$ | SZYR ₁ | $R_{1,1} + R_{1,1}(SZYR_1)$ | A_1 | SZYR _N | $R_{1,N} + R_{1,N}(SZYR_N)$ | A_N |
| . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . |
| M | $R_{m,1} = a_m + b_m(1)$ | SZYR ₁ | $R_{m,1} + R_{m,1}(SZYR_1)$ | A_1 | SZYR _N | $R_{m,N} + R_{m,N}(SZYR_N)$ | A_N |

In this instance $R_{i,j}$ is completely generalized, being defined by the unit least square formulas. Note, however, that the smoothing process results in the deviations of the smoothed $R_{i,j}$ as a per cent of the unsmoothed $R_{i,j}$ calculated from the unit least square line being identical for each unit within a given year. Therefore, the sum of these unit percentage deviations for N years is also identical. Consequently, when testing for the dispersion of the smoothed seasonal factors about the unit least square lines to determine if the dispersion is so great it must be reduced, only one unit, for convenience unit No. 1, need be tested to test all the units. If the dispersion, as measured by the sum of the percentage deviations, should be too great, the dispersion will be reduced in the following manner:

$$B_{i,j} = a + b_j i$$

$$R_{i,j} = R_{i,j} + (B_{i,j} - R_{i,j})/2$$

The least square formula seasonal factors, $B_{i,j}$, are generated, and the smoothed seasonal factors, $R_{i,j}$, are packed halfway to the formula values, $R_{i,j}$ now designating the packed seasonal factors. A revised moving average, in vector notation designated as A_j , is then generated in the following manner:

$$A_j = \frac{D_j}{R_j}$$

Where: D_j = raw data
 R_j = packed seasonal factors

This revised moving average now becomes the basis for further seasonal adjustment calculations.

4.3 SEASONAL FACTOR PREDICTION AND SEASONALLY ADJUSTED SALES COMPILATION ROUTINE

4.3.1 PREDICTING SEASONAL FACTORS

Continuing with the matrix notation, seasonal factors are predicted for each unit for years $N + 1$ through $N + 4$ as follows:

$$R_{i,j} = a_j + b_j i$$

Where: $N + 1 \leq i \leq N + 4$

The predicted seasonal factors are then smoothed as follows on an annual basis:

$$SZYR = (FK3 - ZYR)/ZYR$$

$$R_{i,j} = R_{i,j} + R_{i,j} (SZYR)$$

4.3.2 COMPUTING SEASONALLY ADJUSTED SALES

Reverting once again to the vector notation, for years 1 through $K2 - 1$ seasonally adjusted sales are computed as follows:

$$D_j = \frac{D_j}{R_j}$$

Where: New D_j = seasonally adjusted sales

Old D_j = raw data

R_j = smoothed seasonal factors

After seasonally adjusted sales are computed, excess positions in the D block are zeroed.

4.3.3 NORMALIZING SEASONAL FACTORS

Seasonal factors are normalized in the following manner:

$$R_j = 100 R_j$$

Normalized seasonal factors will be interpreted as percentage quantities instead of decimal quantities. Following the normalization computations, excess positions in the R block are zeroed.

5.0 PRINTER OUTPUT ROUTINE

The printer outputs information in the form of messages to inform the operator of the progress which the seasonal adjustment program makes as it seasonally adjusts data. No seasonally adjusted information will be output on the printer. The printer outputs the following general types of messages:

- a. Identification messages, which inform the operator of the contents of the job number element and the identification element of the card input routine.
- b. Programmed messages, which inform the operator in which routine or segment of routine the program is currently operating.
- c. Computational messages, which inform the operator of the results of a computational procedure which the computer has made.
- d. Request messages, which inform the operator to take a course of action.
- e. Program error messages, which inform the operator that a program error has occurred. However, not all program errors are detected by the computer.
- f. Action messages, which inform the operator of some action the computer has taken.

On the basis of these messages, the operator may see fit to manually intervene with the seasonally adjustment process, or he may satisfy himself that the seasonal adjustment process has been adequately performed for a given set of data. The printer outputs the following specific messages as the program processes data (Note: messages need not be printed in the order listed, and many need not be printed at all for a given set of data):

1. Start Reading Data Message - When the computer is ready to read data the following message will be printed:
GO 23
2. Job Number Message - After the computer reads the parameter and job number cards, the job number will be printed. The printing of this message may be bypassed by setting $K20 = 1$.
3. Identification No. 1 Message - After the computer reads identification card one it will print the contents of this card. The printing of this message may be bypassed by setting $K20 = 1$.
4. Identification No. 2 Message - After the computer reads identification card two it will print the contents of this card. The printing of this message may be bypassed by setting $K20 = 1$.
5. Program Error No. 10 Message - If $K20$ is set at 2 or more, the following program error message will be printed:

After this message has been printed the computer will stop processing the current set of data and begin processing the next set of data, if such data is available.

6. Approximate Seasonal Factors Computed Message - After the program has computed the approximate seasonal factors the following messages will be printed:

GO 11

7. Bypass Least Squares Fit of Approximate Seasonal Factors Message No. 1 - If $K_{17} = 1$, the program will bypass fitting least square lines to the seasonal factors and the following message will be printed:

GO 30

8. Bypass Least Squares Fit of Approximate Seasonal Factor Message No. 2 - If $K_{17} = 0$ and $K_{14} = 2$, the program will bypass fitting least square lines to the seasonal factors and the following message will be printed:

GO 50

9. Compute Least Squares Fit of Approximate Seasonal Factors Message - If $K_{17} = 0$ or 2 and $K_{14} = 0$ or 1 the program will fit least square lines to the seasonal factors, immediately preceding which the following message will be printed:

GO 40

10. Moving Average Error Message No. 1 - A measure of the percentage of the errors or deviations between the old and new moving averages will be printed in the following format:

MEAS MAGN M/A ER = XXXXXX.XX

11. Moving Average Error Message No. 2 - The number of extreme pairs of points or deviations between the old and new moving averages will be printed in the following format:

NUM M/A EXT PTS = XXXXX

12. Moving Average Error Message No. 3 - The mean of the square root of the sum of the absolute percentage magnitudes of the errors or deviations between the old and new moving averages will be printed in the following format:

M/A MEAN ER = XXXXXX.XX

13. Moving Average Test Failure and at Least One More Iterative Pass Available Message - When the moving average test fails and at least one more iterative pass is available, immediately prior to computing new seasonal factors the following message will be printed:

GO 03

14. Moving Average Test Failure But No More Iterative Passes Available Message - When the moving average test fails and no more iterative passes are available, immediately prior to branching ahead the following message will be printed:

M/A FAILS GO 02

15. Bypass Seasonal Factor Prediction And Seasonally Adjusted Sales Compilation Routine Message - If $K_{14} = 1$, the seasonal factor prediction and seasonally adjusted sales compilation routine will be bypassed after the following message is printed:

GO 25

16. Moving Average Test OK Message - When the moving average test is OK, immediately prior to branching ahead the following message will be printed:

GO 01

17. Predict Seasonal Factors Message - After the following message is printed the seasonal factors will be predicted:

GO 05

18. Sense Switch No. 2 On Message - If the program detects sense switch No. 2 on, the following message will be printed:

SENSE SWITCH 2 IS ON

19. Manual Abort Message - After the program has detected that sense switch No. 3 is on it will abort the processing of the current set of data after printing the following message:

MANUAL ABORT

20. No Seasonal Output Message - When the program has detected that sense switch No. 4 is on it will bypass the processing of current data after printing the following message:

NO SEASONAL OUTPUT
END

21. Turn Off All Sense Switches Message - After the program has tested all sense switches and detected at least one of them on, it will perform the programmed operations. After these operations have been performed the program will once again test all sense switches. If one or more sense switches are detected on, the printer will print the following message and continue printing it until all sense switches have been turned off:

TURN OFF ALL SENSE SWITCHES

22. Bypass Compute Seasonally Adjusted Sales Message - After the seasonal factors have been predicted, K_{18} is tested. If $K_{18} = 2$, seasonally adjusted sales will not be computed and the following message is printed:

GO 14

23. Seasonally Adjusted Sales Computed Message - After the seasonal factors have been predicted, K_{18} is tested. If $K_{18} = 0$ or 1, seasonally adjusted sales will be computed and the following message printed:

GO 09

24. Dispersion Smooth Indicator On Message - When $K_{18} = 1$ has been initially detected, the dispersion smooth indicator will be interpreted as being on and the following message will be printed:

GO 04

25. Seasonal Factor Dispersion Message No. 1 - The measure of the sum of the absolute percentage magnitudes of the errors or deviations between the smoothed seasonal factors and the least squares generated seasonal factors for unit one (which is identical to that of all other units) will be printed in the following format:

SQRT MAGN S/F ER = XXXXXX.XX

26. Seasonal Factor Dispersion Message No. 2 - The number of extreme pairs of points or deviations between the smoothed seasonal factors and the least square generated seasonal factors for unit one (which is identical to that of all other units) will be printed in the following format:

S/F MEAN ER = XXXXX

27. Seasonal Factor Dispersion Message No. 3 - The mean of the square root of the sum of the absolute percentage magnitudes of the errors or deviations between the smoothed seasonal factors and the least square generated seasonal factors for unit one (which is identical to that of all other units) will be printed in the following format:

S/F MEAN ER = XXXXXX.XX

28. Seasonal Factor Mean Error Plus Moving Average Mean Error Message - The sum of the seasonal factor mean error and the moving average mean error will be printed in the following format:

S/F MEAN ER PLUS M/A MEAN ER = XXXXXX.XX

29. Least Square Dispersion Reduced Message - If the seasonal factor dispersion reduction test fails, after the seasonal factors have been packed about the unit least square lines, reducing thereby the dispersion between the smoothed seasonal factors and the least square generated seasonal factors for each unit, the following message will be printed:

GO 24
DISPERSION REDUCED ABOUT L/S LINE
GO 08

30. Program Error 3 Message - If NR is incremented above 1, the computer will stop processing the current set of data and begin processing the next set of data after printing the following message:

PGM ER 03

31. No Least Square Dispersion Reduction Required Message - If the seasonal factor dispersion reduction test is OK, the seasonal factors will not be packed about the unit least square lines and the following message will be printed:

NO DISPERSION REDUCTION ABOUT L/S LINE REQUIRED
GO 07

32. No More Seasonal Factor Dispersion Reduction Passes Available Message - After the last pass has been made through the moving average and seasonal factor generation iterative process routine and the dispersion smooth switch is on but no more passes are available in the least squares dispersion reduction routine, the following message will be printed:

NO MORE S/F REDUC PASSES AVAILABLE
GO 06

33. Test Summation Results Message - If the last pass through the least squares dispersion reduction routine has just been made and the seasonal factor dispersion reduction test fails, the test summation results message will be printed in the following format:

TEST SUMMATION RESULTS

The message precedes a summation of the results of the moving average deviation and least squares deviation tests.

34. Fail 01 Message - If too many pairs of moving average extreme points have been detected, the following message will be printed after the test summation results message:

FAIL 01

35. Fail 02 Message - If the sum of the absolute magnitudes of the moving average deviations is too great, the following message will be printed after the test summation results message:

FAIL 02

36. Fail 03 Message - If too many pairs of least square dispersion extreme points have been detected, the following message will be printed after the test summation results message:

FAIL 03

37. Fail 04 Message - If the sum of the absolute magnitudes of the least square dispersion deviations is too great, the following message will be printed after the test summation results message:

FAIL 04

38. Fail 05 Message - If the sum of the means of the magnitudes of the moving average and least square dispersion errors is too great, the following message will be printed after the test summation results message:

FAIL 05

39. Program Error 5 Message - If K₁₅ is set at 2 or more, the computer will stop processing the current set of data and begin processing the next set of data after printing the following message:

PGM ER 05

40. Return To The Moving Average And Seasonal Factor Generation Iterative Process Routine Message - Whenever the program has left the moving average and seasonal factor generation iterative process routine and just prior to returning to that routine the following message will be printed:

GO 32

41. Parameter Output Message No. 1 - Whenever K₁₅ has been detected as one or sense switch No. 2 only has been thrown on, the following message will be printed (note - the actual values of the parameters appear in place of the parameters indicated):

PARAMETER PRINTOUT
K₅ K₆ K₇ K₈ K₉ K₁₀ K₁₁ K₁₂ K₁₃
K₁₄ K₁₅ K₁₆ K₁₇ K₁₈ K₁₉ K₂₀ K₂₁

42. Execute Instruction Message - After parameter output message No. 1 has been printed the following message will be printed:

EX INS SS = 1 ON TO RESET PARAMETERS

This message informs the operator to make a decision concerning inserting new parameters and making additional passes through the program or terminating the iteration procedure.

43. Parameter Output Message No. 2 - Whenever the computer has accepted parameters K₅ through K₁₃ from the typewriter, the following message will be printed (note - the actual values of the parameters appear in place of the parameters indicated):

K₅ K₆ K₇ K₈ K₉ K₁₀ K₁₁ K₁₂ K₁₃

This message enables the operator to check the accuracy of the parameters K₅ through K₁₅ after they have been manually inserted.

44. Parameter Output Message No. 3 - Whenever the computer has accepted parameters K₁₄ through K₂₁ from the typewriter, the following message will be printed (note - the actual values of the parameters appear in place of the parameters indicated):

K₁₄ K₁₅ K₁₆ K₁₇ K₁₈ K₁₉ K₂₀ K₂₁

This message enables the operator to check the accuracy of the parameters K₁₄ through K₂₁ after they have been manually inserted.

45. Leaving Manual Input Routine Message - After the program leaves the manual input routine the following message will be printed:

GO 13

46. Program Error No. 6 Message - If NS is incremented above 1, the computer will stop processing the current set of data and begin processing the next set of data after printing the following message:

PGM ER 06

47. Output Commence Message - Just prior to the time the computer commences to punch out the seasonally adjusted or seasonally predicted data, the following message will be printed:

GO 15

48. Output Stop Message - Immediately after the computer stops punching out the seasonally adjusted and/or seasonally predicted data, the following message will be printed:

GO 21

49. Ready For More Data Message - When the computer has stopped processing the current set of data, the following message will be printed:

READY FOR MORE DATA

The printing of this message may be bypassed by setting K₂₀ = 1.

6.0 MANUAL INPUT ROUTINE

The manual input routine, which enables the operator to manually insert new parameters into the computer from the printer, may be entered either by throwing sense switch No. 2 only on or by the computer detecting K₁₅ = 1. At least one pass must be made through the moving average and seasonal factor generation iterative process routine before sense switch No. 2 is thrown on, in order to avoid the possibility of format errors.

6.1 PARAMETER OUTPUT MESSAGE NO. 1 AND EXECUTE INSTRUCTION MESSAGE FOLLOWED BY A PAUSE

Once the manual input routine is entered parameter output message No. 1 is printed followed by the execute instruction message. These combined printouts will appear as follows (note - the actual values of the parameters appear in place of the parameters indicated):

K₅ K₆ K₇ K₈ K₉ K₁₀ K₁₁ K₁₂ K₁₃

K₁₄ K₁₅ K₁₆ K₁₇ K₁₈ K₁₉ K₂₀ K₂₁

EXEC INS SS = 1 ON TO RESET PARAMETERS

Following this printout, the computer pauses. Parameters K₁ through K₄ are not printed out because they are not generally of value in making a decision whether or not to continue seasonally adjusting data.

6.2 DECISION TO MANUALLY INPUT PARAMETERS

Depending upon the performance of the seasonal adjustment procedure up to this point, the operator will be in a position to make a decision whether one or more new parameter values should be manually inserted in order to further seasonally adjust the data or whether the seasonal adjustment procedure should terminate. If the operator decides to further seasonally adjust the data, sense switch No. 1 will be thrown on and the start button depressed, which will throw the computer into the ACCEPT condition for the first pass.

6.2.1 PARAMETERS K₅ THROUGH K₁₃ INPUT ON THE FIRST PASS

Parameters K₅ through K₁₃ will be inserted from the typewriter into the computer during the first pass in the same format in which they have been printed out, that is, they may be visually lined up with the parameter output message No. 1 printout. In the event that the value of at least one of the parameters does not change, the original value of the parameters involved will be inserted from the typewriter. In the event that a change in the value of one or more of the parameters results in the insertion of a number or numbers containing more or less digit positions than was originally the case, the least significant digit of the new and old parameters should be visually lined up by using the least significant digit positions of the parameter output message No. 1 printout. The new parameters may take on any value as long as their respective values do not exceed the specifications stated in 3.1 above. As a practical matter, inputting of parameters from the typewriter should cause no great problem. Once the parameters are inserted, the release button and start button are depressed in that order.

6.2.2 PARAMETER OUTPUT MESSAGE NO. 2 A CHECK ON THE MANUALLY INPUT PARAMETERS K₅ THROUGH K₁₃

After parameters K₅ through K₁₃ have been inserted and the release and start buttons depressed, these same parameters will be printed

out in parameter output message No. 2, following which the computer will pause. This message will serve as a check on the accuracy of the parameters inserted. If the operator is satisfied the parameters have been correctly inserted he will turn off sense switch No. 1 and depress the start button, which will put the computer into the ACCEPT condition for the second pass. If the operator is not satisfied the parameters have been correctly inserted he will throw on sense switch No. 1 and depress the start button, which will put the computer in the ACCEPT condition for a re-run of the first pass.

6.2.3 PARAMETERS K₁₄ THROUGH K₂₁ INPUT ON THE SECOND PASS

Using the method specified above for the first pass, parameters K₁₄ through K₂₁ will be inserted from the typewriter on the second pass, using parameter output message No. 1 printout to visually line up the new parameter values with the old ones. After the new parameter values have been inserted the release button and start button are depressed in that order.

6.2.4 PARAMETER OUTPUT MESSAGE NO. 3 A CHECK ON THE MANUALLY INPUT PARAMETERS K₁₄ THROUGH K₂₁

After parameters K₁₄ through K₂₁ have been inserted and the release and start buttons depressed, these same parameters will be printed out in parameter output message No. 3, following which the computer will pause. This message will serve as a check on the accuracy of the parameters inserted. If the operator is satisfied the parameters have been correctly inserted he will turn off sense switch No. 1 and depress the start button, which will transfer the operation of the program out of the manual input routine. If the operator is not satisfied that the parameters have been correctly inserted he will throw on sense switch No. 1 and depress the start button, which will put the computer in the ACCEPT condition for a re-run of the second pass.

6.3 DECISION NOT TO MANUALLY INPUT PARAMETERS

If the operator decides not to manually input new parameters after parameter output message No. 1 and the execute message have been printed out and the computer pauses, sense switch No. 1 will be thrown off and the start button depressed. This will result in program control being transferred out of the manual input routine.

7.0 SENSE ROUTINE

Entry into the sense routine is always made by throwing on sense switch No. 2 during the operation of the program. Entry into the sense routine is made for the reasons enumerated below:

7.1 TO MANUALLY ABORT THE SEASONAL ADJUSTMENT PROCESS

The operator may manually abort the seasonal adjustment process. In this instance sense switch No. 3 should be thrown on immediately prior to the throwing on of sense switch No. 2. Under no circumstances should sense switches 3 and 2 be thrown on to manually abort the program prior to the compilation of at least one complete pass through the moving average and seasonal factor generation iterative process routine (see 2.7.2 above), because format errors may occur if this rule is violated.

It is possible to determine when one complete pass has been made by noting the information contained in printer output (see 5.0 above). Manually aborting the operation of the program results in the termination of the seasonal adjustment process as of the time the manual abort command is detected by the computer. Program control is transferred to the seasonal factor prediction and seasonally adjusted sales compilation routine. In the event sense switches 3 and 2 are thrown on too soon and format errors occur, the operation of the program should be stopped, a FORTRAN II restart card should be read into the computer, and the seasonal adjustment procedure started over again.

7.2 TO MANUALLY BYPASS SEASONAL OUTPUT

The operator may manually bypass seasonal output. In this instance sense switch No. 4 should be thrown on immediately prior to the throwing on of sense switch No. 2. Bypassing seasonal output results in the termination of the seasonal adjustment process as of the time the manual bypass command is detected by the computer. The next set of data, if available, will be read in without any seasonal output for the current set of data being punched. When bypassing seasonal output sense switches 4 and 2 may be thrown on at any time.

7.3 TO MANUALLY ENTER THE MANUAL INPUT ROUTINE

The operator may manually enter the manual input routine. In this instance only sense switch No. 2 is thrown on. Under no circumstances should sense switch No. 2 be thrown on prior to the compilation of at least one complete pass through the moving average and seasonal factor generation iterative process routine because format errors may occur if this rule is violated.

8.0 PUNCH OUTPUT ROUTINE

Seasonally adjusted output is by punched cards, which must be run through the 407 tabulating machine in order to obtain a printed listing. Seasonally adjusted punched output will vary according to the parameter card inputs, the degree of the seasonal pattern inherent in the data, and the manual sense switch actions taken by the operator. Each card which is punched out will contain a job number and a consecutively ordered card counter or LO number. Consequently, when the punched cards are run through the 407 tabulating machine each line of the printed listing will contain a job number and a consecutively ordered card counter or LO number. These numbers may be used to sort a deck if it is dropped or mingled with another deck. The job number will always be punched in card position 63-65,

while the card counter or LO number will always be punched in card position 69-71. Since these numbers are common to each card and, consequently, to each line of the 407 printed listing, no further reference to them will be made.

- a. Job Number Card - The first card punched is always the job number card. This card contains the job number input on the job number element card of the card input routine. The job number will be punched in card position 8 - 10. This card will result in the number being printed as the first line on the 407 listing, and it indicates the start of a new set of seasonally adjusted data.

Example: 001

- b. Identification Card Set - Following the job number card the identification card set of two cards will be punched as identification card No. 1 and identification card No. 2. These cards contain the information input on identification cards No. 1 and No. 2, respectively, of the identification element of the card input routine. The information contained in this card set will be printed as two consecutive lines, respectively, on the 407 listing immediately after the job number if $K_{20} = 0$ or $K_{20} = 1$. This printout will identify the seasonally adjusted data which normally follows.

Example: 20 MTP PACK BOR MO LB SLS
SEAS ADJ FROM 1952

If parameter K_{20} is greater than one a program error will be detected and the identification card set will not be punched. In this instance the information contained in the program error output incomplete card (see c below) will be printed as the line immediately after the job number on the 407 listing, following which the next set of data will be processed.

- c. Program Error Output Incomplete Card - Whenever the program detects a program error, such as an incorrectly set parameter or indicator, the program error card will be punched. If a program error card is punched there will be no seasonally adjusted data punched. The information contained on this card will be printed as the last line of a particular output on the 407 listing if a program error is detected, and if punched, this information will appear somewhere after the job number, usually within several lines of it.

Example: PROGRAM ERROR OUTPUT INCOMPLETE

It should be noted however, that not every program error will be detected.

- d. Seasonal Output Incomplete Card - When the operator manually bypasses seasonal output by throwing on sense switches No. 2 and No. 4 the computer, when it detects the on condition of these two sense switches, will punch the seasonal output incomplete card. The information contained on this card will be printed as the line immediately after the second identification line on the 407 listing.

Example: NO SEASONAL OUTPUT

After this card is punched, the end card set is punched (see x below), and the information contained on the end card is printed as the next and final line of the 407 listing. Then, the next set of data will be processed.

- e. Manual Abort Card - When the operator manually aborts the seasonal adjustment process by throwing on sense switches No. 2 and No. 3 the computer, when it detects the on condition of these two sense switches, will punch the manual abort card. The information contained on this card will be printed as the line immediately after the second identification line on the 407 listing.

Example: MANUAL ABORT

This information serves as a record of the manual abort action.

- f. No Manual Abort Card - If the operator has not taken the manual abort action, after the computer has completed the seasonal adjustment procedure the no manual abort card will be punched. The information contained on this card will be printed as the line immediately after the second identification line on the 407 listing.

Example: NO MANUAL ABORT

This information serves as a record that no manual abort action has been taken.

- g. Seasonal Factor Identification Card - Following either the manual abort card or the no manual abort card the seasonal factor identification card will be punched. The information contained on this card will be printed on the 407 listing as the line immediately after either the manual abort line or the no manual abort line, depending upon whether a manual abort action was or was not taken.

Example: SEASONAL FACTORS

This information serves as an identification of the table of seasonal factors which follows:

- h. Seasonal Factor Heading Card No. 1 - Following the seasonal factor identification card the seasonal factor heading card No. 1 will be punched. This card will contain a heading of seven consecutive years, beginning with the first year for which seasonal factors have been compiled. The information contained on this card will be printed as the line immediately after the seasonal factors heading on the 407 listing.

Example: 1956 1957 1958 1959 1960 1961 1962

- i. Seasonal Factor Output Card Set No. 1 - Following the seasonal factor heading card No. 1 the seasonal factor output card set No. 1 will be punched. Each card of this set will contain a consecutively ordered number indicating the order of a particular unit (month, bi-monthly period, or quarter) in a year and the seasonal factors corresponding to each unit for each year designated by the seasonal factor heading card No. 1. The information contained in the seasonal factor output card set No. 1 will be printed as consecutive lines of

the 407 listing immediately following the printout of the contents on seasonal factor heading card No. 1, with the unit designation in the extreme left hand margin. If monthly data has been processed, twelve lines of output will be printed; if bi-monthly data has been processed six lines of output will be printed; if quarterly data has been processed four lines of output will be printed. For those years for which seasonal factors have not been compiled zeroes will be printed.

Example: (bi-monthly data processed)

| | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|
| 1 | 85 | 90 | 95 | 100 | 105 | 110 | 115 |
| 2 | 115 | 110 | 105 | 100 | 95 | 90 | 85 |
| 3 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 4 | 110 | 105 | 100 | 95 | 90 | 85 | 80 |
| 5 | 90 | 95 | 100 | 105 | 110 | 115 | 120 |
| 6 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Each column of data will be headed by one of the years printed on the 407 listing from the seasonal factor heading card No. 1.

- j. Seasonal Factor Heading Card No. 2 - Following the last card of the seasonal factor output card set No. 1 the seasonal factor heading card No. 2 will be punched. This card will contain a heading of seven consecutive years, beginning with the year following the last year punched on seasonal factor heading card No. 1. The information contained in this card will be printed on the 407 listing as the line immediately following the printed output of the last card of the seasonal factor output card set No. 1.

Example: 1963 1964 1965 1966 1967 1968 1969

- k. Seasonal Factor Output Card Set No. 2 - Following the seasonal factor heading card No. 2 the seasonal factor output card set No. 2 will be punched. The information contained in this card set will be similar to that contained in the seasonal factor output card set No. 1 excepting that the seasonal factors in card set No. 2 will apply to the years designated by the printout of seasonal factor heading card No. 2. The information contained in the seasonal factor output card set No. 2 will be printed as consecutive lines of the 407 listing immediately following the printout of the contents of seasonal factor heading card No. 2, with the unit designation in the extreme left hand margin. For those years for which seasonal factors have not been compiled zeroes will be printed.

Example: (bi-monthly data processed)

| | | | | | | | |
|---|-----|-----|-----|---|---|---|---|
| 1 | 120 | 125 | 130 | 0 | 0 | 0 | 0 |
| 2 | 80 | 75 | 70 | 0 | 0 | 0 | 0 |
| 3 | 100 | 100 | 100 | 0 | 0 | 0 | 0 |
| 4 | 75 | 70 | 65 | 0 | 0 | 0 | 0 |
| 5 | 125 | 130 | 135 | 0 | 0 | 0 | 0 |
| 6 | 100 | 100 | 100 | 0 | 0 | 0 | 0 |

Each column of data will be headed by one of the years printed on the 407 listing from the seasonal factor heading card No. 2.

1. Least Square Vector Identification Card - If the input parameters are set to punch seasonally adjusted sales ($K_{18} = 0$ or $K_{18} = 1$), following the last card of the seasonal factor card set No. 2 the least square vector identification card will be punched. The information contained in this card will be printed as the line immediately after the last line of the printout of seasonal factor output card set No. 2 on the 407 listing.

Example: LEAST SQUARE VECTORS, YEAR ONE = 1959

This information serves as an identification for the unit linear least square vectors which follow, together with an indication of year one with respect to the least square calculations.

- m. Least Square Vector Heading Card - Following the least square vector identification card the least square vector heading card will be punched. The information contained on this card will be printed as the line immediately after the least squares vector identification line on the 407 listing.

Example: V (I,1) V (I,2)

V (I,1) will serve as the heading for the column of "a" or constant terms of the linear least square equations, while V (I,2) will serve as the heading for the column of "b" or coefficient terms for the independent variable, where I refers to the unit number.

- n. Least Square Vector Output Card Set - Following the least square vector heading card the least square vector output card set will be punched. Each card of this set will contain a consecutively ordered number indicating the order of a particular unit (month, bi-monthly period, or quarter) in a year and the unnormalized values to two decimal places of the "a" and "b" terms of the linear least square equation for that unit. The information contained in the least square vector output card set will be printed as consecutive lines of 407 listing immediately after the least square vector heading line, with the unit designation in the extreme left hand margin. If monthly data has been processed, twelve lines of output will be printed; if bi-monthly data has been processed, six lines of output will be printed; if quarterly data has been processed, four lines of output will be printed.

Example: (bi-monthly data processed)

| | | |
|---|------|------|
| 1 | .80 | .05 |
| 2 | 1.20 | -.05 |
| 3 | 1.00 | 0.00 |
| 4 | 1.15 | -.05 |
| 5 | .85 | .05 |
| 6 | 1.00 | 0.00 |

Column two will be headed by V (I,1), the "a" heading, and column three will be headed by V (I,2) the "b" heading.

- o. Seasonally Adjusted Sales Identification Card - Following the last card of the least square vector output card set the seasonally adjusted sales identification card will be punched. The information contained on this card will

be printed on the 407 listing as the line immediately after the last printed line of the least square vector output.

Example: SEASONALLY ADJUSTED SALES

This information serves as an identification of the table of seasonally adjusted sales which follows.

- p. Seasonally Adjusted Sales Heading Card No. 1 - Following the seasonally adjusted sales identification card the seasonally adjusted sales heading card No. 1 is punched. This card will contain a heading of five consecutive years, beginning with the first year for which seasonally adjusted sales have been compiled. The information contained on this card will be printed on the line immediately after the seasonally adjusted sales identification line on the 407 listing.

Example: 1956 1957 1958 1959 1960

- q. Seasonally Adjusted Sales Output Card Set No. 1 - Following the seasonally adjusted sales heading card No. 1 the seasonally adjusted sales output card set No. 1 is punched. Each card in this set will contain a consecutively ordered number indicating the order of a particular unit (month, bi-monthly period, or quarter) in a year and the seasonal factors corresponding to each unit for each year designated by the seasonally adjusted sales heading card No. 1. The information contained in the seasonally adjusted sales output card set No. 1 will be printed as consecutive lines on the 407 listing immediately following the printout of the contents of the seasonally adjusted sales heading card No. 1, with the unit designation in the extreme left hand margin. If monthly data has been processed, twelve lines of output will be printed; if bi-monthly data has been processed, six lines of output will be printed; if quarterly data has been processed, four lines of data will be printed. For those years for which seasonally adjusted sales have not been computed zeroes will be printed.

Example: (bi-monthly data processed)

| | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|
| 1 | 1,000,000 | 1,600,000 | 1,700,000 | 2,000,000 | 2,300,000 |
| 2 | 1,100,000 | 1,700,000 | 1,800,000 | 2,000,000 | 2,400,000 |
| 3 | 1,200,000 | 1,600,000 | 1,800,000 | 2,100,000 | 2,500,000 |
| 4 | 1,300,000 | 1,500,000 | 1,900,000 | 2,200,000 | 2,600,000 |
| 5 | 1,400,000 | 1,600,000 | 1,800,000 | 2,300,000 | 2,700,000 |
| 6 | 1,500,000 | 1,600,000 | 1,900,000 | 2,200,000 | 2,800,000 |

Each column of data will be headed by one of the years printed on the 407 listing from the seasonally adjusted sales heading card No. 1.

- r. Seasonally Adjusted Sales Heading Card No. 2 - Following the last card of the seasonally adjusted sales output card set No. 1 the seasonally adjusted sales heading card No. 2 will be punched. This card will contain a heading of five consecutive years beginning with the year following the last year punched on seasonally adjusted sales heading card No. 1. The information

COMPUTER
TECHNOLOGY

contained on this card will be printed on the 407 listing as the line immediately following the printed output of the last card of the seasonally adjusted sales output card set No. 1.

Example: 1961 1962 1963 1964 1965

- s. Seasonally Adjusted Sales Output Card Set No. 2 - Following the seasonally adjusted sales heading card No. 2 the seasonally adjusted sales output card set No. 2 will be punched. The information contained in this card set will be similar to that contained in seasonally adjusted sales output card set No. 1 excepting that the seasonally adjusted sales in card set No. 2 will apply to the years designated by the printout of seasonally adjusted sales heading card No. 2. The information contained in the seasonally adjusted sales output card set No. 2 will be printed as consecutive lines on the 407 listing immediately following the printout of the contents of seasonally adjusted sales heading card No. 2, with the unit designation in the extreme left hand margin. For those years for which seasonally adjusted sales have not been computed zeroes will be printed.

Example: (bi-monthly data processed)

| | | | | | |
|---|-----------|---|---|---|---|
| 1 | 2,800,000 | 0 | 0 | 0 | 0 |
| 2 | 2,900,000 | 0 | 0 | 0 | 0 |
| 3 | 2,800,000 | 0 | 0 | 0 | 0 |
| 4 | 2,900,000 | 0 | 0 | 0 | 0 |
| 5 | 2,900,000 | 0 | 0 | 0 | 0 |
| 6 | 3,000,000 | 0 | 0 | 0 | 0 |

Each column of data will be headed by one of the years printed on the 407 listing from the seasonally adjusted sales heading card No. 2.

- t. Parameter Heading Card - Following the last card of the seasonally adjusted sales output card set No. 2 the parameter heading card will be punched. The information contained in this card will be printed on the 407 listing as the line immediately following the printed output of the seasonally adjusted sales output card set No. 2.

Example: PARAMETERS

This information serves as an identification of the table of parameters which follows.

- u. Parameter Card Set - Following the parameter heading card the parameter card set of three cards will be punched. Card No. 1 of this set will contain, respectively, parameters K_1 through K_9 in consecutive order. Card No. 2 of this set will contain, respectively, parameters K_{10} through K_{16} in consecutive order. Card No. 3 of this set will contain, respectively, parameters K_{17} through K_{21} in consecutive order. The information contained in this card set will be printed as three consecutive lines of 407 listing immediately following the parameter heading. For a description of the parameters see 3.1 above.

Example: 1958 4 6 4 5 2 2 5 3
 6 2 120 15 135 0 0
 0 1 0 0 1

- v. Compiled Counters Heading Card - Following the last card of the parameter card set the compiled counters heading card will be punched. The information contained in this card will be printed on the 407 listing as the line immediately following the printed output of the parameter card set.

Example: COMPILED COUNTERS

This information serves as an identification of the table of compiled counters which follows.

- w. Compiled Counters Card Set - Following the compiled counters heading card the compiled counters card set of two cards will be punched. Card No. 1 of this set will contain, respectively, the contents of counters FMI, FM, FNI, FN, and FNP4 in consecutive order. Card No. 2 of this set will contain, respectively, the contents of counters MPI, NQ1, NH1, NG1, NLI, and NM1 in consecutive order. The punched values of these counters are those which were compiled at the time the seasonal adjustment procedure terminated. The compiled counters are identified as follows:

FMI = Measure of the percentage magnitude of the sum of the absolute deviations between the old moving average and the new moving average

FM = Mean FMI

FNI = Measure of the percentage magnitude of the sum of the absolute deviations between the smoothed seasonal factors and the least square generated seasonal factors for unit No. 1.

FN = Mean FNI

FNP4 = FM + FN

MPI = Number of pairs of extreme moving average points

NQ1 = Number of pairs of extreme smoothed seasonal factor points and least square generated seasonal factor points for unit No. 1.

NH1 = Number of moving average passes of the most recent run through the program. This counter will normally be set to zero when program control is transferred out of the moving average and seasonal factor generation and iterative process routine. When the manual abort action has been taken it is possible that a positive, non-zero value will appear in this counter.

NG1 = Number of moving average passes when program control is transferred out of the moving average and seasonal factor generation iterative process routine. The contents of NG1 are generated from counter NH1. When the seasonal factors are packed about the unit least square lines this counter is set to zero.

NL1 = Number of moving average passes when the seasonal factors have been packed about the unit least square lines and program control is transferred out of the least square dispersion reduction routine. The contents of NL1 are generated from NG1. The total number of moving average passes is always the sum of NH1 + NG1 + NL1.

NM1 = Number of passes through the least squares dispersion reduction routine in which the dispersion has been reduced.

The information contained in the compiled counters card set will be printed as two consecutive lines of 407 listing immediately following the compiled counters heading.

Example: 77.57 4.30 6.78 2.26 6.57
8 0 0 3 0 0

- x. End Card Set - Following the last card of the compiled counters card set if it has been punched, or, following the seasonal output incomplete card if the operator manually bypasses seasonal output by throwing on sense switches No. 2 and No. 4, or, following the last card of the seasonal factor output card set No. 2 if $K_{18} = 2$, the end card set of two cards will be punched. Card No. 1 of this set will be the end card, containing the word END. Card No. 2 of this set will be a blank card. The information contained on these cards will be printed on the 407 listing as the last line and a space for a given set of output data, except when a program error has been detected, in which instance the end card set will not be punched.

Example: END

This information serves as an identification of the end of a set of seasonally adjusted data, and provides a space between two consecutive sets of data.

9.0 TIME REQUIRED TO OPERATE THE PROGRAM

The time required to operate the program depends upon the amount of data input, the path traced through the program, the amount of seasonal adjustment which is required, the parameter settings, the output which is required, and other factors too numerous to mention. With ten years of raw data input on a monthly basis, approximately two minutes are required for each iteration through the moving average and seasonal factor generation iterative process routine, which is the basic routine of the program. If ten years of raw data are input on a bi-monthly basis the time required to iterate through this routine is approximately one minute. Reducing the number of years of input data fifty per cent reduces the time requirement for the operation of this routine approximately fifty per cent. In general, the computer time requirement - input units of raw data relationship is a one-to-one linear relationship with respect to the moving average and seasonal factor generation iterative process routine. This relationship is modified, of course, by the time required for the operation of the printer during the routine, which amounts to an approximately constant fifteen seconds.

It is possible to save a substantial amount of computer time seasonally adjusting data in a number of ways. The most obvious course of action is to set the parameters so only one pass will be made through the program. Other courses of action involve inputting fewer years of data, for example, five years, and/or substituting bi-monthly periods or quarterly periods of input raw data for monthly periods. Another suggestion is to raise the acceptable error tolerance by parameter settings. However, if a more optimum balance between realism and computer time economy is desired, the following course of action is recommended:

- 1) By parameter setting, allow for at most two passes through the moving average and seasonal factor generation iterative process routine for each time program control enters this routine.
- 2) By parameter setting, allow for exactly one pass through the least squares dispersion reduction routine.
- 3) By parameter setting, allow for tolerance deviations of exactly one per cent.

Two passes through the moving average and seasonal factor generation iterative process routine will, in most instances, establish the seasonal pattern. Variations in these seasonal patterns will normally exist when only two passes have been made, however, but these variations, if they are too great, will usually be reduced substantially with a single pass through the least squares dispersion reduction routine. No matter what the variations are, program control will be transferred back to the moving average and seasonal factor generation iterative process routine for at most two more passes, after which the program stops computing seasonal factors.

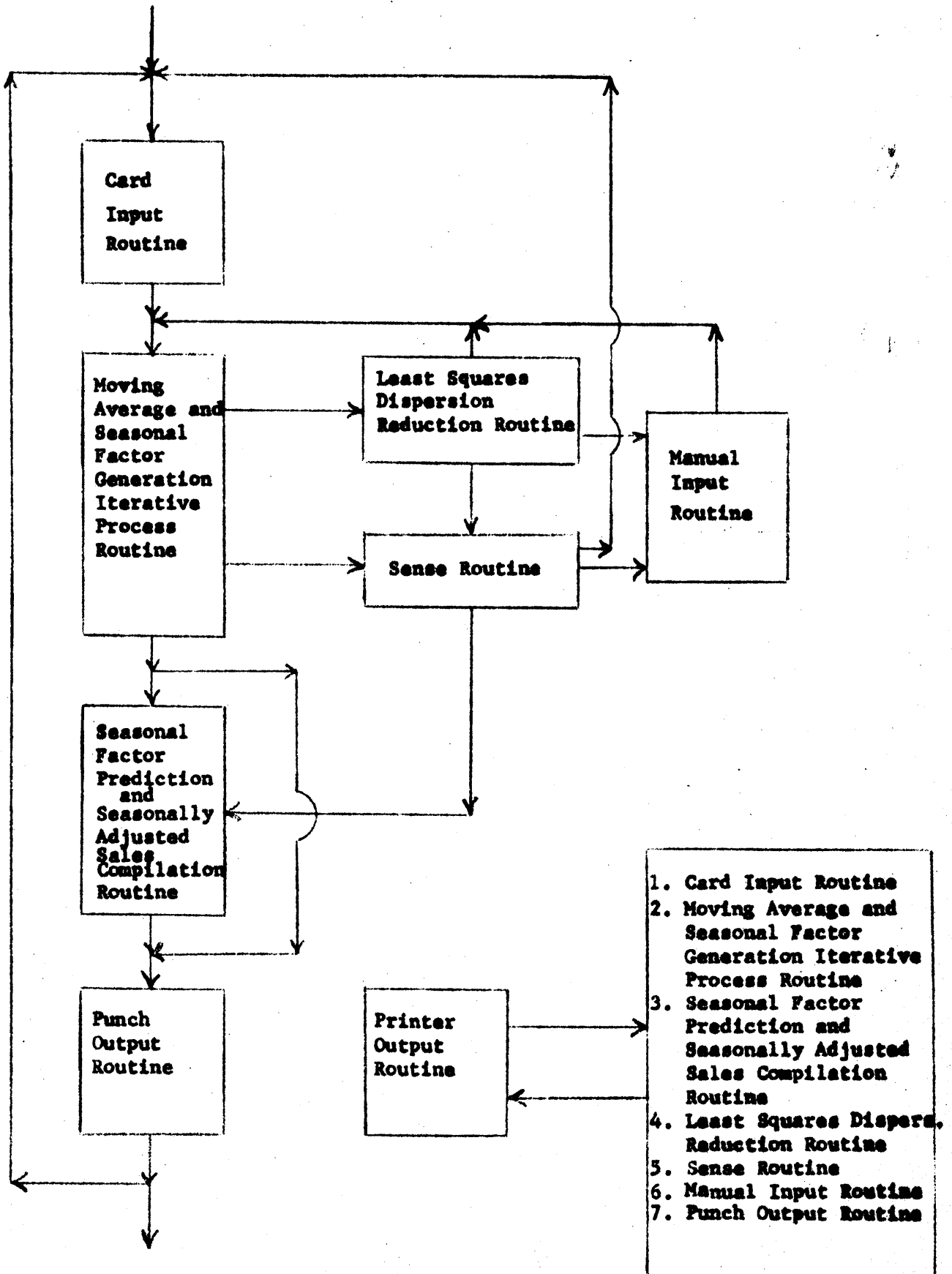
Assuming the most possible input units of raw data, there will be at most, four passes through the moving average and seasonal factor generation iterative process routine at approximately two minutes per pass, one pass through the least squares dispersion reduction routine which will take approximately one minute, and approximately one minute required to read in the data, print the job number and identification information, predict the seasonal factors, compute seasonally adjusted sales, and punch the output on cards. This means that, with the most possible input units of raw data, a fairly reliable seasonal adjustment computation can be performed in approximately ten minutes. As the number of input units of raw data is reduced, the computer time is likewise reduced in an approximately linear manner. Admittedly this procedure is not foolproof, and it is no substitute for providing for the possibility of more iterating through the program and smaller acceptable deviations, for example, one-half of one per cent.

By performing a single pass through part of the moving average and seasonal factor generation iterative process routine, it is possible to compile and punch out on cards seasonal factors only in approximately two minutes when the most possible units of raw data are input. If, in addition to the seasonal factors, seasonally adjusted sales and predicted seasonal factors are also desired on a one pass basis, approximately one additional minute will be required, for a total of approximately three minutes. Using this one pass procedure will result in first estimates only; but these may be adequate for certain seasonal requirements. While it is true that reducing the number of input units of raw data will reduce the computer time required, in the instance of a one-pass procedure the time reduction will not be proportionately as great as in multiple pass procedures because a substantial constant time element in both cases is involved with input-output.

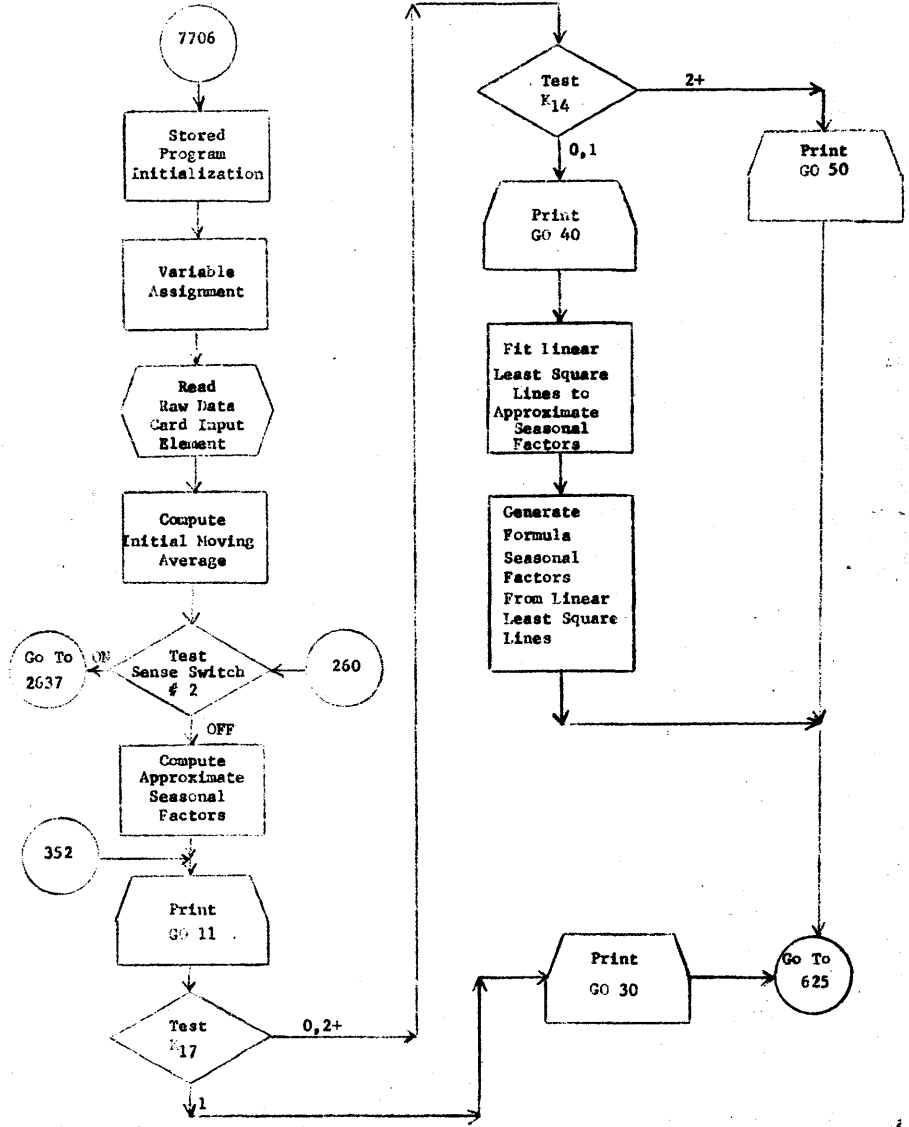
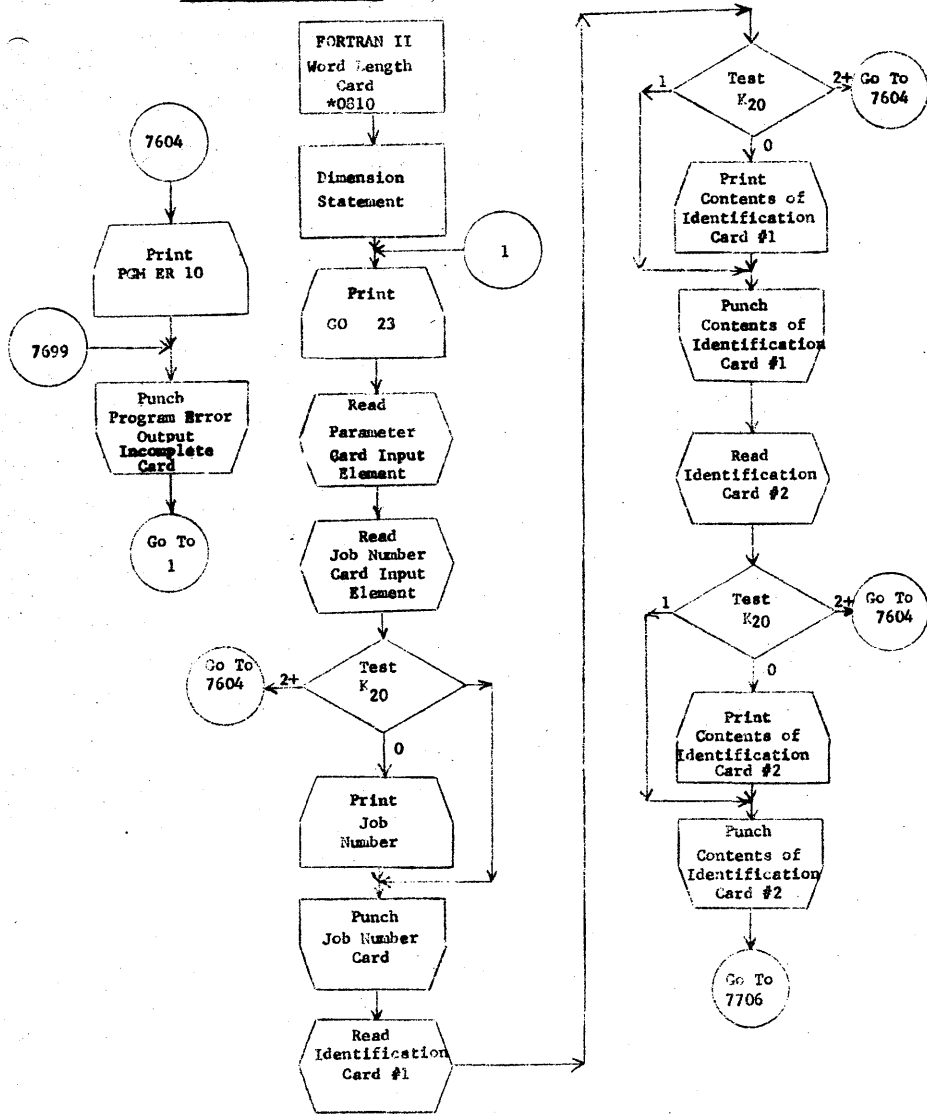
10.0 FLOW DIAGRAM

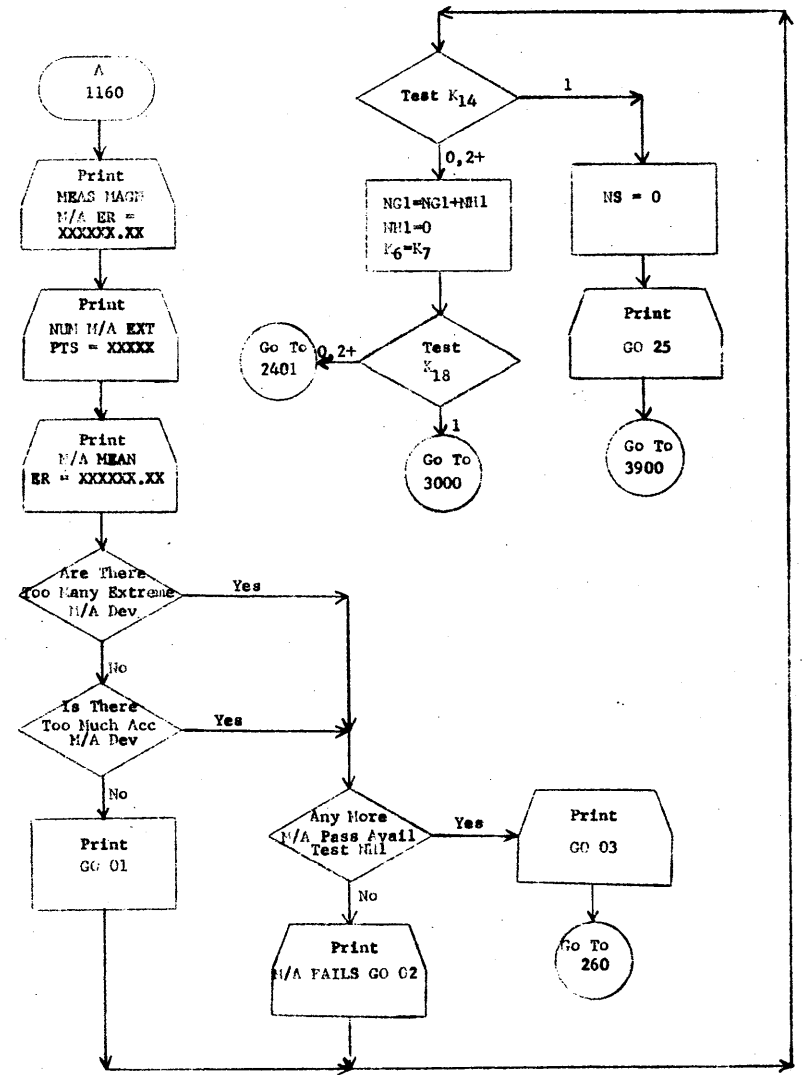
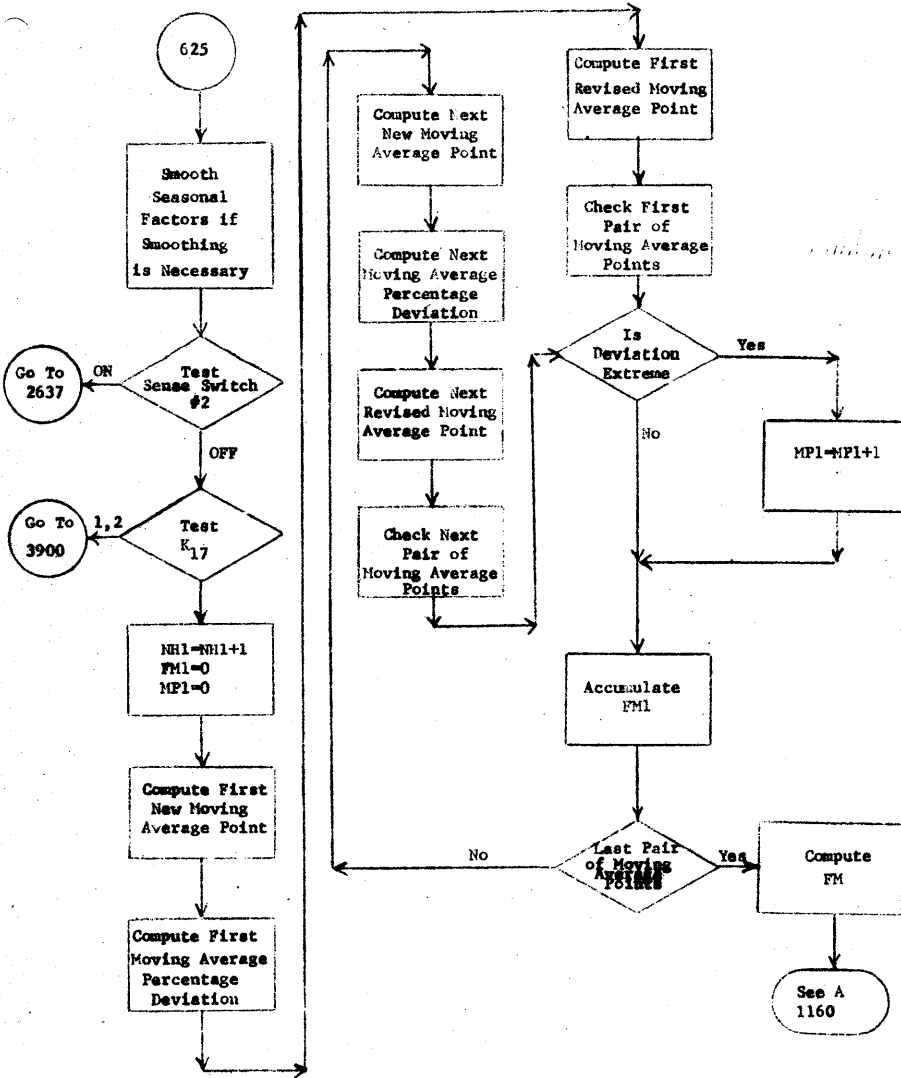
The flow diagram consists of two parts, the flow summation and the detailed flow diagram. The flow summation illustrates the ordering and sequencing of the program routines, while the detailed flow diagram consists of a series of conventional flow charts which summarize the FORTRAN II listing. Numbers appearing on the detailed flow diagram refer to statement numbers on the FORTRAN II listing. Letters appearing on the detailed flow diagram are used as pseudo numbers and provide for a continuous logical flow of information from one chart to the next, but the letters do not appear on the FORTRAN II listing. The numbers appearing with the letters in this instance represent the number of the FORTRAN II statement on the listing which is closest to that statement indicated by the letter or pseudo number.

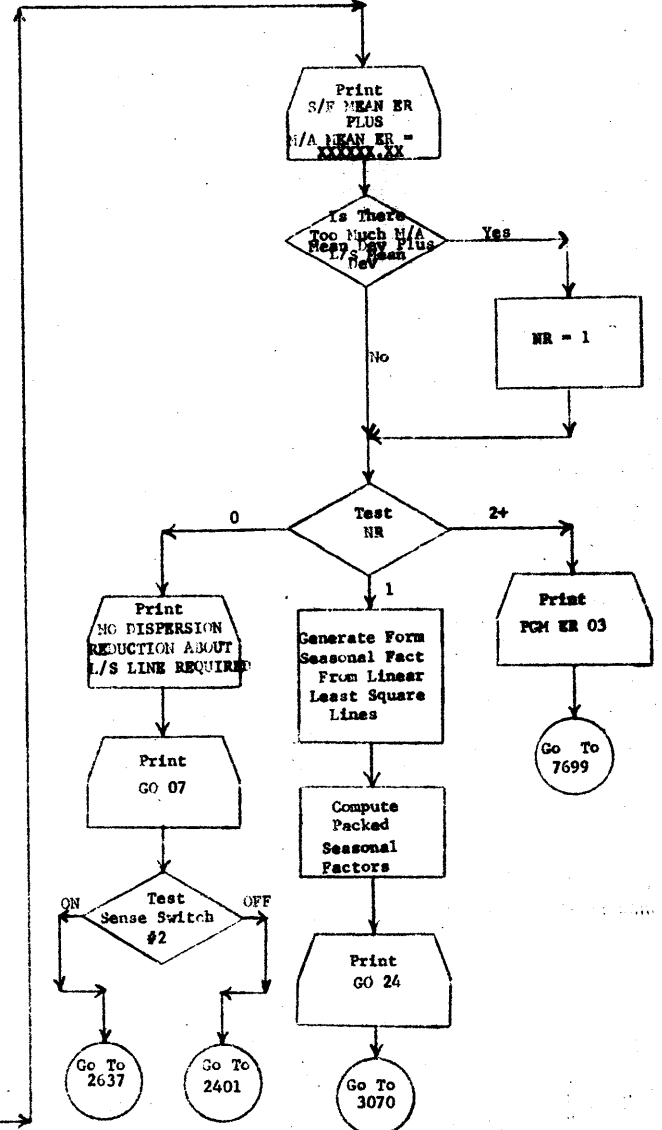
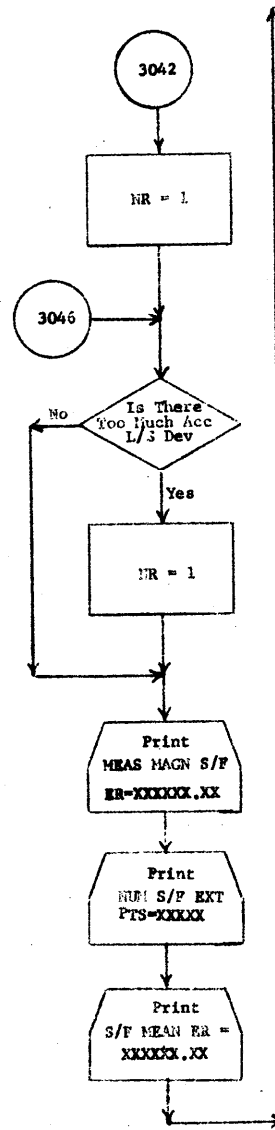
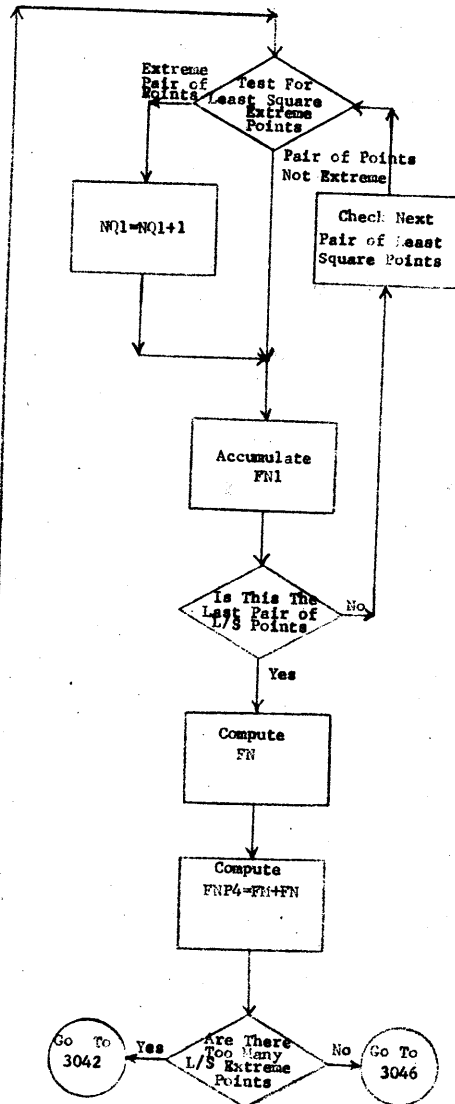
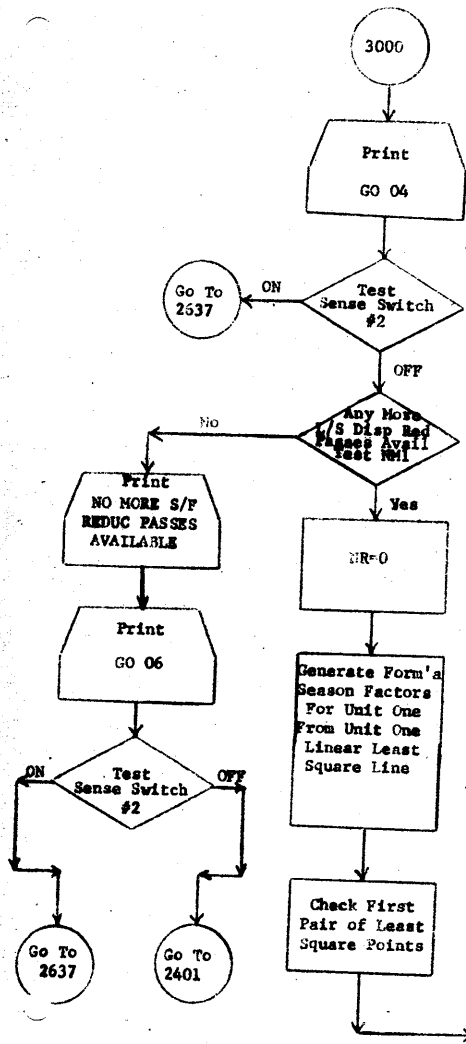
10.1 FLOW SUMMATION

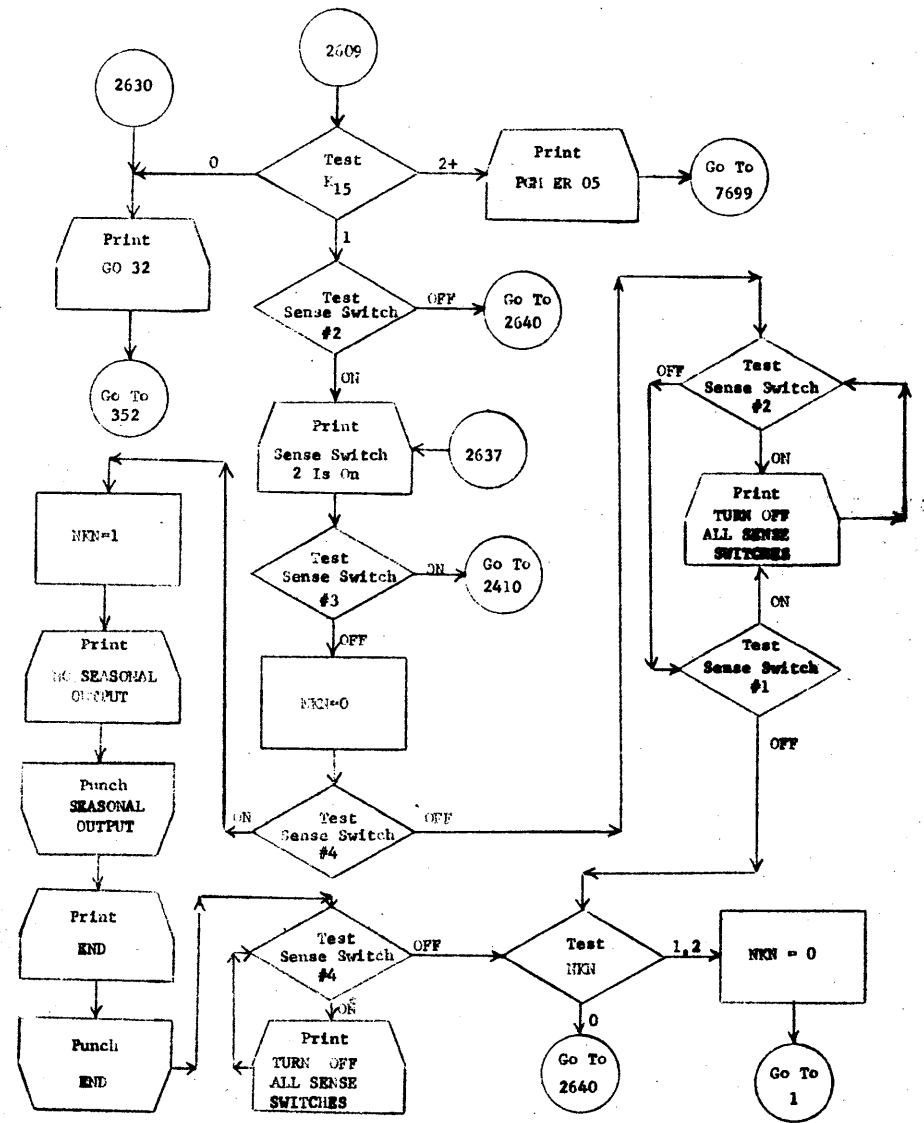
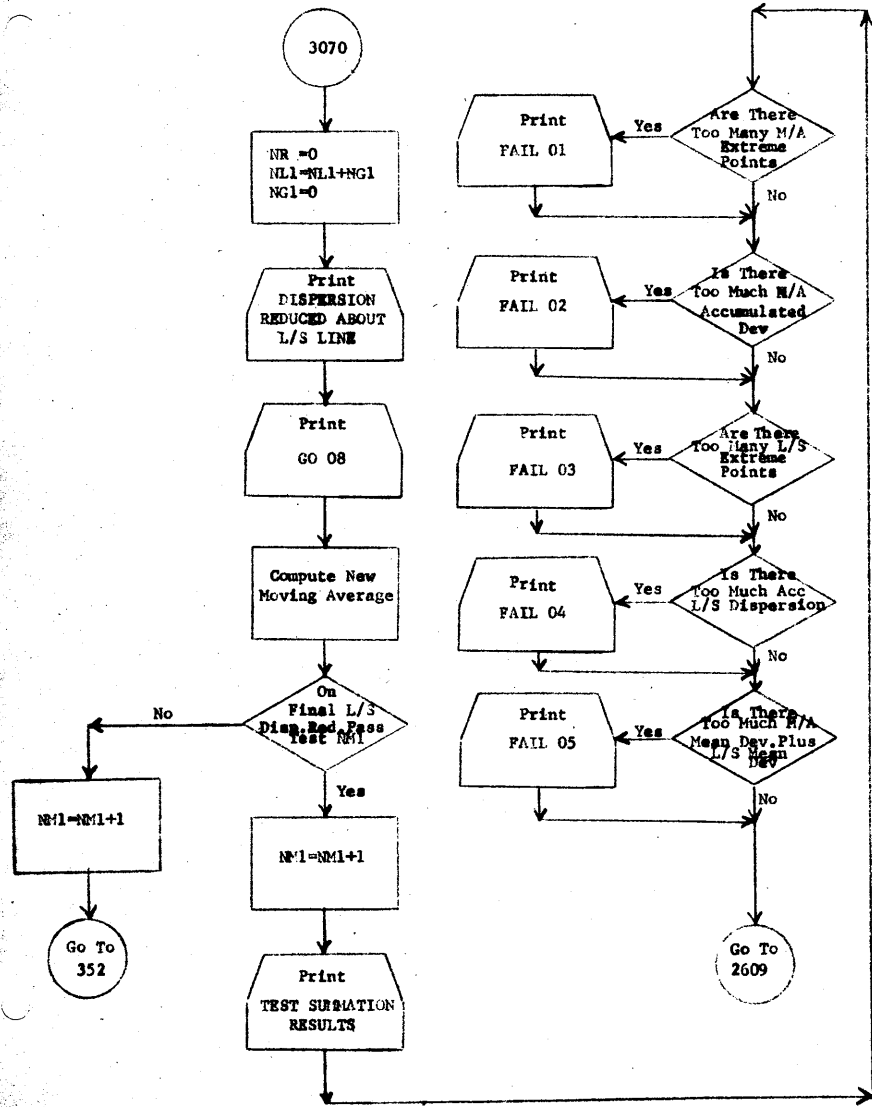


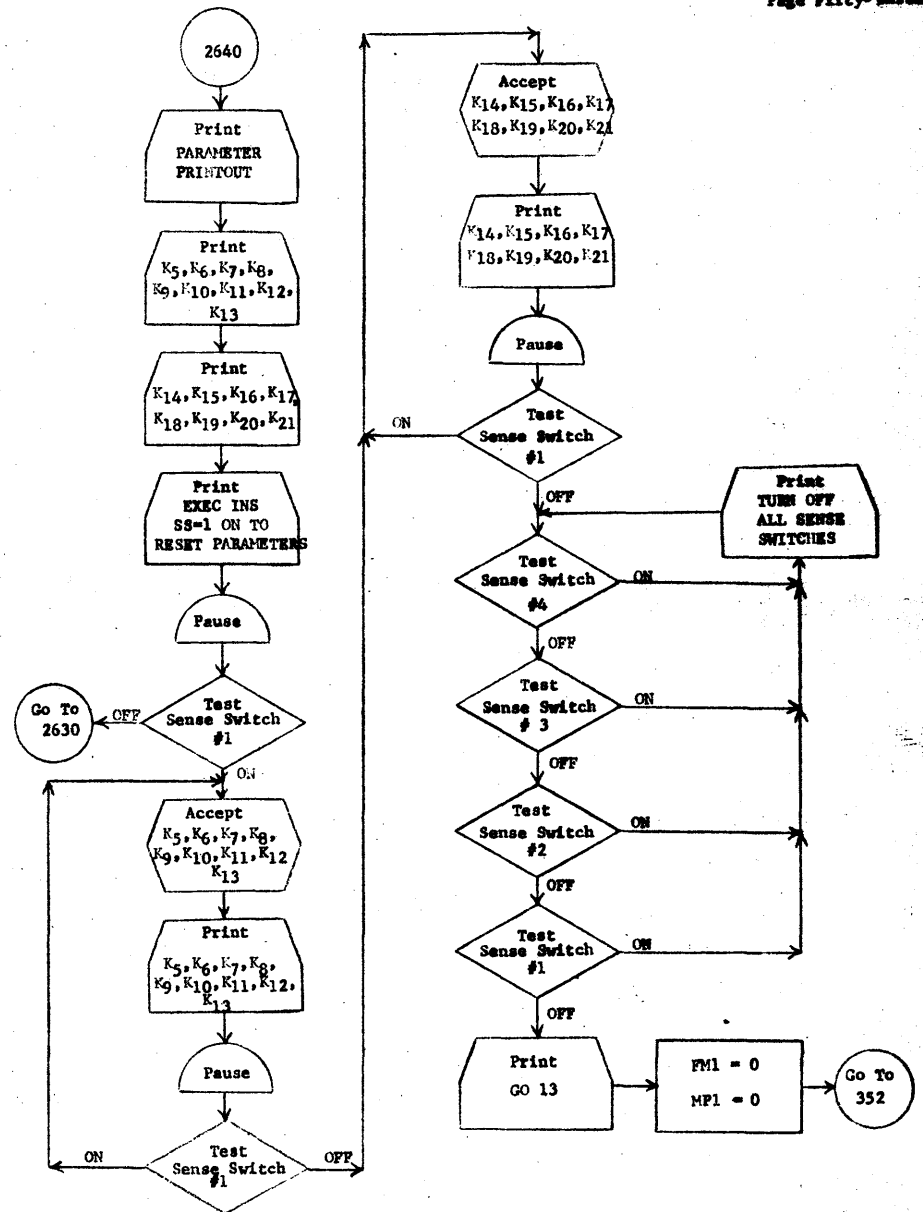
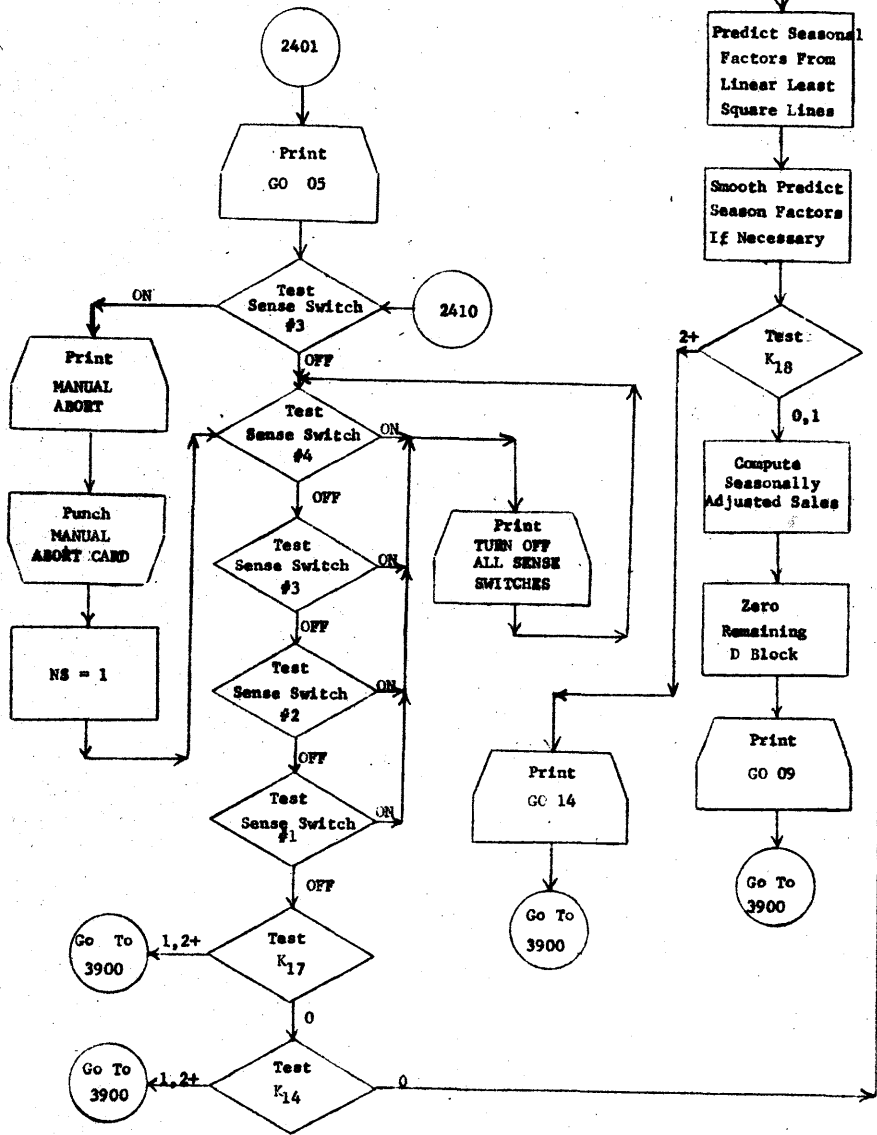
10.2 DETAILED FLOW DIAGRAM

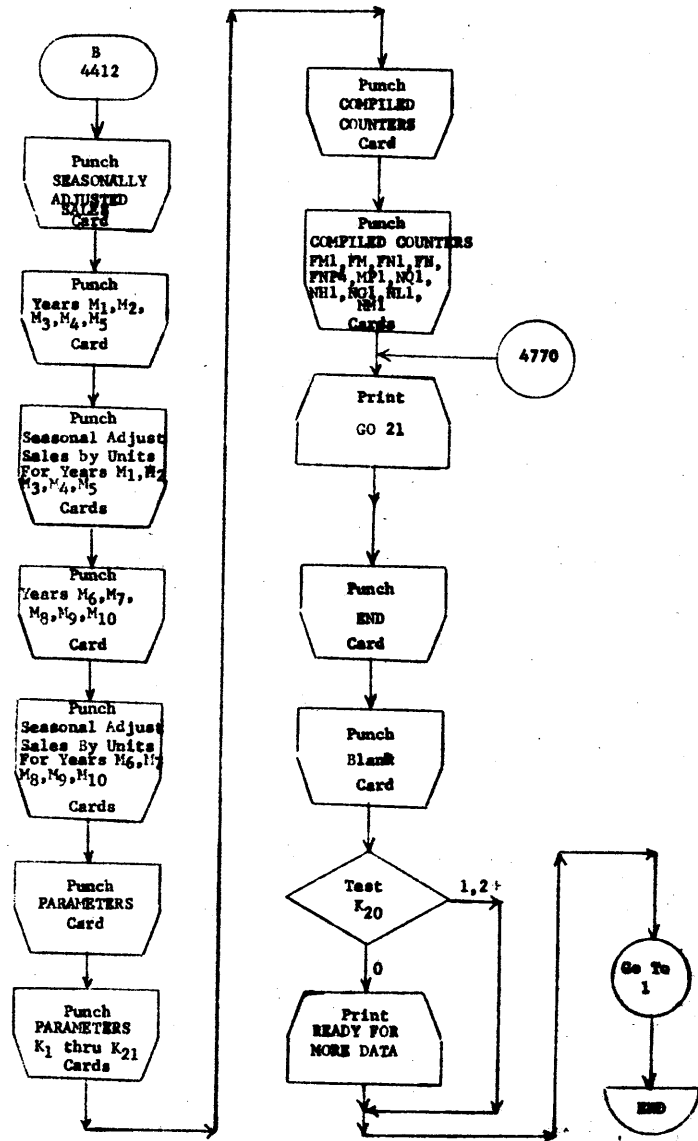
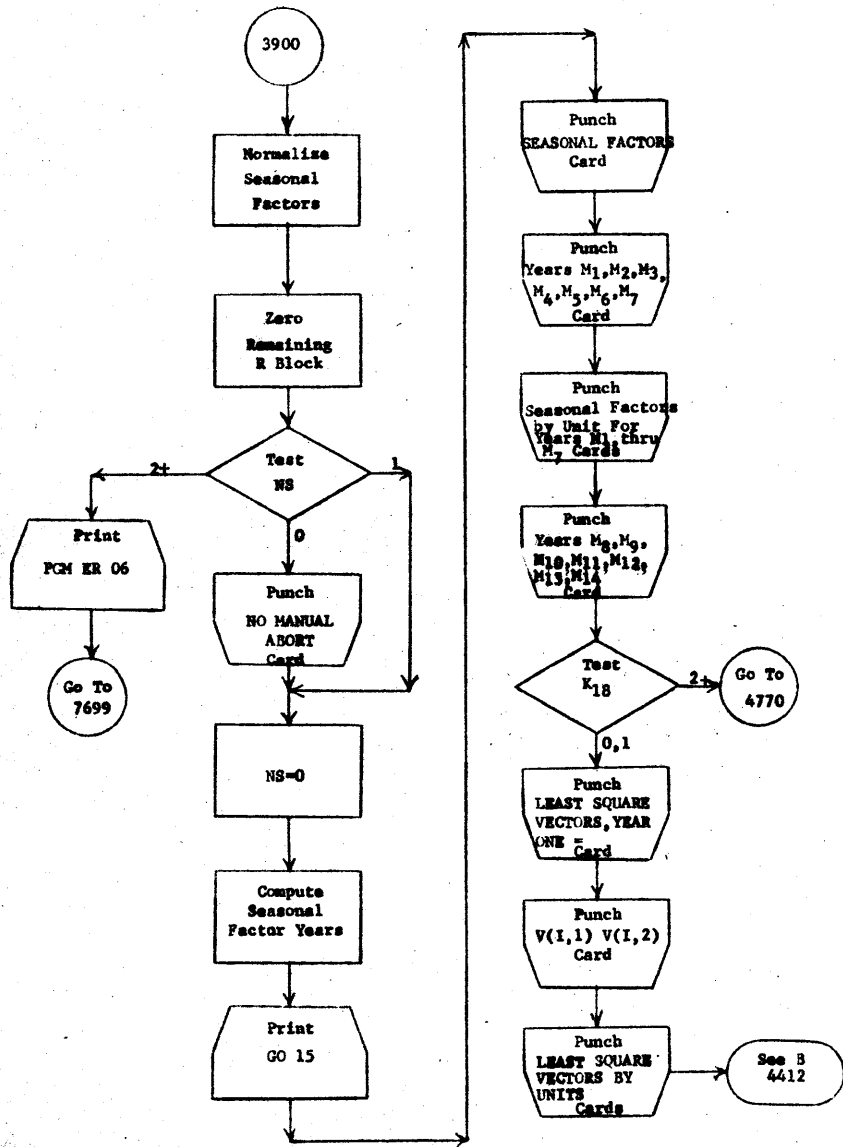












11.0 PORTMAN II LISTING

*0810

C SEASONAL ADJUSTMENT PROCEDURE BASED ON MOVING AVERAGE
 C TECHNIQUE, WHERE THE NUMBER OF UNITS GOING INTO THE
 C COMPILATION OF THE MOVING AVERAGE = THE NUMBER OF UNITS
 C INTO WHICH EACH YEAR IS DIVIDED
 C NO ATTEMPT MADE TO CENTER MOVING AVERAGE IN MIDDLE OF UNIT
 C APPROXIMATE SEASONAL FACTORS GENERATED FROM RAW DATA AND MOVING
 C AVERAGE
 C FOR EACH UNIT LINEAR LEAST SQUARE LINE FITTED TO APPROXIMATE
 C SEASONAL FACTORS
 C FORMULA LEAST SQUARE SEASONAL FACTORS GENERATED FOR EACH UNIT
 C SMOOTHED FOR EACH YEAR BY SIMPLE RATIO METHOD
 C NEW MOVING AVERAGE GENERATED FROM RAW DATA AND SEASONAL FACTORS
 C IF NEW MOVING AVERAGE DEVIATES TOO MUCH FROM OLD MOVING AVERAGE
 C GENERATE REVISED MOVING AVERAGE BY AVERAGING
 C GENERATE APPROXIMATE SEASONAL FACTORS AND REPEAT THE PROCESS AS
 C OFTEN AS NECESSARY
 C PREDICT AND SMOOTH SEASONAL FACTORS FOR FOUR YEARS INCLUDING
 C CURRENT YEAR
 C GENERATE SEASONALLY ADJUSTED SALES.
 C OPTIONAL SEASONAL FACTOR DISPERSION REDUCTION ROUTINE
 C OPTIONAL PARAMETER MANUAL INPUT ROUTINE
 C SEASONAL FACTORS, SEASONALLY ADJUSTED SALES, LEAST SQUARE VECTORS
 C INPUT PARAMETERS, AND COMPILED COUNTERS PUNCHED OUT
 C THIS SEASONAL ADJUSTMENT PROCEDURE IS APPLICABLE TO THE FOLLOWING
 C GENERALIZED UNITS - MONTHS, BIMONTHLY PERIODS, AND QUARTERS
 C THE EXTENT OF SEASONAL ADJUSTMENT IS DETERMINED BY CARD
 C INPUT PARAMETERS

C OPTIONAL SHORT CUT ROUTINE RESULTING ONLY IN S/F COMPUTED AND
 C PUNCHED OUT
 C MAXIMUM OF 11 YEARS OF RAW DATA INPUT (132 MONTHS OR 66 BIMONTHLY
 C PERIODS OR 44 QUARTERS). RAW DATA COMMENCES WITH LAST HALF OF YEAR
 C ZERO AND ENDS WITH FIRST HALF OF YEAR N+1, GIVEN THAT COMPLETE
 C DATA IS AVAILABLE FOR YEARS 1 THRU N.
 C ADJUSTED OUTPUT DATA FOR COMPLETE YEARS 1 THRU N BY UNITS
 C PREDICTED OUTPUT DATA FOR COMPLETE YEARS N+1 THRU N+4 BY UNITS
 C DIMENSION STATEMENTS
 DIMENSION D(132),A(120),R(169),w(120),b(120),V(12,2),K(21),M(14)
 C CARD COUNTER ASSIGNMENT
 1 LO=1
 C PRINT PROCESS BEGIN MESSAGE
 PRINT 7500
 7500 FORMAT(5HGO 23)
 C PARAMETER READ LOOP
 DO 10 I=1,21,6
 READ 20,K(I),K(I+1),K(I+2),K(I+3),K(I+4),K(I+5)
 10 CONTINUE
 20 FORMAT(6I10)
 C JOB NUMBER READ
 READ 2,JOB,JOB,LO
 2 FORMAT(11I10,45X,11I10,2X,114,1X)
 C TEST FOR PRINT BYPASS
 IF(K(20)-1)7600,7602,7604
 7600 PRINT 2,JOB
 7602 PUNCH 2,JOB,JOB,LO
 LO=LO+1

GO TO 7702

C PROGRAM ERROR PRINTOUT

7604 PRINT 7605

7605 FORMAT(9HPGM ER 10)

7699 PUNCH 7700,JOB,LO

7700 FORMAT(33HPROGRAM ERROR OUTPUT INCOMPLETE,22X,1I10,2X,1I4)

GO TO 1

C READ IDENTIFICATION CARD ONE

7702 READ 3,JOB,LO

3 FORMAT(39H ,16X,1I10,2X,1I4)

C TEST FOR PRINT BYPASS

IF(K(20)-1)7606,7608,7610

7606 PRINT 3

7608 PUNCH 3,JOB,LO

LO=LO+1

GO TO 7704

C PROGRAM ERROR PRINTOUT

7610 GO TO 7604

C READ IDENTIFICATION CARD TWO

7704 READ 4,JOB,LO

4 FORMAT(39H ,16X,1I10,2X,1I4)

C TEST FOR PRINT BYPASS

IF(K(20)-1)7612,7614,7616

7612 PRINT 4

7614 PUNCH 4,JOB,LO

LO=LO+1

GO TO 7706

C PROGRAM ERROR PRINTOUT

7616 GO TO 7604

C STORED PROGRAM INITIALIZATION

7706 NL1=0

NM1=0

NG1=0

NH1=0

MP1=0

FM1=0.

FM=0.

NQ1=0

FN1=0.

FN=0.

FNP4=0.

NS=0

C VARIABLE ASSIGNMENT

K2=K(2)

FK2=K2

K3=K(3)

FK3=K3

C MONS=ACTUAL UNITS OF RAW DATA

MONS=K2*K3

C MONSA=MONS-NUMBER OF UNITS IN YEAR(MOVING AVERAGE SUBSCRIPT LIMIT)

MONSA=MONS-K3

N1=MONSA+1

N2=MONSA+K(4)*K3

N3=N1+K3-1

L=K3/2

FK5=K(5)

FK5=FK5/1000.

FK6=K(6)

FK8=K(8)

FK8=FK8/1000.

FMA=MONSA

NZ=K(2)-1

ZN=NZ

C READ IN DATA TO BE SEASONALLY ADJUSTED LOOP

DO 64 I=1,MONS,L

C D(I)=RAW DATA

READ 68,D(I),D(I+1),D(I+2),D(I+3),D(I+4),D(I+5)

64 CONTINUE

68 FORMAT(6F10.0)

C COMPUTE MOVING AVERAGE

C A(1)=INITIAL SUBTOTAL OF RAW DATA D(J)

C COMPUTE INITIAL SUBTOTAL LOOP

A(1)=0.

DO 200 J=1,K3,1

A(1)=A(1)+D(J)

200 CONTINUE

C COMPUTE MOVING SUBTOTAL LOOP

C A(I)=MOVING SUBTOTAL

DO 225 I=2,MONSA,1

J=I-1+K3

A(I)=A(I-1)+D(J)-D(I-1)

225 CONTINUE

DO 250 I=1,MONSA,1

C COMPUTE MOVING AVERAGE LOOP

```
C   A(I)=MOVING AVERAGE
      A(I)=A(I)/FK3
250 CONTINUE
C   SENSE SWITCH =2 ON MEANS TEST FOR MANUAL ABORT OR TEST NO SEASONAL
C   OUTPUT OR GO TO MANUAL INPUT BLOCK
C   SENSE SWITCH =2 OFF MEANS CONTINUE ITERATION
260 IF(SENSE SWITCH 2)2637,325
C   COMPUTE APPROXIMATE SEASONAL FACTORS
C   R(J)=APPROXIMATE SEASONAL FACTOR.   D(JJ)=RAW DATA
C   R(J) CORRESPONDS TO D(JJ) AND A(J).  A(J)=MOVING AVERAGE
325 DO 350 J=1,MONSA,1
      JJ=J+L
      R(J)=D(JJ)/A(J)
350 CONTINUE
352 PRINT 355
355 FORMAT(5HGO 11)
C   TEST FOR BYPASSING LEAST SQUARES FIT OF SEASONAL FACTORS
      IF(K(17)-1)375,362,375
362 PRINT 364
364 FORMAT(5HGO 30)
      GO TO 625
C   COMPUTE LINEAR LEAST SQUARES FIT OF SEASONAL FACTORS FOR EACH UNIT
C   ZX1=SUM OF X, WHERE X=YEAR NUMBER
C   ZX2=SUM OF X SQUARED
C   ZY1=SUM OF Y, WHERE Y=SEASONAL FACTOR
C   ZX1Y1=SUM OF XY
C   R(J)=APPROXIMATE SEASONAL FACTOR
C   V(I,1)=AA VECTOR FOR CONSTANT TERM
```

C V(I,2)=BB VECTOR FOR COEFFICIENT OF INDEPENDENT VARIABLE

375 IF(K(14)-1)390,390,380

380 PRINT 382

382 FORMAT(5HGO 50)

GO TO 625

390 PRINT 392

392 FORMAT(5HGO 40)

GO TO 395

395 ZX1=0.

ZX2=0.

C SUM OF X AND SUM OF X SQUARED LOOP

DO 400 J=1,NZ,1

ZX=J

ZX1=ZX1+ZX

ZX2=ZX2+ZX*ZX

400 CONTINUE

C SUM OF Y AND SUM OF XY OUTSIDE LOOP INCREMENT UNITS

DO 500 I=1,K3,1

ZY1=0.

ZX1Y1=0.

X1=0.

C SUM OF Y AND SUM OF XY INSIDE LOOP COMPUTE FOR EACH UNIT

DO 450 J=I,MONSA,K3

ZY1=ZY1+R(J)

X1=X1+1.

ZX1Y1=ZX1Y1+X1*R(J)

450 CONTINUE

C NZ=NUMBER OF YEARS OF SEASONAL FACTORS

```

C      ZN=NZ
      AA=(ZY1*ZX2-ZX1Y1*ZX1)/(ZN*ZX2-ZX1*ZX1)
      BB=(ZN*ZX1Y1-ZY1*ZX1)/(ZN*ZX2-ZX1*ZX1)
      V(I,1)=AA
      V(I,2)=BB
500 CONTINUE
C      GENERATION OF SEASONAL FACTORS BY VECTORS V(I,1) AND V(I,2)
C      R(J)=LEAST SQUARE SEASONAL FACTOR
C      YR=YEAR NUMBER
C      L/S S/F GENERATION OUTSIDE LOOP
      DO 600 I=1,K3,1
      YR=0.
C      L/S S/F GENERATION INSIDE LOOP
      DO 550 J=I,MONSA,K3
      YR=YR+1.
      R(J)=V(I,1)+V(I,2)*YR
550 CONTINUE
600 CONTINUE
C      R(J)=UNSMOOTHED SEASONAL FACTOR
C      ZYR=SUM OF UNSMOOTHED SEASONAL FACTORS FOR A GIVEN YEAR
C      SMOOTH R(J)          OUTSIDE LOOP          INCREMENT YEARS
625 DO 1094 I=1,MONSA,K3
      ZYR=0.
      MONSC=I+K3-1
C      COMPUTE ZYR          INSIDE ADDING LOOP          COMPUTE FOR EACH YEAR
      DO 650 J=I,MONSC,1
      ZYR=ZYR+R(J)
650 CONTINUE

```

```
C TEST TO DETERMINE IF SMOOTHING IS NECESSARY
  IF(ZYR-FK3)1091,1093,1091

C SZYR=SMOOTHING FACTOR
  1091 SZYR=(FK3-ZYR)/ZYR

C SMOOTH R(J) INSIDE LOOP FACTORS IN A GIVEN YEAR
  DO 1092 J=1,MONSC,1
  R(J)=R(J)+R(J)*SZYR

C R(J)=SMOOTHED SEASONAL FACTOR
  1092 CONTINUE

C NO SMOOTHING NECESSARY R(J)=SMOOTHED SEASONAL FACTOR
  1093 CONTINUE

  1094 CONTINUE

C SENSE SWITCH =2 ON MEANS TEST FOR MANUAL ABORT OR TEST NO SEASONAL
C OUTPUT OR GO TO MANUAL INPUT BLOCK
C SENSE SWITCH =2 OFF MEANS CONTINUE ITERATION
  1095 IF(SENSE SWITCH 2)2637,1096

C TEST FOR PUNCH ROUTINE
  1096 IF(K(17)-1)1098,3900,3900

C INCREMENT MOVING AVERAGE PASS COUNTER,NH1,BY ONE
  1098 NH1=NH1+1

C FM2=MEASUREMENT OF MAGNITUDE OF MOVING AVERAGE ERROR.
C FM1=RUNNING SUBTOTAL OF FM2
  FM1=0.

C MP1=NUMBER OF EXTREME MOVING AVERAGE ERROR POINTS
  MP1=0

C FM1=SQRT(FM2) FM=MEAN FM1 FMA=MONSA
C MOVING AVERAGE RE-COMPILATION LOOP
C R(J) = SMOOTHED SEASONAL FACTOR B(J)=NEW MOVING AVERAGE
```

```
C      W(J) = MOVING AVERAGE ERROR
C      FIRST A(J)=OLD MOVING AVERAGE   SECOND A(J)=REVISED MOVING AVERAGE
C      D(JJ)=RAW DATA
1130 DO 1160 J=1,MONSA,1
      JJ=J+L
      B(J)=D(JJ)/R(J)
      W(J)=(B(J)-A(J))/A(J)
      A(J)=A(J)-(A(J)-B(J))/2.
C      CALCULATIONS FOR MOVING AVERAGE ERROR PRINTOUT
      IF(W(J))1132,1140,1140
1132 IF(W(J)+FK5)1135,1150,1150
1135 MP1=MP1+1
      GO TO 1150
1140 IF(W(J)-FK5)1150,1150,1135
1150 FM2=1000000.*W(J)*W(J)
      FM2=SQRTF (FM2)
      FM1=FM1+FM2
1160 CONTINUE
      FM=FM1/FMA
C      MOVING AVERAGE ERROR PRINTOUTS
      PRINT 1127,FM1
1127 FORMAT(19HMEAS MAGN M/A ER = ,1F10.2)
      PRINT 1128,MP1
1128 FORMAT(18HNUM M/A EXT PTS = ,1I5)
      PRINT 1129,FM
1129 FORMAT(14HM/A MEAN ER = ,1F10.2)
C      TEST NUMBER OF EXTREME MOVING AVERAGE POINTS
      M11=FM1
```

```
IF(MP1-K(10))1165,1165,1170
C TEST SQUARE ROOT OF MAGNITUDE OF MOVING AVERAGE ERROR
1165 IF(M11-K(12))1190,1190,1170
C ONE AND/OR BOTH MOVING AVERAGE TESTS FAIL. TEST NUMBER OF MOVING
C AVERAGE PASSES
1170 IF(NH1-K(6))1180,1195,1195
C AT LEAST ONE MOVING AVERAGE PASS AVAILABLE.
C COMPUTE NEW SEASONAL FACTORS
1180 PRINT 1181
1181 FORMAT(5HGO 03)
GO TO 260
C BOTH MOVING AVERAGE TESTS OK. PROCEED TO DISPERSION SMOOTH TEST.
1190 PRINT 1191
1191 FORMAT(5HGO 01)
GO TO 1100
C AT LEAST ONE MOVING AVERAGE TEST FAILS. NO MORE PASSES AVAILABLE.
C PROCEED TO DISPERSION SMOOTH TEST
1195 PRINT 1196
1196 FORMAT(17HM/A FAILS GO 02)
GO TO 1100
C TEST INDICATOR K(14). IF ON,NORMALIZE SEASONAL FACTORS AND PUNCH
1100 IF(K(14)-1)1120,1101,1120
1101 NS=0
PRINT 1102
1102 FORMAT(5HGO 25)
GO TO 3900
C RE-SET PARAMETERS BY PROGRAM CONTROL
1120 NG1=NG1+NH1
```

NH1=0

K(6)=K(7)

GO TO 2400

C TEST DISPERSION SMOOTH INDICATOR

2400 IF(K(18)-1)2401,3000,2401

C DISPERSION SMOOTH INDICATOR OFF.

2401 PRINT 2402

2402 FORMAT(5HGO 05)

C TEST FOR MANUAL ABORT

2410 IF(SENSE SWITCH 3)2417,2411

2411 IF(SENSE SWITCH 4)2415,2412

2412 IF(SENSE SWITCH 3)2415,2413

2413 IF(SENSE SWITCH 2)2415,2414

2414 IF(SENSE SWITCH 1)2415,2420

2415 PRINT 2416

2416 FORMAT(27HTURN OFF ALL SENSE SWITCHES)

GO TO 2411

2417 PRINT 2418

2418 FORMAT(12HMANUAL ABORT,43X,1I10,2X,1I4)

C PUNCH CARD INDICATING MANUAL ABORT

2419 PUNCH 2418,JOB,LO

LO=LO+1

C SET NS INDICATOR TO ONE FOR BY-PASSING BLANK PUNCH

NS=1

GO TO 2411

C SEASONAL FACTOR PREDICTION OUTSIDE LOOP. INCREMENT UNITS

2420 IF(K(17)-1)2421,3900,3900

2421 IF(K(14)-1)2422,3900,3900


```
2422 DO 2430 I=1,K3,1
      YR=K(2)-1
C     SEASONAL FACTOR PREDICTION INSIDE LOOP.  UNITS FOR EACH YEAR
      NMN=MONSA+I
      DO 2425 J=NMN,N2,K3
      YR=YR+1.
      R(J)=V(I,1)+V(I,2)*YR
2425 CONTINUE
2430 CONTINUE
C     PREDICT SEASONAL FACTORS FOR FOUR YEARS, INCLUDING CURRENT YEAR
C     SEASONAL FACTOR PREDICTION SMOOTH OUTSIDE LOOP.  INCREMENT YEARS
2525 DO 2570 I=N1,N2,K3
C     ZYR=SUM OF PREDICTED SEASONAL FACTORS FOR A GIVEN YEAR
      ZYR=0.
      MONSC=I+K3-1
C     R(J)=PREDICTED SEASONAL FACTORS
C     SEASONAL FACTOR PREDICTION SMOOTH INSIDE LOOP.  UNITS FOR EACH YEAR
      DO 2530 J=I,MONSC,1
      ZYR=ZYR+R(J)
2530 CONTINUE
      IF(ZYR-FK3)2555,2565,2555
2555 SZYR=(FK3-ZYR)/ZYR
C     SMOOTHING LOOP, WHERE SZYR=SMOOTHING FACTOR
      DO 2560 J=I,MONSC,1
      R(J)=R(J)+R(J)*SZYR
2560 CONTINUE
2565 CONTINUE
2570 CONTINUE
```

```
C    TEST FOR SEASONAL ADJUSTMENT CALCULATION
      IF(K(18)-1)2680,2680,2695
C    COMPUTE SEASONALLY ADJUSTED SALES
C    D(J)=SEASONALLY ADJUSTED SALES
C    D(JJ)=RAW DATA
C    R(J)=SEASONAL FACTORS
C    SEASONALLY ADJUSTED SALES LOOP
2680 DO 2685 J=1,MONSA,1
      JJ=J+L
      D(J)=D(JJ)/R(J)
2685 CONTINUE
C    ZERO REMAINING D BLOCK
      DO 2800 J=N1,132,1
      D(J)=0.
2800 CONTINUE
      PRINT 2690
2690 FORMAT(5HGO 09)
      GO TO 3900
C    DO NOT COMPUTE SEASONALLY ADJUSTED SALES
2695 PRINT 2696
2696 FORMAT(5HGO 14)
      GO TO 3900
C    DISPERSION SMOOTH ROUTINE TO REDUCE SEASONAL FACTOR DISPERSION
3000 PRINT 3001
3001 FORMAT(5HGO 04)
C    SENSE SWITCH =2 ON MEANS TEST FOR MANUAL ABORT OR TEST NO SEASONAL
C    OUTPUT OR GO TO MANUAL INPUT BLOCK
C    SENSE SWITCH =2 OFF MEANS CONTINUE ITERATION
```

```
3002 IF(SENSE SWITCH 2)2637,3003
C   TEST NUMBER OF LEAST SQUARES DISPERSION REDUCTION PASSES
3003 IF(NM1-K(9))3004,3004,3120
C   COMPARE SMOOTHED SEASONAL FACTORS WITH LEAST SQUARE LINES
C   CHECK DISPERSION ERRORS FOR ONE UNIT ONLY BECAUSE THE SAME
C   RESULTS APPLY TO EACH UNIT (SEE SMOOTHING TECHNIQUE)
3004 YR=0.
      NR=0
C   LEAST SQUARE SEASONAL FACTOR LOOP
C   B(J)=LEAST SQUARE SEASONAL FACTORS GENERATED FROM VECTORS V(I,1)
C   AND V(I,2)
      DO 3005 J=1,MONSA,K3
      YR=YR+1.
      B(J)=V(1,1)+V(1,2)*YR
3005 CONTINUE
C   SEASONAL FACTOR DISPERSION ERROR CALCULATION LOOP
C   W(J)=SEASONAL FACTOR DISPERSION ERRORS
C   R(J)=SMOOTHED SEASONAL FACTORS
      DO 3010 J=1,MONSA,K3
      W(J)=(B(J)-R(J))/B(J)
3010 CONTINUE
C   SEASONAL FACTOR DISPERSION ERROR DISCRIMINATION LOOP
C   FN2=MEASUREMENT OF MAGNITUDE OF DISPERSION ERROR
C   FN1=RUNNING SUBTOTAL OF FN2
      FN1=0.
C   NQ1=NUMBER OF EXTREME DISPERSION POINTS
      NQ1=0
C   FN=MEAN FN1
```

```
DO 3020 J=1,MONSA,K3
  IF(W(J))3011,3014,3014
3011 IF(W(J)+FK8)3012,3016,3016
3012 NQ1=NQ1+1
      GO TO 3016
3014 IF(W(J)-FK8)3016,3016,3012
3016 FN2=1000000.*W(J)*W(J)
      FN2=SQRTF (FN2)
      FN1=FN1+FN2
3020 CONTINUE
      FN=FN1/ZN
      N11=FN1
C      FNP4=SUM OF MEANS OF MAGNITUDES OF MOVING AVERAGE ERROR AND L/S
C      DISPERSION ERROR
      FNP4=FM+FN
      NP4=FNP4
C      TEST NUMBER OF SEASONAL FACTOR EXTREME POINTS
      IF(NQ1-K(11))3023,3023,3022
3022 NR=1
C      TEST MAGNITUDE OF SEASONAL FACTOR DISPERSION ERROR
3023 IF(N11-K(13))3025,3025,3024
3024 NR=1
C      SEASONAL FACTOR DISPERSION PRINTOUT
3025 PRINT 3035, FN1
3035 FORMAT(19HMEAS MAGN S/F ER = ,1F10.2)
      PRINT 3036, NQ1
3036 FORMAT(18HNUM S/F EXT PTS = ,1I5)
      PRINT 3037, FN
```

```
3037 FORMAT(14HS/F MEAN ER = ,1F10.2)
      PRINT 3040,FNP4
3040 FORMAT(31HS/F MEAN ER PLUS M/A MEAN ER = ,1F10.2)
C     TEST NP4
      IF(NP4-K(19))3046,3046,3042
3042 NR=1
C     SEASONAL FACTOR CORRECTION TEST
3046 IF(NR-1)3060,3048,3055
C     OUTSIDE L/S S/F GENERATION LOOP
C     B(J)=LEAST SQUARE SEASONAL FACTORS GENERATED FROM VECTORS V(I,1)
C     AND V(I,2)
3048 DO 7660 I=1,K3,1
      YR=0.
C     INSIDE L/S S/F GENERATION LOOP
      DO 7650 J=1,MONSA,K3
      YR=YR+1.
      B(J)=V(I,1)+V(I,2)*YR
7650 CONTINUE
7660 CONTINUE
C     SEASONAL FACTOR CORRECTION OUTSIDE LOOP.      INCREMENT UNITS
      DO 3050 I=1,K3,1
      YR=0.
C     SEASONAL FACTOR CORRECTION INSIDE LOOP.      INCREMENT YEARS
      DO 3049 J=1,MONSA,K3
      YR=YR+1.
C     PACK SEASONAL FACTORS CLOSER TO THE LEAST SQUARES LINE
C     B(J)=LEAST SQUARE SEASONAL FACTORS GENERATED FROM VECTORS V(I,1)
C     AND V(I,2)
```

```
C      OLD R(J)=SMOOTHED SEASONAL FACTORS
C      NEW R(J)=PACKED SEASONAL FACTORS
      R(J)=R(J)+(B(J)-R(J))/2.
3049 CONTINUE
3050 CONTINUE
3051 PRINT 3052
3052 FORMAT(5HGO 24)
      GO TO 3070
C      PROGRAM ERROR PRINTOUT
3055 PRINT 3056
3056 FORMAT(9HPGM ER 03)
      GO TO 7699
C      SEASONAL FACTOR DISPERSION ERROR UNDER CONTROL
3060 PRINT 3062
3062 FORMAT(47HNO DISPERSION REDUCTION ABOUT L/S LINE REQUIRED)
      PRINT 3063
3063 FORMAT(5HGO 07)
C      SENSE SWITCH =2 ON MEANS TEST FOR MANUAL ABORT OR TEST NO SEASONAL
C      OUTPUT OR GO TO MANUAL INPUT BLOCK
C      SENSE SWITCH =2 OFF MEANS CONTINUE ITERATION
3064 IF(SENSE SWITCH 2)2637,2401
3070 NR=0
C      RE-SET PARAMETERS BY PROGRAM CONTROL
3075 NL1=NL1+NG1
      NG1=0
C      PRINT INDICATION OF DISPERSION REDUCTION
      PRINT 3080
3080 FORMAT(33HDISPERSION REDUCED ABOUT L/S LINE)
```

```
PRINT 3115
3115 FORMAT(5HGO 08)
C COMPUTE NEW MOVING AVERAGE BASED ON PACKED SEASONAL FACTORS
C AND RAW DATA
C R(J)=PACKED SEASONAL FACTORS
C D(JJ)=RAW DATA
C NEW A(J)=REVISED MOVING AVERAGE
C OLD A(J)=OLD MOVING AVERAGE
C NEW MOVING AVERAGE LOOP
DO 3119 J=1,MONSA,1
JJ=J+L
A(J)=D(JJ)/R(J)
3119 CONTINUE
IF(NM1-K(9))3110,2600,2600
3110 NM1=NM1+1
GO TO 352
3120 PRINT 3121
3121 FORMAT(34HNO MORE S/F REDUC PASSES AVAILABLE)
PRINT 3122
3122 FORMAT(5HGO 06)
GO TO 3064
C TEST SUMMATION
2600 NM1=NM1+1
NP4=FNP4
PRINT 2601
2601 FORMAT(22HTEST SUMMATION RESULTS)
C TEST NUMBER OF EXTREME MOVING AVERAGE POINTS
IF(MP1-K(10))2602,2602,2611
```

```
C    TEST MAGNITUDE OF MOVING AVERAGE ERROR
2602 IF(M11-K(12))2603,2603,2614

C    TEST NUMBER OF L/S DISPERSION EXTREME POINTS
2603 IF(NQ1-K(11))2604,2604,2618

C    TEST MAGNITUDE OF L/S DISPERSION ERROR
2604 IF(N11-K(13))2605,2605,2622

C    TEST SUM OF MEANS OF MAGNITUDES OF M/A AND L/S DISPERSION ERRORS
2605 IF(NP4-K(19))2609,2609,7000
2609 IF(K(15)-1)2630,2636,2633
2611 PRINT 2612
2612 FORMAT(7HFAIL 01)
      GO TO 2602
2614 PRINT 2616
2616 FORMAT(7HFAIL 02)
      GO TO 2603
2618 PRINT 2620
2620 FORMAT(7HFAIL 03)
      GO TO 2604
2622 PRINT 2624
2624 FORMAT(7HFAIL 04)
      GO TO 2605
7000 PRINT 7002
7002 FORMAT(7HFAIL 05)
      GO TO 2609
2630 PRINT 2631
2631 FORMAT(5HGO 32)
      GO TO 352

C    PROGRAM ERROR PRINTOUT
```



```
2633 PRINT 2634
2634 FORMAT(9HPGM ER 05)
      GO TO 7699
C     SENSE SWITCH =2 ON MEANS TEST FOR MANUAL ABORT OR TEST NO SEASONAL
C     OUTPUT OR GO TO MANUAL INPUT BLOCK
2636 IF(SENSE SWITCH 2)2637,2640
2637 PRINT 2638
2638 FORMAT(20HSENSE SWITCH 2 IS ON)
C     TEST FOR MANUAL ABORT
      IF (SENSE SWITCH 3) 2410,1500
C     TEST FOR NO SEASONAL OUTPUT
1500 NKN=0
      IF(SENSE SWITCH 4) 1518,1514
1505 PRINT 1508
1508 FORMAT(27HTURN OFF ALL SENSE SWITCHES)
1514 IF(SENSE SWITCH 2)1505,1516
1516 IF(SENSE SWITCH 1)1505,1550
1518 NKN=1
      PRINT 1520
1520 FORMAT(18HNO SEASONAL OUTPUT,37X,1I10,2X,1I4,1X)
      PUNCH 1520,JOB,LO
      LO=LO+1
      PRINT 5010
      PUNCH 5010,JOB,LO
1530 IF(SENSE SWITCH 4)1540,1550
1540 PRINT 1508
      GO TO 1530
1550 IF(NKN-1)2640,1560 ,1560
```

```
1560 NKN=0
      GO TO 1
C     DECISION FOR CONTINUING TO ITERATE OR FOR TERMINATING ITERATION
2640 PRINT 2642
2642 FORMAT(18HPARAMETER PRINTOUT)
      PRINT 2644,K(5),K(6),K(7),K(8),K(9),K(10),K(11),K(12),K(13)
2644 FORMAT(7I7,2I8)
      PRINT 2646,K(14),K(15),K(16),K(17),K(18),K(19),K(20),K(21)
2646 FORMAT(5I5,1I7,2I6)
2650 PRINT 2652
2652 FORMAT(39HEXEC INS  SS =1 ON TO RESET PARAMETERS)
      PAUSE
C     IF CONTINUE ITERATION,RE-SET PARAMETERS BY MANUAL INPUTS
C     IF TERMINATE ITERATION, PREDICT SEASONAL FACTORS
C     SENSE SWITCH =1 ON MEANS CONTINUE ITERATION
C     SENSE SWITCH =1 OFF MEANS TERMINATE ITERATION
      IF(SENSE SWITCH 1)2660,2630
2660 ACCEPT 2662,K(5),K(6),K(7),K(8),K(9),K(10),K(11),K(12),K(13)
2662 FORMAT(7I7,2I8)
      PRINT 2662,K(5),K(6),K(7),K(8),K(9),K(10),K(11),K(12),K(13)
      PAUSE
C     SENSE SWITCH 1 ON MEANS ERROR
      IF(SENSE SWITCH 1)2660,2668
2668 ACCEPT 2670,K(14),K(15),K(16),K(17),K(18),K(19),K(20),K(21)
2670 FORMAT(5I5,1I7,2I6)
      PRINT 2670,K(14),K(15),K(16),K(17),K(18),K(19),K(20),K(21)
      PAUSE
C     SENSE SWITCH 1 ON MEANS ERROR
```

```
      IF(SENSE SWITCH 1)2668,2692
2692 IF(SENSE SWITCH 4)2689,2686
2686 IF(SENSE SWITCH 3)2689,2687
2687 IF(SENSE SWITCH 2)2689,2688
2688 IF(SENSE SWITCH 1)2689,2693
2689 PRINT 2416
      GO TO 2692
2693 PRINT 2698
2698 FORMAT(5HGO 13)
C      ITERATE THROUGH PROCEDURE AGAIN
C      RESET MOVING AVERAGE COUNTERS
      FM1=0.
      MP1=0
      GO TO 352
C      NORMALIZE SEASONAL FACTORS BY GENERATING R(I)=100R(I)
C      NEW R(I)=NORMALIZED SEASONAL FACTORS
C      OLD R(I)=UN-NORMALIZED SEASONAL FACTORS
C      NORMALIZE SEASONAL FACTOR LOOP
3900 DO 3910 I=1,N2,1
      R(I)=R(I)*100.
3910 CONTINUE
C      ZERO REMAINING POSITIONS IN TABLE R, IF ANY EXIST
C      ZERO LOOP
      J=N2+1
      DO 3912 I=J,169,1
      R(I)=0.
3912 CONTINUE
      IF(NS-1)3914,4000,3917
```

```
C      PUNCH CARD INDICATING NO MANUAL ABORT
3914 PUNCH 3915,JOB,LO
3915 FORMAT(15HNO MANUAL ABORT,40X,1I10,2X,1I4)
      LO=LO+1
      GO TO 4000
C      PROGRAM ERROR PRINTOUT
3917 PRINT 3918
3918 FORMAT(9HPGM ER 06)
      GO TO 7699
C      SET NS=0
4000 NS=0
C      SEASONAL FACTOR PUNCH ROUTINE FOLLOWS
C      YEAR HEADING EDITING LOOP
C      M(I)=YEAR
4005 DO 4010 I=1,14,1
      M(I)=K(1)+I
4010 CONTINUE
C      PRINT OUTPUT COMMENCE MESSAGE
      PRINT 4011
4011 FORMAT(5HGO 15)
C      SEASONAL FACTOR HEADING PUNCH
      PUNCH 4012,JOB,LO
4012 FORMAT(16HSEASONAL FACTORS,39X,1I10,2X,1I4,1X)
      LO=LO+1
      PUNCH 4015,M(1),M(2),M(3),M(4),M(5),M(6),M(7),JOB,LO
4015 FORMAT(1I10,6I7,3X,1I10,2X,1I4)
C      UNITS MARGIN LOOP
C      LI=PARTICULAR UNIT CORRESPONDING TO A PARTICULAR YEAR
```

C R(LI)=SEASONAL FACTOR CORRESPONDING TO LI

4016 DO 4100 N=1,K3,1

L1=(N-1)+1

L2=L1+K3

L3=L2+K3

L4=L3+K3

L5=L4+K3

L6=L5+K3

L7=L6+K3

LO=LO+1

PUNCH 4017,N,R(L1),R(L2),R(L3),R(L4),R(L5),R(L6),R(L7),JOB,LO

4017 FORMAT(1I3,7F7.2,3X,1I10,2X,1I4,1X)

4100 CONTINUE

LO=LO+1

PUNCH 4120,M(8),M(9),M(10),M(11),M(12),M(13),M(14),JOB,LO

4120 FORMAT(1I10,6I7,3X,1I10,2X,1I4)

4150 N=0

NN11=L7+1

KK33=L7+K3

DO 4199 JJJ=NN11,KK33,1

N=N+1

L1=(JJJ-1)+1

L2=L1+K3

L3=L2+K3

L4=L3+K3

L5=L4+K3

L6=L5+K3

L7=L6+K3

```
LO=LO+1
PUNCH 4160,N,R(L1),R(L2),R(L3),R(L4),R(L5),R(L6),R(L7),JOB,LO
4160 FORMAT(1I3,7F7.2,3X,1I10,2X,1I4,1X)
4199 CONTINUE
C SEASONAL FACTOR LEAST SQUARE VECTOR PUNCH FOLLOWS
C V(I,1)=A VECTOR FOR CONSTANT TERM
C V(I,2)=B VECTOR FOR COEFFICIENT OF INDEPENDENT VARIABLE
C TEST TO DETERMINE IF REMAINING CARD PUNCHES SHOULD BE SKIPPED
IF(K(18)-1)4250,4250,4770
C LYRON=YEAR ONE=K(1)+1
4250 LYRON=K(1)+1
LO=LO+1
PUNCH 4300,LYRON,JOB,LO
4300 FORMAT(32HLEAST SQUARE VECTORS, YEAR ONE = ,1I5,18X,1I10,2X,1I4,1X)
LO=LO+1
C LEAST SQUARES VECTOR HEADING PUNCH
PUNCH 4330,JOB,LO
4330 FORMAT(5X,25H V(I,1) V(I,2),25X,1I10,2X,1I4,1X)
C LEAST SQUARES VECTOR PUNCH LOOP
DO 4350 I=1,K3,1
LO=LO+1
PUNCH 4340,I,V(I,1),V(I,2),JOB,LO
4340 FORMAT(1I3,2X,1F10.2,5X,1F10.2,25X,1I10,2X,1I4,1X)
4350 CONTINUE
LO=LO+1
C SEASONALLY ADJUSTED SALES PUNCH ROUTINE FOLLOWS
C SEASONALLY ADJUSTED SALES HEADING PUNCH
PUNCH 4412,JOB,LO
```

4412 FORMAT(25HSEASONALLY ADJUSTED SALES,30X,1I10,2X,1I4,1X)

LO=LO+1

PUNCH 4415,M(1),M(2),M(3),M(4),M(5),JOB,LO

4415 FORMAT(2X,5I10,3X,1I10,2X,1I4)

C UNITS MARGIN LOOP

C LI=PARTICULAR UNIT CORRESPONDING TO A PARTICULAR YEAR

C D(LI)=SEASONALLY ADJUSTED SALES CORRESPONDING TO LI

4416 DO 4500 N=1,K3,1

L1=(N-1)+1

L2=L1+K3

L3=L2+K3

L4=L3+K3

L5=L4+K3

LO=LO+1

PUNCH 4417,N,D(L1),D(L2),D(L3),D(L4),D(L5),JOB,LO

4417 FORMAT(1I3,1X,5I10,1X,1I10,2X,1I4,1X)

4500 CONTINUE

LO=LO+1

PUNCH 4520,M(6),M(7),M(8),M(9),M(10),JOB,LO

4520 FORMAT(2X,5I10,3X,1I10,2X,1I4)

4550 N=0

NN111=L5+1

KK333=L5+K3

DO 4599 JJJJ=NN111,KK333,1

N=N+1

L1=(JJJJ-1)+1

L2=L1+K3

L3=L2+K3

L4=L3+K3

L5=L4+K3

LO=LO+1

PUNCH 4560,N,D(L1),D(L2),D(L3),D(L4),D(L5),JOB,LO

4560 FORMAT(1I3,1X,5I10,1X,1I10,2X,1I4,1X)

4599 CONTINUE

4700 LO=LO+1

C PARAMETER PUNCH

C PARAMETER HEADING

4720 PUNCH 4730,JOB,LO

4730 FORMAT(10HPARAMETERS,45X,1I10,2X,1I4,1X)

LO=LO+1

PUNCH 4740,K(1),K(2),K(3),K(4),K(5),K(6),K(7),K(8),K(9),JOB,LO

4740 FORMAT(1I7,2I5,1I4,5I6,4X,1I10,2X,1I4,1X)

LO=LO+1

PUNCH 4750,K(10),K(11),K(12),K(13),K(19),K(20),K(21),JOB,LO

4750 FORMAT(2I6,3I7,2I6,10X,1I10,2X,1I4,1X)

LO=LO+1

PUNCH 4760,K(14),K(15),K(16),K(17),K(18),JOB,LO

4760 FORMAT(5I4,35X,1I10,2X,1I4,1X)

LO=LO+1

C COMPILED COUNTERS PUNCH

PUNCH 4761,JOB,LO

4761 FORMAT(17HCOMPILED COUNTERS,38X,1I10,2X,1I4)

LO=LO+1

PUNCH 4762,FM1,FM,FN1,FN,FNP4,JOB,LO

4762 FORMAT(5F10.2,5X,1I10,2X,1I4)

LO=LO+1

PUNCH 4764,MP1,NQ1,NH1,NG1,NL1,NM1,JOB,LO

4764 FORMAT(6I8,7X,1I10,2X,1I4)

C PRINT OUTPUT TERMINATE MESSAGE

4770 PRINT 4775

4775 FORMAT(5HGO 21)

LO=LO+1

C END ROUTINE

5000 PUNCH 5010,JOB,LO

5010 FORMAT(3HEND,52X,1I10,2X,1I4,1X)

LO=LO+1

PUNCH 5012,JOB,LO

5012 FORMAT(55X,1I10,2X,1I4)

LO=LO+1

C TEST FOR PRINT BYPASS

5015 IF(K(20)-1)7618,7620,7620

7618 PRINT 5020

5020 FORMAT(19HREADY FOR MORE DATA)

7620 GO TO 1

END