SUPPLEMENT TO CENSUS TECHNICAL PAPER NO. 15

THE USES AND FEATURES OF X-11.2 AND X-11Q.2

by Brian C. Monsell
Statistical Research Division
Bureau of the Census
Washington, DC 20233

January 6, 1989

TABLE OF CONTENTS

Technical questions concerning the X-11.2 and X-11Q.2 programs may be directed to the author at the address given above, or by calling (301) 763-3957.

TABLE OF CONTENTS (CONTINUED)

CHAPTER 1 : HOW TO USE X-11.2

I. Introduction

X-11.2 is the latest version of the Census X-11 seasonal adjustment program. The program was written in Lahey FORTRAN 77 for IBM and compatible microcomputers. Only minor changes, if any, should be needed to make it compatible with FORTRAN 77 compliers for other systems provided they support the NAMELIST feature. The five major enhancements contained in this release are:

(a) The incorporation of the sliding spans analysis of seasonal adjustment stability. This is a powerful new diagnostic procedure which compares adjustments obtained from overlapping spans of the series being analyzed. If the percentage of months where adjustments vary excessively from span to span ("unstable" adjustments) is too high, it is an indication that, with the options chosen, the program cannot reliably adjust the data. The seasonal movements of some data are so erratic that they cannot be reliably adjusted. The reader is referred to Findley, Monsell, Shulman, and Pugh (1988) for examples of the use of sliding spans diagnostics.

NOTE: the sliding spans procedure is computationally intensive. It involves repeating the seasonal adjustment process on smaller spans of data. X-11.2 runs which request a sliding spans analysis should run much slower than X-11.2 runs without sliding spans analysis requested.

(b) The addition of several other diagnostics to help the user determine the adequacy of a given seasonal adjustment. Many of these originally appeared in X-11-ARIMA, a seasonal adjustment package developed by Statistics Canada. Among these are an F-test to detect moving seasonal performed after the D8 (final unmodified SI-ratios), which is used with the traditional F-test for stable seasonality to perform a test of the presence of identifiable seasonality. Users who want more details on this test are referred to Morry and Lothian (1978). The X-11-ARIMA quality control statistics, which provide an overall indication of whether a given seasonal adjustment is acceptable, has also been incorporated into the X-11.2 seasonal adjustment package. A brief description of the diagnostics produced in Tables F2 and F3 of the X-11.2 output is given in Appendix D; those seeking more information on the Quality Control Statistics are referred to Lothian and Morry (1978).

An F-test to detect residual seasonality in the seasonally adjusted data has been added to the output for Table D11 (final seasonally adjusted data) and Table E2 (modified seasonally adjusted data). Spectrum plots of the differenced seasonally adjusted data and the modified irregular series (Table E3) are produced with the graphics option to help the user determine, by examining peaks, if there are residual seasonal or trading day effects. To help inexperienced users, the seasonal filter length recommended by the criterion of Lothian (1984) is now printed out with Table D9.A (year-to-year change in irregualar and seasonal components and moving seasonality ratio) when the program is run with default filters.

(c) The improvement of the input procedure, utilizing namelists of options variables to make entering X-11 options easier. The user can now run the program either in an interactive mode or in a batch mode. Also, the user now has more flexibility with input formats for reading the original data and the prior monthly adjustment factors.

(d) The addition of a table storage option, by means of which user-selected X-11.2 output tables are stored in separate ASCII files. This option makes it easier to input the results of X-11.2 runs into other programs and packages.

(e) Slight modifications were made to the X-11 method to improve the outlier detection procedure and the numerical precision of seasonal and trend moving averages. Since these modifications are not found in previous versions of X-11, the results from a seasonal adjustment using X-11.2 should not be expected to match precisely those of any previous version of X-11.

This chapter will deal with enhancements (c) and (d). We will begin with a brief description of the namelist feature, and show how namelists are used by X-11.2. A brief description of the table storage option is also given. Then, using sample X-11.2 runs, we will show how the X-11.2 program can be used interactively or with commands stored in an ASCII file.

The compiled program file can be used on IBM PC-compatable microcomputers with or without a **math coprocessor** (8087, 80287, or 80387). The X-11.2 run file (X11SS.EXE) will execute much faster if a math coprocessor has been installed in your PC. Microcomputer users should also note that the output is 132 columns wide; to capture printout, set your printer to print 17 characters per inch.

II. The Namelist Feature

Namelists are a means of reducing the information which the user must input to the program. The input can be limited to just those option settings for which default settings are not desired or not available. X-11.2 uses three namelists, which are to be entered in this order :

(a) NLX11, the X-11.2 main namelist. This namelist includes variables providing the program with the series name, its starting and ending dates, and the input data format. This namelist also includes variables invoking the sliding spans analysis and selection of seasonal and trend cycle filters.

(b) NLXOP, the X-11.2 options namelist. This namelist contains the variables associated with trading day adjustment, prior factor adjustment, and holiday adjustment.

(c) NLTBL, the X-11.2 table storage namelist. This namelist contains variables which identify the tables to be stored separately and the format to be used. This namelist is invoked only when the variable NUMTBL of the NLX11 namelist is greater than zero.

A complete listing of the variables in each of the namelists is given in Table A (for NLX11), Table B (for NLXOP), and Table C (for NLTBL). In these tables, the default values used by X-11.2 to initialize each namelist variable are indicated.

In interactive mode, X-11.2 will prompt you for input for each namelist. You can then assign values to all or any subset of variables or arrays within the namelist. Since each namelist variable is initialized by the program, the user enters only those variables and arrays which need to be changed from their default values.

Namelist input procedures vary depending on whether X-11.2 is run interactively or whether commands are read from a separate (ASCII) file. We will illustrate the difference by showing how we would input values for the NLX11 namelist, first in interactive mode and then in batch mode.

Suppose we have a series called X11DAT, which begins in January of 1970 and ends in December of 1986. We have to enter values for namelist variables SER (series name), BEGYR (beginning year), and LSTYR (last year). Note that we do not need to specify BEGOB (beginning observation) and LSTOB (last observation), since the default values for these variables are appropriate for this series. All the other namelist variables will be left at their default values.

If the program is being run interactively, a prompt will appear containing the name of the namelist being read. When values of namelist variables in namelist NLX11 are requested, the following will appear on the screen :

```
/NLX11/?
```

The user then assigns values to individual namelist variables using the following form :

```
nlname=value
```

where nlname = variable or array name in the namelist being read, and
value = constant of the appropriate type.

For example, we can set the beginning year of the series (namelist variable BEGYR) to be 70 by entering

```
BEGYR=70
```

after the /NLX11/ prompt.

There are three types of constants used with namelist variables : INTEGER numbers (no decimal point, such as 70), REAL numbers (with a decimal point, such as 1.8), and CHARACTER entries (such as 'X11DAT'). When entering values for a namelist variable, be certain that the entry has the correct type. Tables A, B, and C give what type of constant should be used with each namelist variable. Note that entries for character variables must be enclosed in single quotes.

For our example, an acceptable response is given below :

```
/NLX11/? SER='X11DAT',BEGYR=70,LSTYR=86  &END
```

This sets the series name (SER) to be X11DAT, the beginning year of the series (BEGYR) to be 70, and the last year of the series (LSTYR) to be 86. The rest of the variables in the namelist NLX11 are left to their default values.

The "&END" at the end of the response defines the termination of the namelist input. This can be abbreviated to just "&". Note the commas between the entries; a space will also suffice. If more than one line is needed to enter the namelist variables, enter a carriage return to continue entry to the next line. The namelist variables can be entered in any order. Note that the "&END" entry must be on the last line of namelist input. Our current /NLX11/ example could also have been entered as:

```
/NLX11/? LSTYR=86 BEGYR=70
/NLX11/? SER='X11DAT' &
```

To input options using an ASCII file instead of the terminal, the procedure is similar, but there are some important differences. X-11.2 will search the file for the first record having the characters "&NLX11" as its first nonblank characters. In general, the first entry for any namelist file input should be "&" followed by the name of the namelist being read. X-11.2 will then read the entries that follow (in the same "nlname=value" format as specified above). For our previous example, the first record of the input file could be :

```
&NLX11  SER='X11DAT',BEGYR=70,LSTYR=86  &END
```

Before we move on, a word about entering <u>arrays</u> in namelists. The X-11.2 namelists have 4 arrays :

(a) SIGLIM of the NLX11 namelist, a two-term array which sets upper and lower outlier sigma limits;
(b) SMA of the NLX11 namelist, a twelve-term array which sets monthly seasonal moving averages;
(c) PTDWT of the NLXOP namelist, a seven-term array which sets prior trading day weights for each day of the week;
(d) TBL of the NLTBL namelist, a ten-term array which identifies the tables to be stored.

There are a variety of ways such arrays can be input to a namelist. One can specify each array element separately :

```
&NLX11  SIGLIM(1) = 1.8, SIGLIM(2) = 2.8  &END
```

or the array as a whole can be specified :

```
&NLX11  SIGLIM=1.8,2.8      &END
```

Note that these two statements yield the same result : the first element of SIGLIM is set equal to 1.8 and the second element is set equal to 2.8. Also, one can assign a single value to consecutive array elements by using a repeat count with the constant. For example, the expression

```
&NLXOP  PTDWT = 5*1.4,2*0.0   &END
```

assigns to the first five elements of array PTDWT the value 1.4 and to the last two elements the value 0.

Null values (which indicate an array element or variable will not be changed from its current value) can be specified by an initial comma for the first value, two consecutive commas for intermediate values, or by a trailing comma for the final value. To illustrate this, we will assume we are performing an X-11.2 run where RESET='Y' (all namelist variables are set to default values before execution). Entering the expression

```
&NLX11  SIGLIM = ,3.0, SMA = '5',,'9','9','9','S','S','S','9','9','9','9'     &END
&NLXOP  PTDWT = 1.0,1.0,1.0,1.0,1.5,1.5,                                       &END
```

would have the following effect :

(a) the first element of SIGLIM stays at its default value (1.5), while the second element is set equal to 3;
(b) the second element of SMA stays at its default value (a blank), while the others are set as indicated;
(c) the seventh (and final) element of PTDWT stays at its default (0.0), while the others are set as indicated.

Interactive users are given a chance to re-enter the namelist input if it is found to contain an error. Error messages are displayed on the screen, not stored in a file.

When running X-11.2 from stored commands, if you misspell the name of a variable or array in a namelist, or set a namelist variable equal to a constant of an incorrect type, program execution will cease for that run. X-11.2 will attempt to execute any subsequent set of control cards for other runs stored in the X-11.2 command file. When running the program from stored commands, users must supply the name of an X-11.2 error file, into which error messages, if any, will be written.

If you are unsure about a specific option, refer to Tables A, B, and C of this document.

TABLE A
SPECIFICATIONS FOR NLX11 : X-11.2 MAIN NAMELIST

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
FMT	CHARACTER*30	'1'	Input Format Control. '1' = Year and series identifier on right, data in 6-digit fields : (12F6.0,I2,A6). '2' = Year and series identifier on right (two cards per year for monthly series), data in 12-digit fields : (6F12.0,/,6F12.0,I2,A6). Else, user-supplied FORTRAN format describing the data areas only.
SER	CHARACTER*6	' '	Series Identifier may be numeric, alphabetic or mixed; must be identical to the identifier found in columns 75-80 of the entries in the data file if FMT='1' or '2'. The series identifier must be left justified. Note that if a user supplied FORTRAN format is used to read the data, SER becomes a label used in the output. It is not used to confirm the name of the series.
INDEC	INTEGER	0	Number of Decimals on Input Data. This option can be used to modify input formats '1' and '2' above. Admissible values for INDEC are from 0 to 5, inclusive.
BEGOB	INTEGER	1	Number of the period in which the series starts: 1 for January, 2 for February, . . . , 12 for December. Admissible values for BEGOB are from 1 to 12, inclusive.
BEGYR	INTEGER	0	Last two digit of the year in which the series starts. The first two digits of the year, for this variable and all others calling for a year entry, are assumed to be 19. BEGYR should never be negative.
LSTOB	INTEGER	12	Number of the period in which the series ends. Admissible values for LSTOB are from 1 to 12, inclusive.
LSTYR	INTEGER	0	Last two digits of the year in which the series ends. LSTYR should never be negative.
REWIND	CHARACTER*1	'Y'	Rewind Input Data File. 'Y' = Rewind data file before reading in data. 'N' = Don't rewind data file before reading in data.
ADDMUL	CHARACTER*1	'M'	Type of Adjustment. 'M' = Multiplicative seasonal adjustment 'A' = Additive seasonal adjustment
SEAADJ	CHARACTER*1	'Y'	Type of Program. 'Y' = Seasonal adjustment run. 'N' = Summary measures run : develops estimates of the trend cycle, irregular, MCD and residual trading day and seasonal variation from a seasonally adjusted input.
OUTDEC	INTEGER	0	Number of Decimals on Output Tables. Most tables will be printed with the number of decimals entered here. Admissible values for OUTDEC are 0 to 3, inclusive.

TABLE A : SPECIFICATIONS FOR NLX11 (CONTINUED)

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
PRTOUT	CHARACTER*1	'D'	Type of Printout. For more information concerning this option, see Appendix B. 'D' = Standard printout. 11 to 21 tables are printed (depending on options selected). 'S' = Short printout. From five to 12 tables are printed. 'L' = Long printout. From 24 to 38 tables are printed. 'F' = Full printout. From 44 to 60 tables are printed.
CHART	CHARACTER*1	'N'	Charts. 'N' = No charts. 'S' = Produce charts of the original series, the final seasonally adjusted series, and the original series compared with the seasonally adjusted data as well as spectral plots of the differenced final seasonally adjusted data, the final irregular, and the modified irregular. 'A' = In addition to the charts produced with option 'S', produce charts of the final unmodified SI ratios, the final seasonal factors, and the final irregular series.
ASCIBM	CHARACTER*1	'Y'	Character Type Used in Charts. 'N' = Use the regular ASCII character set to produce these charts. 'Y' = Use the extended IBM ASCII character set to produce these charts.
SIGLIM(1), SIGLIM(2)	REAL	1.5,2.5	Lower and Upper Sigma Limit for Graduating Extreme Values in Estimating Seasonal and Trend-cycle Components. Irregulars will be assigned full weight within SIGLIM(1) and zero weight outside SIGLIM(2). SIGLIM(1) and SIGLIM(2) should be greater than zero, with SIGLIM(1) less than or equal to SIGLIM(2).
SSPAN	CHARACTER*1	'N'	Sliding Spans Analysis. Perform sliding spans analysis with span lengths appropriate for the seasonal filters being used, provided the series is long enough. Length of spans, number of spans, and starting date for first sliding span are determined by the program. 'N' = Do not perform sliding spans analysis. 'A' = Perform sliding spans analysis, print all tables. 'S' = Perform sliding spans analysis, print selected tables.
SSYEAR	INTEGER	0	Last two digits of the year in which sliding spans comparisons are to start. SSYEAR should be greater than or equal to zero. If SSYEAR=0, the first year of comparisons will begin with the first observation of the second span.
NUMTBL	INTEGER	0	Number of X-11.2 tables to be stored separately by this X-11.2 run. The user can choose up to ten tables, which are then written to separate (ASCII) files.
TREND	CHARACTER*2	'PS'	Moving Average for Variable Trend-cycle Routine. 'PS' = Program automatically selects an appropriate moving average from those listed. '09' = Select a 9-term Henderson moving average. '13' = Select a 13-term Henderson moving average. '23' = Select a 23-term Henderson moving average.

TABLE A : SPECIFICATIONS FOR NLX11 (CONTINUED)

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
SMA(1)	CHARACTER*1	'D'	Seasonal Moving Averages for January. (Note : for series shorter than five complete years, the program automatically selects the stable seasonal filter and the user has no control over the selection). 'D' = Select a 3 X 3 for the first seasonal estimate in each iteration and a 3 X 5 for the final estimate for January. '1' = Select a 3 term moving average for January. '3' = Select a 3 X 3 moving average for January. '5' = Select a 3 X 5 moving average for January. '9' = Select a 3 X 9 moving average for January. 'S' = Select a stable seasonal (average of all values for the period) for January.
SMA(2)-SMA(12)	CHARACTER*1	' '	Seasonal Moving Averages for Other Months. ' ' = Use same seasonal moving average that was used in January. 'D' = Select a 3 X 3 for the first seasonal estimate in each iteration and a 3 X 5 for the final estimate. '1' = Select a 3 term moving average. '3' = Select a 3 X 3 moving average. '5' = Select a 3 X 5 moving average. '9' = Select a 3 X 9 moving average. 'S' = Select a stable seasonal (average of all values for the period).
RESET	CHARACTER*1	'Y'	Reset Namelist Variables. 'Y' = Reset all variables in all namelists to default values. 'N' = Retain previous values of variables in namelists.
PROMPT	CHARACTER*1	'N'	Produce Namelist Prompt. (Note : this option only works in demand mode) 'Y' = Produces prompt after namelist input has been read in demand mode. Allows the user to change previously entered namelist input. 'N' = No prompt will be given after namelist input.
STOP	CHARACTER*1	'N'	'Y' = Stop execution of X-11.2 'N' = Continue execution of X-11.2

TABLE B
SPECIFICATIONS FOR NLXOP : X-11.2 OPTIONS NAMELIST

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
TD	CHARACTER*1	'N'	Trading Day Adjustment. Estimates of the trading day factors and weights associated with each of the days of the week may be obtained from the data. Prior weights, if supplied, may optionally be corrected by these estimates. 'N' = Trading day adjustment will not be computed. 'D' = Trading day factors will be computed and displayed, but will not be applied to the series. 'A' = Trading day factors will be computed and applied to the series. 'F' = Trading day factors will be computed, but will be applied to the series only if they explain signficant variation on the basis of the F-test.
YRCOMP	INTEGER	0	Starting Date for Computing Trading Day Regression. This option is functional only if trading day adjustments are computed. Estimates of the trading day weights are derived using only the part of the series beginning in January of YRCOMP as input to the adjustment. If YRCOMP = 0, the entire series is used in trading day adjustment. YRCOMP should not be negative.
YRAPP	INTEGER	0	Starting Date for Applying Trading Day Regression. This option is functional only if the trading day adjustments are computed. The starting date determined by this variable is independent of the starting date mentioned in YRCOMP. The trading day adjustment is applied only to the part of the series beginning with January of YRAPP. If prior weights are supplied, the part of the series preceding this date is adjusted by the prior weights only, and the part of the series from this date to the end of the series is adjusted by the prior weights corrected by the adjustment estimates. If YRAPP = 0, apply trading day adjustment estimates to entire series. YRAPP should not be negative.
TDSIG	REAL	2.5	Sigma Limit for Excluding Extreme Values for Trading Day Regression. This option is functional only if the trading day adjustments are computed. In estimating trading day variation from the data, irregular values more than a designated number of standard deviations from 1.0 (multiplicative) or 0.0 (additive) are excluded from the calculations as extreme. These values are shown in Tables B14 and C14. TDSIG should be greater than zero.
LOM	CHARACTER*1	'N'	Length-of-month Allowance. This option is functional only if a trading day adjustment is made, and is available only with multiplicative adjustment. The option assigns the variations arising from the length of the month either to the seasonal factors or to the trading day factors. 'N' = Adjust the series for length of month before trading day effects are estimated. Length-of-month variations are included with the seasonal factors. Divisors used in the construction of monthly weights are 31, 30 and 28.25 for 31 and 30 day months and February, respectively. 'Y' = Include length-of-month variation in the trading day factors rather than in the seasonal factors. The divisor for all months is 30.4375, the average length of a month.

TABLE B : SPECIFICATIONS FOR NLXOP (CONTINUED)

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
PTDWT(1)-PTDWT(7)	REAL	0.0	Prior Daily Weights. This option is available only with multiplicative adjustment. Seven daily weights may be entered in these columns to be used to adjust for trading day variation prior to the seasonal adjustment calculations. The seven weights are combined to yield the prior trading day adjustment factors shown in table A4. The range of acceptable weights is from 0.0000 to 7.000. The program scales the weights to total 7.000. These weights may optionally be modified by the trading day adjustment routine.
PTDWT(1)	REAL	0.0	Prior weight for Monday.
PTDWT(2)	REAL	0.0	Prior weight for Tuesday.
PTDWT(3)	REAL	0.0	Prior weight for Wednesday.
PTDWT(4)	REAL	0.0	Prior weight for Thursday.
PTDWT(5)	REAL	0.0	Prior weight for Friday.
PTDWT(6)	REAL	0.0	Prior weight for Saturday.
PTDWT(7)	REAL	0.0	Prior weight for Sunday.
HOLDAY	CHARACTER*1	'N'	Holiday Adjustment. An analysis of the final irregular from an automatic preliminary X-11.2 seasonal adjustment (the printout is suppressed) is used to estimate holiday adjustment factors for Easter, Labor Day, and Thanksgiving. These factors are then applied as prior adjustment factors in a second and final X-11.2 adjustment. For more information on this option, see Appendix A. 'N' = No holiday adjustment will be performed. 'E' = Holiday adjustment will be performed for Easter only. 'A' = Holiday adjustment will be performed for Easter, Labor Day, and Thanksgiving. 'F' = Holiday adjustment will be performed for Easter. Holiday adjustment factors will be applied for Labor Day and Thanksgiving only if they explain significant variation according to their respective F-tests.
PRFMT	CHARACTER*30	'N'	Format for Prior Adjustment Factors. This option is used to specify a prior adjustment and the format for reading the file containing the prior factors are to be read. The prior factors are divided into the original data before a multiplicative adjustment, or are subtracted from the original series before an additive adjustment. 'N' = No prior adjustment factors used in this run. '1' = Year and prior adjustment identifier on right, data in 6-digit fields : (12F6.0,I2,A6). '2' = Year and prior adjustment identifier on right (two records per year for monthly series), data in 12-digit fields : (6F12.0,/,6F12.0,I2,A6). Else, user-supplied FORTRAN format describing the time series data areas only.
PRSER	CHARACTER*6	' '	Prior Adjustment Identifier. This code may be numeric, alphabetic or mixed. Must be identical to the prior adjustment identifier found in columns 75-80 of the entries on the data records if PRFMT = '1' or '2'.
PRDEC	INTEGER	3	Number of Decimals on Prior Monthly Adjustment Factors. This option can be used to modify input formats '1' and '2' above. Admissible values for PFDEC are between 0 and 5, inclusive.
STOP	CHARACTER*1	'N'	'Y' = Stop execution of X-11.2 'N' = Continue execution of X-11.2

TABLE C
SPECIFICATIONS FOR NLTBL : X-11.2 TABLE STORAGE NAMELIST

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
NUMTBL	INTEGER	0	Number of X-11.2 tables to be stored separately by this X-11.2 run. The user can choose up to ten tables, which are then written to separate (ASCII) files.
TBL(1)-TBL(10)	CHARACTER*3	' '	Name of tables to be stored. The table names correspond to those on the X-11.2 printout. Only tables that have been selected for the printout of this run can be stored. The table name must be left-justified (i.e., 'B01', 'B 1', or 'B1 ', rather than ' B1'). The user should be sure that the printout option selected with PRTOUT of the NLX11 namelist includes all tables to be stored (see Appendix B).
TBLFMT	CHARACTER*40	' '	Table Output Format. Note that data input format and table output format do not have to be the same. ' ' = Format the same as for data input (see FMT in NLX11 namelist). '1' = Year and identifier on right, data in 6-digit fields : (12F6.0,I2,A6). '2' = Year and identifier on right (two records per year for monthly series), data in 12-digit fields : (6F12.0,/,6F12.0,I2,A6). Else, user-supplied FORTRAN format describing the time series data areas only.
TBLDEC	INTEGER	0	Number of Decimals to be Used in Table Storage Formats. This option can be used to modify input formats '1' and '2' above. Admissible values for TBLDEC are from 0 to 5, inclusive.
DRIVE	CHARACTER*40	' '	Specifies on which drive the files generated by X-11.2 will be stored. The user can also specify subdirectories.
FORCST	CHARACTER*1	'N'	Storage of Factor-Forecasts. 'N' = Do not append factor-forecasts to the seasonal, trading day, holiday, or combined adjustment factors when storage of these series is requested. 'Y' = Append factor-forecasts to the seasonal, trading day, holiday, or combined adjustment factors when storage of these series is requested.
OVERIT	CHARACTER*1	'Y'	Overwrite Existing File. 'Y' = If the output file specified for the run already exists, the program will overwrite the contents of the existing file. 'N' = If the output file specified for the run already exists, the existing file will be preserved and the program will attempt to create a new file for the table. 'A' = If the output file specified for the run already exists, the table will be appended to the existing file. 'O' = Store all tables in a file named X11SS.TBL. If X11SS.TBL exists, overwrite the contents of the existing file.
TRESET	CHARACTER*1	' '	Reset NLTBL Namelist Variables. ' ' = Set TRESET to be the same as RESET of NLX11 namelist. 'Y' = Reset all variables in the NLTBL namelist to default values. 'N' = Retain previous values of variables in the NLTBL namelist.
STOP	CHARACTER*1	'N'	'Y' = Stop execution of X-11.2 'N' = Continue execution of X-11.2

III. The Table Storage Option (MS-DOS Systems only)

The table storage option allows the user to write out the contents of up to ten of the X-11.2 tables out to files other than the usual X-11.2 output. The tables selected are written into separate ASCII files without the headings and titles found on the X-11.2 printout. This option makes it easier to use the output of X-11.2 runs as input to other software packages.

This option is invoked by setting the variable NUMTBL of the NLX11 namelist equal to the number of tables to be stored. If this is done, you can use the NLTBL namelist to identify the tables you wish to store (with the TBL array), the format of the table output (with TBLFMT), and other options as you see fit. If NUMTBL is zero, the table storage option is not invoked and you will not be asked to supply values for NLTBL. A complete description of the variables in the NLTBL namelist is given in Table C.

The printout option selected using the variable PRTOUT of the NLX11 namelist (see Table A) must include the table or tables to be stored. Table B.2 of Appendix B shows the tables associated with each choice of PRTOUT.

X-11.2 uses information available to the program to determine into which file a table will be stored. In DOS, a file specification consists of three parts :

(a) the drive specifier, which specifies the drive which contains the file;
(b) the filename, which can be up to eight characters;
(c) the filename extension, which can be up to three characters (preceded by a period).

For the file **A:COMP1F.DAT**, the drive specifier is **A:**, the filename is **COMP1F**, and the filename extension is **.DAT**. For table storage in X-11.2, these three parts are defined as follows :

(a) the drive specifier is set equal to the variable DRIVE from the NLX11 namelist;
(b) the filename is set equal to the name of the series being adjusted, stored in SER from the NLX11 namelist;
(c) the filename extension is set equal to the number of the table as it appears in the X-11.2 printout (preceded by a period), taken from one of the entries in the TBL array of the NLTBL namelist. If the number of a table is entered with an internal space ('D 8'), the space will be replaced by the character '_' ('D_8'). A complete listing of the table numbers for each of the X-11.2 tables is given in Table B.1 of Appendix B.

In an X-11.2 run where SER='COMP1F' and DRIVE='B:', table D10 (the final seasonal factors), if selected, would be stored in file **B:COMP1F.D10**. The seasonal factors stored in this file would be the same as those found in the X-11.2 output, just stored in its own separate file.

If the file is to be stored in an existing directory or subdirectory, the name of the directory or subdirectory should be included in the variable DRIVE. For example, if the above file were to be stored in **B:\X11SS\COMP1F.D10**, DRIVE should be set equal to 'B:\X11SS\'. Note that all colons and backslashes should be included in DRIVE.

Normally, X-11.2 will overwrite the contents of an existing file with the same name. However, if OVERIT of the NLTBL namelist is set to 'N', X-11.2 will attempt to store the table in a new file, which it creates. Two characters will be appended to the filename

specifier; the first a dollar sign (**$**), the second one of the following set of characters:

(a) the whole numbers (0 to 9);
(b) the alphabet (**A** to **Z**);
(c) ASCII characters #, **$**, **%**, **&**.

To illustrate this, let's assume that **A:COMP1F.D10** already exists. X-11.2 will then try to store table D10 in a file named **A:COMP1F$0.D10**. If this file exists, X-11.2 will try to store the table in **A:COMP1F$1.D10**, and so on, until either the program finds a file which does not exist or the program runs out of acceptable characters. If more than one table is being stored, X-11.2 checks to ensure that, for each table being stored, all the files have the same filename and that no existing files will be overwritten.

If the variable OVERIT of the NLTBL namelist is set to 'A' (append), then rather than overwriting an existing file the contents of the table to be stored will be appended to the end of an existing file. If OVERIT is set to '0' (one table), then all the tables selected will be stored in one file (named **X11SS.TBL**). The drive for this file will be taken from the variable DRIVE in the NLTBL namelist. If a previous version of **X11SS.TBL** exists, it will be overwritten.

The formats available for table storage are the same as those available for data and prior factor input. The user can select one of the X-11.2 supplied formats, or specify his/her own.

Finally, note that NLTBL has its own reset variable, TRESET. This allows you to leave the storage options as they are while resetting variables from other namelists to their default values. If TRESET = ' ', TRESET is set to be the same as RESET.

WARNING : This option may not work correctly with operating systems different from MS- (or PC-) DOS.

IV. Running X-11.2

This section will (a) show how to run X-11.2 interactively, (b) show how to set up a file of stored X-11.2 commands and run X-11.2 with it, (c) discuss examples of sample X-11.2 runs. The compiled program (called **X11SS.EXE**) can be used only on IBM PC-compatible microcomputers having a math coprocessor (8087, 80287, or 80387). For the examples given in this document, a computer with two disk drives was used (both drives are not used in all of the examples).

There is a basic command sequence for running X-11.2, regardless of whether the program is run interactively or with stored commands. In an X-11.2 run involving many series, this sequence must be repeated for each series. The sequence is given below:

(1) Assign values to variables and arrays in the NLX11 namelist. See the previous section for more information on namelist input.

(2) Assign values to variables and arrays in the NLXOP namelist.

(3) If the table storage option is used in this run, assign values to variables and arrays in the NLTBL namelist.

(4) Specify a title for the X-11.2 run. The user can

(a) simply enter a title of up to eighty characters in length;
(b) enter the character "@", to use the previous title;
(c) enter the character "*", to print out the previous title for examination.

Please note that "*" is only to be used with interactive X-11.2 runs. If '*' is specified, X-11.2 will ask the user to specify a title or "@" again.

(5) Specify the data file containing the time series for this X-11.2 run. The user can

(a) enter the name of the data file (up to 80 characters long);
(b) enter "@" or "*" as described in (4).

(6) Specify the output file to be used with this X-11.2 run. The user can

(a) enter the name of the output file (up to 80 characters long);
(b) enter "@" or "*" as described in (4).

(7) If prior monthly adjustment factors are used in this run, specify the prior monthly factor file. The user can

(a) enter the name of the prior monthly factor file (up to 80 characters long);
(b) enter "@" or "*" as described in (4).

This can be repeated for as many series as you wish to run. To stop executing X-11.2, set the variable STOP='Y' in any of the X-11.2 namelists.

We now turn to the three examples of X-11.2 runs provided in this document. In each of these examples, the entries made by the user are numbered to illustrate the steps.

EXAMPLE 1 : An Interactive X-11.2 Run

Table D gives an example of how to run X-11.2 interactively. This is a very simple run, and we will use it to illustrate the basic command sequence. In this example, JAPNIM (Imports from Japan) will be seasonally adjusted with no trading day, holiday, or prior adjustments. For this example, Disk 1 (containing the X-11.2 run file) should be loaded into drive A.

Note : <CR> denotes a carriage return should be performed after the action specified.

{1} First, enter the filename of the X-11.2 run file, preceded by the designation of its disk drive (in this example, **a:x11ss**). <CR>

{2} X-11.2 asks you to enter either and input command file name (an ASCII file containing the X-11.2 commands) or "CON" (the input will come from the console). Enter "con" to run X-11.2 interactively. <CR>

{3} Next, X-11.2 displays the current setting of the variables in the NLX11 namelist. The program will then prompt you to enter values for the NLX11 namelist. Enter data for those namelist variables you wish to change (see previous section for more information on namelist input) in this namelist. <CR>

In this run, we are setting SER, the series identifier, to be "JAPNIM". We are setting FMT='2' (one of the default formats given by X-11.2) and INDEC=3 because the original series is stored in six twelve-digit fields, with three decimal places in each field. Year and series identifier are read in at the end of a given year's data. This makes the FORTRAN format of the original data file (6F12.3,/,6F12.3,I2,A6). Note that the series identifiers read in with the data must be the same as the series identifier specified in SER. The data file used in this example is reproduced in Table E.

The seasonal adjustment will be performed on data beginning in January of 1974 (BEGYR=74, BEGOB kept at default value) and ending in October of 1984 (LSTOB=10, LSTYR=84). A 3x5 seasonal filter will be used to estimate seasonal factors for all the months (SMA(1)='5'), and a sliding spans analysis will be performed (SSPAN='A').

{4} X-11.2 displays the current setting of the variables in both the NLX11 and NLXOP namelists. The program will then prompt you to enter values for the NLXOP namelist. Since neither trading day, holiday, nor prior adjustments are desired, none of the NLXOP variables needs to be changed from its default values. Therefore "&" is entered. <CR>

{5} After displaying the current settings for the NLXOP namelist, X-11.2 asks for a title for the X-11.2 run. Enter the title for the X-11.2 run. <CR>

{6} X-11.2 then requests the name of the input data file containing the data to be adjusted during this run. This should be an ASCII file, and the data should be formatted as indicated by the variable FMT of the NLX11 namelist. For this example, the data is in the file **A:JAPNIM.DAT**. Enter this name. <CR>

{7} X-11.2 then requests the name of the file that the output from this X-11.2 run should be written into. For this example, the X-11.2 output will be written into **A:JAPNIM.OUT**. Enter this name. <CR>

{8} The program will now perform the seasonal adjustment requested. Once X-11.2 is finished, it will again print out the current settings of NLX11. Since we are done, set STOP='y'.

TABLE D : AN EXAMPLE OF AN INTERACTIVE X-11.2 RUN

```
{1} C:\>a:x11ss                                                          <CR>

    ENTER X-11.2 COMMAND FILE NAME OR CON (FOR INTERACTIVE PROCESSING) :
{2}  > con                                                               <CR>


    CURRENT SETTINGS FOR NLX11 NAMELIST ARE :
  &NLX11 SER=       ,FMT=1
  INDEC=0,BEGOB=1,BEGYR=0,LSTOB=12,LSTYR=0,REWIND=N,ADDMUL=M,SEAADJ=Y,PRTOUT=D,
  OUTDEC=0,CHART=N,ASCIBM=Y,SIGLIM=1.50000,2.50000,SSPAN=N,SSYEAR=0,TREND=PS,
  SMA=D, , , , , , , , , , , , ,RESET=Y,NUMTBL=0,PROMPT=N,STOP=N &END

    ENTER VARIABLES AND THEIR SETTINGS FOR NLX11 NAMELIST :
{3} /NLX11/? ser='JPNIMP', fmt='2', indec=3, begyr=74, lstob=10, lstyr=84,   <CR>

{3} /NLX11/? sma(1)='5', sspan='s' &                                     <CR>

  &NLX11 SER=JPNIMP,FMT=2
  INDEC=3,BEGOB=1,BEGYR=74,LSTOB=10,LSTYR=84,REWIND=N,ADDMUL=M,SEAADJ=Y,
  PRTOUT=D,OUTDEC=0,CHART=N,ASCIBM=Y,SIGLIM=1.50000,2.50000,SSPAN=s,
  SSYEAR=0,TREND=PS,SMA=5, , , , , , , , , , , , ,RESET=Y,NUMTBL=0,PROMPT=N,
  STOP=N &END

    CURRENT SETTINGS FOR NLXOP NAMELIST ARE :
  &NLXOP TD=N,YRCOMP=0,YRAPP=0,TDSIG=2.50000,LOM=N,PTDWT=0.000000,0.000000,
  0.000000,0.000000,0.000000,0.000000,0.000000,HOLDAY=N,
  PRFMT=N                                          ,PRSER=      ,
  PRDEC=3,STOP=N &END

    ENTER VARIABLES AND THEIR SETTINGS FOR NLXOP NAMELIST :
{4} /NLXOP/? &                                                           <CR>

  &NLXOP TD=N,YRCOMP=0,YRAPP=0,TDSIG=2.50000,LOM=N,PTDWT=0.000000,0.000000,
  0.000000,0.000000,0.000000,0.000000,0.000000,HOLDAY=N,
  PRFMT=N                                          ,PRSER=      ,
  PRDEC=3,STOP=N &END

     ENTER TITLE FOR X-11.2 RUN :
{5}  > jpnimp : unadjusted imports from japan                            <CR>

     ENTER DATA FILE NAME :
{6}  > a:jpnimp.dat                                                      <CR>

     ENTER OUTPUT FILE NAME :
{7}  > a:jpnimp.out                                                      <CR>


       X-11.2 IS NOW EXECUTING . . . JPNIMP
       X-11.2 RUN FOR JPNIMP COMPLETED.
```

TABLE D : AN EXAMPLE OF AN INTERACTIVE X-11.2 RUN (CONTINUED)

```
  CURRENT SETTINGS FOR NLX11 NAMELIST ARE :
&NLX11 SER=      ,FMT=1                                                    ,
INDEC=0,BEGOB=1,BEGYR=0,LSTOB=12,LSTYR=0,REWIND=N,ADDMUL=M,SEAADJ=Y,PRTOUT=D,
OUTDEC=0,CHART=N,ASCIBM=Y,SIGLIM=1.50000,2.50000,SSPAN=N,SSYEAR=0,TREND=PS,
SMA=D, , , , , , , , , , , , ,RESET=Y,NUMTBL=0,PROMPT=N,STOP=N &END

  ENTER VARIABLES AND THEIR SETTINGS FOR NLX11 NAMELIST :
{8} /NLX11/? stop='y'       &END                                          <CR>
```

TABLE E : CONTENT OF JPNIMP.DAT

```
       1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

 8355.000  7656.000  8093.000  9550.000 10304.000  9758.000
11758.000 11570.000 11276.000 11815.000 11242.000 11988.00074JPNIMP
11909.000  9163.000 10064.000  9291.000  8083.000  8581.000
 9526.000  9155.000  8406.000  9381.000  8671.000 10449.00075JPNIMP
11567.000  9950.000 13083.000 12312.000 11846.000 13994.000
13545.000 14078.000 13304.000 12967.000 14269.000 14128.00076JPNIMP
14116.000 11977.000 15416.000 14119.000 15454.000 16198.000
15207.000 17633.000 16242.000 16204.000 15591.000 18071.00077JPNIMP
17844.000 18424.000 21037.000 21819.000 20101.000 20489.000
22172.000 20655.000 20648.000 21204.000 20246.000 19939.00078JPNIMP
22473.000 18654.000 19851.000 23006.000 20920.000 23199.000
21833.000 22761.000 21887.000 22998.000 23491.000 21355.00079JPNIMP
24965.000 22498.000 23852.000 25647.000 26566.000 26774.000
26134.000 25413.000 26420.000 25689.000 25918.000 27137.00080JPNIMP
31961.000 23412.000 30531.000 32230.000 30305.000 31476.000
31407.000 35429.000 29101.000 36989.000 33265.000 30015.00081JPNIMP
37200.000 27080.000 35866.000 37594.000 29404.000 29672.000
28879.000 38147.000 29042.000 32740.000 26951.000 24862.00082JPNIMP
29532.000 28944.000 34402.000 35035.000 32933.000 33262.000
32596.000 36338.000 29757.000 40707.000 40257.000 38070.00083JPNIMP
46138.000 36342.000 47582.000 46380.000 48891.000 45043.000
62596.000 50846.000 49401.000 50750.000                      84JPNIMP
```

EXAMPLE 2 : An Interactive X-11.2 Run With Two Series

Using the example given in Table F, we will show how to invoke some of the features available in X-11.2, including table storage, prior monthly factor adjustment, and prompting. Two series will be seasonally adjusted in this example: APPLRS (Retail Sales of Appliances) and LETHTI (Total Inventories of Leather and Other Products). For this example, place Disk 1 in drive A and Disk 4 in drive B.

{1} First, enter the filename of the X-11.2 run file, preceded by the designation of its disk drive (**a:x11ss**). <CR>

{2} X-11.2 asks you to enter either an input command file name or an indication that the input will come from the console. Enter "con" to run X-11.2 interactively. <CR>

{3} X-11.2 displays the current setting of the variables in the NLX11 namelist, and then prompts you to enter values for the NLX11 namelist. Enter data for those namelist variables you wish to change from their default values in this namelist. <CR>

{4} X-11.2 now displays the current setting of the variables in both the NLX11 and NLXOP namelists and prompts you to enter values for the NLXOP namelist. Enter data for those namelist variables you wish to change in this namelist. <CR>

{5} X-11.2 displays the current settings of the NLXOP namelist. Since NUMTBL was set to three (3) in the NLX11 namelist, the program will display the current settings of the variables and arrays in the NLTBL namelist and will prompt you to enter values for the NLTBL namelist. Enter data for those namelist variables you wish to change in this namelist. <CR>

{6} After displaying the current settings for the NLTBL namelist, X-11.2 then asks for a title for the X-11.2 run. Enter the title for the X-11.2 run. <CR>

{7} X-11.2 then requests the name of the input data file containing the data to be adjusted during this run. Enter the name of the input data file. <CR>

{8} X-11.2 then requests the name of the file that the output from this X-11.2 run should be written into. Enter name of output file. <CR>

{9} Since prior monthly adjustment factors were requested in namelist NLXOP, X-11.2 requests the name of the file where the prior adjustment factors are stored. This must also be an ASCII file, and the data should be formatted as indicated by the variable PRFMT of the NLXOP namelist. In this example, the data is in the file **B:APPLRS.HOL**, in (12f8.3) FORMAT. Enter this name. <CR>

{10} The program then performs the seasonal adjustment requested and shows the tables stored by this run of X-11.2 and the ASCII files they were written into. Then X-11.2 again gives the current settings of the NLX11 namelist. Note that since RESET='Y', all of the namelist variables were reset to their default values. Enter new values for namelist NLX11 for the next run. <CR>

Note that the value of BEGOB is being changed to 7. This reflects the fact that LETHTI begins in July of 1970. When a series starts in a month other than the first, zeroes or blank fields must appear on the data records for the missing months. Table G gives the contents of **LETHTI.DAT**, the data file for LETHTI. Since BEGOB=7, the first six observations of the file are set equal to

zero. These fields are ignored by the program but must be inserted. If a user-defined format is used, this is no longer true. The user then has complete control over the format specifications.

{11} As before, the current settings of the variables and arrays in namelist NLX11 is shown. Since PROMPT='y', the user has another opportunity to change one or more of the namelist values shown. Since we do not wish to change the settings in this namelist, enter "n". <CR>

{12} The current settings for the NLXOP namelist is shown. For this adjustment, none of the variables in namelist NLXOP need to be changed from their default values, so enter "&". <CR>

{13} The current settings for NLXOP are displayed, and a prompt appears asking if we wish to change NLXOP. Enter "n" to specify no change. <CR>

{14} The current settings for NLTBL are displayed. Since TRESET='N', the values of the NLTBL namelist remain the same as they were set in the first run. Enter new values for namelist NLTBL. <CR>

{15} Current settings for NLTBL are displayed, and the prompt appears asking if we wish to change NLTBL. Enter "y" to specify a change.

{16} Enter new values for namelist NLTBL. <CR>

{17} Current settings for NLTBL are displayed, and the prompt appears asking if we wish to change NLTBL. Enter "n" to specify no change.

{18} Current settings for NLTBL are displayed, and a title for this run is requested. Enter a new title. <CR>

{19} An input data file name for this run is requested. Enter the name of a new data file. <CR>

{20} An output file name for this run is requested. Enter the name of a new output file. <CR>

{21} The program performs the seasonal adjustment requested. Note that since we did not request prior adjustment factors this time, the program did not request a prior adjustment factors file. The tables (and the corresponding files) stored in this run are given. Once X-11.2 is finished, it will again print out the current settings of NLX11. Since we are done, set STOP='Y'. <CR>

TABLE F : AN EXAMPLE OF AN INTERACTIVE X-11.2 RUN WITH TWO SERIES

```
{1}  C:\>a:x11ss                                                          <CR>

     ENTER X-11.2 COMMAND FILE NAME OR CON (FOR INTERACTIVE PROCESSING) :
{2}   > con                                                               <CR>


        CURRENT SETTINGS FOR NLX11 NAMELIST ARE :
     &NLX11 SER=       ,FMT=1                                ,
     INDEC=0,BEGOB=1,BEGYR=0,LSTOB=12,LSTYR=0,REWIND=N,ADDMUL=M,SEAADJ=Y,PRTOUT=D,
     OUTDEC=0,CHART=N,ASCIBM=Y,SIGLIM=1.50000,2.50000,SSPAN=N,SSYEAR=0,TREND=PS,
     SMA=D, , , , , , , , , , , , ,RESET=Y,NUMTBL=0,PROMPT=N,STOP=N &END

       ENTER VARIABLES AND THEIR SETTINGS FOR NLX11 NAMELIST :
{3}  /NLX11/? ser='applrs', fmt='(6f12.3)', begyr=67, lstyr=83, sspan='s'  <CR>

{3}  /NLX11/? siglim=1.8,2.8, numtbl=3       &                            <CR>

     &NLX11 SER=applrs,FMT=(6f12.3)                                  ,
     INDEC=0,BEGOB=1,BEGYR=67,LSTOB=12,LSTYR=83,REWIND=N,ADDMUL=M,SEAADJ=Y,
     PRTOUT=D,OUTDEC=0,CHART=N,ASCIBM=Y,SIGLIM=1.80000,2.80000,SSPAN=S,
     SSYEAR=0,TREND=PS,SMA=D, , , , , , , , , , , , ,RESET=Y,NUMTBL=3,PROMPT=N,
     STOP=N &END

       CURRENT SETTINGS FOR NLXOP NAMELIST ARE :
     &NLXOP TD=N,YRCOMP=0,YRAPP=0,TDSIG=2.50000,LOM=N,PTDWT=0.000000,0.000000,
     0.000000,0.000000,0.000000,0.000000,0.000000,HOLDAY=N,
     PRFMT=N                                        ,PRSER=      ,
     PRDEC=3,STOP=N &END

       ENTER VARIABLES AND THEIR SETTINGS FOR NLXOP NAMELIST :
{4}  /NLXOP/? td='f', lom='y', yrcomp=76, prfmt='(12f8.3)', prser='holday'  &  <CR>

     &NLXOP TD=F,YRCOMP=76,YRAPP=0,TDSIG=2.50000,LOM=Y,PTDWT=0.000000,0.000000,
     0.000000,0.000000,0.000000,0.000000,0.000000,HOLDAY=N,
     PRFMT=(12f8.3)                                 ,PRSER=holday,
     PRDEC=3,STOP=N &END

       CURRENT SETTINGS FOR NLTBL NAMELIST ARE :
     &NLTBL NUMTBL=3,TBL=    ,    ,    ,    ,    ,    ,    ,    ,    ,    ,
     TBLFMT=                                                ,
     DRIVE=                                         ,TBLDEC=0,FORCST=N,TRESET= ,
     OVERIT=Y,STOP=N &END

       ENTER VARIABLES AND THEIR SETTINGS FOR NLTBL NAMELIST :
{5}  /NLTBL/? tbl(1)='d10', tbl(2)='d11', tbl(3)='d20', drive='b:', forcst='y'  <CR>

{5}  /NLTBL/? tblfmt='(6f12.3)', treset='n'  &                            <CR>

     &NLTBL NUMTBL=3,TBL=d10,d11,d20,    ,    ,    ,    ,    ,    ,    ,
     TBLFMT=(6f12.3)                                        ,
     DRIVE=b:                                       ,TBLDEC=0,FORCST=Y,TRESET=n,
     OVERIT=Y,STOP=N &END
```

TABLE F : AN EXAMPLE OF AN INTERACTIVE X-11.2 RUN WITH TWO SERIES (CONTINUED)

```
        ENTER TITLE FOR X-11.2 RUN :
{6}   > x-11.2 sample run for applrs, sliding spans, trading day, prior factors    <CR>

        ENTER DATA FILE NAME :
{7}   > b:applrs.dat                                                              <CR>

        ENTER OUTPUT FILE NAME :
{8}   > b:applrs.out                                                              <CR>

        ENTER PRIOR MONTHLY FACTOR FILE NAME :
{9}   > b:applrs.hol                                                              <CR>


         X-11.2 IS NOW EXECUTING . . . applrs
        TABLE d10 WAS STORED IN FILE b:applrs.d10
        TABLE d11 WAS STORED IN FILE b:applrs.d11
        TABLE d20 WAS STORED IN FILE b:applrs.d20
         X-11.2 RUN FOR applrs COMPLETED.


      CURRENT SETTINGS FOR NLX11 NAMELIST ARE :
     &NLX11 SER=       ,FMT=1
     INDEC=0,BEGOB=1,BEGYR=0,LSTOB=12,LSTYR=0,REWIND=N,ADDMUL=M,SEAADJ=Y,PRTOUT=D,
     OUTDEC=0,CHART=N,ASCIBM=Y,SIGLIM=1.50000,2.50000,SSPAN=N,SSYEAR=0,TREND=PS,
     SMA=D, , , , , , , , , , , , ,RESET=Y,NUMTBL=0,PROMPT=N,STOP=N &END

      ENTER VARIABLES AND THEIR SETTINGS FOR NLX11 NAMELIST :
{10} /NLX11/? ser='LETHTI', begob=7, begyr=70, lstyr=87, fmt='2', indec=3         <CR>

{10} /NLX11/? sspan='s', numtbl=2, prompt='y'    &                               <CR>

     &NLX11 SER=LETHTI,FMT=2
     INDEC=3,BEGOB=7,BEGYR=70,LSTOB=12,LSTYR=87,REWIND=N,ADDMUL=M,SEAADJ=Y,
     PRTOUT=D,OUTDEC=0,CHART=N,ASCIBM=Y,SIGLIM=1.50000,2.50000,SSPAN=S,
     SSYEAR=0,TREND=PS,SMA=D, , , , , , , , , , , , ,RESET=Y,NUMTBL=2,PROMPT=Y,
     STOP=N &END¶

     DO YOU WISH TO CHANGE ANY OF THE CURRENT SETTINGS IN NLX11? (Y=YES,N=NO)
{11} > n                                                                          <CR>


      CURRENT SETTINGS FOR NLXOP NAMELIST ARE :
     &NLXOP TD=N,YRCOMP=0,YRAPP=0,TDSIG=2.50000,LOM=N,PTDWT=0.000000,0.000000,
     0.000000,0.000000,0.000000,0.000000,0.000000,HOLDAY=N,
     PRFMT=N                                          ,PRSER=      ,
     PRDEC=3,STOP=N &END

      ENTER VARIABLES AND THEIR SETTINGS FOR NLXOP NAMELIST :
{12} /NLXOP/? &end                                                                <CR>

     &NLXOP TD=N,YRCOMP=0,YRAPP=0,TDSIG=2.50000,LOM=N,PTDWT=0.000000,0.000000,
     0.000000,0.000000,0.000000,0.000000,0.000000,HOLDAY=N,
     PRFMT=N                                          ,PRSER=      ,
     PRDEC=3,STOP=N &END
```

```
     DO YOU WISH TO CHANGE ANY OF THE CURRENT SETTINGS IN NLXOP? (Y=YES,N=NO)
{13} > n                                                                    <CR>

       CURRENT SETTINGS FOR NLTBL NAMELIST ARE :
     &NLTBL NUMTBL=2,TBL=d10,d11,d20,   ,   ,   ,   ,   ,   ,   ,
     TBLFMT=(6f12.3)                                    ,
     DRIVE=b:                                          ,TBLDEC=0,FORCST=Y,TRESET=n,
     OVERIT=Y,STOP=N &END

       ENTER VARIABLES AND THEIR SETTINGS FOR NLTBL NAMELIST :
{14} /NLTBL/? tbl(3)='   '   &                                              <CR>

     &NLTBL NUMTBL=2,TBL=d10,d11,   ,   ,   ,   ,   ,   ,   ,   ,
     TBLFMT=(6f12.3)                                    ,
     DRIVE=b:                                          ,TBLDEC=0,FORCST=Y,TRESET=n,
     OVERIT=Y,STOP=N &END

     DO YOU WISH TO CHANGE ANY OF THE CURRENT SETTINGS IN NLTBL? (Y=YES,N=NO)
{15} > y                                                                    <CR>


       ENTER VARIABLES AND THEIR SETTINGS FOR NLTBL NAMELIST :
{16} /NLTBL/? tblfmt='2', tbldec=3   &                                      <CR>

     &NLTBL NUMTBL=2,TBL=d10,d11,   ,   ,   ,   ,   ,   ,   ,   ,
     TBLFMT=2                                           ,
     DRIVE=b:                                          ,TBLDEC=3,FORCST=Y,TRESET=n,
     OVERIT=Y,STOP=N &END

     DO YOU WISH TO CHANGE ANY OF THE CURRENT SETTINGS IN NLTBL? (Y=YES,N=NO)
{17} > n                                                                    <CR>


       ENTER TITLE FOR X-11.2 RUN :
{18} > x-11.2 sample run for lethti, sliding spans                          <CR>

       ENTER DATA FILE NAME :
{19} > b:lethti.dat                                                         <CR>

       ENTER OUTPUT FILE NAME :
{20} > b:lethti.out                                                         <CR>


        X-11.2 IS NOW EXECUTING . . . LETHTI
       TABLE d10 WAS STORED IN FILE b:LETHTI.d10
       TABLE d11 WAS STORED IN FILE b:LETHTI.d11
        X-11.2 RUN FOR LETHTI COMPLETED.


       CURRENT SETTINGS FOR NLX11 NAMELIST ARE :
     &NLX11 SER=      ,FMT=1                                            ,
     INDEC=0,BEGOB=1,BEGYR=0,LSTOB=12,LSTYR=0,REWIND=N,ADDMUL=M,SEAADJ=Y,PRTOUT=D,
     OUTDEC=0,CHART=N,ASCIBM=Y,SIGLIM=1.50000,2.50000,SSPAN=N,SSYEAR=0,TREND=PS,
     SMA=D, , , , , , , , , , , , ,RESET=Y,NUMTBL=0,PROMPT=N,STOP=N &END
```

TABLE F : AN EXAMPLE OF AN INTERACTIVE X-11.2 RUN WITH TWO SERIES (CONTINUED)

```
 ENTER VARIABLES AND THEIR SETTINGS FOR NLX11 NAMELIST :
{21} /NLX11/? stop='y' &                                          <CR>

 C:\>
```

TABLE G : CONTENT OF LETHTI.DAT

```
      1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

     0.        0.        0.        0.        0.        0.
   154.      151.      134.      142.      139.      143.70LETHTI
   141.      143.      145.      144.      144.      138.
   148.      147.      147.      147.      151.      151.71LETHTI
   155.      150.      150.      143.      154.      156.
   158.      154.      154.      157.      164.      170.72LETHTI
   180.      189.      192.      178.      186.      179.
   184.      183.      187.      186.      181.      184.73LETHTI
   174.      167.      167.      158.      164.      164.
   170.      170.      174.      172.      177.      182.74LETHTI
   184.      173.      176.      167.      161.      165.
   174.      169.      172.      172.      174.      182.75LETHTI
   188.      186.      189.      182.      180.      183.
   185.      183.      191.      202.      206.      209.76LETHTI
   218.      219.      218.      223.      212.      199.
   208.      195.      188.      194.      201.      219.77LETHTI
   228.      228.      234.      233.      241.      220.
   243.      254.      233.      245.      254.      262.78LETHTI
   262.      282.      254.      267.      270.      280.
   296.      273.      272.      265.      285.      279.79LETHTI
   263.      271.      265.      272.      264.      241.
   246.      239.      236.      247.      278.      287.80LETHTI
   298.      291.      283.      282.      268.      246.
   282.      248.      273.      284.      297.      296.81LETHTI
   331.      310.      316.      330.      327.      311.
   288.      272.      272.      281.      286.      316.82LETHTI
   338.      336.      325.      330.      346.      307.
   339.      354.      353.      356.      366.      363.83LETHTI
   339.      332.      340.      321.      354.      300.
   326.      338.      314.      346.      331.      325.84LETHTI
   285.      287.      280.      270.      259.      200.
   246.      242.      260.      264.      277.      307.85LETHTI
   311.      322.      301.      272.      280.      239.
   255.      253.      277.      293.      280.      292.86LETHTI
   300.      299.      314.      333.      349.      345.
   356.      360.      351.      357.      361.      364.87LETHTI
```

EXAMPLE 3 : An X-11.2 Run Using Stored Commands

Table G gives an example of a noninteractive X-11.2 run performed by means of commands stored in a file. First, there is a listing of a sample X-11.2 command file, whose different sets of records have been numbered for convenience. The rest of Table G shows how to execute these commands. For this example, place Disk 1 in drive A and Disk 3 in drive B. This command file is set up to cause two seasonal adjustments of the series COMP1F (Completions of Single Family Housing) to be performed, the first without trading day adjustment, the second with trading day adjustment. In both runs, 3X9 seasonal filters are used and a sliding spans analysis is performed.

{1} The first set of records in **COMP1F.X12** assigns values to the variables in the NLX11 namelist.

{2} Next, values are assigned to the variables and arrays in the NLXOP namelist. Since trading day, holiday, or prior factor adjustment will not be performed in this adjustment of COMP1F, none of the variables in the NLXOP namelist needs to have new values entered here.

{3} Since the table storage option has been invoked, values are assigned to the variables and arrays in the NLTBL namelist.

{4} A title for the X-11.2 run is entered on this record.

{5} The name of the input data file for this run is entered on this record.

{6} The name of the output file for this run is entered on this record.

{7} Since there are no prior adjustment factors, the next set of records is used to assign values for the variables in the NLX11 namelist for the second X-11.2 run. Since RESET='N' in the first run, the namelist values are not reset to their default settings but remain as they were set in the previous run. Therefore, we only need to enter REWIND='y', to rewind the input data file so that it can be read by X-11.2 again, and NUMTBL=3, to denote an additional table will be stored by X-11.2.

{8} Again, we assign values for the variables and arrays in the NLXOP namelist. Only the trading day and length of month variables need to be changed.

{9} We assign values for the variables and arrays in the NLTBL namelist. We only need to add a third table (C16) to be stored.

{10} A new title is entered on this record.

{11} Since we wish to use the same data as before, the character "@" is entered in the first column of this record.

{12} The "@" on this record signifies that we wish to use the same output file.

{13} We wish to stop execution at this point, so we set STOP='Y' in namelist NLX11.

Once the command file is set up, the user needs to enter the name of the X-11.2 command file (in this case, **B:COMP1F.X12**) and an X-11.2 error file (in this case, **B:COMP1F.ERR**). The program will then read the stored commands from this file, and perform the requested seasonal adjustment. Note that, since there were no errors in this run, nothing will be stored in **B:COMP1F.ERR**.

TABLE H : AN EXAMPLE OF AN X-11.2 RUN USING STORED COMMANDS

CONTENTS OF A FILE NAMED COMP1F.X12 CONTAINING STORED COMMANDS

```
{1}   &nlx11  ser='COMP1F', begyr=72, lstyr=85, outdec=2, reset='n', sspan='s',
         sma(1) = '9', numtbl=2  &end
{2}   &nlxop  &end
{3}   &nltbl  tbl(1)='d10', tbl(2)='d11', tblfmt='(6f12.3)', overit='n', treset='n'
         drive='b:', forcst='y'  &end
{4}  x-11.2 test run for comp1f with sliding spans
{5}  b:comp1f.dat
{6}  b:comp1f.out
{7}   &nlx11  rewind='y', numtbl=3  &end
{8}   &nlxop  td='a', lom='y'  &end
{9}   &nltbl  tbl(3)='c16'  &end
{10} x-11.2 test run for comp1f with sliding spans, trading day
{11} @
{12} @
{13}  &nlx11   stop='y'   &end
```

EXECUTION OF THESE COMMANDS

```
C:\>a:x11ss

ENTER X-11.2 COMMAND FILE NAME OR CON (FOR INTERACTIVE PROCESSING) :
 > b:comp1f.x12

ENTER X-11.2 ERROR FILE NAME OR @ (ERRORS STORED IN C:\X11.ERR) :
 > b:comp1f.err


     X-11.2 IS NOW EXECUTING . . . COMP1F
     TABLE d10 WAS STORED IN FILE b:X11SS.TBL
     TABLE d11 WAS APPENDED TO FILE b:X11SS.TBL
     X-11.2 RUN FOR COMP1F COMPLETED.



     X-11.2 IS NOW EXECUTING . . . COMP1F
     TABLE d10 WAS APPENDED TO FILE b:X11SS.TBL
     TABLE d11 WAS APPENDED TO FILE b:X11SS.TBL
     TABLE c16 WAS APPENDED TO FILE b:X11SS.TBL
     X-11.2 RUN FOR COMP1F COMPLETED.


C:\>
```

CHAPTER 2 : OTHER ENHANCEMENTS INCLUDED IN X-11.2

I. Introduction

The other options and features included in X-11.2 and described in this document are enhancements which first appeared in X-11.1 and X-11.1Q, the previous release of the Census X-11 seasonal adjustment program for the microcomputer. This chapter describes these features, which are not discussed in the basic document for the X-11 programs, Census Bureau Technical Paper No. 15, **The X-11 Variant of the Census Method II Seasonal Adjustment Program.**

II. Final Combined Adjustment Factors

This table combines the final seasonal, trading day, and holiday factors to arrive at a final combined adjustment factor. One-year-ahead forecasts of the combined adjustment factors are also printed out. This table is listed as Table **D20**, the Final Combined Adjustment Factors.

Note that if no trading day or holiday adjustment is performed, then the final combined adjustment factors are equal to the final seasonal factors in Table **D10**. In this case, Table **D20** is not printed out.

III. New Graphics

Line printer type graphs associated with selected tables in the X-11.2 output can be obtained. These include:

(a) a graph of the original series (Table **A1** or **B1**);

(b) a graph of the final seasonally adjusted series (Table **D11**);

(c) a graph of the original series and the final seasonally adjusted series on the same axis;

(d) a monthly (or, in X-11.2Q, quarterly) subseries plot of the final unmodified SI-ratios (Table **D8**).

(e) a monthly (quarterly) subseries plot of the final seasonal factors (Table **D10**);

(f) a graph of the final irregular series (Table **D13**);

Each of these graphs is printed immediately after the table it depicts, except (c), which is printed just before the E Tables.

The user has the option of printing out all of these plots, just plots (a) through (c), or none of them. Note that for X-11.2, if the series is longer than nine years, only the last nine years will appear in each plot.

IV. Holiday Adjustments

Currently, the Bureau of the Census performs holiday adjustments on certain of its published retail sales series. The procedure used by the Census Bureau to obtain these adjustments has been incorporated into the X-11.2 program. The holidays (and months)

adjusted for are:

(a) Easter (March and April);
(b) Labor Day (August and September);
(c) Thanksgiving (November and December).

When doing a holiday adjustment, the X-11.2 program calculates a preliminary seasonal adjustment of the data (with no printed output) using the adjustment options supplied by the user, in order to get the final irregular component (Table **D13**). As is described in detail in **Appendix A**, this irregular component is used to determine the holiday adjustment factors, either by passing a line though the means of data segments surrounding the holiday (Easter) or by a linear least square regression line technique (Labor Day and Thanksgiving). These prior factors are automatically applied as prior factors to a second execution of the X-11.2 program, whose output is the requested combined seasonal, trading day (if applicable) and holiday adjustment. Please note that currently the holiday adjustment is an available option only when the series is adjusted multiplicatively.

The X-11.2 program also supplies the user with one-year-ahead projected holiday factors. The regression F-test statistics are printed out for the Labor Day and Thanksgiving holiday regressions. The user can also request as an option (HOLDAY='F') that holiday factors not be applied if the final regression F-test is insignificant. There is no analogous statistic for the Easter holiday procedure.

CHAPTER 3 : HOW TO USE X-11Q.2

I. Introduction

X-11Q.2 is a quarterly version of the X-11.2 seasonal adjustment program. As with the X-11.2 program, X-11Q.2 was created using Lahey FORTRAN 77 for IBM and comparable microcomputers, and the compiled program (called **X11Q2.EXE**) can only be used on microcomputers with or without a math coprocessor (8087, 80287, or 80327). This version contains many of the enhancements of the X-11.2 seasonal adjustment program :

(a) the sliding spans analysis of seasonal adjustment stability;
(b) the namelist input of X-11Q.2 options;
(c) the table storage option.

There have been other enhancements made to the original X-11Q program which were incorporated into this version. A wider selection of seasonal and trend filter lengths are available in X-11Q.2. New formats for data input have been created for X-11Q.2. The numerical precision of the program has also been improved.

In this chapter, we will briefly discuss the X-11Q.2 namelists. Then, using a sample X-11Q.2 interactive run, we will show how the X-11Q.2 program can be used. The namelist input and table storage features are described in Chapter 1 and will not be discussed here.

II. The X-11Q.2 Namelists

Two namelists are used by X-11Q.2 to set program options to values supplied by the user. The first namelist is called NLX11Q, the X-11Q.2 main namelist. This namelist includes variables providing the program with the series name, its starting and ending dates, and the input data format. The variables used in this namelist have the same names as those used in the NLX11 namelist of the X-11.2 program. A complete listing of the variables in NLX11Q, with their default values, is given in Table F.

The second namelist is NLTBLQ, the X-11Q.2 table storage namelist. NLTBLQ is almost identical to the NLTBL namelist of the X-11.2 program. It contains variables which identify the tables to be stored and the format to be used, and is invoked only when the variable NUMTBL of the NLX11Q namelist is greater than zero. A complete listing of the variables in NLTBLQ, with their default values, is given in Table G.

The namelist input procedures for X-11Q.2 are the same as those for X-11.2 detailed in section II of Chapter 1. If you seek more information about a specific option, refer to Tables I and J of this document.

TABLE I
SPECIFICATIONS FOR NLX11Q : X-11Q.2 MAIN NAMELIST

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
FMT	CHARACTER*30	'1'	Input Format Control. '1' = Year and series identifier on right, data in 18-digit fields : (4F18.0,I2,A6). '2' = Year and series identifier on right, data in 12-digit fields : (4F12.0,24X,I2,A6). Else, User supplied FORTRAN format describing the data areas only.
SER	CHARACTER*6	' '	Series Identifier may be numeric, alphabetic or mixed; must be identical to the identifier found in columns 74-80 of the entries in the data file if FMT='1' or '2'. The series identifier must be left justified. Note that if a user supplied FORTRAN format is used to read the data, this becomes a label used in the output and is not used to check the data.
INDEC	INTEGER	0	Number of Decimals on Input Data. This option can be used to modify input formats '1' and '2' above. Admissible values for INDEC are from 0 to 5, inclusive.
BEGOB	INTEGER	1	Number of the period in which the series starts: 1 for the first quarter, . . . , 4 for the fourth quarter. Admissible values for BEGOB are from 1 to 4, inclusive.
BEGYR	INTEGER	0	Last two digit of the year in which the series starts. The first two digits of the year, in this field and all others calling for a year entry, are assumed to be 19. BEGYR should never be negative.
LSTOB	INTEGER	4	Number of the period in which the series ends. Admissible values for LSTOB are from 1 to 4, inclusive.
LSTYR	INTEGER	0	Last two digits of the year in which the series ends. LSTYR should never be negative.
REWIND	CHARACTER*1	'Y'	Rewind Input Data File. 'Y' = Rewind data file before reading in data. 'N' = Don't rewind data file before reading in data.
ADDMUL	CHARACTER*1	'M'	Type of Adjustment. 'M' = Multiplicative seasonal adjustment 'A' = Additive seasonal adjustment
SEAADJ	CHARACTER*1	'Y'	Type of Program. 'Y' = Seasonal adjustment run. 'N' = Summary measures run : develops estimates of the trend cycle, irregular, MCD and residual trading day and seasonal variation from a seasonally adjusted input.
PRTOUT	CHARACTER*1	'D'	Type of Printout. 'D' = Standard printout. About 18 tables are printed. 'S' = Short printout. About seven tables are printed. 'L' = Long printout. About 26 tables are printed. 'F' = Full printout. About 45 tables are printed.

TABLE I: SPECIFICATIONS FOR NLX11Q (CONTINUED)

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
OUTDEC	INTEGER	0	Number of Decimals on Output Tables. Most tables will be printed with the number of decimals entered here. Admissible values for OUTDEC are from 0 to 3, inclusive.
CHART	CHARACTER*1	'N'	Charts. 'N' = No charts. 'S' = Produce charts of the original series, the final seasonally adjusted series, and the original series compared with the seasonally adjusted data. 'A' = In addition to the charts produced with option 'S', produce charts of the final unmodified SI ratios, the final seasonal factors, and the final irregular series.
ASCIBM	CHARACTER*1	'Y'	Character Type Used in Charts. 'N' = Use the regular ASCII character set to produce these charts. 'Y' = Use the extended IBM ASCII character set to produce these charts.
SIGLIM(1), SIGLIM(2)	REAL	1.5,2.5	Lower and Upper Sigma Limit for Graduating Extreme Values in Estimating Seasonal and Trend-cycle Components. Irregulars will be assigned full weight within SIGLIM(1) and zero weight outside SIGLIM(2). SIGLIM(1) and SIGLIM(2) should be greater than zero, with SIGLIM(1) less than or equal to SIGLIM(2).
SSPAN	CHARACTER*1	'N'	Sliding Spans Analysis. Perform sliding spans analysis with span lengths appropriate for the seasonal filters being used, provided the series is long enough. Length of spans, number of spans, and starting date for first sliding span is determined by the program. 'N' = Do not perform sliding spans analysis. 'A' = Perform sliding spans analysis, print all tables. 'S' = Perform sliding spans analysis, print selected tables.
SSYEAR	INTEGER	0	Last two digits of the year in which sliding spans comparisons are to start. SSYEAR should be greater than or equal to zero. If SSYEAR=0, the first year of comparisons will begin with the first observation of the second span.
NUMTBL	INTEGER	0	Number of X-11Q.2 tables to be stored separately by this X-11Q.2 run. The user can choose up to ten tables, which are then written to separate (ASCII) files.
SMA(1)	CHARACTER*1	'D'	Seasonal Moving Averages for the First Quarter. (Note : for series shorter than five complete years, the program automatically selects the stable seasonal filter and the user has no control over the selection). 'D' = Select a 3 X 3 for the first seasonal estimate in each iteration and a 3 X 5 for the final estimate for the first quarter. '1' = Select a 3 term moving average for the first quarter. '3' = Select a 3 X 3 moving average for the first quarter. '5' = Select a 3 X 5 moving average for the first quarter. '9' = Select a 3 X 9 moving average for the first quarter. 'S' = Select a stable seasonal (average of all values for the period) for the first quarter.

TABLE I: SPECIFICATIONS FOR NLX11Q (CONTINUED)

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
SMA(2)-SMA(4)	CHARACTER*1	' '	Seasonal Moving Averages for Other Quarters. ' ' = Use same seasonal moving average that was used in the first quarter. 'D' = Select a 3 X 3 for the first seasonal estimate in each iteration and a 3 X 5 for the final estimate. '1' = Select a 3 term moving average. '3' = Select a 3 X 3 moving average. '5' = Select a 3 X 5 moving average. '9' = Select a 3 X 9 moving average. 'S' = Select a stable seasonal (average of all values for the period).
TREND	CHARACTER*1	'PS'	Moving Average for Variable Trend-cycle Routine. 'S' = Program automatically selects an appropriate moving average from those listed. '5' = Select a 5-term Henderson moving average. '7' = Select a 7-term Henderson moving average.
RESET	CHARACTER*1	'Y'	Reset Namelist Variables. 'Y' = Reset all variables in all namelists to default values. 'N' = Retain previous values of variables in namelists.
PROMPT	CHARACTER*1	'N'	Produce Namelist Prompt. (Note : this option only works in demand mode) 'Y' = Produces prompt after namelist input has been read in demand mode. Allows the user to change previously entered namelist input. 'N' = No prompt will be given after namelist input.
STOP	CHARACTER*1	'N'	'Y' = Stop execution of X-11Q.2 'N' = Continue execution of X-11Q.2

TABLE J
SPECIFICATIONS FOR NLTBLQ : X-11Q.2 TABLE STORAGE NAMELIST

VARIABLE NAME	VARIABLE TYPE	DEFAULT	DESCRIPTION
NUMTBL	INTEGER	0	Number of X-11Q.2 tables to be stored separately by this X-11Q.2 run. The user can choose up to ten tables, which are then written to separate (ASCII) files.
TBL(1)-TBL(10)	CHARACTER*3	' '	Name of tables to be stored. The table names correspond to those on the X-11Q.2 printout. Only tables that have been selected for the printout of this run can be stored. The table name must be left-justified (i.e., 'B01', 'B 1', or 'B1 ', rather than ' B1'). The user should be sure that the printout option selected with PRTOPT of the NLX11Q namelist includes all tables to be stored.
TBLFMT	CHARACTER*40	' '	Table Output Format. Note that data input format and table output format do not have to be the same. ' ' = Format the same as for data input (see FMT in NLX11Q namelist). '1' = Year and identifier on right, data in 18-digit fields : (4F18.0,I2,A6). '2' = Year and identifier on right, data in 12-digit fields : (4F12.0,24X,I2,A6). Else, User supplied FORTRAN format describing the time series data areas only.
TBLDEC	INTEGER	0	Number of Decimals to be Used in Table Storage Formats. This option can be used to modify input formats '1' and '2' above. Admissible values for TBLDEC are from 0 to 5, inclusive.
DRIVE	CHARACTER*40	' '	Specifies on which drive the files generated by X-11Q.2 will be stored.
FORCST	CHARACTER*1	'N'	Storage of Factor Forecasts. 'N' = Do not append factor forecasts to the seasonal factors when storage of these tables is requested. 'Y' = Append factor forecasts to the seasonal factors when storage of these tables is requested.
OVERIT	CHARACTER*1	'Y'	Overwrite Existing File. 'Y' = If the output file selected by the program already exists, overwrite the contents of the existing file. 'N' = If the output file selected by the program already exists, the contents of the existing file will be preserved and an attempt will be made to create a new file for the table. 'A' = If the output file selected by the program already exists, the contents of the table will be appended to the end of the existing file. 'O' = Store all tables in a file named X11Q2.TBL. If X11Q2.TBL exists, overwrite the contents of the existing file.
TRESET	CHARACTER*1	' '	Reset NLTBLQ Namelist Variables. ' ' = Set TRESET to be the same as RESET of NLX11Q namelist. 'Y' = Reset all variables in the NLTBLQ namelist to default values. 'N' = Retain previous values of variables in the NLTBLQ namelist.
STOP	CHARACTER*1	'N'	'Y' = Stop execution of X-11Q.2 'N' = Continue execution of X-11Q.2

III. Running X-11Q.2

This section discusses the basic command sequence for running X-11Q.2 and gives an example of an interactive X-11Q.2 run. The sequence for running X-11Q.2 is very similar to that of X-11.2, and is given below :

(1) Assign values to variables and arrays in the NLX11Q namelist.

(2) If the table storage option is being used in this run, assign values to variables and arrays in the NLTBLQ namelist.

(3) Specify a title for the X-11Q.2 run. The user can

(a) simply enter a title of up to eighty characters in length;
(b) enter the character "@", to use the previous title (during multiple runs);
(c) enter the character "*", to print out the previous title.

Please note that "*" is only to be used with interactive X-11Q.2 runs. If "*" is specified, X-11Q.2 will ask the user to specify a title or "@" again.

(4) Specify which data file contains the time series for this X-11Q.2 run. The user can

(a) enter the name of the data file (up to 80 characters long);
(b) enter "@" or "*" as described in (3).

(5) Specify the output file which will be used in this X-11Q.2 run. The user can

(a) enter the name of the output file (up to 80 characters long);
(b) enter "@" or "*" as described in (3).

This can be repeated for as many series as you wish to run. To stop executing X-11.2, set the variable STOP='Y' in either X-11Q.2 namelist.

EXAMPLE 4 : An Interactive X-11Q.2 Run

Table K gives an example of how to run X-11Q.2 interactively. We have numbered each entry made by the user to enable us to illustrate each step. <CR> denotes a carriage return should be performed after the action specified. For this example, Disk 2 (the X-11Q.2 program diskette, contaning the run file **X11Q2.EXE**) was placed in drive A.

{1} First, enter the filename of the X-11Q.2 run file, preceded by the designation of its disk drive (**A:X11Q2**). <CR>

{2} X-11Q.2 asks you to enter either an input command file name (an ASCII file containing the X-11Q.2 commands) or "CON" (the input will come from the console). Enter "con" to run X-11Q.2 interactively. <CR>

{3} Next, X-11Q.2 displays the current setting of the variables in the NLX11Q namelist and prompts you to enter values for the NLX11Q namelist. Enter data for those namelist variables you wish to change in this namelist. <CR>

{4} X-11Q.2 displays the current settings of the NLX11Q namelist. Since NUMTBL was set to one (1) in the NLX11Q namelist, the program displays the current settings of the variables and arrays in the NLTBLQ namelist and prompts you to enter values for the NLTBLQ namelist. Enter data for those namelist variables you wish to change in this namelist. <CR>

{5} After displaying the current settings for the NLTBLQ namelist, X-11Q.2 then asks for a title for the X-11Q.2 run. Enter the title for the X-11Q.2 run. <CR>

{6} X-11Q.2 then requests the name of the input data file containing the data to be adjusted during this run. This should be an ASCII file, and the data should be formatted as indicated by the variable FMT of the NLX11 namelist. For this example, the data is in the file ␣A:X11Q2.DAT␣, in (4F18.3,I2,A6) FORMAT (note: data is stored with year and series labels). Enter this name. <CR>

{7} X-11Q.2 then requests the name of the file that the output from this X-11Q.2 run should be written into. Enter name of output file. <CR>

{8} The program then performs the seasonal adjustment requested. After this adjustment is complete, the tables stored in this run of X-11Q.2 are shown, as well as the ASCII files they were written into. X-11Q.2 will again print out the current settings of the NLX11 namelist. Since RESET='N', the namelist variables retain the values from the prior X-11Q.2 execution. Enter new values for namelist NLX11Q for the next run. <CR>

{9} As before, the current settings for the NLX11Q and NLTBLQ namelists are shown. For this adjustment, none of the variables in namelist NLTBLQ need to be changed from their default values, so enter "&". <CR>

{10} Current settings for NLTBLQ are displayed, and a new title is requested. Enter "*" to see the previous title. <CR>

{11} The title for the previous run is printed out, and a new title is requested. Enter a new title. <CR>

{12} An input data file name for this run is requested. Since we wish to use the same data as before, the character "@" is entered. <CR>

{13} An output file name for this run is requested. Enter "@" to signify that we wish to use the same output file. <CR>

{14} The program then performs the seasonal adjustment requested. The tables stored in this run of X-11Q.2 are shown, as well as the ASCII files they were written into. X-11Q.2 will again print out the current settings of the NLX11 namelist. Since we are done, set STOP='Y'. <CR>

X-11Q.2 can also be run using stored commands. The command file structure is similar to that of an X-11Q.2 command file. The reader is referred to Section IV of Chapter 1 for an example of an X-11.2 run using stored commands.

TABLE K : AN EXAMPLE OF AN INTERACTIVE X-11Q.2 RUN

```
{1}  C:\>A:X11Q2                                                          <CR>

       ENTER X-11Q.2 COMMAND FILE NAME OR CON (FOR INTERACTIVE PROCESSING)
{2}    > con                                                              <CR>


       CURRENT SETTINGS FOR NLX11Q NAMELIST ARE :
      &NLX11Q SER=       ,FMT=1
      INDEC=0,BEGOB=1,BEGYR=0,LSTOB=4,LSTYR=0,REWIND=N,ADDMUL=M,SEAADJ=Y,PRTOUT=S,
      OUTDEC=0,CHART=N,ASCIBM=0,SIGLIM=1.50000,2.50000,SSPAN=N,SSYEAR=0,TREND=S,
      SMA=D, , , ,RESET=Y,NUMTBL=0,PROMPT=N,STOP=N &END

       ENTER VARIABLES AND THIER SETTINGS FOR NLX11Q NAMELIST :
{3}   /NLX11Q/? ser='BNKBAL', begyr=50, lstob=3, lstyr=64, siglim=1.0,2.0  <CR>

{3}   /NLX11Q/? reset='n', numtbl=1, rewind='y', sma(1)='3'   &             <CR>

      &NLX11Q SER=BNKBAL,FMT=1
      INDEC=0,BEGOB=1,BEGYR=50,LSTOB=3,LSTYR=64,REWIND=y,ADDMUL=M,SEAADJ=Y,PRTOUT=S,
      OUTDEC=0,CHART=N,ASCIBM=0,SIGLIM=1.00000,2.00000,SSPAN=N,SSYEAR=0,TREND=S,
      SMA=3, , , ,RESET=n,NUMTBL=1,PROMPT=N,STOP=N &END

       CURRENT SETTINGS FOR NLTBLQ NAMELIST ARE :
      &NLTBLQ NUMTBL=1,TBL=   ,   ,   ,   ,   ,   ,   ,   ,   ,   ,
      TBLFMT=
      DRIVE=                                          ,TBLDEC=0,FORCST=N,TRESET= ,
      OVERIT=Y,STOP=N &END

       ENTER VARIABLES AND THEIR SETTINGS FOR NLTBLQ NAMELIST :
{4}   /NLTBLQ/? tbl(1)='d10', tblfmt='2', drive='a:', tbldec=3, forcst='y'  <CR>

{4}   /NLTBLQ/? treset='n', overit='a'        &                           <CR>

      &NLTBLQ NUMTBL=1,TBL=d10,   ,   ,   ,   ,   ,   ,   ,   ,   ,
      TBLFMT=2
      DRIVE=a:                                        ,TBLDEC=3,FORCST=Y,TRESET=n,
      OVERIT=a,STOP=N &END

       ENTER TITLE FOR X-11Q.2 RUN :
{5}    > test run for x-11q.2 on bnkbal, 3 x 3 seasonal factors            <CR>

       ENTER DATA FILE NAME :
{6}    > a:bnkbal.dat                                                     <CR>

       ENTER OUTPUT FILE NAME :
{7}    > a:bnkbal.out                                                     <CR>

        X-11Q.2 IS NOW EXECUTING . . . BNKBAL
       TABLE d10 WAS STORED IN FILE a:BNKBAL.d10
        X-11Q.2 RUN FOR BNKBAL COMPLETED.
```

TABLE K : AN EXAMPLE OF AN INTERACTIVE X-11Q.2 RUN (CONTINUED)

```
  CURRENT SETTINGS FOR NLX11Q NAMELIST ARE :
&NLX11Q SER=BNKBAL,FMT=1
INDEC=0,BEGOB=1,BEGYR=50,LSTOB=3,LSTYR=64,REWIND=y,ADDMUL=M,SEAADJ=Y,PRTOUT=S,
OUTDEC=0,CHART=N,ASCIBM=0,SIGLIM=1.00000,2.00000,SSPAN=N,SSYEAR=0,TREND=S,
SMA=3, , , ,RESET=n,NUMTBL=1,PROMPT=N,STOP=N &END

  ENTER VARIABLES AND THIER SETTINGS FOR NLX11Q NAMELIST :
{8} /NLX11Q/? sma(1)='5'    &                                          <CR>

&NLX11Q SER=BNKBAL,FMT=1
INDEC=0,BEGOB=1,BEGYR=50,LSTOB=3,LSTYR=64,REWIND=y,ADDMUL=M,SEAADJ=Y,PRTOUT=S,
OUTDEC=0,CHART=N,ASCIBM=0,SIGLIM=1.00000,2.00000,SSPAN=N,SSYEAR=0,TREND=S,
SMA=5, , , ,RESET=n,NUMTBL=1,PROMPT=N,STOP=N &END

  CURRENT SETTINGS FOR NLTBLQ NAMELIST ARE :
&NLTBLQ NUMTBL=1,TBL=d10,   ,   ,   ,   ,   ,   ,   ,   ,   ,
TBLFMT=2
DRIVE=a:                                          ,TBLDEC=3,FORCST=Y,TRESET=n,
OVERIT=a,STOP=N &END

  ENTER VARIABLES AND THEIR SETTINGS FOR NLTBLQ NAMELIST :
{9} /NLTBLQ/? &                                                         <CR>

&NLTBLQ NUMTBL=1,TBL=d10,   ,   ,   ,   ,   ,   ,   ,   ,   ,
TBLFMT=2
DRIVE=a:                                          ,TBLDEC=3,FORCST=Y,TRESET=n,
OVERIT=a,STOP=N &END

  ENTER TITLE FOR X-11Q.2 RUN :
{10} > *                                                                <CR>
test run for x-11q.2 on bnkbal, 3 x 3 seasonal factors

  ENTER TITLE FOR X-11Q.2 RUN :
{11} > test run for x-11q.2 on bnkbal, 3 x 5 seasonal factors           <CR>

  ENTER DATA FILE NAME :
{12} > @                                                                <CR>

  ENTER OUTPUT FILE NAME :
{13} > @                                                                <CR>


   X-11Q.2 IS NOW EXECUTING . . . BNKBAL
  TABLE d10 WAS APPENDED TO FILE a:BNKBAL.d10
   X-11Q.2 RUN FOR BNKBAL COMPLETED.


  CURRENT SETTINGS FOR NLX11Q NAMELIST ARE :
&NLX11Q SER=BNKBAL,FMT=1
INDEC=0,BEGOB=1,BEGYR=50,LSTOB=3,LSTYR=64,REWIND=y,ADDMUL=M,SEAADJ=Y,PRTOUT=S,
OUTDEC=0,CHART=N,ASCIBM=0,SIGLIM=1.00000,2.00000,SSPAN=N,SSYEAR=0,TREND=S,
SMA=5, , , ,RESET=n,NUMTBL=1,PROMPT=N,STOP=N &END
```

TABLE K : AN EXAMPLE OF AN INTERACTIVE X-11Q.2 RUN (CONTINUED)

```
      ENTER VARIABLES AND THIER SETTINGS FOR NLX11Q NAMELIST :
{14} /NLX11Q/? stop='y'      &                                    <CR>

     C:\>
```

BIBLIOGRAPHY

Findley, D. F., Monsell, B. C., Shulman, H. B., and Pugh, M. G. (1988). "Sliding Spans Diagnostics for Seasonal and Related Adjustments". Bureau of the Census, Statistical Research Division Report No. CENSUS/SRD/RR-86/18.

Lothian, J. (1984). "The Identification and Treatment of Moving Seasonality in the X-11-ARIMA Seasonal Adjustment Method". Research Paper, Business Finance Division, Statistics Canada.

Lothian, J. and Morry, M. (1978). "A Set of Quality Control Statistics for the X-11-ARIMA Seasonal Adjustment Method". Research Paper, Seasonal Adjustment and Time Series Staff, Statistics Canada.

Morry, M. and Lothian, J. (1978). "A Test for the Presence of Identifiable Seasonality When Using the X-11-ARIMA Program". Research Paper, Seasonal Adjustment and Time Series Staff, Statistics Canada.

Shiskin, J., Young, A. H., and Musgrave, J. C. (1967). "The X-11 Variant of the Census Method II Seasonal Adjustment Program". Technical Paper No. 15, Bureau of the Census, U. S. Department of Commerce.

APPENDIX A: HOLIDAY ADJUSTMENT OF RETAIL SALES

by David V. Bateman and Fred Mayes
revised by Brian C. Monsell

Monthly retail sales series for many types of businesses contain variation which is related to the date of a particular holiday. The **seasonal adjustment** process usually removes the major part of this variation, that which recurs in the same month every year. An example is the high level of sales every year associated with Christmas buying. Christmas has a fixed date, however. Holidays such as Easter, Labor Day, and Thanksgiving occur on varying dates and have an effect on the sales activity of adjacent months which are influenced by the exact date of the holiday. **Holiday adjustment** attempts to eliminate that variation between adjoining months caused by the variable date of the holiday. Such variation appears in the irregular component, just as trading day variation does.

Holiday adjustment is justified if holiday variation is actually present in the series and its removal has the effect that (a) the trend cycle is more clearly revealed and (b) the estimates of trading day variation are more reliable. Holiday variation is especially important when attempting to assess the underlying cyclical movement over short time spans (1 or 2 months). Over longer spans it is of less importance, since it does not accumulate the way seasonal and cyclical movements do.

In the standard ratio to moving average methods of seasonal adjustment, the unadjusted data is sequentially separated into three components: trend cycle, seasonal, and irregular. When holiday variation is present in the unadjusted data, it is primarily included in the estimate of the irregular component, rather than in the seasonal or trend cycle, since it more closely resembles random movement. To estimate holiday variation from internal evidence, it is therefore reasonable to examine the estimate of the irregular component provided by the X-11 seasonal adjustment.

The holiday adjustments currently being applied at the Census Bureau to the irregular component of most nondurable kind-of-business series are given below, after an important piece of terminology is introduced.

Reciprocals

Both holiday adjustment procedures described below are estimated using "reciprocal" pairs of factors. This means that the sum of the factors for the two affected months is forced to sum to 200 (percent). The reasoning behind the use of such factor pairs is that, after the seasonal component's effect has been accounted for, the holiday's effect on one month will be countered by its effect on the other month, e.g. a three percent increase in one month (103%) will be balanced out by a three percent decrease in the next month (97%). As we use this terminology, the "reciprocal" factor is 200 minus the irregular factor of the month in question.

I. Easter

The shifting of Easter between March 22 and April 25 causes retail sales to be high in April and low in March, when Easter is late, and to be high in March and low in April, when Easter is early. The method used in X-11.1 to determine the effect of the date of Easter upon March and April sales is a modification of the "ideal" procedure described by Stephen N. Marris in an article entitled "The Measurement of Calendar Variation" from the collection **Seasonal Adjustment on Electronic Computers** (OECD, 1960, pp 356-59).

The actual derivation of the holiday factors for a given series is done by fitting five line segments to the irregulars as follows:

(1) The simple mean is computed for the data consisting of March irregulars and "reciprocal" April irregulars for the years when Easter occurs between March 22 and April 1, inclusive.

(2) The standard deviation is computed for these data. With this standard deviation, a trimmed mean of this initial segment is then computed, where those values which vary from the mean obtained in (1) by two or more standard deviations are excluded. We will refer to this trimmed mean as m_1.

(3) Repeat (1) and (2) for the irregulars from years in which Easter falls between April 16 and April 25, inclusive. We will call the resulting trimmed mean m_4.

(4) Compute simple means for irregulars from years in which Easter falls between April 2-8 inclusive (call this mean m_2); and for irregulars from years in which Easter falls between April 9-15 inclusive (call this mean m_3).

(5) Calculate preliminary values for the holiday factors for data in years where Easter falls between April 2 and April 15, inclusive, using the following definitions:

Let $\hat{Y}_t(M)$ denote the Easter factor for March in a year where Easter falls t days after March 21; and let $\hat{Y}_t(A)$ denote the Easter factor for April in a year where Easter falls t days after March 21.

If $10 < t \leq 14$ (Easter between April 2-5, inclusive) then

$$\hat{Y}_t(M) = m_1 + (m_2 - m_1)(t - 10)/4.$$

If $14 < t < 21$ (Easter between April 6-11, inclusive) then

$$\hat{Y}_t(M) = m_2 + (m_3 - m_2)(t - 14)/7.$$

If $21 \leq t < 25$ (Easter between April 12-15, inclusive) then

$$\hat{Y}_t(M) = m_3 + (m_4 - m_3)(t - 21)/4.$$

For all t above,

$$\hat{Y}_t(A) = 200. - \hat{Y}_t(M).$$

(6) Using the preliminary Easter factors derived in (5), compute separate standard errors for the preliminary factors from years in which Easter falls between April 2-8 and for the preliminary factors from years in which Easter falls between April 9-15. Compute trimmed means m_2 (for April 2-8) and m_3 (for April 9-15) by excluding data which differ from their preliminary Easter factor by two or more standard errors.

(7) The final holiday factors are calculated by repeating step (5), using the new trimmed means m_2 and m_3 derived in (6). For data in years where Easter falls between March 22 and April 1 ($1 \leq t \leq 10$), set

$$\hat{Y}_t(M) = m_1.$$

For data in years where Easter falls between April 16 and April 25 ($25 \leq t \leq 34$), set

$$\hat{Y}_t(M) = m_4.$$

For all t,

$$\hat{Y}_t(A) = 200. - \hat{Y}_t(M).$$

These final Easter factors are used as **prior adjustment factors** in a second execution of the seasonal and trading day adjustment program which is automatically performed to get the final seasonal adjustment.

An example of this procedure is shown in Chart I. This graph shows the results for retail shoe sales. In this case, $m_1 = 112.0$, $m_2 = 103.5$, $m_3 = 97.8$, and $m_4 = 96.7$. Note how the five line segments drawn through these trimmed means fit the March irregulars and "reciprocal" April irregulars.

A final note on Easter adjustment. If the last month of the series being holiday adjusted is March, then the irregular value for this month is used in the procedure, despite the fact that there is no April value. If the series being adjusted begins in an April, then this irregular value is **not** included in the Easter adjustment procedure. A value is imputed for that first April holiday factors based on the results from the rest of the data.

II. Labor Day and Thanksgiving

For both holidays a simple linear regression line is fit to the irregulars of the earlier month involved (August for Labor Day, November for Thanksgiving) and the "reciprocal" of the later month involved (September for Labor Day, December for Thanksgiving). The values of the fitted curves are used as holiday factors for August and November, and their "reciprocals" are the holiday factors for September and December. They are applied along with the Easter factors (if these are calculated) as prior factors in a subsequent seasonal adjustment.

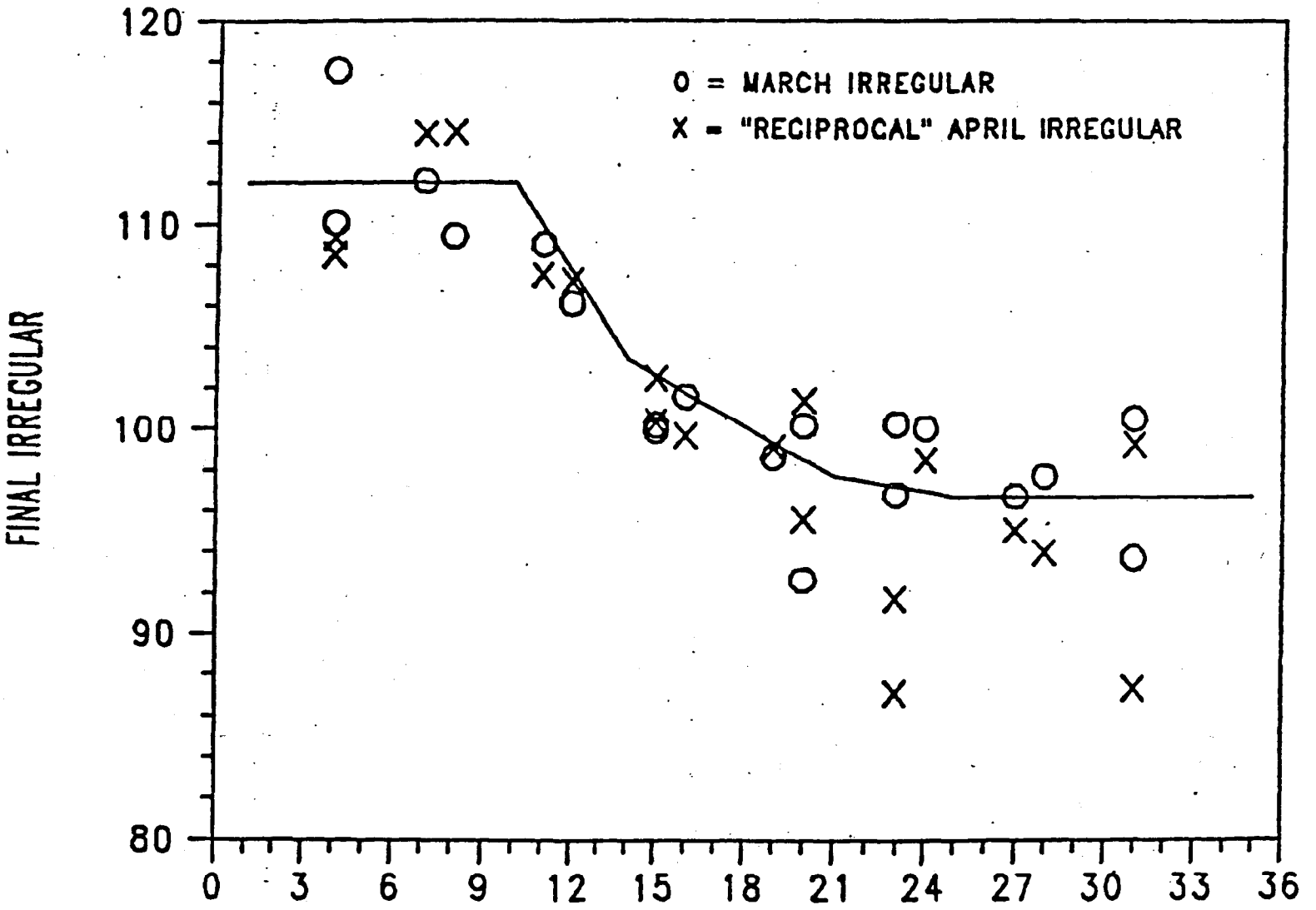
The Labor Day adjustment is based on the idea that September and August sales are influenced by whether Labor Day occurs early or late in September. When Labor Day is early (on or near September 1), certain retail sales are concentrated in August rather than in September. Chart II shows the regression fit of the Labor Day adjustment for retail grocery sales.

The Thanksgiving adjustment is based on the assumption that people begin their Christmas shopping after Thanksgiving. If Thanksgiving is early, the sales for November will be relatively high and sales for December will be lower. If Thanksgiving is late, the sales for November will be relatively low and sales for December will be higher. Chart III illustrates the regression fit of the Thanksgiving adjustment for Eating and Dining Establishments.

The examples selected illustrate a final point concerning Labor Day and Thanksgiving adjustments. The regression F-test is significant for both adjustments; the F-test for the Labor Day regression was 23.117 (with 1 and 35 degrees of freedom), and the F-test for the Thanksgiving regression was 11.809 (with 1 and 35 degrees of freedom). Despite this statistical significance, the holiday factors obtained in both cases are quite close to 100. The user may wish to consider whether such a slight adjustment is worthwhile.

CHART A.1

EASTER ADJUSTMENT FOR RETAIL SHOE SALES



NOTE : 1 = MARCH 23, 2 = MARCH 24, ETC.

CHART A.2

LABOR DAY ADJUSTMENT FOR RETAIL GROCERY SALES

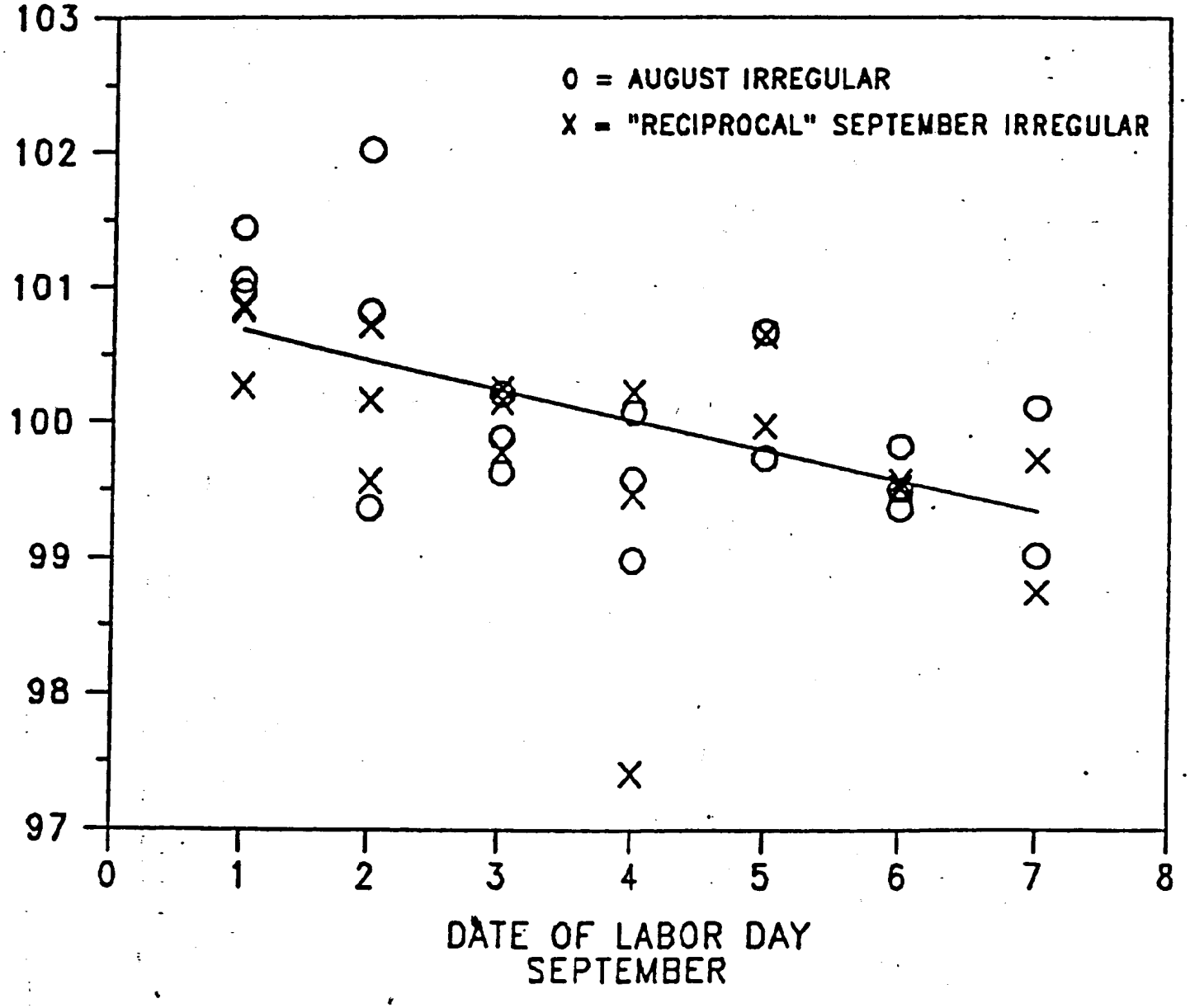
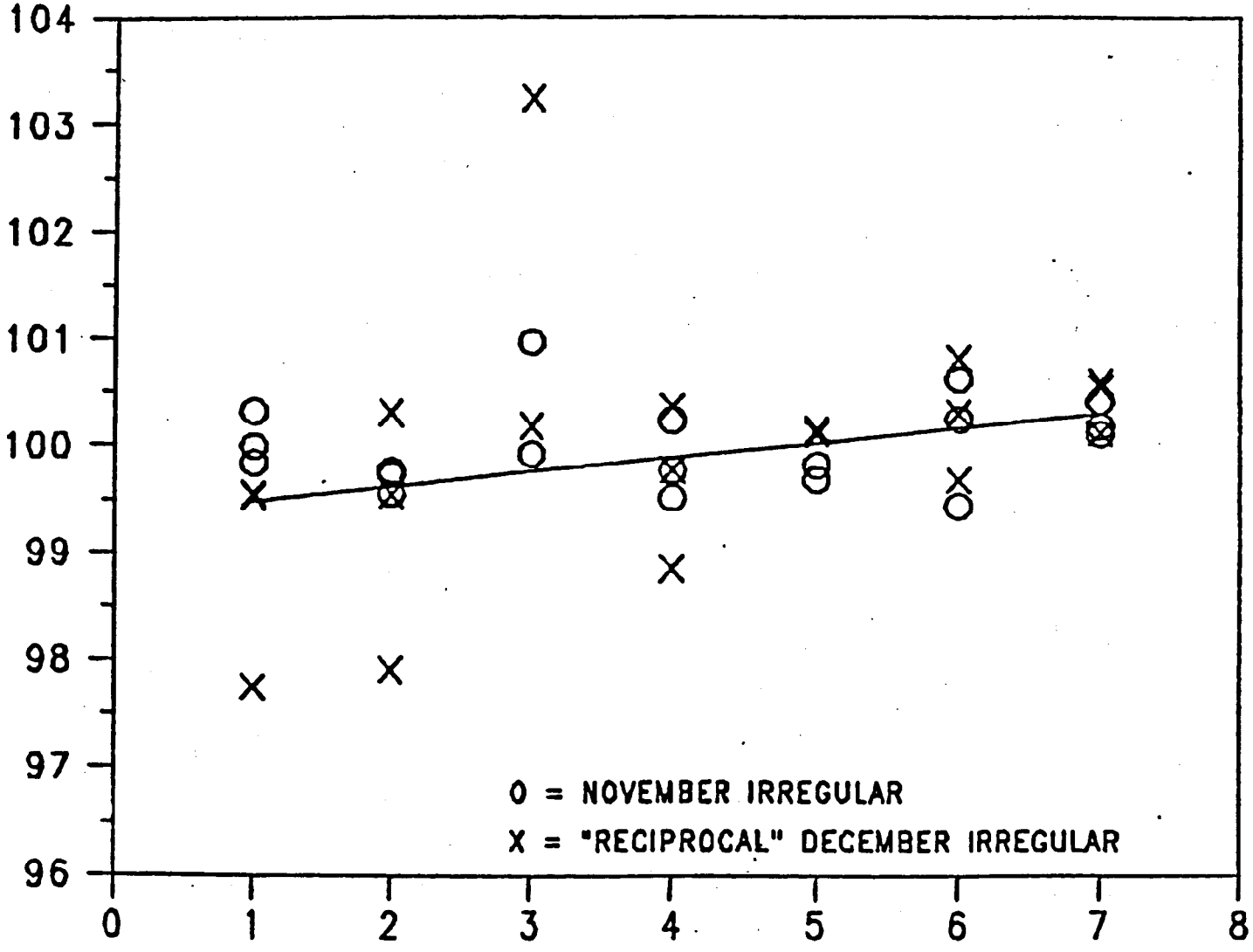


CHART A.3

THANKSGIVING ADJUSTMENT FOR EATING AND DINING ESTABLISHMENTS



APPENDIX B : X-11.2 AND X-11Q.2 TABLES

The table storage option requires that tables being stored in separate ASCII files must be among those being printed to the main printout. In this appendix, we provide tables showing (in Table B.1) the tables which can be printed out by the X-11.2 program and (in Table B.2) which tables are printed out for different values of PRTOUT, the variable in X-11.2 namelist NLX11 which sets the type of printout.

TABLE B.1 TABLES PRINTED BY X-11.2 AND X-11Q.2

TABLE	TABLE DESCRIPTION
H1	HOLIDAY PRIOR ADJUSTMENT FACTORS
H1.A	HOLIDAY FACTORS ONE YEAR AHEAD
A1	ORIGINAL SERIES
A2	PRIOR MONTHLY ADJUSTMENT FACTORS
A2.B	COMBINED PRIOR AND HOLIDAY MONTHLY ADJUSTMENT FACTORS
A3	ORIGINAL SERIES ADJUSTED BY PRIOR MONTHLY ADJUSTMENT FACTORS
A4	PRIOR TRADING DAY ADJUSTMENT FACTORS
A4.A	PRIOR DAILY WEIGHTS
A4.B	PRIOR TRADING DAY ADJUSTMENT FACTORS
A4.C	PRIOR TRADING DAY ADJUSTMENT FACTORS, ONE YEAR AHEAD
B1	PRIOR ADJUSTED ORIGINAL SERIES
B2	TREND CYCLE- CENTERED 12-TERM {4-TERM} MOVING AVERAGE
B3	UNMODIFIED SI RATIOS [DIFFERENCES]
B4	REPLACEMENT VALUES FOR EXTREME SI RATIOS [DIFFERENCES]
B5	SEASONAL FACTORS
B6	SEASONALLY ADJUSTED SERIES
B7	TREND CYCLE - HENDERSON CURVE
B8	UNMODIFIED SI RATIOS [DIFFERENCES]
B9	REPLACEMENT VALUES FOR EXTREME SI RATIOS [DIFFERENCES]
B10	SEASONAL FACTORS
B11	SEASONALLY ADJUSTED SERIES
B13	IRREGULAR SERIES
B14	EXTREME IRREGULAR VALUES EXCLUDED FROM TRADING DAY REGRESSION
B15	PRELIMINARY TRADING DAY REGRESSION
B16	TRADING DAY ADJUSTMENT FACTORS DERIVED FROM REGRESSION COEFFICIENTS
B17	PRELIMINARY WEIGHTS FOR IRREGULAR COMPONENT
B18	TRADING-DAY ADJUSTMENT FACTORS FROM COMBINED DAILY WEIGHTS
B19	ADJUSTED ORIGINAL SERIES
C1	ADJUSTED ORIGINAL SERIES MODIFIED BY PRELIMINARY WEIGHTS
C2	TREND CYCLE- CENTERED 12-TERM {4-TERM} MOVING AVERAGE
C4	MODIFIED SI RATIOS [DIFFERENCES]
C5	SEASONAL FACTORS
C6	SEASONALLY ADJUSTED SERIES
C7	TREND CYCLE - HENDERSON CURVE
C9	MODIFIED SI RATIOS [DIFFERENCES]
C10	SEASONAL FACTORS
C11	SEASONALLY ADJUSTED SERIES
C13	IRREGULAR SERIES
C14	EXTREME IRREGULAR VALUES EXCLUDED FROM TRADING DAY REGRESSION
C15	FINAL TRADING DAY REGRESSION

TABLE B.1 TABLES PRINTED BY X-11.2 AND X-11Q.2 (CONTINUED)

TABLE	TABLE DESCRIPTION
C16	TRADING DAY ADJUSTMENT FACTORS DERIVED FROM REGRESSION COEFFICIENTS
C16.A	REGRESSION COEFFICIENTS
C16.B	REGRESSION TRADING DAY ADJUSTMENT FACTORS
C16.C	REGRESSION TRADING DAY ADJUSTMENT FACTORS, ONE YEAR AHEAD
C17	FINAL WEIGHTS FOR IRREGULAR COMPONENT
C18	TRADING-DAY ADJUSTMENT FACTORS FROM COMBINED DAILY WEIGHTS
C18.A	COMBINED DAILY WEIGHTS
C18.B	COMBINED TRADING-DAY ADJUSTMENT FACTORS WITH LENGTH OF MONTH ADJUSTMENT
C18.C	COMBINED TRADING-DAY ADJUSTMENT FACTORS, ONE YEAR AHEAD
C19	ADJUSTED ORIGINAL SERIES
D1	ADJUSTED ORIGINAL SERIES MODIFIED BY FINAL WEIGHTS
D2	TREND CYCLE- CENTERED 12-TERM {4-TERM} MOVING AVERAGE
D4	MODIFIED SI RATIOS [DIFFERENCES]
D5	SEASONAL FACTORS
D6	SEASONALLY ADJUSTED SERIES
D7	TREND CYCLE - HENDERSON CURVE
D8	FINAL UNMODIFIED SI RATIOS [DIFFERENCES]
D9	FINAL REPLACEMENT VALUES FOR EXTREME SI RATIOS [DIFFERENCES]
D9.A	YEAR TO YEAR CHANGE IN IRREGULAR AND SEASONAL COMPONENTS AND MOVING SEASONALITY RATIO
D10	FINAL SEASONAL FACTORS
D10.A	SEASONAL FACTORS, ONE YEAR AHEAD
D11	FINAL SEASONALLY ADJUSTED SERIES
D12	FINAL TREND CYCLE - HENDERSON CURVE
D13	FINAL IRREGULAR SERIES
D20	FINAL COMBINED ADJUSTMENT FACTORS
D20.A	ACOMBINED FACTORS, ONE YEAR AHEAD
E1	ORIGINAL SERIES MODIFIED FOR EXTREMES
E2	MODIFIED SEASONALLY ADJUSTED SERIES
E3	MODIFIED IRREGULAR SERIES
E4	RATIOS OF ANNUAL TOTALS, ORIGINAL AND ADJUSTED SERIES
E5	MONTH-TO-MONTH {QUARTER-TO-QUARTER} CHANGES IN ORIGINAL SERIES
E6	MONTH-TO-MONTH {QUARTER-TO-QUARTER} CHANGES IN FINAL SEASONALLY ADJUSTED SERIES
F1	MCD {QCD} MOVING AVERAGE
F2	SUMMARY MEASURES
F3	QUALITY CONTROL STATISTICS

The table descriptions above are for the case of a multiplicative seasonal adjustment of a monthly series.

[...] denotes changes in the table description for an additive seasonal adjustment using X-11.2 or X-11Q.2.

{ ... } denotes changes in the table description for an adjustment of a quarterly series using X-11Q.2.

TABLE B.2 : TABLES PRINTED FOR DIFFERENT CHOICES OF PRTOUT

X-11.2 TABLE	X-11Q.2 TABLE	PRTOUT CHOICE FULL	LONG	DEFAULT	SHORT	SPECIAL COMMENTS
H1	---	YES	YES	YES	YES	Prints only when Holiday adjustment is done.
A1	---	YES	YES	YES	YES	Prints only when either Holiday, Prior Trading Day, and/or Prior Monthly Factor adjustment are done.
A2	---	YES	YES	YES	YES	Prints only when Prior Monthly Factor adjustment is done.
A3	---	YES	YES	YES	YES	Prints only when either Holiday or Prior Monthly Factor adjustment is done.
A4	---	YES	YES	YES	YES	Prints only when Prior Trading Day adjustment is done.
B1	B1	YES	YES	YES	YES	
B2	B2	YES	YES	---	---	
B3	B3	YES	---	---	---	
B4	B4	YES	---	---	---	
B5	B5	YES	---	---	---	
B6	B6	YES	---	---	---	
B7	B7	YES	---	---	---	
B8	B8	YES	---	---	---	
B9	B9	YES	---	---	---	Not available for output to ASCII files.
B10	B10	YES	YES	---	---	
B11	B11	YES	---	---	---	
B13	B13	YES	YES	---	---	
B14	---	YES	YES	---	---	Prints only when Trading Day adjustment is done. Not available for output to ASCII files.
B15	---	YES	YES	---	---	Prints only when Trading Day adjustment is done. Not available for output to ASCII files.
B16	---	YES	YES	---	---	Prints only when Trading Day adjustment is done.
B17	B17	YES	YES	---	---	
B18	---	YES	YES	---	---	Prints only when Trading Day adjustment is done with length of month option and/or Prior Trading Day adjustment.
B19	---	YES	---	---	---	
C1	C1	YES	YES	---	---	
C2	C2	YES	---	---	---	
C4	C4	YES	---	---	---	
C5	C5	YES	---	---	---	
C6	C6	YES	---	---	---	
C7	C7	YES	YES	---	---	
C9	C9	YES	---	---	---	
C10	C10	YES	YES	---	---	
C11	C11	YES	---	---	---	
C13	C14	YES	YES	---	---	

TABLE B.2 : TABLES PRINTED FOR DIFFERENT CHOICES OF PRTOUT (CONTINUED)

X-11.2 TABLE	X-11Q.2 TABLE	PRTOUT CHOICE FULL	LONG	DEFAULT	SHORT	SPECIAL COMMENTS
C14	---	YES	YES	YES	---	Prints only when Trading Day adjustment is done. Not available for output to ASCII files.
C15	---	YES	YES	YES	---	Prints only when Trading Day adjustment is done. Not available for output to ASCII files.
C16	---	YES	YES	YES	YES	Prints only when Trading Day adjustment is done.
C17	C17	YES	YES	YES	YES	
C18	---	YES	YES	YES	YES	Prints only when Trading Day adjustment is done with length of month option and/or Prior Trading Day adjustment.
C19	---	YES	---	---	---	
D1	D1	YES	YES	---	---	
D2	D2	YES	---	---	---	
D4	D4	YES	---	---	---	
D5	D5	YES	---	---	---	
D6	D6	YES	---	---	---	
D7	D7	YES	YES	---	---	
D8	D8	YES	YES	YES	YES	
D9	D9	YES	YES	YES	YES	Not available for output to ASCII files.
D10	D10	YES	YES	YES	YES	
D11	D11	YES	YES	YES	YES	
D12	D12	YES	YES	YES	---	
D13	D13	YES	YES	YES	---	
D20	---	YES	YES	YES	YES	Prints only when Trading Day and/or Holiday adjustment are is done.
E1	E1	YES	YES	---	---	
E2	E2	YES	---	---	---	
E3	E3	YES	---	---	---	
E4	E4	YES	---	---	---	Not available for output to ASCII files.
E5	E5	YES	YES	YES	---	
E6	E6	YES	YES	YES	---	
F1	F1	YES	---	---	---	
F2	F2	YES	YES	YES	---	Not available for output to ASCII files.
F3	F3	YES	YES	YES	---	Not available for output to ASCII files.

APPENDIX C : CONTENTS OF THE X-11.2 AND X-11Q.2 DISKETTES

This section describes the files contained on each of the four diskettes distributed with this document. These double density diskettes contain the X-11.2 run and source code files, as well as the data files used in the examples given in the document.

DISK 1 :
- X11SS.EXE - Run file for the X-11.2 program.
- JPNIMP.DAT - ASCII file containing data for JPNIMP used in Example 1 of Chapter 1. The content of this file is given in Table E.
- JPNIMP.OUT - X-11.2 output for JPNIMP generated in Example 1 of Chapter 1.

DISK 2 :
- X11Q2.EXE - Run file for the X-11Q.2 program.
- BNKBAL.DAT - ASCII file containing data for BNKBAL used in Example 4 of Chapter 3.
- BNKBAL.OUT - X-11Q.2 output for BNKBAL generated in Example 4 of Chapter 3.
- BNKBAL.D10 - ASCII file containing seasonal factors generated in Example 4 of Chapter 3.

DISK 3 :
- X11SS.FOR - Source code for the X-11.2 program. To compile this code, a FORTRAN compiler which supports the NAMELIST feature must be used.
- COMP1F.DAT - ASCII files containing data for COMP1F used in Example 3 of Chapter 1.
- COMP1F.X12 - X-11.2 command file for COMP1F used in Example 3 of Chapter 1.
- COMP1F.OUT - X-11.2 output for COMP1F generated in Example 3 of Chapter 1.
- X11SS.TBL - ASCII file containing seasonal factors, seasonally adjusted data, and trading day factors for COMP1F generated in Example 3 of Chapter 1.
- COMP1F.ERR - X-11.2 error file for COMP1F generated in Example 3 of Chapter 1. NOTE: this file is empty.

DISK 4 :
- X11Q2.FOR - Source code for the X-11Q.2 program. To compile this code, a FORTRAN compiler which supports the NAMELIST feature must be used.
- APPLRS.DAT - ASCII file containing data for APPLRS used in Example 2 of Chapter 1.
- APPLRS.HOL - ASCII file containing holiday adjustment factors for APPLRS. These are used as prior adjustment factors in Example 2 of Chapter 1.
- APPLRS.OUT - X-11.2 output for APPLRS generated in Example 2 of Chapter 1.
- APPLRS.D10 - ASCII file containing seasonal factors for APPLRS generated in Example 2 of Chapter 1.
- APPLRS.D11 - ASCII file containing seasonally adjusted data for APPLRS generated in Example 2 of Chapter 1.
- APPLRS.D20 - ASCII file containing combined adjustment factors for APPLRS generated in Example 2 of Chapter 1.
- LETHTI.DAT - ASCII file containing data for LETHTI used in Example 2 of Chapter 1. The content of this file is given in Table G.
- LETHTI.OUT - X-11.2 output for LETHTI generated in Example 2 of Chapter 1.
- LETHTI.D10 - ASCII file containing seasonal factors for LETHTI generated in Example 2 of Chapter 1.
- LETHTI.D11 - ASCII file containing seasonally adjusted data for LETHTI generated in Example 2 of Chapter 1.

APPENDIX D: A DISCUSSION OF THE X-11.2 F-TABLES AND QUALITY CONTROL STATISTICS

On the X-11.2 output, there are summary tables with diagnostics which can aid the analyst in determining how good (or bad) a seasonal adjustment has been performed on the series in question. These tables are collected in the F 2 section of the X-11.2 output. We will go through each of these tables individually, showing how each of these tables are derived and how they can be interpreted.

Also, X-11.2 prints out a set of quality control statistics to give the user an indication as to the quality of the seasonal adjustment. These measures first appeared in X-11-ARIMA, a seasonal adjustment package developed by Statistics Canada. Table F 3 prints out each of the 11 quality control statistics (M1-M11) and the Q measure for overall seasonal adjustment adequacy. We will also go through these measures individually, to see how they are derived and how they are used.

We will be using a sample X-11.2 run from the series FTD1 as an example throughout this discussion. The F 2 and F 3 tables for FTD1 are given in Table D.3 at the end of this section.

F 2.A Average Percent Change Without Regard to Sign Over Selected Spans

Let $\bar{O}_k$ = Average percent change without regard to sign for the original data over the kth span.

$$= \frac{\sum_{t=k+1}^{N} \frac{| O_t - O_{t-k} |}{O_{t-k}}}{N - k}, \quad k = 1, \ldots, 12;$$

where N = number of observations.

This is also done for the seasonally adjusted data, the seasonal, irregular, trend, and trading day components, and other quantities. This measure can be used to assess the degree of smoothness of the adjustment.

F 2.B Relative Contribution of Components to the Percent Changes in the Original Series

Let $\bar{O}_k^2$ be the sum of squares or the percent changes over span k, or

$$\bar{O}_k^2 = \sum_{t=1+k}^{N} \left(\frac{(O_t - O_{t-k}) / O_{t-k}}{N - k} \right)^2, \quad k = 1, \ldots, 12;$$

with N as before.

We can define similar quantities for the seasonal (S_k^2), trend cycle (T_k^2), irregular (I_k^2), and trading day (TD_k^2) components. We then use the following relationship:

$D_k^2 \cong S_k^2 + T_k^2 + I_k^2 + TD_k^2$. Define $D_k^{2'} = S_k^2 + T_k^2 + I_k^2 + TD_k^2$. Then the relative contribution of the changes for each component can be expressed as:

$\frac{S_k^2}{D_k^{2'}}$, $\frac{T_k^2}{D_k^{2'}}$, $\frac{I_k^2}{D_k^{2'}}$, $\frac{TD_k^2}{D_k^{2'}}$, respectively. Use the ratio $\frac{D_k^{2'}}{D_k^2}$ to see how good the approximation above is.

F 2.C Average Duration of Run

The average duration of run (referred to as ADR) can be defined as (a) the average number of consecutive monthly changes in the same direction or (b) the average number of points between turning points.

The average duration of run is computed for the seasonally adjusted data, the final irregular component and the final trend cycle component. The ADR can be used to test the irregular component for randomness. If the ADR for the irregular component is too large or too small, this can point to correlation in the irregular.

For more information on the average duration of run measure, see Wallis and Moore (1941).

F 2.D Months for Cyclical Dominance

$$\text{Let } \bar{I}_k = \sum_{i=1+k}^{N} (|I_i - I_{i-k}|) / I_{i-k}$$

$$\text{and } \bar{C}_k = \sum_{i=1+k}^{N} (|C_i - C_{i-k}|) / C_{i-k}$$

be the month-to month change in the irregular and trend cycle components, respectively, over span k for k = 1, ... , 12.

We can then compare the ratios $\bar{I}_k / \bar{C}_k$ for k = 1, ... , 12. Let the months for cyclical dominance (referred to as MCD) be equal to k if:

$$\bar{I}_k / \bar{C}_k \leq 1 \quad \text{and} \quad \bar{I}_{k-1} / \bar{C}_{k-1} \geq 1.$$

If the MCD is large, movement in the irregular may be too large to separate the trend and irregular components components effectively.

F 2.E Means and Standard Deviations of Percent Changes

Computes the means and standard deviations of the percent changes for the original data, irregular component, seasonal component, trend cycle component, and trading day component over each span t, t = 1, ..., 12.

F 2.F Relative Contribution of the Components to the Stationary Portion of the Variance of the Original Series

This procedure has two steps:

(a) Make the series "stationary" by removing an estimated trend (a "spline" trend fit to the trend cycle [or the log of the trend cycle, if the adjustment is multiplicative]) from the original data, trend cycle.

(b) Calculate the relative contribution for the "stationary" series for each of the components of the seasonal adjustment.

Example : S_t = final seasonal factors.

O'_t = "stationary" series = $\dfrac{\text{original series}}{\text{estimated trend}}$.

Relative contribution of the seasonal component to the stationary portion of the series = $\dfrac{\text{Variance}(S_t)}{\text{Variance}(O'_t)}$.

This can be done for the other components as well.

F 2.G Final I / C Ratio from Table D12
Final I / S Ratio from Table D10

These two quantities are reprinted from the X-11.2 printout. They can be used to help the user choose filter lengths for trend cycle and seasonal factor estimation.

The X-11.2 program uses the I / C ratio in its automatic filter length selection for the trend cycle. This ratio is computed using the following steps:

(1) As a preliminary estimate of C, compute a 13-term Henderson moving average of the seasonally adjusted series. Do not extend to the ends of the series.

(2) As a preliminary estimate of I, divide {subtract if the adjustment is additive} the 13-term moving average into {from} the seasonally adjusted series.

(3) Compute the average month-to-month percent change {difference} without regard to sign (see the description of F 2.A for details) in the preliminary estimates of the irregular (I) and the trend cycle (C). Compute their ratio to get I / C.

The I / S ratio (also called the Moving Seasonal Ratio or MSR) is calculated in much the same manner. The computation procedure for this measure is described below:

(1) A seven term moving average of the SI ratios, artificially lengthened to ensure all the observations will receive an estimate, is applied to each month's SI ratios separately to get an estimate of the seasonal ($\hat{S}_t$). Averages of the three nearest SI ratios are used as the three extra values at the beginning and end of each month.

(2) This is divided into {subtracted from, if additive adjustment is being used} the SI ratios to get a preliminary estimate of the irregular ($\hat{I}_t$).

(3) The average seasonal change for each month is calculated ($\bar{S}_j$) as well as the average irregular change ($\bar{I}_j$). These quantities are also adjusted by a scale factor which depends of the length of the data. The MSR for a particular month j is the ratio:

$$MSR_j = \bar{I}_j / \bar{S}_j \quad .$$

(4) To define a global MSR, we define $\bar{I}$ to be the average over all months of the average irregular change, and $\bar{S}$ to be the average of the average seasonal change. The global MSR is the ratio:

$$GMSR = \bar{I} / \bar{S} \quad .$$

For a more complete discussion and derivation of the Moving Seasonality Ratio, see Lothian (1984).

F 2.I F-test and Probability Levels

The results for the hypothesis test performed by X-11.2 are summarized here. They are:

(a) F-test for trading day variation, Table C 15;
(b) F-test for stable seasonality, Table D 8;
(c) F-test for moving seasonality, Table D 8.

F 3 Quality Control Statistics

This table consists of eleven quality control measures, which are used in a weighted a average to get Q, an overall measure of the acceptability of the adjustment. These measures are calibrated to range from 0 to 3, and have an acceptance region of 0 to 1. Each of the eleven quality control measures evaluates a specific characteristic of the adjustment. We will describe each of these quality control measures, show how they are derived, and how they are used to calculate Q. The information contained in this section is taken from Lothian and Morry (1978).

M1 The Relative Contribution of the Irregular over a Three Month Span

This uses the results from the F 2.B table to test the relative contribution of the irregular. If this is too high, the seasonal and irregular components cannot be separated efficiently.

Common practice in the past has been to test examine these figures using a one month span (i.e., first differences). Why does X-11.2 examine the third month span? An analysis of transfer functions of the differencing operators on the different components showed that the third span was optimal for comparing the seasonal to the irregular component. The major disadvantage to using the third span is that the trend cycle is not completely removed, thus not allowing us a direct comparison between the seasonal and the irregular. Let

$R_{I(3)}$ = Relative contribution of the irregular at the third span, and

$R_{P(3)}$ = Relative contribution of the prior monthly factors at the third span.

$$M1 = \frac{[R_{I(3)} \ / \ (1 - (R_{P(3)} \ / \ 100))]}{10.0}.$$

Example : $R_{I(3)} = 5.66$, $R_{P(3)} = 0.00$, then

$$M1 = \frac{[5.66 \ / \ (1-0)]}{10.0} = 0.566$$

M2 The Relative Contribution of the Irregular Component to the Variance of the Stationary Portion of the Series

This measure uses the F 2.F table to determine if the irregular is too large. We use this table because we wish to minimize the effect of the trend component. However, the method used in previous versions of X-11-ARIMA to make the series "stationary" uses a straight line as a detrender. This is not a desirable method. An alternative is to fit a crude trend to allow for different slopes for each year of data. This is described in more detail in Appendix A of Findley and Monsell (1984).

Let S_I = contribution of the irregular to the "stationary" portion of the variance,

and S_P = contribution of the prior factors to the "stationary" portion of the variance.

$$M2 = \frac{[S_I \ / \ (1 - (S_P \ / \ 100))]}{10.0}.$$

Example : $S_I = 12.91$, $S_P = 0.00$, then

$$M2 = \frac{[12.91 \ / \ (1 - 0)]}{10.0} = 1.291$$

M3 The Amount of Month-to-Month Change in the Irregular as Compared to the Amount of Month-to-Month Change in the Trend Cycle

This measure uses the $\bar{I} / \bar{C}$ ratio (given in Table 2.H) to determine if the amount of irregular movement is too high relative to the movement in the trend cycle. M3 is set to give a failing score if $\bar{I} / \bar{C} > 3$, so M3 is set such that

$$M3 = [(\bar{I} / \bar{C}) - 1] / 2 \ .$$

Example : $\bar{I} / \bar{C} = 1.862$, $M3 = [1.862 - 1] / 2 = 0.431$.

M4 The Amount of Autocorrelation in the Irregular.

This measure uses the Average Duration of Run (ADR) statistic to test if the irregular component is a random process against the alternative hypothesis that the errors follow a first order autoregressive process of the form:

$$I_t = \rho I_{t-1} + e_t,$$

where ρ is the autocorrelation coefficient and e_t is a purely random process.

The formula used to derive M4 is based on the normal approximation of the Average Duration of Run given by Bradley (1968).

It is given below:

$$M4 = \frac{\left| \frac{N-1}{ADR} - \frac{2(N-1)}{3} \right|}{\sqrt{\frac{16N - 29}{90}} \times 2.58} \ , \quad \text{where N = length of series.}$$

If M4 is greater than 1, there is significant autocorrelation present in the residuals and the series fails this test.

M5 The Months for Cyclical Dominance

M5 uses a variation of the Months for Cyclical Dominance (MCD) measure printed in table F 2.E to examine the relative size of the trend cycle and irregular components. If there is too much irregular relative to the trend cycle, then it will be difficult to estimate the two components.

Let the MCD in table F 2.E be equal to k, and $\overline{IC}_k = \bar{I}_k / \bar{C}_k$.

Then:

$$MCD' = k + \frac{\overline{IC}_{k-1} - 1}{\overline{IC}_{k-1} - \overline{IC}_k} - 1 \ .$$

$$\text{Example : MCD}' = 3 + \frac{2.905 - 1}{1.506 - .85} - 1$$

$$= 2 + \frac{0.506}{0.559} = 2.905.$$

An MCD $\geq$ 6 is considered to be unacceptable, so we set:

$$\text{M5} = \frac{\text{MCD'} - 0.5}{5.0} .$$

$$\text{Example: M5} = \frac{2.905 - 0.5}{5.0} = \frac{2.405}{5.0} = 0.481.$$

M6 The Amount of Year-to-Year Change in the Irregular as Compared to the Amount of Year-to-Year Change in the Seasonal

This measure uses the $\bar{I} / \bar{S}$ ratio printed in Table F 2.H to see if a 3 x 5 moving average is adequate to adjust the series.

NOTE: this measure is only used when the series is adjusted using 3 x 5 filters.

Prior work by Lothian indicated that when the $\bar{I} / \bar{S}$ ratio fell between 1.5 and 6.5, the 3 x 5 moving average worked relatively well. Therefore,

$$\text{M6} = \frac{|(\bar{I} / \bar{S}) - 4.0|}{2.5} .$$

Example: $\bar{I} / \bar{S} = 4.852$, so

$$\text{M6} = \frac{| 4.852 - 4.0 |}{2.5} = \frac{0.852}{2.5} = 0.341.$$

It should be noted that Lothian has since published an updated version of this study in Lothian (1984).

M7 The Amount of Stable Seasonality Present Relative to the Amount of Moving Seasonality

This measure uses the F-tests for stable and moving seasonality from Table D 8 to determine if the seasonality in the series can be identified by X-11.2. This is the most important of the 11 quality control statistics, since if the seasonality cannot be identified, how can we perform a seasonal adjustment? Therefore, this measure is given the most weight in calculating Q.

The formula is the same as one given in Morry and Lothian (1978). Let:

F_S = F-test for stable seasonality, and
F_M = F-test for moving seasonality; then

$$M7 = \sqrt{\frac{1}{2}\left(\frac{7}{F_S} + \frac{3F_M}{F_S}\right)} .$$

If M7 > 1, the seasonality assumed to be present in the series cannot be identified.

Example: $F_S = 80.565$, $F_M = 0.625$,

$$M7 = \sqrt{\frac{1}{2}\left(\frac{7}{80.565} + \frac{3(0.625)}{80.565}\right)} = \sqrt{\frac{1}{2}\left(0.087 + 0.023\right)}$$

$$= \sqrt{0.110 / 2} = \sqrt{0.055} = 0.235$$

M8-M11 Year-to-Year Movement of the Seasonal Component

The last 4 quality control statistics examine specific types of year-to-year movement in the final seasonal factor estimates. Two types of year-to-year movement are examined:

a) Random fluctuations in the seasonal component. These are tested using the absolute year-to-year change.

b) Linear movement in the seasonal component. These are tested using the arithmetic mean of the year-to-year changes.

A summary of the M8-M11 quality control statistics is given below. Note that all of these measures are calculated using a normalized seasonal factor S' where:

$$S'_t = (S_t - \bar{S}) / (\text{standard deviation of } S_t) .$$

M8 The Size of the Fluctuations in the Seasonal Component Throughout the Whole Series.

The fluctuations are measured by the average absolute change, given below:

$$|\bar{S}'| = \frac{1}{J(N-1)} \sum_{j=1}^{J} \sum_{i=2}^{N} | S'_{J(i)+j} - S'_{J(i-1)+j} | ,$$

where n is the number of years and J equals 4 or 12, depending on whether the series is quarterly or monthly. The maximum change was set at 10 percent, so the M8 measure is

calculated :

$$M8 = |\bar{S}'| \times 10.0$$

M9 The Average Linear Movement in the Seasonal Component Throughout the Whole Series

We will use the arithmetic mean of the year-to-year changes. If we look at the sum of the year-to-year changes, we see that:

$$\sum_{i=1}^{N-1} (S'_{J(i)+j} - S'_{J(i-1)+j}) = S'_{J(N-1)+j} - S'_j ,$$

J and N as before.

Again, setting a limit of 10 percent, we get:

$$M9 = \frac{\sum_{j=1}^{J} |S'_{j(N-1)+j} - S'_j|}{J(N-1)} \times 10.0 .$$

M10 The Size of the Fluctuations in the Seasonal Component in Recent Years
M11 The Average Linear Movement in the Seasonal Component in Recent Years

These measures are calculated exactly the same way as the M8 and M9 measures were, respectively, only these measures are used to see what has occurred in some of the more recent years of data. If N is the last year of the series, M10 and M11 are calculated using data from years N-2, N-3, N-4, and N-5.

Note that none of the measures M8-M11 calculated above have any meaning if the series is adjusted using the stable seasonal option, or if the series is less than 6 years long.

How Q is Generated

The overall quality control measure Q is generated to give the user a measure of the acceptability of the adjustment performed on a given series. The eleven previously defined quality control measures are combined using a weighted average to get Q. The weights are listed in Table D.1.

Note, if the moving average used to adjust the data is not a 3 x 5, the weight for M6 should be equal to zero.

TABLE D.1 : WEIGHTS FOR GENERATING Q

Quality Control Measure (M_i)	Weights (w_i) Standard	Stable Seasonal or N < 6
M1	10	11
M2	11	15
M3	10	10
M4	8	8
M5	11	11
M6	10	10
M7	18	32
M8	7	0
M9	7	0
M10	4	0
M11	4	0

The formula used to calculate Q is given below:

$$Q = \frac{\sum_{i=1}^{11} (M_i \times w_i)}{\sum_{i=1}^{11} w_i} .$$

Traditionally, values of Q greater than 1 meant to reject the adjustment as being unacceptable. It has been our experience, however, to recommend the following guidelines in interpreting Q:

$0.0 \leq Q < 0.8$	Adjustment is accepted.
$0.8 \leq Q < 1.0$	Adjustment is conditionally accepted; results should be checked to see if series should be accepted.
$1.0 \leq Q < 1.2$	Adjustment is conditionally rejected; results should be checked to see if series should be rejected.
$1.2 \leq Q \leq 3.0$	Adjustment is rejected.

TABLE D.2 : REFERENCES

Bradley, James V. (1968): Distribution Free Statistical Tests. Prentice Hall, Englewood Cliffs, N.J.

Findley, David F. and Monsell, Brian C. (1984): "New Techniques for Determining if a Time Series Can Be Seasonally Adjusted Reliably, and Their Application to U.S. Foreign Trade Series." Bureau of the Census, Statistical Research Division Report No. CENSUS/SRD/RR-84/14.

Lothian, John (1984): "The Identification and Treatment of Moving Seasonality in the X-11-ARIMA Seasonal Adjustment Method." Research Paper, Business Finance Division, Statistics Canada.

Lothian, John and Morry, Marietta (1978): "A Set of Quality Control Statistics for the X-11-ARIMA Seasonal Adjustment Method." Research Paper, Seasonal Adjustment and Time Series Staff, Statistics Canada.

Morry, Marietta and Lothian, John (1978): "A Test for Identifiable Seasonality When Using the X-11-ARIMA Program." Research Paper, Seasonal Adjustment and Time Series Staff, Statistics Canada.

Wallis, W. A. and Moore, G. H. (1941): "A Significance Test for Time Series." National Bureau of Economic Research, Technical Paper 1.

TABLE D.3 : SAMPLE F-TABLES FOR FTD1

F 2. SUMMARY MEASURES

F 2.A: AVERAGE PER CENT CHANGE WITHOUT REGARD TO SIGN OVER INDICATED SPAN

SPAN IN MONTHS	B1 O	D11 CI	D13 I	D12 C	D10 S	A2 P	C18 TD*	F1 MCD	E1 MOD.O	E2 MOD.CI	E3 MOD.I
1	8.40	4.09	3.75	1.27	7.45	0.00	0.00	1.83	8.06	2.98	2.62
2	13.19	4.90	3.81	2.53	11.77	0.00	0.00	3.29	12.94	3.75	2.51
3	15.24	5.60	3.55	3.75	13.99	0.00	0.00	4.56	14.93	4.64	2.35
4	15.21	6.78	3.75	4.92	13.06	0.00	0.00	5.59	14.76	5.79	2.44
5	11.73	7.50	3.40	6.04	9.09	0.00	0.00	6.57	11.35	6.75	2.39
6	10.98	8.33	3.52	7.13	7.15	0.00	0.00	7.58	10.28	7.62	2.34
7	13.22	9.49	3.61	8.20	8.99	0.00	0.00	8.55	12.78	8.68	2.40
9	18.06	11.15	3.31	10.38	13.92	0.00	0.00	10.55	17.75	10.68	2.20
11	15.05	13.31	3.31	12.63	7.37	0.00	0.00	12.82	14.68	12.90	2.20
12	14.54	14.52	3.71	13.72	0.43	0.00	0.00	13.99	14.05	14.04	2.40

F 2.B: RELATIVE CONTRIBUTIONS OF COMPONENTS TO VARIANCE IN ORIGINAL SERIES

SPAN IN MONTHS	D13 I	D12 C	D10 S	A2 P	C18 TD*	TOTAL	RATIO (X100)
1	19.75	2.27	77.98	0.00	0.00	100.00	100.79
2	9.12	4.02	86.87	0.00	0.00	100.00	91.65
3	5.66	6.31	88.03	0.00	0.00	100.00	95.84
4	6.74	11.59	81.68	0.00	0.00	100.00	90.19
5	8.84	27.88	63.27	0.00	0.00	100.00	94.97
6	10.84	44.48	44.68	0.00	0.00	100.00	94.81
7	8.07	41.72	50.21	0.00	0.00	100.00	92.13
9	3.50	34.48	62.02	0.00	0.00	100.00	95.88
11	4.87	70.97	24.16	0.00	0.00	100.00	99.18
12	6.80	93.11	0.09	0.00	0.00	100.00	95.56

F 2.C: AVERAGE DURATION OF RUN

CI	I	C	MCD
1.70	1.47	10.67	3.36

F 2.D: I/C RATIO FOR MONTHS SPAN

1	2	3	4	5	6	7	8	9	10	11	12
2.95	1.51	0.95	0.76	0.56	0.49	0.44	0.37	0.32	0.30	0.26	0.27

MONTHS FOR CYCLICAL DOMINANCE 3

F 2.E: AVERAGE PER CENT CHANGE WITH REGARD TO SIGN AND STANDARD DEVIATION OVER INDICATED SPAN

SPAN	B1		D13		D12		D10		D11		F1	
IN	O		I		C		S		CI		MCD	
MONTHS	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.
1	1.53	10.82	0.08	4.93	0.95	1.22	0.49	9.42	1.04	5.21	0.95	2.14
2	3.10	15.66	0.10	5.18	1.91	2.41	1.05	14.16	2.03	6.06	1.93	3.63
3	4.25	17.62	0.09	4.89	2.89	3.52	1.19	15.64	3.01	6.56	2.91	4.81
4	5.09	17.01	0.10	5.12	3.87	4.55	1.01	14.46	4.01	7.50	3.89	5.63
5	5.60	14.15	0.08	4.50	4.86	5.47	0.55	10.90	4.99	7.75	4.86	6.34
6	6.34	12.73	0.08	4.79	5.86	6.31	0.31	8.34	5.97	8.52	5.84	7.05
7	7.67	14.90	0.05	4.92	6.86	7.09	0.67	10.85	6.94	9.11	6.83	7.69
9	10.40	20.04	0.07	4.58	8.89	8.56	1.27	15.66	8.99	10.13	8.86	9.00
11	11.53	15.89	0.05	4.51	10.95	9.98	0.43	9.61	11.05	11.50	10.91	10.49
12	12.11	12.38	0.07	5.07	11.98	10.64	0.00	0.55	12.11	12.37	11.95	11.25

TABLE D.3 : SAMPLE F-TABLES FOR FTD1 (CONTINUED)

F 2.F: RELATIVE CONTRIBUTION OF THE COMPONENTS TO THE STATIONARY PORTION OF THE VARIANCE IN THE ORIGINAL SERIES

I	C	S	P	TD	TOTAL
12.91	4.91	76.88	0.00	0.00	94.70

F 2.G: THE FINAL I/C RATIO FROM TABLE D12: 1.86
THE FINAL I/S RATIO FROM TABLE D10: 4.85

F 2.H:

		STATISTIC	PROBABILITY LEVEL
F-TEST FOR STABLE SEASONALITY FROM TABLE D 8.	:	95.315	0.00%
F-TEST FOR MOVING SEASONALITY FROM TABLE D 8.	:	0.619	87.45%

* (TRADING DAY ADJUSTMENT FACTORS WITHOUT LENGTH OF MONTH ADJUSTMENT)

F 3. MONITORING AND QUALITY ASSESSMENT STATISTICS

ALL THE MEASURES BELOW ARE IN THE RANGE FROM 0 TO 3 WITH AN ACCEPTANCE REGION FROM 0 TO 1.

1. THE RELATIVE CONTRIBUTION OF THE IRREGULAR OVER THREE MONTHS SPAN (FROM TABLE F 2.B). M1 = 0.566

2. THE RELATIVE CONTRIBUTION OF THE IRREGULAR COMPONENT TO THE STATIONARY PORTION OF THE VARIANCE (FROM TABLE F 2.F). M2 = 1.291

3. THE AMOUNT OF MONTH TO MONTH CHANGE IN THE IRREGULAR COMPONENT AS COMPARED TO THE AMOUNT OF MONTH TO MONTH CHANGE IN THE TREND-CYCLE (FROM TABLE F2.G). M3 = 0.431

4. THE AMOUNT OF AUTOCORRELATION IN THE IRREGULAR AS DESCRIBED BY THE AVERAGE DURATION OF RUN (TABLE F 2.C). M4 = 0.164

5. THE NUMBER OF MONTH S IT TAKES THE CHANGE IN THETREND-CYCLE TO SURPASS THE AMOUNT OF CHANGE IN THE IRREGULAR (FROM TABLE F 2.D). M5 = 0.481

6. THE AMOUNT OF YEAR TO YEAR CHANGE IN THE IRREGULAR AS COMPARED TO THE AMOUNT OF YEAR TO YEAR CHANGE IN THE SEASONAL (FROM TABLE F 2.G). M6 = 0.341

7. THE AMOUNT OF MOVING SEASONALITY PRESENT RELATIVE TO THE AMOUNT OF STABLE SEASONALITY (FROM TABLE F 2.H). M7 = 0.216

8. THE SIZE OF THE FLUCTUATIONS IN THE SEASONAL COMPONENT THROUGHOUT THE WHOLE SERIES. M8 = 0.506

9. THE AVERAGE LINEAR MOVEMENT IN THE SEASONAL COMPONENT THROUGHOUT THE WHOLE SERIES. M9 = 0.231

10. SAME AS 8, CALCULATED FOR RECENT YEARS ONLY. M10 = 0.767

11. SAME AS 9, CALCULATED FOR RECENT YEARS ONLY . M11 = 0.722

*** ACCEPTED *** AT THE LEVEL 0.49

*** CHECK THE 1 ABOVE MEASURES WHICH FAILED.