FRIDEN MODEL 1155
ADVANCED PROGRAMMABLE
CALCULATOR

Friden 1155 calculator

SINGER

SINGER
BUSINESS MACHINES

PROGRAM ABSTRACTS

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ADVANCED PROGRAMMABLE
CALCULATOR

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INTRODUCTION TO ABSTRACTS

This publication contains abstracts of all programs prepared by Singer Business Machines for use with the 1155 Programmable Calculator.

Programs may be ordered from the local Singer Business Machines Office. Publication numbers have been changed to reflect a new numbering system for documents. When ordering, please specify the publication number in this manual for the program wanted.

ABSTRACTS

52-8003-001   AMORTIZATION OF A LOAN

There are several options available:

(1)   Calculation of payment/period, x, necessary to amortize a loan if the principal, P, annual interest rate, i, and number of periods, n, with m periods per year are known.

(2)   Determination of n, the number of full payments of x dollars given P, i, m and x. Also calculate the amount of the last payment.

(3)   For a given $n_1 < n$ or $n_a \le n_1 \le n_b$, determine the interest payment for n_1, payment on the principal, total principal paid to date, total interest paid to date, total amount paid to date, and the principal remaining.

52-8003-002   ANNUAL PERCENTAGE RATE

This program uses the Muller iterative method to determine i such that

$$R = P \frac{i(1 + i)^n}{(1 + i)^n - 1}$$

where

R = payment/period
P = principal
n = number of payments
i = interest rate/period

The process stops when the difference between two successive i values $\le 10^{-4}$.

To determine the APR, it is necessary to multiply i by the number of periods per year.

52-8003-003   COMPOUND INTEREST

Evaluates the formula

$$A = P(1 + \frac{i}{p})^n$$

where P = principal, i = annual interest rate, p = number of periods per year, n = number of periods. For each period, the interest is printed, the total interest to date, and the total amount to date.

52-8003-004 **BUDGETING**

The distribution of payments on a principal is determined meeting specific requirements. The year is divided into quarters. The payment during the first month of each quarter is approximately equal to 1.25 times the latter 2 months. Monthly totals and the grand total are printed.

52-8003-005 **LIFE ANNUITIES**

The program performs calculations for the values of whole life annuities and temporary life annuities.

52-8003-006 **AUTOMOBILE DEALER CALCULATIONS**

Given the amount to be financed, the number of months, the number of extra days and the add-on rate, the program calculates APR, the amount of life insurance premium, the amount of accident and health insurance premium, the total to be financed including insurance, the amount of the finance charge and the monthly payment for each of five insurance options. It is easily tailored to individual needs.

52-8003-007 **JOB COST COMPUTATIONS**

Consider a table consisting of fewer than 26 items, each having two associated cost values - for example, price/item and labor (hr)/item. The user simply keys in a quantity for each item and the machine will print total material cost and total labor cost for that item. At the same time, it keeps running totals. After all items have been entered, it will compute total job cost based on a sales tax rate and an hourly labor rate.

52-8003-008 **REBAR WEIGHT SUMMARY**

The program accepts three input values: number of bars, size of bar, and length per bar. Given the pound/foot for each size as a part of the program, the machine determines total length and poundage for each size bar as well as the grand weight total.

52-8003-009 **AUTOMOBILE FINANCING**

This program is set up to be tailored to the user's needs. The input includes principal, number of months, odd days. add-on rate. There is an opportunity to input other charges such as title or recording fee. Various rates for credit life, A/H insurance, taxes, etc. are incorporated into the program by the user. Included in the output are the total note value, the amount financed, the finance charge, insurance charges, total other charges, monthly payment, and APR.

52-8003-010   SEVERAL FINANCIAL CALCULATIONS

Amortization Schedule
Discounting a Note
Status of a Loan
Number of Payments to Pay Off a Loan

52-8003-011   SHORT TERM DISCOUNT NOTE

Given the face value, maturity and transaction dates, and one of the three values discount rate, effective yield, or price, the program will determine the other two values.

52-8003-012   BOND PRICE OR YIELD

Given the date of maturity, settlement date, bond rate, and gross yield, the program will calculate dollar price. If the former three values and dollar price are known, it will determine the gross yield.

52-8003-013   BOND PRICE WITH CONCESSIONS

This program determines the bond price when given either the expected yield or the straight price.

52-8003-014   TAX EXEMPT BOND - GENERAL PROGRAM

This program will determine the following.

1. Dollar price required for a specified gross or **true** yield
2. Gross yield for a specified dollar price or true yield
3. True yield (after capital gains tax, if any) for a specified dollar price or gross yield
4. Any of the above for a call date (with possibly a different redemption value)
5. Any of the above for a different tax rate
6. The dollar price and actual price after concessions
7. The accrued interest for the present coupon period
8. The total price

52-8003-015   BONDS - GENERAL PROGRAM (48% Tax Rate, Par Only)

The program determines 1 through 4 and 6 through 8 as for Business Program 014 above. It assumes a 48% tax rate and that all bonds are redeemable at par even on call dates.

52-8003-016   BONDS - GENERAL PROGRAM (48% Tax Rate)

This program is the same as Business Program 015 except that bonds redeemable at premium are allowed.

52-8003-017   INSURANCE REBATE: SHORT RATE OR PRORATE

This program will determine the rebate factor commonly found on an insurance rebate 'wheel'. This may be either the short rate factor or the prorate factor. It then multiplies this factor by the annual premium to determine the actual amount of the rebate.

52-8003-018   INTEREST ON LOAN FOR TAX DEDUCTION

This program will compute the amount of interest paid on a loan during one tax year. If the loan was not prepaid during the year, the finance charge is prorated by month. If it was prepaid, the amount of tax-deductable interest is the finance charge minus the rebate on the finance charge minus the interest paid in previous years.

52-8003-019   INSTALLMENT LOAN - PAYMENT KNOWN

Given a principal balance, add-on rate, payment per period, number of periods per year (52, 26, 24, 12), and an insurance option, the program will determine term, amount financed, finance charges, last payment, APR.

ABSTRACTS

52-8004-001   QUALITY CONTROL CHART

This program prepares a quality control chart for a given set of data for a particular parameter (preferably greater than 30 observations). It determines the number of observations (N), the mean ($\bar{x}$), standard deviation (S. D.), $\bar{x} \pm 2$ S. D., and the coefficient of variation (v). It includes an error routine for incorrectly entered data.

ABSTRACTS

52-8005-001   DECAY CONSTANT AND HALF LIFE

This program calculates the decay constant and half-life given a number of activity readings at various times.   There is an option available to calculate $\left\{ \dfrac{M_t}{M_0} \right\}$ for $t_a \leq t \leq t_b$ where M_0 is initial mass and M_t = mass at time t.   There is an error routine for incorrectly entered data.

52-8005-002   RELATIVE ELEMENTAL PERCENTAGES

The program determines the % of an element in a particular compound. The atomic weights of twelve common elements are already incorporated into the program (the user may elect to add others). An element number and the number of atoms of that particular element present are entered for each element. An error routine is available for incorrectly entered data.

52-8005-003   OUTPUT CONCENTRATION - VARIGRAD

This program calculates the output concentration of a variable gradient device consisting of a number of identical chambers (not more than 12) connected in series in hydrostatic equilibrium.

ABSTRACTS

52-8009-001   FLUX DENSITY - CIRCULAR LOOP

The program calculates the flux density along the axis of a circular loop.

52-8009-002   CIRCUIT ANALYSIS

Given a circuit containing two nodes and five branches, the program determines the voltages at the two nodes. The user inputs a topology matrix which describes the circuit; resistances, and voltages.

52-8009-003   FOURIER TRANSFORM

The program evaluates:

$$g(\omega) = \int_{-\infty}^{\infty} F(t) \cos \omega t \; dt - j \int_{-\infty}^{\infty} F(t) \sin \omega t \; dt = A_f - j B_f$$

for frequency, $f \geq 0$ ($\omega = 2\pi f$) in increments of Δf (f may increment arithmetically, geometrically or logarithmically).

52-8009-004   FOURIER TRANSFORM - PULSE

This program performs the same function as 003 except that it is especially written for a pulse and is faster in execution.

52-8009-005   EULER-FOURIER FORMULAS - PERIODIC FUNCTIONS

The program determines a_n (n=0, 1, 2 ...), b_n (n=1, 2, ...) such that (t = time)

$$f(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} (a_n \cos 2\pi nt + b_n \sin 2\pi nt)$$

where

$$a_n = 2 \int_{-.5}^{.5} f(t) \cos 2\pi nt \; dt \; (n = 0, 1, 2 \ldots)$$

$$b_n = 2 \int_{-.5}^{.5} f(t) \sin 2\pi nt \; dt \; (n = 1, 2, 3 \ldots)$$

then

$$c_n \text{ (amplitude)} = \sqrt{a_n{}^2 + b_n{}^2}$$

$$\Psi_n \text{ (phase)} = \tan^{-1}\left(\frac{b_n}{a_n}\right)$$

f(t) is defined by the user and each of the integrals may be a sum of integrals of functions defined on sub-intervals.

52-8009-006   EULER-FOURIER FORMULAS - f(t) = CONSTANT

This program performs the same function as 005 except that f(t) = a constant value for an interval of t and thus the execution time is faster.

52-8009-007   CURRENT - RESONANT RLC CIRCUIT

Given voltage (V), resistance (R), inductance (L), capacitance (C), the program calculates i (current) for time t between a and b in increments of Δt.

$$i = \frac{2Ve^{-Rt/(2L)}}{\sqrt{4L/C - R^2}} \cdot \sin\left(\frac{t}{2L} \cdot \sqrt{4L/C - R^2}\right)$$

when $L \dfrac{di}{dt} + Ri + \dfrac{1}{C}\displaystyle\int i\ dt = 0$

and $i = 0,\ L \cdot di/dt = V$ at $t = 0$

52-8009-008   POWER SUPPLY DESIGN

This program is an aid to the designing of power supplies - series or shunt. The user supplies the voltage and current values. The suggested values for capacitor, resistor, and transformer ac may be accepted or replaced. The machine prints out the appropriate values for low, nominal, and high for either series or shunt or both if so desired.

ABSTRACTS

52-8012-001   CAM DESIGN

This program determines the displacement, velocity, and acceleration for the following types of curves for cams with (1) a radial translating roller follower, or (2) an offset translating roller follower:

        a. parabolic
        b. harmonic
        c. cycloidal

52-8012-002   COMPRESSION SPRING DESIGN – ROUND WIRE

Find various spring parameters given the values of other parameters.

$$S = \frac{8PD}{\pi d^3} \quad ; \quad \frac{P}{F} = \frac{Gd^4}{8D^3N}$$

$$H = (N+1)d + 2(D-d)$$

52-8012-003   CAM DESIGN – MODIFIED CYCLOID

The program determines the velocity and acceleration of various points (values of θ).

52-8012-004   EXTENSION SPRING DESIGN – STRESS CONCENTRATION

Find any one of the parameters given the values of the others.

$$S_B = \frac{32PR}{\pi d^3} \cdot \frac{r_1}{r_3}$$

$$S_T = \frac{16PR}{\pi d^3} \cdot \left(\frac{4c-1}{4c-4}\right) \quad ; \quad c = \frac{2r_2}{d}$$

52-8012-005   TORSION SPRING CALCULATIONS

Given all but one of the parameter values, find the remaining one:

$$S = \frac{32PR}{\pi d^3} \quad ; \quad M = \frac{Ed^4T}{10.8\,DN}$$

52-8012-006   FLAT SPRING CALCULATIONS

Given all but one of the parameter values, find the remaining one for either
(1) a cantilever type (rectangular section), or (2) an elliptical type (rectangular
section).

(1)   (2)

$$S = \frac{6PL}{bh^2} \quad ; \quad F = \frac{2SL^2}{3Eh} \qquad\qquad S = \frac{3}{2}\frac{PL}{bh^2} \quad ; \quad F = \frac{SL^2}{6Eh}$$

ABSTRACTS

52-8008-001   CANTILEVER BEAM - PARTIAL UNIFORM LOAD

Given the following parameters: the modulus of elasticity of the material (E); the moment of inertia (I); the load (W); and L, a, b (refer to diagram), the program calculates V_{AB} (shear A to B), M_{AB} (bending moment A to B), Y_{AB} (deflection A to B), V_{BC}, M_{BC}, Y_{BC}, V_{CD}, M_{CD}, Y_{CD}, M_{max}, Y_{max}, θ (end slope) for any x value. It contains an error routine for incorrectly entered data.
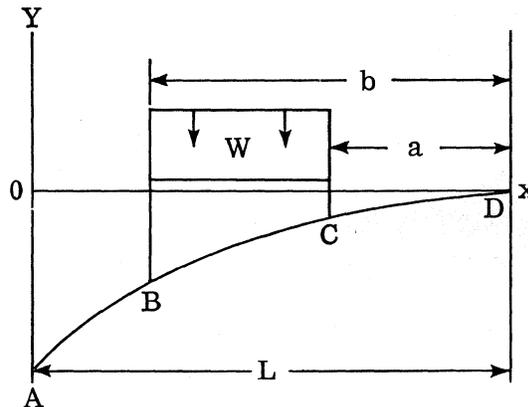
52-8008-002   STRESS AND STRAIN - ELASTIC BODIES

Given R_1 and R_1' (max and min radii of curvature for body 1; R_2 and R_2' for body 2; modulus of elasticity for each body; Poisson's ratio for each body; total pressure; and the angle between the planes containing $1/R_1$ and $1/R_2$, the program calculates the maximum unit compressive stress, the major and minor semi-axes of elliptical contact area and the combined deformation of both bodies at each contact along the axis of load.

52-8008-003   WEIBULL DISTRIBUTION FUNCTION

This program may be used for analysis of failure data. It performs a regression analysis on the number pairs (x, F(x)), where x is the time to failure and $F(x) = $ median rank $= \dfrac{i - .3}{n + .4}$ [i = the failure order number (1, 2, 3, - - -); n= size of the samples].

52-8007-001
(revised)

TRAVERSE CLOSURE

This is a set of 17 programs designed to solve the general problem of determining the successive coordinates of the points as well as the amount of error of closure, and then of balancing the traverse using compass, transit, or Crandalls Rule if the error is too large. The data may be in the form of bearings, azimuths, or field deflection angles along with a distance. The traverse may be either 'closed' or 'open' and may contain curved legs. Up to 39 (if all straight) legs may be accepted as input. The area will be printed in square feet and acres. Surveying programs 013. 014. and 015 are designed to be used in conjunction with this program to perform various coordinate geometry functions.

52-8007-002 **TRAVERSE CALCULATIONS**

Given the coordinates of two successive points of a traverse, the program determines the bearing, the changes in latitude and departure and the distance between them.

52-8007-003 **COORDINATES OF AN OBSERVER'S POSITION**

Finds the coordinates of an observer's position by measuring two angles and the coordinates of three points.

52-8007-004 **AREA BY HELON'S FORMULA**

Find the area of a triangle given the lengths of its three sides, using the formula:

$$S = \sqrt{1\,(1-a)(1-b)(1-c)}$$

52-8007-005 **CUT AND FILL CALCULATIONS**

This program will calculate cross-sectional areas, volume of earth between two cross-sectional areas separated by a length L, Σ volume, and Σ L. The input is series of number pairs describing the contour.

52-8007-004 **MANNING'S EQUATION**

This program calculates Q; volume of water flow not under pressure, where

$$Q = \frac{1.49}{n} A \cdot R^{2/3} \cdot S^{1/2}$$

A = end area

R = hydraulic radius

n = roughness factor

S = drop per foot.

52-8007-007   CONVERSION BETWEEN AZIMUTH AND BEARING

This program will convert the azimuth of a line, measured from the north meridian in a clockwise direction, to a bearing and vice versa.

52-8007-008   INTERSECTION OF TWO LINES

This program will determine the coordinates (N., E.) of the point of intersection of two lines, each defined by a point and a bearing or azimuth.

52-8007-009   INTERSECTION OF A LINE AND A CIRCLE

Given a line described by a point (N., E.) and a bearing or azimuth and a circle defined by the coordinates of its center and a radius, the program will calculate the coordinates of the point(s) of intersection.

52-8007-010   INTERSECTION OF TWO CIRCLES

Given two circles described by the coordinates of their centers and the lengths of their respective radii, the program will determine the points of intersection.

52-8007-011   GRADE ELEVATIONS

Given a starting stake number and elevation, the program will determine the grade % change and the elevations at all 50-foot stakes in between.

52-8007-012   COMPUTATION OF CURVE DATA

Consider the following diagram:
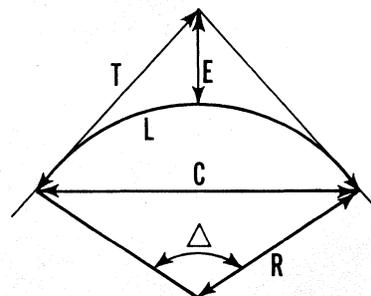
Given a value for Δ or R and one of the other five values, the program will determine the four remaining values as well as the area of the segment.

52-8007-013   LONG CHORD DATA FOR TRAVERSE CLOSURE

This program can be used to prepare for option (-1) of Surveying Program 001;
i.e., it finds the bearing and length of the long chord of an arc. The following
values must be known: the radius of the arc, either the delta angle or length of
the arc, either a tangent to one of the ends of the arc or the tangent to an arc
that eventually connects tangentially to the arc.

52-8007-014   COORDINATE GEOMETRY FOR A TRAVERSE

Using the information stored by one of the Surveying Program 001 programs, the
following coordinate geometry functions may be performed.

1. Find the bearing and distance between any two points.

2. Given a point and a bearing of a straight line from that point determine either
    a. the point of intersection of that line with a straight line or with a circular
        arc defined by two other points , or
    b. the coordinates of a point at a given distance along that straight line.

3. Determine the intersection of two lines each defined by two point numbers.

4. Add a point to the set of points already defined.

5. Calculate the area of a portion or all of the traverse, accumulating areas if
    so desired.

52-8007-015   AREA OF A TRAVERSE

This program may be used in conjunction with Surveying Program 001 or inde-
pendently. The user may find the complete area of a traverse defined in the
aforementioned program where the data represents the balanced or unbalanced
state, or he may key in the coordinates himself. The area of portions of the
traverse may be determined by referencing individual point numbers or a num-
ber of consecutive points. A routine for finding the area of a segment of a
circle is included.

52-8007-016   VERTICAL CURVE EQUATION

Given two grades, the length of the curve, and the station and elevation of the
point of intersection of the grades, the program will determine the station and
elevation of the high point and the elevations at desired station increments along
52-8007-017   the curve.

DEFLECTION ANGLE CALCULATIONS

Given the radius, beginning and ending stations, and station increment, the pro-
gram will determine deflection angles as well as the chord lengths for the suc-
cessive stations beginning with the first even station after the initial one.

52-8007-018   TRAVERSE CLOSURE USING INTERIOR ANGLES

Given the interior angle measurements for a traverse, the program finds the sum, compares it against the theoretical sum, distributes the error, and determines azimuths and bearing given the first known azimuth or bearing.

52-8007-019   CURVE STAKING CALCULATION

This program determines the total deflection angle from initial stake point and the chordal distance between successive stakes when the radius of the staked curve, the radius of the stationing curve, and the station numbers are given.

52-8013-001   HARDY CROSS NETWORK ANALYSIS

This program performs a standard hydraulic network analysis using the Hardy Cross method. The total number of loops and pipes handled by the machine can be calculated from the following formula.

$$\left[2 \cdot (\text{total no. of pipes in a system of } n \text{ loops}) + 1/4 \sum_{i=1}^{n} (p_i + 2) \right] < 87$$

where p_i = number of pipes in loop i.

ABSTRACTS

52-8001-001   SOLUTION TO THREE LINEAR EQUATIONS

Given the coefficients for three simultaneous linear equations, the program determines the values of the three unknowns.

52-8001-002   SOLUTION OF A QUADRATIC EQUATION

If A, B, and C are given such that $AX^2 + BX + C = 0$, the program determines X by the formula

$$X = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$, X may be real or complex.

52-8001-003   SIMPSON'S RULE FOR INTEGRATION

This program uses Simpson's one-third rule to evaluate the definite integral $\int_a^b f(x)\, dx$ given 'n' number of intervals. The user inserts a routine to calculate f(x). There is an option available to combine two approximations to yield a third and better one.

52-8001-004   CALCULATION OF COEFFICIENTS OF A POLYNOMIAL

Given two or three real roots, the program will calculate the coefficients of the corresponding quadratic or cubic.

52-8001-005   EVALUATION OF A POLYNOMIAL AND ITS DERIVATIVES

For a particular value of x, evaluate a polynomial of degree n; also its first and second derivatives.

Option 1   does not save the coefficients, i.e., for each value of x the coefficients must be re-entered.

Option 2   saves the coefficients ($n \leq 10$) so that multiple values of x may be entered.

52-8001-006   INVERSION OF A 3x3 MATRIX

Given the elements of a 3x3 matrix, A, determine the elements of a 3x3 matrix, B, such that $B = A^{-1}$.

52-8001-007   MULTIPLICATION OF TWO 3x3 MATRICES

If the elements of two 3x3 matrices are keyed in, the program will determine the elements of the matrix C which is the product, C = AB. An error routine is included for data which is incorrectly entered.

52-8001-008   DETERMINANT OF A 3x3 MATRIX

Given the elements of a 3x3 matrix, the program will calculate the value of the determinant.

52-8001-009   +, -, PRODUCT FOR VECTORS

Given two three dimensional vectors determine the vector obtained by addition, and subtraction; also the dot product and cross product.

52-8001-010 $\times$, $\div$, 1/X FOR COMPLEX NUMBERS

This program finds:

(a) the reciprocal of a complex number
(b) the product of two or more complex numbers
(c) the quotient of two or more complex numbers.

52-8001-011   NEWTON-RAPHSON METHOD

Given the coefficients of a polynomial P(x) of degree n ($n \leq 12$), the program will find the real roots using the Newton-Raphson method. For each root a starting value, x_0, and an accuracy ε is input. The iterative process stops when $|x_{i+1} - x_i| < \varepsilon$.

52-8001-012   3x3 MATRIX MULTIPLIED BY A COLUMN VECTOR

This program multiplies a 3x3 matrix A by a 3-element column vector b to yield a 3-element vector x. $x = A \cdot b$.

52-8001-013   EVALUATE $y = f(x_1, x_2, \ldots x_n)$

Evaluates a function of n variables ($n \leq 4$) for all values of $a_i \leq x_i \leq b_i$ at increments of Δx_i. The user must insert the necessary instructions for the evaluation of the function (assuming Register 01 - Register n contain x_1, x_2, $\ldots x_n$ respectively).

52-8001-014 ROOT OF A NON-LINEAR EQUATION

This program uses the Muller method to determine a root of a non-linear algebraic equation in the variable x, represented by f(x) = 0. This method uses a quadratic equation as an approximation through three points.

52-8001-015 FACTORIZATION INTO PRIMES

Given an integral value, x, factor it into prime numbers such that their product equals x.

52-8001-016 EVALUATION OF A POLYNOMIAL - COMPLEX VALUE

If the real coefficients of a polynomial of degree n (n $\leq$ 10) are input to the program, the function f(x) and its first derivative are evaluated for any complex values x = a + bi. Naturally, if b = 0, then the evaluations are made using the real value of x.

52-8001-017 ROOT OF A POLYNOMIAL - REAL OR COMPLEX

Finds the roots (real, complex) of a polynomial of degree $n(n \leq 8)$, using Newton's method. It prints the answer if $|x_{i+1} - x_i| < 10^{-7}$. Each root requires an initial guess for the components a and b of a + bi.

52-8001-018 DIVISION OF POLYNOMIALS

This program divides a polynomial of degree n by a polynomial of degree m where m $\leq$ n. The value of n ranges from 2 to 13 and m ranges from 1 to 6 depending upon the value of n. There is an error routine for incorrectly entered data.

52-8001-019 SOLUTION OF A DIFFERENTIAL EQUATION

This program solves a 1st, 2nd or 3rd order differential equation f(x, y, y' ... $y^{(n)}$). The Runge-Kutta method is used to solve a system of first order equations to which the 2nd or 3rd order equation has been reduced. The input values are: the degree, n; the corresponding initial conditions; h, the constant increment in x; N, the number of values to be calculated.

52-8001-020 BINARY-DECIMAL CONVERSIONS

Converts a decimal integer < 4096 to a binary number or converts a binary integer to a decimal integer.

52-8001-021   HARMONIC ANALYSIS

$A_0, A_1, \ldots, A_n, B_1, B_2, \ldots, B_{n-1}$ are determined such that

$$y = A_0 + \sum_{K=1}^{n} A_K \cos Kx + \sum_{K=1}^{n-1} B_K \sin Kx$$

give 2n observed values (x_i, y_i), $(i = 0, 1, 2, \ldots, 2n-1)$ assuming

(a) repetition of values starting with y_{2n}

(b) equal spacing of the x_i where $x_0 = 0$

and $x_{2n} = 2\pi$

(c) $2n \leq 120 \div$ (number of sig. digits + 1).

52-8001-022   PRODUCT OF TWO n x n MATRICES ($n \leq 6$)

Given two n x n matrices, A and B, the program will find their matrix product.
One of the matrices is replaced by the product while the other is retained. The
program can easily be used to find the product of a chain of n x n matrices.

52-8001-023   SOLUTION OF N LINEAR EQUATIONS

This program uses a modified Gauss elimination method to solve a system of
N nonhomogeneous linear equations in N unknowns with $N \leq 9$.

52-8001-024   n x n MATRIX INVERTER ($n \leq 9$)   (Restricted)

Given an n x n matrix A, the program will find A^{-1} and the determinant of A. It
may be necessary to exchange rows in the original A matrix in order to find A^{-1}.
The algorithm used replaces A by A^{-1} in the memory.

ABSTRACTS

52-8002-001   MEAN, S.D., S.E., T-VALUES

Calculates $\bar{x}$, s.d. and s.e. for up to four groups of observations. Then it determines the T-value comparing each group mean against the other means. It includes a correction routine.

52-8003-002   COVARIANCE, CORRELATION, AND REGRESSION

Option 1: For a given set of N observations (x_i, y_i), the program determines the measure of covariance, the correlation coefficient, the regression coefficient and the standard error. It includes a correction routine.

Option 2: The above statistics are calculated from the input data — N, $\bar{x}$, σ_x, $\bar{y}$, σ_y, Σxy.

52-8002-003   FITTING OF A QUADRATIC TO DATA PAIRS

It uses the least squares approximation method to fit N data pairs (x_i, y_i) to a second degree polynomial with real coefficients A_j. It includes an error correction routine. An option permits the calculation of $\hat{y} = A_1 + A_2x + A_3x^2$ for a given (x,y) pair, also $\hat{y} - y$, $\Sigma (\hat{y}-y)^2$.

52-8002-004   LINEAR REGRESSION

The program uses the least squares method to fit the equation $y = mx + b$ to $\{(x_i, y_i)\}$. There is an optional routine to determine $\hat{y}$, $\hat{y}-y$ and $\Sigma(\hat{y}-y)^2$ to check the goodness of fit. An error routine is incorporated into the program.

52-8002-005   FITTING OF $y = Ae^{Bx}$ TO DATA PAIRS

This program determines B and C such that $\ln y = Bx + C$. Then $A = e^C$. Calculation of $\hat{y}$, $\hat{y}-y$, and $\Sigma(\hat{y}-y)^2$ is optional. An error correction routine is included.

52-8002-006 χ^2 FOR A 2x2 CONTINGENCY TABLE

It determines χ^2 for a 2x2 contingency table using Yate's correction.

52-8002-007 χ^2 FOR n by m CONTINGENCY TABLE

This program evaluates χ^2 for an nxm contingency table where $n \leq 10$ and m is unbounded. It includes an error correction routine.

52-8002-008   PAIRED-T TEST

A t-value is determined for n paired values (x_i, y_i). It has an error correction routine.

52-8002-008   BINOMIAL DISTRIBUTION

For a given n and p, it finds $P(r)$ for $r = 0, 1, 2, ---, n$ which equals the probability of exactly r occurrences in n independent trials.

52-8002-010   POISSON DISTRIBUTION

For a given m = expected value of x, it determines the Poisson distribution $P(x)$.

52-8002-011   MEAN, S.D., S.E., RANGE FOR DATA

For a set of data, either grouped or ungrouped, the following statistics are derived - number of observations, range, standard deviation, standard error, arithmetic and geometric means. An error routine is included for incorrectly entered data.

52-8002-012   SIGNIFICANCE BETWEEN TWO PROPORTIONS

It computes the level of significance for the difference between two sample proportions.

52-8002-013   LIKELIHOOD RATIO

The program determines the likelihood ratio for K sample variances of the same sample size.   L = 1 indicates maximum uniformity and = 0 indicates maximum non-uniformity.

52-8002-014   COMBINATIONS, PERMUTATIONS

It calculates the number of permutations of n different items taken r at a time.
OR
It calculates the number of combinations of n different items taken r at a time.
OR
It calculates the number of permutations of n items of which q, r, s --- z are alike.

52-8002-015   MULTIPLE CORRELATION COEFFICIENTS

It determines the multiple correlation coefficients among three variables, given the simple correlation coefficients between two of the variables.

52-8002-016   NORMAL DISTRIBUTION ORDINATES

Given μ, σ, and x, it computes the ordinate of the normal distribution.

52-8002-017   LEAST SQUARES FIT TO $y = ax^b$

The program finds C and D such that $\ln y = C \cdot \ln x + D$ is a least squares fit to $\{(x_i, y_i)\}$. Then $a = e^D$ and $b = C$. There is an error correction routine.

52-8002-018   ONE-WAY ANALYSIS OF VARIANCE

It performs a standard one-way analysis of variance between K groups of data producing for each group – n and $\bar{x}$; then it finds degrees of freedom, sum of squares for 'between', 'within' and 'total' sources of variation, mean square for 'between' and 'within' and finally the F-ratio. An error routine is included.

52-8002-019   ANOVA TABLE – 2x2 FACTORIAL DESIGN

It computes a standard analysis of variance table for a 2x2 factorial design with n observations in each cell.

52-8002-020 χ^2 DISTRIBUTION ORDINATES

The program finds various points on the χ^2 distribution curve, given the degrees of freedom, limits a and b, $\Delta\chi^2$ (for which $a \leq \chi^2 < b$ in increments of $\Delta\chi^2$).

52-8002-021   F DISTRIBUTION ORDINATES

This determines values on the F distribution given f_1 and f_2 degrees of freedom for $a \leq F < b$ in increments of ΔF.

52-8002-022   INTEGRALS FOR THE NORMAL DISTRIBUTION

The machine will calculate either the area under the curve between $-\infty$ and Z or between -Z and Z using Simpson's Rule.

52-8002-023   INTEGRAL FOR THE χ^2 DISTRIBUTION

The program finds the area under the curve for the limits χ^2 and ∞ and degrees of freedom, f, using a modified Simpson's Rule.

52-8002-024   RELIABILITY TESTING – TEST PERIOD

In machine reliability testing, given a target MTBF (MTBSC or MCBSC), m, a confidence limit, $1 - \alpha$, and a number of failures r, it determines the minimum length of the test period needed to reject the hypothesis $\hat{m} < m$ and to accept the alternative $\hat{m} \geq m$ with confidence $1 - \alpha$. Termination of the test may either occur at the time of the rth failure or sometime after the rth failure.

52-8002-025   RELIABILITY TESTING – CONFIDENCE LIMITS

Given a testing time t during which r failures (or service calls) were observed, the program determines confidence limits for m (MTBF, MTBSC, or MCBSC) given α.

52-8002-026   RELIABILITY TESTING – CONFIDENCE LEVEL

Given a testing time t during which r failures occurred and a traget m(MTBF, MCBSC or MTBSC), it determines the level $1 - \alpha$ at which you can accept $\hat{m} \geq m$.

52-8002-027   RANDOM PERMUTATIONS OF SEQUENCED INTEGER VALUES

Given two integers a and b, the program finds a pseudo-random permutation of all the integers between a and b, inclusive.

52-8002-028   PSEUDO-RANDOM NUMBER TABLE

This program generates a table of ten-digit integral numbers, printing them in groups of ten. A different starting value produces a different table.

52-8002-029   CHECK FOR RANDOMNESS OF DIGITS IN A TABLE

This program provides a frequency distribution of the occurrence of the digits 0, 1, 2, $\cdots$, 9 in the table generated by Statistics Program 028.

52-8002-030   GENERATION OF A SET OF PSEUDO-RANDOM INTEGER VALUES

This program will generate n pseudo-random integer values between two limits.

52-8002-031   STATISTICS OF A SET OF GROUPS

This program will determine the mean and standard deviation for n values in a group. It will them compute the overall mean and SD for a set of up to five groups. Each time that a new groups is added, the lowest numbered group will be dropped from the statistics for the next set of groups.

52-8002-032   MULTIPLE LINEAR REGRESSION

This program will determine the values for B_1, B_2, B_3, and A such that $\hat{y} = B_1x_1 + B_2x_2 + B_3x_3 + A$ will be the best fit for n data points (x_1, x_2, x_3, y). It will also determine the standard error of the estimate. If the data points consist of (x_1, x_2, y), then the regression equation will be $\hat{y} = B_1x_1 + B_2x_2 + A$. The program will save up to 18 data points for three independent variables or 24 data points for two independent variables. Any points above these limits will be used in the calculation of the regression coefficients but then are destroyed. After the regression coefficients have been determined, the user may elect to have the machine automatically print x_1, x_2, x_3, y, $\hat{y}$, $(y - \hat{y})$ for each data point stored.

Then additional data points may be entered to be included in the standard error.

52-8002-033   (Not written)

52-8002-034   LEAST SQUARE FIT WITH A POLYNOMIAL

This program will fit a polynomial to data pairs (x, y): that is, determine A_0, A_1, . . . , A_n such that $\hat{y} = A_n$

$$\hat{y} = A_nx^n + A_{n-1}x^{n-1} + \ . \ . \ . \ +A_1x_1 + A_0$$

is a least squares fit. The value of n may be between 2 and 11, inclusive. The number of data points stored depends upon the order of the polynomial to be fitted. The standard error of the estimate is determined.

52-8014-001   REAL ESTATE INVESTMENT PROJECTION ANALYSIS

This program accepts such input values as purchase price, down payment, conditions of up to ten mortgages, itemized income, itemized expenses, tax bracket, vacancy factor, depreciation method and percent, and will print for whatever number of years selected the following information among others.

1. Net operating income
2. Equity and interest on all loans as well as total
3. Net spendable before taxes
4. Net income after interest
5. Depreciation
6. Taxable net income and taxes
7. Net spendable after taxes
8. Capitalization rate
9. Return on equity

Grand totals and averages per year are printed at the end.

52-8014-002   DEPRECIATION CALCULATIONS

This program calculates depreciation by any of three methods:

Straight line

Declining balance

Sum of integers

52-8014-003   MORTGAGE YIELD

Given the value of the note, the interest rate, the time due (years), monthly payment, and the yield or discount rate, the machine will determine either of the latter two rates not given. If the time = 0, the machine will use that time that will completely amortize the loan.

ABSTRACTS

52-8010-001   TEST CORRECTION: LESS THAN 40 QUESTIONS

Given a test of less than 40 multiple choice questions each having 9 or less choices (numbered 1-9), the program screens student responses for wrong answers, assigns a score, determines the group mean, the number of students, the standard deviation and a frequency distribution for all questions of the number of incorrect answers per question. There is an error routine for incorrectly entered data.

52-8010-002   TEST CORRECTION: 40 - 50 QUESTIONS

Performs the same functions as 001 but the corrections are made on 13 questions at a time rather than the entire test. There is an error routine for incorrectly entered data.

52-8010-003   DETERMINATION OF GRADES

This program will average the test scores for a student [eliminating the x lowest scores (x≤7)]. It will find his standard deviation: also, the over-all class average and standard deviation. Error routines are included.

ABSTRACTS

52-8006-001   PACK VALUES

This subroutine accepts values through the keyboard and packs them beginning
with Register 01. The number of values packed per register depends upon the
number of significant digits per value (x) and $= 12/(x + 1)$. Each value has a
sign digit = 1 for negative or = 0 for positive. The subroutine uses Register 00,
16-19. It is usually used with subroutine 002.

52-8006-002   UNPACK VALUES

Given up to 15 packed registers (Register 01-15), containing from 1-6 values
(depending upon the number of significant digits) the subroutine will return a
particular value from the register to which Register 00 is pointing. It is
usually used in conjunction with subroutine 001.

52-8006-003   ROUND A DECIMAL VALUE

This is a small routine to round a decimal value to x decimal places.

52-8006-004   VECTOR SORTING ROUTINES

It arranges a vector of up to 18 elements in ascending or descending order,
storing the results in Register 01-N.

ABSTRACTS

52-8011-001   NAVIGATIONAL COURSE CALCULATION

The program calculates a navigational course consisting of one or more
adjoining legs. Output variables include: compass heading; ground speed;
distance of the leg; cumulative distance; flying time; cumulative flying time;
fuel consumption; cumulative fuel consumption, given input variables: initial
latitude and longitude; destination latitude and longitude; magnetic variation;
wind direction and speed; air speed; fuel consumption rate.

52-8011-002   SIX GEOMETRIC PROBLEMS

(a) Given distance d and $\Delta \theta$ from a known point $K(x, y)$ find the coordinates
     of the unknown point U.

(b) Points on a line from P_0 to P_n in increments of Δx.

(c) Points on a circle, given a starting angle, stopping $\angle$ and $\Delta \angle$.

(d) Point of intersection of 2 lines.

(e) An angle in degrees, minutes and seconds converted to decimal degrees.

(f) Distance between 2 points and the $\angle$ made by a line connecting them and
     the x axis.

52-8011-003   MANUAL MODE DIAGNOSTIC

This procedure is designed to test the operability of the machine. It should be
used in conjunction with 001 to make sure that the machine is functioning in the
manner it should be.