Honeywell Bull

TIME-SHARING APPLICATIONS LIBRARY GUIDE VOLUME II - STATISTICS ADDENDUM A

SERIES 600/6000

APPLICATIONS

SUBJECT:

Additions to the Statistical Time-Sharing Programs.

SPECIAL INSTRUCTIONS:

This update, Order Number DA44A, is the first addendum to DA44, Revision 0, dated June 1971. The attached pages are to be inserted into the manual as indicated in the collating instructions on the back of this cover.

Three additional programs are being added with this addendum; these programs are listed in the Preface.

NOTE: This cover should be inserted following the manual cover to indicate the updating of the document with Addendum A.

DATE:

December 1972

ORDER NUMBER:

DA44A, Rev. 0

6359
1.3173
Printed in France

COLLATING INSTRUCTIONS

To update this manual, remove old pages and insert new pages as follows:

Remove	Insert
iii, iv	iii, Blank
ix through xiii	ix through xiv
FOURIER	FOURIER
	STAT17 after STAT16
	STAT20 after STAT18
	STAT21 after STAT20

File No.: 16M3, 17M3, 1JZ3

PREFACE

This manual describes and discusses the usage of the statistical time-sharing programs available with Series 600 and 6000 information processing systems. The programs are listed alphabetically in the table of Contents.

Each program description includes the purpose of the program; language in which it is written; method of approach, if applicable; instructions for use; restrictions if any; and sample problems and solutions. In the sample solutions, all information typed by the user is underlined.

The instructions provided assume that the programs are available in the user master catalog LIBRARY and accessible with READ or EXECUTE permission. In the sample solution printouts, the programs had already been accessed using the GET command, and/or copied onto the current file using the OLD or LIB command.

Time-sharing programs for other classifications are also available from Honeywell under the following titles:

Series 600/6000 Time-Sharing Applications Library Guide, Volume I - Mathematics, Order No. DA43

Series 600/6000 Time-Sharing Applications Library Guide, Volume III - Industry, Order No. DA45

Series 600/6000 Time-Sharing Applications Library Guide, Volume IV - Business and Finance, Order No. DA46

A complete listing of the programs in the library is available by listing the library program, CATALOG. A copy of this listing follows the Contents. Additional programs incorporated in the December 1972 Addendum.

STAT17
STAT20
STAT21

Series 600/6000 Time Sharing Applications Library programs are available to users of the DATANETWORK service. Please contact your local Honeywell representative for further details.

This document describes programs that originated from a variety of sources, such as users and the Honeywell field organization. The programs and documentation are made available in the general form and degree of completeness in which they were received. Honeywell Information Systems Inc., therefore, neither guarantees the accuracy of the programs nor assumes support responsibility.

FILE TYPE INDICATØR:

LANGUAGE (FIRST LETTER)		MØDE (FØLLØWING LETTERS)	
A	ALGØL	P	(ØR BLANK) PRØGRAM
B	BASIC	S	SUBRØUTINE(S)
C	CARDIN	F	FUNCTIØN(S)
D	DATABASIC	P-S	PRØGRAM WITH EXTRACTABLE SUBRØUTINE(S)
E	TEXT EDITØR	R	RELØCATABLE ØBJECT (C*)
F	FØRTRAN	H	SYSTEM LØADABLE ØBJECT (H*)

ALL FILES ARE SØURCE MØDE UNLESS ØTHERWISE INDICATED.

SUBJECTS	DØCUMENTATIØN MANUAL
MATHEMATICS (MA)	ØRDER # DA43
INTEGRATIØN	
DIFFERENTIATIØN, DIFFERENTIAL EQ.	
INTERPØLATIØN	
PØLYNØMIALS	
LINEAR EQUATIØNS	
MATRICES	
NØN-LINEAR EQUATIØNS	
SPECIAL FUNCTIØN EVALUATIØN	
LØGIC AND NUMBER THEØRY	
STATISTICS (ST)	ØRDER # DA44
CURVE FITTING AND REGRESSIØN	
ANALYSIS ØF VARIANCE	
PRØBABILITY DISTRIBUTIØNS	
CØNFIDENCE LIMITS	
HYPØTHESIS TESTING	
DESCRIPTIVE STATISTICS	
RANDØM NUMBER GENERATIØN	
MISCELLANEØUS STATISTICS	
BUSINESS AND FINANCE (BF)	ØRDER # DA46
MANAGEMENT SCIENCE AND ØPTIMIZATIØN (MS)	ØRDER # DA45
LINEAR PRØGRAMMING	
INTEGER PRØGRAMING	
NØN-LINEAR ØPTIMIZATIØN	
NETWØRK ANALYSIS	
FØRECASTING	
SIMULATIØN	
ENGINEERING (EN)	
GEØMETRIC AND PLØTTING (GP)	
EDUCATIØN AND TUTØRIAL (ED)	
DEMØNSTRATIØN (DE)	
UTILITY AND MISCELLANEØUS (UM)	

THE DØCUMENTATIØN FØR THESE PRØGRAMS IS AVAILABLE IN FØUR MANUALS:
SEE ØRDER # DA43 FØR PRØGRAMS IN MATHEMATICS
ØRDER # DA44 FØR PRØGRAMS IN STATISTICS
ØRDER # DA46 FØR PRØGRAMS IN BUSINESS AND FINANCE
ØRDER # DA45 FØR PRØGRAMS IN ALL ØTHER CATEGØRIES.

SUBRØUTINES THAT ARE CALLED BY A PRØGRAM AND MUST BE EXECUTED WITH IT ARE LISTED IN BRACKETS AT THE END ØF THE DESCRIPTIØN.

THESE PRØGRAMS HAVE ALL BEEN REVIEWED AND TESTED BUT NØ RESPØNSIBILITY CAN BE ASSUMED.

**********MA--MATHEMATICS**********

INTEGRATION

CLCINT	FF	INTEGRATION BY SIMPSON'S RULE
FINT	FF	EVALUATE FOURIER INTEGRALS BY FILON'S FORMULA
GAHER	FF	GAUSS-HERMITE QUADRATURE
GALA	FF	GAUSS-LAGUERRE QUADRATURE
GAUSSN	FF	EVALUATE DEFINITE DOUBLE OR TRIPLE INTEGRALS
GAUSSQ	FF	GAUSSIAN QUADRATURE
NCOATES	FP-S	NEWTON-COATES QUADRATURE
NUMINT	B	GAUSSIAN QUADRATURE
ROMBINT	FP-S	ROMBERG INTEGRATION
SPLINE	B	INTEGRATE TABULATED FUNCTION BY SPLINE FITS

DIFFERENTIATION, DIFFERENTIAL EQ.

AMPBX	FS	ADAMS-MOULTON FOR 1ST-ORDER DIFF. EQNS [RKPBX]
FDRVUL	FF	DIFFERENTIATE TABULATED FUNCTION, UNEQUAL SPACING
HDRVEB	FF	DIFFERENTIATE TABULATED FUNCTION, EQUAL SPACING
RKPBX	FS	RUNGE-KUTTA FOR 1ST-ORDER DIFF. EQNS

INTERPOLATION

SPLINT	B	SPLINE INTERPOLATION
TNT1	FF	SINGLE LAGRANGIAN INTERPOLATION [TLU1]
TNT2	FF	DOUBLE LAGRANGIAN INTERPOLATION [TLU1]
TNT2A	FF	VARIABLE DOUBLE LINEAR INTERPOLATION [TLU1]

POLYNOMIALS

BICOF	FS	CALCULATE BINOMIAL COEFFICIENTS
CLPLY	FF	EVALUATE REAL POLY AT REAL ARGUMENT
CPOLY	FS	FINDS ZEROES OF A COMPLEX POLYNOMIAL
CPOLY-DR	FP	FINDS ZEROES OF A COMPLEX POLYNOMIAL [CPOLY]
DVALG	FS	POLYNOMIAL DIVISION
EUALG	FS	G.C.D. OF TWO POLYNOMIALS [DVALG]
MTALG	FS	MULTIPLY POLYNOMIALS
PLMLT	FS	REAL POLY COEFFICIENTS RECONSTRUCTED FROM REAL ROOTS
POLRTS	FP	SOLUTION OF POLY BY BAIRSTOWS METHOD
POLYC	FS	REAL POLY COEFFICIENTS RECONSTRUCTED FROM COMPLEX ROOTS
POLYV	FS	EVALUATE REAL POLY AT COMPLEX ARGUMENT
QUADEQ	B	SOLUTION TO QUADRATIC EQUATIONS
ROOTER	B	SOLUTION OF POLY BY BAIRSTOWS METHOD
ZCOP	FP	ROOTS OF POLYNOMIAL WITH COMPLEX COEFF.
ZCOP2	FS	ROOTS OF POLYNOMIAL WITH COMPLEX COEF. [ZCOP2]
ZORP	FP	ROOTS OF REAL POLY
ZORP2	FS	ROOTS OF REAL POLY

LINEAR EQUATIONS

GJSIMEQ	FS	SOLVE LINEAR SYSTEMS BY GAUSS-JORDAN
GSEIDEL	FP-S	SOLVE LINEAR SYSTEMS BY GAUSS-SEIDEL
LINEQ	FS	SOLVE LINEAR SYSTEMS BY GAUSSIAN ELIMINATION
LINSR	FP	SOLVE LINEAR SYSTEMS BY GAUSSIAN ELIMINATION [LINEQ]
SIMEQN	B	SOLVE LINEAR SYSTEMS BY MATRIX INVERSION

MATRICES

DETE	FF	EVALUATE DETERMINANT OF REAL MATRIX
DOMEIG	FP-S	DOMINANT EIGENVALUES OF REAL MATRIX
EIG1	FS	EIGENVALUES OF SYM MATRIX BY JACOBI METHOD
EIGNHC	FS	EIGENVALUES & VECTORS OF COMPLEX NON-HERMITIAN MATRICES
EIGNSR	FS	EIGENVALUES & VECTORS OF REAL NON-SYMMETRIC MATRICES
EIGSR	FP	EIGENVALUES AND VECTORS OF REAL SYM. MATRIX [EIG1]
LINSD	FS	SOLVE LIN. SYS. W/ SYMMETRIC DOUBLE PREC. COEF. MATRIX
LINSS	FS	SOLVE LIN. SYS. W/ SYMMETRIC SINGLE PREC. COEF. MATRIX
MTINV	FS	MATRIX INVERSION BY PIVOTS
MTMPY	FS	MATRIX MULTIPLICATION
MTRAN	FS	TRANSPOSE A MATRIX
SPEIG1	FS	SPECIAL EIGEN PROBLEMS [EIG1]
SYMEIG	FP	EIGENVALUES OF SYM MATRIX BY JACOBI METHOD

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***NØN-LINEAR EQUATIØNS***
BRØWN       FS     SØLN ØF SIMULTANEØUS SYSTEMS BY BRØWN METHØD
SECANT      FS     SØLN ØF SIMULTANEØUS SYSTEMS BY SECANT METHØD [MTINV]
SØLN        FF     ZERØ ØF AN ARBITRARY FUNCTIØN
ZERØES      B      ZERØ,MAX,MIN ØF FUNCTIØN

***SPECIAL FUNCTIØN EVALUATIØN***
ARCTAN      FF     ARCTANGENT IN RADIANS ØF Y/X
BESL        FS     BESSEL FUNCTIØN [GAMF]
CØMP1       FF     EVALUATES REAL HYPERBØLIC TRIG FUNCTIØNS
CØMP2       FS     CØMPLEX MULT. AND DIVISIØN
CØMP3       FS     EVALUATES VARIØUS FUNCTIØNS FØR CØMPLEX ARGUMENT [CØMP2]
ERRF        FF     ERRØR FUNCTIØN
ERRINV      FF     INVERSE ERRØR FUNCTIØN
FRESNL      FS     EVALUATES FRESNAL INTEGRALS
GAMF        FF     GAMMA FUNCTIØN
JACELF      FS     EVALUATES JACØBIAN ELLIPTIC FUNCTIØNS SN, CN, DN
ØRTHP       FF     EVALUATE ØRTHØGØNAL PØLYNØMIALS
STIRLING    FP-S   N FACTØRIAL BY STIRLINGS APPRØXIMATIØN
TMFCEV      B      EVALUATE DAMPED ØR UNDAMPED FØURIER SERIES

***LØGIC AND NUMBER THEØRY***
4SQRS       B      WRITES INTEGERS AS SUM ØF SQUARES ØF FØUR INTEGERS
BASE        FP     CØNVERTS NUMBERS FRØM ØNE BASE TØ ANØTHER
CØNCLUDE    B      DETERMINES LØGICAL CØNCLUSIØNS FRØM PRØPØSITIØNAL LØGIC
GCDN        FS     G.C.D. ØF N INTEGERS

**********ST--STATISTICS**********

***CURVE FITTING AND REGRESSIØN***
CFIT        FP     LEAST SQRS. PØLY. WITH RESTRAINTS
CURFIT      B      FITS SIX DIFFERENT CURVES BY LEAST SQRS
FØRIR       FP     LEAST SQUARES ESTIMATE ØF FINITE FØURIER SERIES MØDEL
FØURIER     B      CØEFF ØF FØURIER SERIES TØ APPRØX A FUNCTIØN
LINEFIT     FS     LEAST SQRS LINE
LINREG      B      LST.SQRS. BY LINEAR, EXPØNENTIAL, ØR PØWER FUNCTIØN
LSPCFP      FP     LEAST SQRS PØLYNØMIAL FIT
LSQMM       FS     GENERALIZED PØLY FIT BY LEAST SQRS ØR MIN-MAX
MREG1       FP     MULTIPLE LINEAR REGRESSIØN
MULFIT      B      MULTIPLE LINEAR FIT WITH TRANSFØRMATIØNS
ØRPØL       FP     LEAST SQRS FIT WITH ØRTHØGØNAL PØLYS
PØLFIT      B      LEAST SQRS PØLYNØMIAL FIT
PØLFT       FP     LEAST SQRS PØLYNØMIAL FIT
SMLRP       FP     MULTIPLE LINEAR REGRESSIØN
SMLRPØBJ    FHP    SYSTEM LØADABLE FILE FØR SMLRP
STAT20      B      EFFRØYMSØN'S MULTIPLE LINEAR REGRESSIØN ALGØRITHM
STAT21      B      CØMPUTES MULTIPLE LINEAR REGRESSIØNS

***ANALYSIS ØF VARIANCE***
ANØVA       FP     ØNE ØR TWØ WAY ANALYSIS ØF VARIANCE
ANVA1       FP     ØNEWAY ANALYSIS ØF VARIANCE
ANVA3       FP     THREE WAY ANALYSIS ØF VARIANCE
ANVA5       FP     MULTIPLE VARIANCE ANALYSIS
KRUWAL      FP     KRUSKAL-WALLIS 2-WAY VARIANCE [XINGAM]
ØNEWAY      B      ØNEWAY ANALYSIS ØF VARIANCE
STAT13      B      ANALYSIS ØF VARIANCE TABLE, 1-WAY RANDØM DESIGN
STAT14      B      ANALYSIS ØF VARIANCE TABLE FØR RANDØMIZED BLØCK DESIGN
STAT15      B      ANALYSIS ØF VARIANCE TABLE FØR SIMPLE LATIN-SQ DESIGN
STAT16      B      ANALYSIS ØF VARIANCE TABLE, GRAECØ-LATIN SQUARE DESIGN
STAT17      B      ANØVA TABLE ØF BALANCED INCØMPLETE BLØCK DESIGN
STAT18      B      ANALYSIS ØF VARIANCE TABLE, YØUDEN SQUARE DESIGN
STAT33      B      ANALYSIS ØF VARIANCE TABLE, 1-WAY RANDØM DESIGN
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***PROBABILITY DISTRIBUTIONS***
ANPF        FF     NORMAL PROBABILITY FUNCTION [ERRF]
BETA        FF     BETA DISTRIBUTION
BINDIS      B      BINOMIAL PROBABILITIES
EXPLIM      B      EXPONENTIAL DISTRIBUTIONS
POISON      FF     POISSON DISTRIBUTION FUNCTION
PROBC       FP     PROBABLITIES OF COMBINATIONS OF RANDOM VARIABLES
PROVAR      B      NORMAL AND T-DISTRIBUTION
TDIST       FF     T-DISTRIBUTION [BETA]
XINGAM      FF     INCOMPLETE GAMA FUNCTION

***CONFIDENCE LIMITS***
BAYES       B      DIFFERENCE OF MEANS IN NON-EQUAL VARIANCE
BICONF      B      CONF. LIMITS FOR POPULATION PROPORTION (BINOMIAL)
BINOM       FP     BINOMIAL PROBABILITIES AND CONFIDENCE BANDS
COLINR      B      CONFIDENCE LIMITS ON LINEAR REGRESSIONS
CONBIN      B      CONF. LIMITS FOR POPULATION PROPORTION (NORMAL)
CONDIF      B      DIFFERENCE OF MEANS IN EQUAL VARIANCE
CONLIM      B      CONF. LIMITS FOR A SAMPLE MEAN
STAT05      B      CONFIDENCE INTERVAL FOR MEAN BY SIGN TEST
STAT06      B      CONFIDENCE LIMITS, WILCOXON SIGNED RANK SUM TEST

***HYPOTHESIS TESTING***
BITEST      B      TEST OF BINOMIAL PROPORTIONS
CHISQR      FS     CHI-SQUARE CALCULATIONS
CORREL      FP     CONTINGENCY COEFFICIENT [XINGAM]
CORRL2      FP     CORRELATION COEFFICIENT [TDIST;BETA]
KOLMO       FP     KOLMOGOROV-SMIRNOV TWO SAMPLE TEST [XINGAM]
SEVPRO      B      CHI-SQUARE
STAT01      B      MEAN, STD OF MEAN, ... , T-RATIO, 2 GROUPS, PAIRED
STAT02      B      MEANS, VARIANCES, AND T-RATIO 2 GROUPS, UNPAIRED DATA
STAT04      B      CHI-SQUARE AND PROBABILITIES, 2X2 TABLES
STAT08      B      COMPARES TWO GROUPS OF DATA USING THE MEDIAN TEST
STAT09      B      COMPARE 2 DATA GROUPS, MANN-WHITNEY 2-SAMPLE RANK TEST
STAT11      B      SPEARMAN RANK CORRELATION COEF. FOR 2 SERIES OF DATA
STAT12      B      COMPUTES CORRELATION MATRIX FOR N SERIES OF DATA
TAU         FP     KENDALL-RANK CORRELATION

***DESCRIPTIVE STATISTICS***
MANDSD      B      FIND MEAN, VARIANCE, STD
STAT        FP     FIND SEVERAL STATISTICS FOR SAMPLE DATA [ANPF;ERRF]
STATAN      B      FIND VARIOUS STATISTICAL MEASURES
TESTUD      B      SAMPLE STATISTICS
UNISTA      B      DESCRIPTION OF UNI-VARIANT DATA

***RANDOM NUMBER GENERATION***
FLATSORC    C      CARDIN SOURCE FILE FOR FLAT
FLAT        FRF    UNIFORM RANDOM NUMBER GENERATOR
RANDX       FF     RANDOM #'S, UNIFORM DIST. BETWEEN 0 AND 1
RNDNRM      FF     CALCULATES NORMAL RANDOM NUM. [FLAT]
UNIFM       FRF    UNIFORM RANDOM NUMBER GENERATOR
UNIFMSOR    C      CARDIN SOURCE FILE FOR UNIFM
URAN        FRF    UNIFORM RANDOM NUMBER GENERATOR
URANSORC    C      CARDIN SOURCE FILE FOR URAN
XNOR1       FF     NORMAL RANDOM NUMBERS, VARIABLE MEAN, STD [RANDX]
XNORM       FF     NORMAL RANDOM NUMBERS, MEAN 0, STD 1. [RANDX]

***MISCELLANEOUS STATISTICS***
FACTAN      FP     FACTOR ANALYSIS
STADES             EXPLANATION OF COLINR, CURFIT, MULFIT, UNISTA
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**********BF--BUSINESS AND FINANCE**********

ANNUIT	B	ANNUITIES,LØANS,MØRTGAGES
BLDGCØST	B	ANALYZE BUILDING CØSTS
BØNDATA	B	ANALYSIS ØF A BØND INVESTMENT PØRTFØLIØ
BØNDPR	B	CØMPUTES PRICE AND ACCRUED INTEREST ØF A BØND
BØNDSW	B	CALCULATES THE EFFECT ØF A BØND SWITCH
BØNDYD	B	CØMPUTES BØND YIELDS
CASHFLØW	B	PREDICTS NEXT YEARS CASH FLØW
DEPREC	B	CALCULATES DEPRECIATIØN BY FØUR METHØDS
INSTLØ	B	CALCULATES MØNTHLY PAYMENT SCHEDULE ØN INSTALLMENT LØAN
INVANL	FP	RETURN ØN INVESTMENT ANALYSIS
LESSEE	B	CØMPARES A LEASE WITH PURCHASE ØF EQUIPMENT
LESSIM	B	SIMULATES LESSØR'S CASH FLØW AND RATE ØF RETURN
LESSØR	B	CALCULATES THE LESSØRS CASH FLØW & RATE ØF RETURN
MAKE-BUY	B	TØ MAKE ØR TØ BUY DECISIØNS
MGSIM	FHP	SIMULATES CØMPETITIVE INTERACTIØN ØF CØMPANIES
MGSIM-CS	FRP	ØBJECT DECKS FØR MGSIM
MGSIM-IN		ØN LINE INSTRUCTIØNS FØR MGSIM
MØRTCST	B	MØRTGAGE SCHEDULE FØR VARIØUS TERMS
MØRTGAGE	FP	CALCULATES A MØRTGAGE REPAYMENT SCHEDULE
RETURN	B	CØMPUTES ANNUAL RETURNS FØR A SECURITY FRØM ANNUAL DATA
SALDATA	B	CØMPUTES PRØFITABILITY ØF DEPARTMENTS ØF A FIRM
SAVING	B	SAVINGS PLAN CALCULATIØNS
SMLBUS	B	PAYMENT SCHEDULES FØR A SMALL BUSINESS ADMST. LØAN
TRUINT	B	INTEREST RATE CALCULATIØNS

**********MS--MANAGEMENT SCIENCE AND ØPTIMIZATIØN**********

LINEAR PRØGRAMMING		
ASSIGNIT	B	THE ASSIGNMENT PRØBLEM
LINPRØ	B	LINEAR PRØGRAMMING
LNPRØG	FP	LINEAR PRØGRAMMING
TRANSPØ	B	THE TRANSPØRTATIØN PRØBLEM
UNDEQ	FS	FINDS A SØLUTIØN FØR AN UNDERDETERMINED LINEAR SYSTEM
INTEGER PRØGRAMMING		
INTØ1	FP	ZIØNTS' MØDIFICATIØN ØF BALAS' ZERØ-ØNE ALGØRITHM
INTLP	FP	GØMØRY'S PURE AND MIXED INTEGER PRØGRAMMING
NØN-LINEAR ØPTIMIZATIØN		
CSM	FS	ØPTIMIZE A LINEARLY CØNSTRAINED CØNVEX FUNCTIØN[UNDEQ]
DAVIDØN	B	DAVIDØN'S UNCØNSTRAINED ØPTIMIZATIØN
GEØSIM	B	HEURISTIC SCHEDULING ØF N JØBS IN A M MACHINE SHØP
GPRØG	FHP	SØLVES GEØMETRIC PRØGRAMMING PRØBLEMS
GPRØG-SØ	C	CARDIN SØURCE FILE FØR GPRØG [UNDEQ;CSM]
JSSIM	B	SCHEDULES N JØBS IN A SHØP WITH M MACHINES
LØGIC3	FP	UNCØNSTRAINED ØPTIMIZATIØN
MAXØPT	FP	UNCØNSTRAINED ØPTIMIZATIØN
NETWØRK ANALYSIS		
CPM	FP	CRITICAL PATH METHØD
KILTER	FP	'ØUT ØF KILTER' ALGØRITHM (MINIMUM CØST CIRCULATIØN)
MAXFLØW	FP	MAXIMUM FLØW THRU NETWØRK
PERT	B	SIMPLE ANALYSIS ØF A PERT NETWØRK
SHØRTEST	FP	SHØRTEST PATH - MIN SPANNING TREE
FØRECASTING		
CØEFS	B	DETERMINE SEASØNAL CØEFFICIENTS ØN TWØ CYCLES
CØMBI	B	DETERMINES ECØNØMIC ØRDER QUANITY FØR INVENTØRY ITEMS
ØPTIM	F	ØPTIMUM SERVICE LEVEL FØR ØNE INVENTØRY ITEM
TCAST	FP	TIME SERIES FØRECASTING [TCAST1;TCAST2]
TCAST1	FH	ØVERLAY MØDULE ØF TCAST
TCAST	FHP	TIME SERIES FØRECASTING
TCAST2	FH	ØVERLAY MØDULE ØF TCAST
TCAST1	FH	ØVERLAY MØDULE ØF TCAST
SMØØTH	FS	TRIPLE SMØØTHING ØF A TIME SERIES

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***SIMULATIØN***
GASPDATA  E     DATA FILE FØR SAMPLE PRØGRAM GASPSAMP
GASPIIA   FS    'GASP' SIMULATIØN SYSTEM
GASPSAMP  FP    SAMPLE PRØGRAM FØR GASPIIA [GASPIIA;GASPDATA]

**********EN--ENGINEERING**********

ACNET     FP    FREQUENCY RESPØNSE Ø F A LINEAR CIRCUIT
BEMDES    B     STEEL BEAM SELECTIØN
GCVSIZ    B     GAS CØNTRØL VALVE CØEFF.
LCVSIC    B     LIQUID CØNTRØL VALVE CØEFF.
LFILTR    B     SYNTHESIZES ACTIVE LØW-PASS FILTERS [LFLDAT]
LFLDAT          DATA FØR LFILTR
LFLTIN          INSTRUCTIØNS FØR LFILTR
LPFILT    B     DESIGN LØW PASS FILTERS
NLNET     FP    GENERAL STEADY-STATE CIRCUIT ANALYSIS
ØTTØ      B     ØTTØ CYCLE Ø F ENGINE
PAVEIT    B     CALCULATES $ CØST AND TØNS Ø F MATERIAL TØ PAVE A RØAD
PVT       FP    FINDS MØLAR VØLUME Ø F A GAS GIVEN TEMPERATURE AND PRES.
SCVSIZ    B     STEAM CØNTRØL VALVE CØEFF.
SECAP     B     STEEL SECTIØN CAPACITIES

**********GP-GEØMETRIC AND PLØTTING**********

CIRCLE    B     DIVIDES A CIRCLE INTØ N EQUAL PARTS
PLØT      FS    PLØTS UP TØ 9 CURVES SIMULTANEØUSLY
PLØTTØ    B     SIMULTANEØUSLY PLØTS 1 TØ 6 FUNCTIØNS
PØLPLØ    FP    PLØTS EQNS IN PØLAR CØØRDINATES
SPHERE    B     SØLVES ANY SPHERICAL TRIANGLE
TRIANG    B     SØLVES FØR ALL PARTS Ø F ANY TRIANGLE
TWØPLØ    B     SIMULTANEØUSLY PLØTS 2 FUNCTIØNS
XYPLØT    B     PLØTS SINGLE-VALVED FUNCTIØNS

**********ED--EDUCATIØN AND TUTØRIAL**********

DRIVES    FHP   DRIVER FØR EXPER, A CØMPUTER ASSISTED INST. LANG.
EXPERN    E     EXPER TUTØRIALS IN EXPER (N=1 TØ 5) [PREPRS;DRIVES]
PREPRS    FHP   PREPRØCESSØR FØR EXPER, A CØMPUTER ASSISTED INST. LANG.

**********DE--DEMØNSTRATIØN**********

AMAZE     B     CØNSTRUCTS MAZES    -  EACH UNIQUE
BLKJAK    B     THE CØMPUTER DEALS BLACKJACK
PØPING    B     PØPULATIØN PRØJECTIØNS FØR AN AREA
PRIME     B     PRIME FACTØRIZATIØN Ø F A NUMBER
XMAS      B     A HØLIDAY SING-ALØNG, CHRISTMAS CARD AND GREETINGS

**********UM--UTILITY AND MISCELLANEØUS**********

ADATER    FP-S  A CALENDER DATING RØUTINE
CATALØG   E     CATALØG Ø F SERIES 6000/600 T/S LIBRARY (THIS FILE)
CØNVRT    B     CØNVERTS MEASUREMENTS FRØM ØNE SCALE TØ ANØTHER
DBLSØRT   FS    SØRT TWØ ARRAYS
DESEQ     FP    STRIPS LINE SEQUENCE NUMBERS FRØM A FILE
REFØRM    FP    REFØRMATS A 'NFØRM' FØRTRAN SØURCE FILE TØ 'FØRM'
RLINE     FS    READS LINE, ØPTIØNALLY STRIPS LINE # & CØUNTS ENTRIES
SGLSØRT   FS    SØRT AN ARRAY
TLU1      FS    TABLE SEARCH
TPLSØRT   FS    SØRT THREE ARRAYS

***END Ø F CATALØG***
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FOURIER

This BASIC program produces the fourier coefficients for a given periodic function of the form:

$$F(X) = A(0)/2 + \sum_{N=1}^{M} (A(N) * COS(N*X) + B(N) * SIN(N*X))$$

which approximates a set of data points. The data points can be supplied either as discrete points equally spaced from 0 to 2π or as a set of defining functions.

INSTRUCTIONS

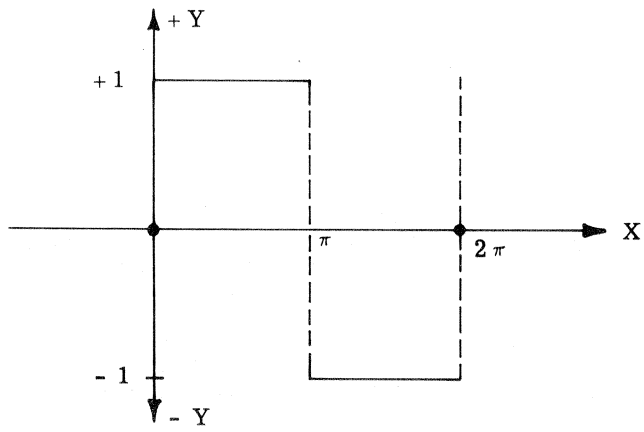
If the data to be approximated consists of discrete points, enter them in data statements at line number 6000 to 6998. If the data consists of defining functions, use lines 2000 to 4000 to define Y as a function of X, for example:

```
2000 IF X < 3.1416 THEN 2030
2010 LET Y = X13.1416
2020 GO TO 2040
2030 LET Y = X13.1416-1.0
```

Additional instructions can be found by running the program.

SAMPLE PROBLEM 1

Find the 9th order periodic function which best approximates the square wave:



by using 20 discrete points.

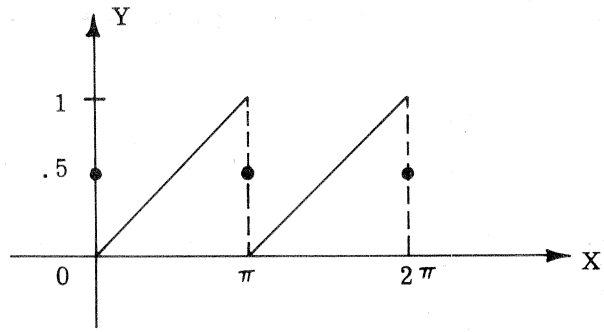
SAMPLE SOLUTION 1

```
*LIB FØURIER
READY
*RUN



------------------------FØURIER SERIES PRØGRAM----------------


DØ YØU DESIRE INSTRUCTIØNS---1=YES,0=NØ ?1

INSTRUCTIØNS:

THIS PRØGRAM CØMPUTES THE FØURIER CØEFFICIENTS FØR A GIVEN
PERIØDIC FUNCTIØN ØF THE FØRM:

                 M
                 -
                 \
   F(X)=A(0)/2+  /(A(N)*CØS(N*X)+B(N)*SIN(N*X))
                 -
                N=1

GIVEN THE FØLLØWING DATA:

   1A. A SUBRØUTINE IN LINES 2000-4000 THAT DEFINES 'Y' AS A
       FUNCTIØN ØF 'X' ØVER THE INTERVAL [0,2*PI).  'PI'
       CØNTAINS THE VALUE ØF PI AND CAN BE USED IN THE
       SUBRØUTINE.  FØR EXAMPLE:

          2000 IF X < P1 THEN 2030
          2010 LET Y=X/P1
          2020 GØ TØ 2040
          2030 LET Y=X/P1-1.0
          2040 RETURN

       ØR

   1B. DATA STATEMENTS IN LINES 6000-6998 CØNTAINING THE
       TABULATED FUNCTIØN VALUES EQUALLY SPACED ØN [0,2*PI]
       SØ THAT THE FIRST PØINT IS THE FUNCTIØN VALUE AT ZERØ
       AND THE LAST PØINT IS THE FUNCTIØN VALUE AT 2*PI.

    2. THE NUMBER ØF PØINTS IF (1B) IS USED TØ DEFINE THE
       FUNCTIØN. (REQUESTED DURING PRØGRAM EXECUTIØN)
       IF (1A) IS USED, THE PRØGRAM USES   201 PØINTS.

    3. THE DESIRED ØRDER ØF THE FØURIER CØEFICIENTS.
       (REQUESTED DURING PRØGRAM EXECUTIØN)

NØTE:  THE ØRDER ØF THE SERIES MUST BE >= ZERØ.

       THE # PØINTS MUST BE > TWICE THE ØRDER ØF THE SERIES.

       B(0) IS ALWAYS ZERØ.
```

```
READY
*6000 DATA 0,1,1,1,1,1,1,1,1,1
*6010 DATA -1,-1,-1,-1,-1,-1,-1,-1,-1,0
*RUN

-------------------------FOURIER SERIES PROGRAM----------------

DO YOU DESIRE INSTRUCTIONS---1=YES,0=NO ?0
ARE YOU USING A FUNCTION TO SUPPLY DATA POINTS (TYPE '1') OR
A SET OF DATA POINTS (TYPE '2') ?2
HOW MANY DATA POINTS ?20
WHAT IS THE MAXIMUM ORDER OF THE HARMONICS TO BE FITTED ?9


FOURIER SERIES COEFFICIENTS:

         A(I)              B(I)              I

 8.66620E-07                 0               0
-3.46504E-07          1.270337               1
 1.98274E-08         -.0175653               2
-7.04884E-08          .4156748               3
 1.80342E-09         -.0361369               4
 4.62300E-08          .2399758               5
-2.66428E-08         -.0569656               6
 1.37723E-07          .1611171               7
-1.31387E-07         -.0819297               8
 5.56659E-07          .1143454               9


DO YOU WISH TO SEE A TABLE OF PREDICTED  VS. ACTUAL VALUES
(1-YES,0=NO) ?1


          X          PRED-Y          ACTUAL-Y          ERROR

          0      6.20530E-07                 0      6.20530E-07
   .330694          .9999991                 1      8.94070E-07
  .6613879         1.000001                  1      9.38773E-07
  .9920819          .9999991                 1      8.79159E-07
  1.322776         1.000001                  1      1.05798E-06
   1.65347          .9999991                 1      8.79159E-07
  1.984164         1.000001                  1      1.20599E-06
  2.314858          .9999992                 1      7.89752E-07
  2.645552         1.000002                  1      1.62423E-06
  2.976246          .9999999                 1      8.94070E-08
   3.30694         -.9999983                -1      1.68893E-06
  3.637634         -.9999995                -1      4.76837E-07
  3.968328         -.9999989                -1      1.07288E-06
  4.299021         -.9999996                -1      3.79980E-07
  4.629715         -.9999991                -1      8.71718E-07
  4.960409         -.9999996                -1      3.72529E-07
  5.291103         -.9999994                -1      6.33299E-07
  5.621797         -.9999999                -1      1.34110E-07
  5.952491                -1                -1      8.94070E-08
  6.283185       2.56234E-07                 0       2.56234E-07

TOTAL ERROR=     1.49360E-05
MEAN ERROR=      7.46800E-07

READY
*
```

SAMPLE PROBLEM 2

Find the 10th order periodic function which best approximates the saw tooth:



SAMPLE SOLUTION 2

```
*LIB FØURIER
READY
*2000 IF ABS(X) < 1E-4   THEN 2510
*2010 IF ABS(X-P1) < 1E-4 THEN 2510
*2020 IF ABS(X-2*P1) < 1E-4 THEN 2510
*2030 IF X > P1 THEN 2540
*2040 LET Y = X/P1
*2050 RETURN
*2510 LET Y = .5
*2520 RETURN
 2540 LET Y = (X-P1)/P1
*2550 RETURN
*RUN


----------FØURIER SERIES PRØGRAM----------


DØ YØU DESIRE INSTRUCTIØNS---1=YES,0=NØ ?0
ARE YØU USING A FUNCTIØN TØ SUPPLY DATA PØINTS (TYPE '1') ØR
A SET ØF DATA PØINTS (TYPE '2') ?1
WHAT IS THE MAXIMUM ØRDER ØF THE HARMØNICS TØ BE FITTED ?10


FØURIER SERIES CØEFFICIENTS:

        A(I)              B(I)              I

     .9998307                0              0
      1.50909E-05       9.64904E-06          1
      1.79135E-05      -.3181999             2
      4.32217E-06       5.53251E-07          3
      1.03547E-05      -.1589442             4
      2.51442E-06      -6.33756E-08          5
      5.79206E-06      -.1057887             6
      1.66236E-06      -1.99909E-07          7
      4.05776E-06      -.0791582             8
      1.21063E-06      -2.49538E-07          9
      3.18545E-06      -.0631376            10
```

```
DØ YØU WISH TØ SEE A TABLE ØF PREDICTED  VS. ACTUAL VALUES
(1-YES,0=NØ) ?1

          X          PRED-Y          ACTUAL-Y          ERRØR

          0          .4999814              .5          1.85855E-05
     .3141593          .0146056              .1          .0853944
     .6283185          .2413414              .2          .0413414
     .9424778          .2776137              .3          .0223863
     1.256637          .4099661              .4          .0099661
     1.570796          .4999118              .5          8.82000E-05
     1.884956          .5898633              .6          .0101367
     2.199115          .7222101              .7          .0222101
     2.513274          .7584961              .8          .0415039
     2.827433          .9852501              .9          .0852501
     3.141593          .4999322              .5          6.77742E-05
     3.455752          .0145697              .1          .0854303
     3.769911          .2413107         .1999999         .0413107
      4.08407          .2775868         .2999999         .0224132
     4.398229          .4099427         .3999999         .0099428
     4.712389          .4998936         .4999999         .0001063
     5.026548          .5898507         .5999999         .0101492
     5.340707          .7222056         .6999999         .0222057
     5.654866          .7585007         .7999999         .0414992
     5.969026          .9852731         .8999998         .0852733
     6.283185          .4999831              .5          1.68754E-05

TØTAL ERRØR=           .6367112
MEAN ERRØR=            .0303196

READY
*
```

This BASIC program produces the ANOVA table of a balanced incomplete block design and F-ratio for treatments. The sum-of-squares is adjusted because of incompleteness.

INSTRUCTIONS

For instructions on data required and constraints of this program list the program by typing:

LIST 1-180

To see the format of data to be entered, type

LIST 900

Let run to end. The following is a sample of STAT17 output:

```
ANØVA TABLE:

ITEM              SS              DF              MS

GRAND TØTAL       3478            12
GRAND MEAN          2133.333      1
TREATMENTS          880.8333      3             293.6111
BLØCKS              100.6667      3    ...BLØCK MS NØT ADJUSTED...
ERRØR               363.1667      5             72.63333

F-RATIØ =    4.042374 , ØN     3 AND     5 DEGREES ØF FREEDØM.

READY
*
```

This BASIC program performs a multiple linear regression according to Effroymson's algorithm.

INSTRUCTIONS

For instructions on data required and constraints of this program, list the program by typing

LIST 1-350

To see the format of the data to be entered, type

LIST 2000

Let run to end. The following is a sample of STAT20 output.

```
READY

*RUN
LIST THIS PROGRAM FOR INSTRUCTIONS.

 EANS
    22.86667        35.33333        46.13333              18

STANDARD DEVIATIONS
    11.87354        7.217703         14.6671        4.035556

CORRELATION COEFFICIENTS
           1        .5614845        .3023933        .5023637

    .5614845               1        .3267932        .2869154

    .3023933        .3267932               1        .7530242

    .5023637        .2869154        .7530242               1


DEPENDENT VARIABLE     1
       INDEX                B        STD.DEV.         T-RATIO
           0               18
STANDARD ERROR OF Y                  4.035556

VARIABLE ENTERING      3
F-LEVEL              17.02624
       INDEX                B        STD.DEV.         T-RATIO
           0        8.441651
           3        .2071897        .0502121        4.125287
STANDARD ERROR OF Y                  2.755505

VARIABLE ENTERING      1
F-LEVEL              2.847233
       INDEX                B        STD.DEV.         T-RATIO
           0        7.252562
           1        .1027441        .0608899        1.687375
           3        .1820381        .0492925        3.693015
STANDARD ERROR OF Y                  2.578492

   *****  END OF PROBLEM  *****
READY
*
```

This BASIC program computes one or more multiple linear regressions on a batch of data.

INSTRUCTIONS

For instructions on data required and constraints of this program, list the program by typing

LIST 1 - 510

To see the format of the data to be entered, type

LIST 2000

Let run to end. The following is a sample of STAT21 output:

```
**REGRESSION NUMBER      1 : DEPENDENT VARIABLE IS      4

        INDEX            MEANS        STANDARD DEV.
            3         46.13333          14.6671
            4               18          4.035556
CORRELATION COEFFICIENTS
            1         .7530242

     .7530242                1

VARIANCE-COVARIANCE MATRIX
     5.872178        -.116314

     -.116314         .0025213
        INDEX               B       STD. ERROR          T-RATIO
            0         8.441652         2.423258        3.483595
            3         .2071896         .0502121        4.125285

R-SQUARED=      .5337411    R=     .7305759

STAND. ERROR OF EST.=      2.755605    D.F.=    13

       ACTUAL        PREDICTED         RESIDUAL
           15         19.62989        -4.629892
           16         12.37825         3.621745
           14         14.65734        -.6573406
           22         21.70179         .2982117
           24         20.87303          3.12697
           19          19.4227        -.4227022
           13         14.45015        -1.450151
           15         19.83708        -4.837082
           23         21.28741         1.712591
           12         15.27891         -3.27891
           25         22.53055         2.469453
           17         17.14362        -.1436162
           18         17.76519         .2348149
           19         16.52205         2.477953
           18         16.52205         1.477953

 DURBIN-WATSON STAT.=    2.373553
```

**REGRESSION NUMBER 2 : DEPENDENT VARIABLE IS 4

INDEX	MEANS	STANDARD DEV.
1	22.86667	11.87354
3	46.13333	14.6671
4	18	4.035556

CORRELATION COEFFICIENTS

1	.3023933	.5023637
.3023933	1	.7530242
.5023637	.7530242	1

VARIANCE-COVARIANCE MATRIX

5.638185	-.042909	-.0913387
-.042909	.0037076	-.0009076
-.0913387	-.0009076	.0024298

INDEX	B	STD. ERROR	T-RATIO
0	7.252562	2.374485	3.054371
1	.1027441	.0608899	1.687375
3	.1820381	.0492925	3.693015

R-SQUARED= .5917512 R= .7692536

STAND. ERROR OF EST.= 2.578492 D.F.= 12

DURBIN-WATSON STAT.= 1.683383

**REGRESSION NUMBER 3 : DEPENDENT VARIABLE IS 4

INDEX	MEANS	STANDARD DE/.
1	22.86667	11.87354
2	35.33333	7.217704
3	46.13333	14.6571
4	18	4.035556

CORRELATION COEFFICIENTS

1	.5614845	.3023933	.5023637
.5614845	.9999999	.3267932	.2869164
.3023933	.3267932	1	.7530242
.5023637	.2869164	.7530242	1

INDEX	B	STD. ERROR	T-RATIO
0	9.301253	3.802671	2.445979
1	.1288076	.0725231	1.775091
2	-.0841979	.1203255	-.699751
3	.1891981	.0514041	3.680604

R-SQUARED= .5736172 R= .7573752

STAND. ERROR OF EST.= 2.635137 D.F.= 11

ACTUAL	PREDICTED	RESIDUAL
15	19.59829	-4.598294
16	14.75456	1.24544
14	13.00608	.9939227
22	20.17709	1.822908
24	22.42748	1.572516
19	19.38901	-.3890102
13	13.69903	-.69903
15	19.50477	-4.50477
23	21.47822	1.521784
12	15.62455	-3.62455
25	24.08996	.9100376
17	16.0493	.9506997
18	16.53772	1.462282
19	18.0679	.932099
18	15.59503	2.403997

DURBIN-WATSON STAT.= 1.825883

```
**REGRESSION NUMBER     4 : DEPENDENT VARIABLE IS     3

        INDEX           MEANS       STANDARD DEV.
            4              18          4.035556
            3        46.13333           14.6671


CORRELATION COEFFICIENTS
            1        .7530242

    .7530242               1


        INDEX               B       STD. ERROR         T-RATIO
            0      -3.129834          12.2157       -.2562141
            4       2.736843           .66327        4.125288

R-SQUARED=     .5337412    R=     .7305759

STAND. ERROR OF EST.=     10.01516    D.F.=    13


DURBIN-WATSON STAT.= 2.13149

      *****PROBLEM COMPLETED*****


READY
*
```