IDENTIFICATION:	BEST FIT LINE
	Demonstration Routine

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PURPOSE: To compute and print out the equation of the line which best fits a set of Cartesian points according to the least-squares criterion.

RESTRICTIONS:

1. Only those keyboard characters which are recognized by the program should be entered; these include 0-9, +, -, lower case, period (.), comma (,), carriage return, S, and T. Any other character will be entered as a digit and cause erroneous operation.

2. All numbers entered must be less than 10 in magnitude.

3. No more than 25 points should be entered.

4. The resulting line may not have a slope or y-intercept whose magnitude is greater than 64.

STORAGE: The program uses all of line 04, 000-177 and 341-375 of line 05, plus all of line 00 for temporary storage.

TIMING: Approximately 50 milliseconds are required to find the equation of the line after the last point has been entered. During print-out, the program proceeds at the Flexowriter speed of 10 characters/second.

ACCURACY: Output of numerical quantities is in error of no more than 5×10^{-3}.

USE:

1. Loading the Program

The program is loaded by means of the Octal Utility Package. The tape is inserted into the reader and

USE (cont.): the F-key depressed. Upon completion of loading, the control is returned to the keyboard. Typing 00004. will transfer control to the beginning of the program where the program will loop waiting for a keyboard entry.

2. Input Codes

a. Digits (0 through 9): are entered in BCD form and are converted and assembled in the B register.

b. + or -: sets the sign of the word being typed in. If no sign is typed, the sign will be positive.

c. Period (.): establishes the decimal point. The decimal point need not be typed if the input number is an integer. No more than two digits may follow the decimal point or an error will result.

d. Comma (,): separates the x-coordinate from the y-coordinate. For example, a coordinate-pair entry might appear as follows: -2.71, 3.6 (c/r).

e. Lower case: resets the present x-coordinate to zero (if it has been typed) and clears the B register. This may be used to clear out the present "point" in the event of an erroneous keyboard entry.

f. Carriage return (c/r): enters the x,y pair into memory. Once a c/r has been typed, the x,y pair may not be cleared by use of the lower case control.

g. S: starts computation. After the last point is entered, the S-key is struck and the machine will type out the equation of the best fit line in slope-intercept form. If only one point is entered, a singular solution results and the machine will type DROP DEAD.

USE (cont.):

h. T: sets tape mode for reading data in from paper tape. The tape reader will continue reading until an S code is sensed, at which point it will stop and the results will be typed out. If the BREAKPOINT switch is down, control will remain in the tape mode upon completion of type out. With the BREAKPOINT switch raised, control will be restored for entry through the keyboard.

3. Suggested Order of Presentation

For greatest effectiveness, the following demonstrating procedure is suggested:

a. Enter two integral coordinate pairs whose solution is known, e.g., (1, 2) and (2, 3) are satisfied by Y = X + 1.

b. Enter two points using the decimal point feature and show the result, e.g., (1.2, 2.3) and (3.06, 6.19) are satisfied by Y = 2.09X - 0.21.

c. Enter three collinear points and demonstrate that the printed result is satisfied by all three points.

d. Enter seven or eight or more points which are obviously not collinear and observe the result. If possible, plot the points and the computed result.

e. Finally, enter only one point. The operator is now asking the computer to find a unique line through a single point which is patently absurd. The machine will reply by typing out DROP DEAD.

METHOD:

x, y pairs are entered, converted to binary, and used to find those values of m and b which minimize E, where

$$E = \sum_{i}^{n} (y_i - mx_i - b)^2$$

METHOD(cont.):   If only two points are entered, the solution will be
the line through those points. If three or more non-
collinear points are entered, the solution represents
the line best fitting those points. If only one point
is entered, or if several points, all with the same
coordinates, are entered, the equations in m and b
are singular and no solution is possible.