Statistician Micro Program

STANDARD DEVIATION, "n" FORMULA

The keytop function for computing the standard deviation on the Micro-Statistician is based on the "n - 1" formula. When the "n" formulation is desired, this program may be used.

$$SD_n = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N}}$$

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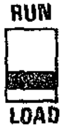
STANDARD DEVIATION, "n" FORMULA

EXAMPLE: Calculate SD_n for 6,3,5,4,7 and 1.

1. 

CLEAR GROUP SET DP 3

2. Enter X_1, Σ nxx. Continue step 2 for all X_i

3. 

Load program from facing page

4. Read SD_n = 1.972

NEXT PROBLEM:

1. 

CLEAR GROUP

2. Enter X_j, Σ nxx . Repeat step 2 for all X_i

3. START/STOP , read SD_n

1	SD MEAN	21		41		61	
2	×	22		42		62	
3	×	23		43		63	
4	(	24		44		64	
5	RCL_n	25		45		65	
6	1	26		46		66	
7	−	27		47		67	
8	1	28		48		68	
9	)	29		49		69	
10	÷	30		50		70	
11	RCL_n	31		51		71	
12	1	32		52		72	
13	=	33		53		73	
14	√	34		54		74	
15	START/STOP	35		55		75	
16	 RUN LOAD	36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

4001(033)

Statistician Micro Program

LEAST SQUARES FIT TO AN EXPONENTIAL CURVE

This program determines the Pearson correlation coefficient and the least squares fit for data in the form of an exponential curve where:

$$Y = be^{mX}$$

Output from the program includes the coefficients necessary for calculating the equation of the line.

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EXAMPLE: Obtain r, m and b for:

X	0.68	1.2	1.8	2.64
Y	2.3	1.65	1.35	0.85

1. 

CLEAR GROUP XY

2. 

Load program from facing page, entering the first X and Y at steps 2 and 5, respectively

3. START STOP

4. Enter next X, START STOP

5. Enter next Y, START STOP . Continue steps 4 and 5 for all X, Y pairs

6. LIN REG , read Pearson "r" = -0.995

7. 2ND FUNC , read m = -0.491

8. 0 LINE e^x 10^x , read b = 3.142

NEXT PROBLEM:

1. 

CLEAR GROUP XY

2. Enter an X, START STOP

3. Enter a Y, START STOP . Repeat steps 2 and 3 for all X, Y pairs

4. LIN REG , read Pearson "r"

5. 2ND FUNC , read m

6. 0 LINE e^x 10^x , read b. Return to step 1 for next problem.

1	1	21		41		61	
2	START STOP	22		42		62	
3	2ND FUNC	23		43		63	
4	2	24		44		64	
5	START STOP	25		45		65	
6	2ND FUNC	26		46		66	
7	XY	27		47		67	
8	2ND FUNC	28		48		68	
9	Ln LOG	29		49		69	
10	=	30		50		70	
11		31		51		71	
12		32		52		72	
13		33		53		73	
14		34		54		74	
15		35		55		75	
16		36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

Statistician Micro Program

FACTORIAL OF N, N!

The following program evaluates the factorial of N, where:

$$N! = N(N-1)(N-2)(N-3) \cdot\cdot\cdot 1, \quad \text{and} \quad 1 \leq N \leq 69$$

The limit of N! where N cannot exceed 69 is due to an overflow condition (the number exceeds 1×10^{98}).

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N FACTORIAL

Example: Compute N! for N = 5.

1. SET DP | 0 | RUN / LOAD | Load program from facing page.

2. 1 | ST_n | 2 , enter N, ST_n | 1 | START / STOP

3. When E - - - - appears in the display,

   RESET | RCL_n | 2 , read N! = 120

Next Problem:

1. 1 | ST_n | 2 , enter N, ST_n | 1 | START / STOP

2. When E - - - - appears in the display,

   RESET | RCL_n | 2 , read N!

Program Steps N FACTORIAL

1	ST_n	21		41		61	
2	×	22		42		62	
3	2	23		43		63	
4	1	24		44		64	
5	ST_n	25		45		65	
6	−	26		46		66	
7	1	27		47		67	
8	RCL_n	28		48		68	
9	1	29		49		69	
10	÷	30		50		70	
11	=	31		51		71	
12	RCL_n	32		52		72	
13	1	33		53		73	
14	RUN	34		54		74	
15	LOAD	35		55		75	
16		36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

Statistician
Micro
Program

STANDARD ERROR OF THE MEAN

This program calculates the standard error of the mean ($S_{\bar{X}}$)

where:

$$S_{\bar{X}} = \frac{SD}{\sqrt{N}}$$

and where

$$SD = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N - 1}}$$

While this program is so brief that it can easily be executed on the keyboard, *it is included as a program to demonstrate the ease of* using the programming capacity of the 342 Statistician.

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STANDARD ERROR OF THE MEAN

EXAMPLE: Compute $S_{\overline{X}}$ for 19, 23, 41, 10, 15, 28, 14.

1. GROUP 1 2 CLEAR GROUP SET DP 3

2. Enter X_1, Σ nx^2

   Continue step 2 for all X_i

3. RUN LOAD Load program from facing page

4. *Read* $S_{\overline{X}}$ *= 3.969*

NEXT PROBLEM:

1. GROUP 1 2 CLEAR GROUP

2. Enter X_i, Σ nx^2 . Repeat step for for all X_i

3. START STOP , read $S_{\overline{X}}$

1	SD MEAN	21		41		61	
2	÷	22		42		62	
3	RCL_0	23		43		63	
4	1	24		44		64	
5	√	25		45		65	
6	=	26		46		66	
7	START STOP	27		47		67	
8	RUN	28		48		68	
9	LOAD	29		49		69	
10		30		50		70	
11		31		51		71	
12		32		52		72	
13		33		53		73	
14		34		54		74	
15		35		55		75	
16		36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

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Statistician Micro Program

GEOMETRIC MEAN

The calculation of the geometric mean is based on the formula:

$$M_G = \sqrt[n]{(X_1)(X_2)\cdots(X_n)}$$

NOTE: $X_i = 0$ will result in $M_G = 0$, and any negative X_i will lead to an error condition when the product under the radical results in a negative value.

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EXAMPLE: To calculate M_G for the following data:
(15, 12, 17, 10, 15, 9) , n = 6

1. RESET SET DP 3 — 0.000
2. Enter X_1 (15) — 15.000
3. Press × repeat steps 2 and 3 for all X_i except for the last one (X_n) — 15.000
4. Enter X_n (9)
5. Press =
6. RUN / LOAD Load program from facing page.

Display now reads: 12.667

NEXT PROBLEM:

1. Enter X_1, × , repeat for all X_i except last one
2. Enter X_n, = , START STOP — 1.
3. Enter n, START STOP

The display now contains M_G

For next problem, return to step 1.

1	y^x	21		41		61	
2	SET DP	22		42		62	
3	0	23		43		63	
4	1	24		44		64	
5	START STOP Enter n	25		45		65	
6	$\frac{1}{x}$	26		46		66	
7	=	27		47		67	
8	SET DP	28		48		68	
9	3	29		49		69	
10	START STOP Read M_G	30		50		70	
11		31		51		71	
12		32		52		72	
13		33		53		73	
14		34		54		74	
15		35		55		75	
16		36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

Statistician Micro Program

HARMONIC MEAN - H

The harmonic mean is the reciprocal of the arithmetic mean of the reciprocals of the data items.

$$H = \frac{N}{\Sigma \frac{1}{X_i}}$$

While this program is so brief that it can easily be executed on the keyboard, it is included as a program to demonstrate the ease of using the programming capacity of the 342 Statistician.

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HARMONIC MEAN

EXAMPLE:

To calculate the harmonic mean of 12, 15, 10 and 14.

1. GROUP 1 2 RESET CLEAR GROUP SET DP 3 — 0.000
2. Enter X_1 (12) — 12.000
3. $\frac{1}{x}$ $\Sigma\ nxx^2$ — 0.083

   Repeat steps 2 and 3 for all data items

4. RUN LOAD Load program from facing page

   Harmonic Mean is displayed — 12.444

NEXT PROBLEM:

1. CLEAR GROUP — 0.000
2. Enter X_i
3. $\frac{1}{x}$ $\Sigma\ nxx^2$

   Repeat steps 2 and 3 for all X_i

4. START STOP, and the display contains the harmonic mean

1	RCL_n	21		41		61	
2	1	22		42		62	
3	RCL_n	23		43		63	
4	÷	24		44		64	
5	2	25		45		65	
6	START STOP	26		46		66	
7	RUN	27		47		67	
8	LOAD	28		48		68	
9		29		49		69	
10		30		50		70	
11		31		51		71	
12		32		52		72	
13		33		53		73	
14		34		54		74	
15		35		55		75	
16		36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

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Statistician Micro Program

LEAST SQUARES FIT TO A POWER CURVE

This program determines the Pearson correlation coefficient (r) and the least squares fit for data in the form of a power curve

where

$$Y = bX^{m} \quad ,$$

where

$$X \text{ and } Y > 0.0$$

Output from the program includes the coefficients necessary for calculating the equation of the line, m and b.

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EXAMPLE: Obtain r, m and b for:

X	1	2.1	2.95	4.05
Y	3.1	4.26	5.22	6.05

1. GROUP 1 2 CLEAR GROUP XY

2. RUN LOAD Load program from facing page, entering the first X and Y at steps 2 and 6, respectively.

3. START STOP

4. Enter next X, START STOP

5. Enter next Y, START STOP

Continue steps 4 and 5 for all X, Y pairs.

6. LIN REG, read Pearson "r" = 0.997

7. 2ND FUNC, read m = 0.4812

8. 0 LINE e^x 10^x, read b = 3.0667

NEXT PROBLEM:

GROUP 1 2 CLEAR GROUP XY

2. Enter an X, START STOP

3. Enter a Y, START STOP. Repeat steps 2 and 3 for all X, Y pairs.

4. LIN REG, read Pearson "r"

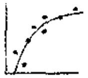
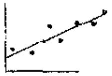
5. 2ND FUNC, read m

6. 0 LINE e^x 10^x, read b. Return to step 1 for next problem.

1	1	21		41		61	
2	START STOP Enter X	22		42		62	
3	Ln LOG	23		43		63	
4	XY	24		44		64	
5	2	25		45		65	
6	START STOP Enter Y	26		46		66	
7	Ln LOG	27		47		67	
8	=	28		48		68	
9	RUN	29		49		69	
10	LOAD	30		50		70	
11		31		51		71	
12		32		52		72	
13		33		53		73	
14		34		54		74	
15		35		55		75	
16		36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

Statistician Micro Program

LOGARITHMIC CURVE FITTING (Probit Analysis)

When the data points on a Cartesian plot resemble  instead of being in a "straight" pattern like  a better "fit" of the data can often be achieved by transforming *the "X" values to their logarithmic equivalents.*

$Y_{est} = mX_{\log_{10}} + b$, *and the Pearson correlation coefficient* will be based on the transformed X values.

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EXAMPLE: To calculate r, m and b on the following data, with X values changed to $\log_{10}$.

X	1	5	10	15	20	25
Y	1	12	18	22	24	25

1. RESET CLEAR GROUP XY

2. 

Load program from facing page, entering the first X and Y at steps 2 and 5 respectively.

3. START STOP

4. Enter X, START STOP; enter Y, START STOP. Continue step 4 for all X, Y pairs

5. LIN REG, read Pearson "r" = 0.9978
2ND FUNC, read m = 17.6641; 0 LINE, read b = 0.5899.

NEXT PROBLEM:

1. CLEAR GROUP XY

2. Enter X, START STOP; enter Y, START STOP. Continue step 2 for all X, Y pairs. (Enter X when "1" is displayed; enter Y when "2" is displayed.)

3. LIN REG, read "r"; 2ND FUNC, read m; 0 LINE, read b. Return to step 1 for new data.

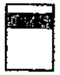
NOTE 1: No X may be less than 1.
NOTE 2: Means of $X_{\log}$ and of Y may be obtained after step 3 by using:

for X and


for Y with SD MEAN, 2ND FUNC.

To calculate line

Enter X Ln Log 2nd Line → Y(est)

1	1	21		41		61	
2	START STOP	22		42		62	
3	Ln LOG	23		43		63	
4	2	24		44		64	
5	START STOP	25		45		65	
6	2ND FUNC	26		46		66	
7	XY	27		47		67	
8	2ND FUNC	28		48		68	
9	=	29		49		69	
10	RUN  LOAD	30		50		70	
11		31		51		71	
12		32		52		72	
13		33		53		73	
14		34		54		74	
15		35		55		75	
16		36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

4009(033)

Statistician Micro Program

COEFFICIENT OF MULTIPLE CORRELATION

The multiple correlation coefficient may be used to determine the relationship that two sets of numbers (the "independent" variables) have with another set (the "dependent" variable).

$$R_{1.23} = \sqrt{\frac{r_{12}^2 + r_{13}^2 - 2r_{12}r_{13}r_{23}}{1 - r_{23}^2}}$$

The program assumes that the 3 pairwise correlations (r_{12}, r_{13}, r_{23}) have already been computed.

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COEFFICIENT OF MULTIPLE CORRELATION

EXAMPLE

Compute $R_{1.23}$ when $r_{12} = 0.48$, $r_{13} = 0.73$, $r_{23} = 0.37$

1. RUN / LOAD Load program from facing page, entering r_{12}, r_{13}, and r_{23} at steps 4, 9 and 14, respectively.
2. The display now reads $R_{1.23} = 0.764$

NEXT PROBLEM

1. START/STOP, display reads "1.0", enter r_{12}
2. START/STOP, display reads "2.0", enter r_{13}
3. START/STOP, display reads "3.0", enter r_{23}
4. START/STOP, display reads answer – $R_{1.23}$

Return to step 1 for next problem.

To calculate $R_{2.13}$, enter the pairwise correlations as follows:

First r_{12}; Second r_{23}; Third r_{13}.

For $r_{3.12}$, enter as follows:

First r_{13}; Second r_{23}; Third r_{12}.

Program Steps   COEFFICIENT OF MULTIPLE CORRELATION

1	2	21	RCL n	41	2ND FUNC	61	
2	×	22	1	42	=	62	
3	1	23	×	43	1/x	63	
4	START/STOP Enter r_{12}	24	)	44	√	64	
5	ST n	25	+	45	START/STOP Read $R_{1.23}$	65	
6	1	26	(	46	RUN LOAD	66	
7	×	27	RCL n	47		67	
8	2	28	2	48		68	
9	START/STOP Enter r_{13}	29	×	49		69	
10	ST n	30	)	50		70	
11	2	31	=	51		71	
12	×	32	2ND FUNC	52		72	
13	3	33	1	53		73	
14	START/STOP Enter r_{23}	34	−	54		74	
15	ST n	35	(	55		75	
16	3	36	RCL n	56		76	
17	=	37	3	57		77	
18	CHG SIGN	38	×	58		78	
19	+	39	)	59		79	
20	(	40	÷	60		80	

Statistician Micro Program

COEFFICIENT OF PARTIAL CORRELATION

The partial correlation coefficient expresses the degree of relationship between 2 variables when the effect of a third variable is removed.

$$r_{12.3} = \frac{r_{12} - r_{13}r_{23}}{\sqrt{1 - r_{13}^2}\sqrt{1 - r_{23}^2}}$$

Here, the effect of variable 3 is removed while determining the relationship of variables 1 and 2.

The program assumes that the 3 pairwise correlations (r_{12}, r_{13}, r_{23}) *have already been computed.*

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COEFFICIENT OF PARTIAL CORRELATION

EXAMPLE

Compute $r_{12.3}$ when $r_{12} = 0.36$, $r_{13} = 0.41$ and $r_{23} = 0.14$.

1. RUN / LOAD — Load program from facing page, entering r_{12}, r_{13} and r_{23} at steps 2, 6 and 11 respectively.
2. The display now reads $r_{12.3} = 0.335$

NEXT PROBLEM

1. START/STOP, display reads "1.0", enter r_{12}
2. START/STOP, display reads "2.0", enter r_{13}
3. START/STOP, display reads "3.0", enter r_{23}
4. START/STOP, display reads answer – $r_{12.3}$

Return to step 1 for next problem.

To calculate $r_{13.2}$, enter the pairwise correlations as follows:
First r_{13}; Second r_{12}; Third r_{23}.

To calculate $r_{23.1}$:
First r_{23}; Second r_{12}; Third r_{13}.

1	1	21	2	41	RUN	61	
2	START/STOP Enter r_{12}	22	×	42	LOAD	62	
3	−	23	)	43		63	
4	(	24	×	44		64	
5	2	25	(	45		65	
6	START/STOP Enter r_{13}	26	1	46		66	
7	ST_n	27	−	47		67	
8	2	28	(	48		68	
9	×	29	RCL_n	49		69	
10	3	30	3	50		70	
11	START/STOP Enter r_{23}	31	×	51		71	
12	ST_n	32	)	52		72	
13	3	33	)	53		73	
14	)	34	=	54		74	
15	=	35	√	55		75	
16	2ND FUNC	36	2ND FUNC	56		76	
17	1	37	÷	57		77	
18	−	38	2ND FUNC	58		78	
19	(	39	=	59		79	
20	RCL_n	40	START/STOP Read $r_{12.3}$	60		80	

Statistician Micro Program

n^{th} ROOT OF X

Any root of a number can be obtained by:

$$\Delta = \sqrt[n]{X}$$

which, for purposes of calculation, can be rewritten as:

$$\Delta = X^{1/n}$$

NOTE: $X \geq 0$
$n > 0$

While this program is so brief that it can easily be executed on the keyboard, it is included as a program to demonstrate the ease of using the programming capacity of the 342 Statistician.

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n^{th} ROOT OF X

EXAMPLE: Obtain the cube root of 27: $\Delta = \sqrt[3]{27} = 27^{1/3}$

1. RESET SET DP 3 — 0.000
2. RUN / LOAD — Load program from facing page. Display now contains Δ — 3.000

NEXT PROBLEM:

1. START STOP — 1.000
2. Enter X
3. START STOP — 2.000
4. Enter n
5. START STOP, display contains Δ.

Return to step 1 for next problem.

NOTE: This solution may at times appear to give erroneous results (i.e. the cube root of 125 will yield 4.999 rather than 5.000). This error is actually less than 0.0000000001.

1	1	21		41		61	
2	START STOP Enter X	22		42		62	
3	Δ^x	23		43		63	
4	2	24		44		64	
5	START STOP Enter n	25		45		65	
6	$\frac{1}{x}$	26		46		66	
7	=	27		47		67	
8	START STOP	28		48		68	
9	RUN	29		49		69	
10	LOAD	30		50		70	
11		31		51		71	
12		32		52		72	
13		33		53		73	
14		34		54		74	
15		35		55		75	
16		36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

4016(033)

Statistician Micro Program

ANALYSIS OF VARIANCE, ONE FACTOR

This program computes the F ratio describing the variance components in *a one factor* design.

The program permits *any number* of levels (groups) and any number of data items at any level (equal or unequal cell sizes).

The output data is complete, and includes the Mean and SD for each level and the *complete* ANOVA table.

Data for Example:

DATA		SD	$\overline{X}$
Level 1	3,5,2,4,8	2.302	4.4
Level 2	4,4,3,2	0.957	3.25
Level 3	6,7,8,6,7,9	1.169	7.166

See Statistics for Psychologists, Hays (1963) for the formulas used in this problem.

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EXAMPLE: *Compute F for the example data.*

1. GROUP 1 2   1 ST_n 1   RUN LOAD   Load program from facing page through step 25.
2. GROUP 1 2   CLEAR GROUP   XY , enter number of levels (3), ST_n 8
3. Enter X, Σ nxx² , repeat step 3 for all X's in the level, then
4. SD MEAN , read SD, 2ND FUNC , read Mean, START STOP
5. Repeat steps 3 and 4 for all 3 levels
6. Carry out steps 31-72. DO NOT LOAD THESE AS PROGRAM STEPS. Leave the program switch in the RUN LOAD position. Notice the output at steps 36, 44, 46, 58, 66, 68, and 72.

SOURCE	SS	df	MS	F
Within	30.783	12	2.565	
Between	41.616	2	20.808	8.111

NEXT PROBLEM:

1. GROUP 1 2   CLEAR GROUP   XY , enter number of levels, ST_n 8
2. Enter X, Σ nxx² , repeat step 2 for all X's in the level, then
3. SD MEAN , *read SD,* 2ND FUNC , *read Mean,* START STOP , *repeat steps 2 and 3* for all levels.
4. Carry out steps 31-72. Leave program switch in RUN LOAD . Record the output for the ANOVA table at steps 36, 44, 46, 58, 66, 68, and 72.

Return to step 1 for the next problem.

1	RCL_n		21	ST_n		41	−		61	(	
2	1		22	+		42	RCL_n		62	RCL_n	
3	ST_n		23	6		43	8		63	8	
4	+		24	CLEAR GROUP		44	=	df_w	64	−	
5	4		25	START STOP		45	)		65	1	
6	RCL_n			RUN LOAD		46	=	MS_w	66	=	df_B
7	2					47	ST_n		67	)	
8	ST_n					48	7		68	=	MS_B
9	+					49	RCL_n		69	÷	
10	5					50	5		70	RCL_n	
11	×		31	RCL_n		51	×		71	7	
12	÷		32	6		52	÷		72	=	F ratio
13	RCL_n		33	−		53	RCL_n		73		
14	1		34	RCL_n		54	4		74		
15	=		35	0		55	−		75		
16	ST_n		36	=	SS_w	56	RCL_n		76		
17	+		37	÷		57	0		77		
18	0		38	(		58	=		78		
19	RCL_n		39	RCL_n		59	CHG SIGN	SS_B	79		
20	3		40	4		60	÷		80		

Statistician
Micro
Program

POINT-BISERIAL CORRELATION (r_{pb})

The point-biserial correlation is useful when the relationship between a dichotomous and a continuous variable is to be determined.

$$r_{pb} = \frac{\overline{Y}_1 - \overline{Y}_0}{S_Y} \sqrt{\frac{N_1 N_0}{N(N-1)}}$$

where:

$\overline{Y}_1$ = mean of Y's associated with 1

$\overline{Y}_0$ = mean of Y's associated with 0

S_Y = standard deviation of all the Y's

$N = N_1 + N_0$ and

where: $t = r_{pb}\sqrt{\frac{N - 2}{1 - r_{pb}^2}}$, $df = N - 2$

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EXAMPLE: For the data

X	1	1	1	1	0	0	0	0
Y	104	92	101	111	82	76	85	95

1. 

CLEAR GROUP SET OP 3

2. Enter a Y_1: Σ nxx², and continue for all Y_1

3. 

CLEAR GROUP

4. Enter a Y_0: Σ nxx², and continue for all Y_0

5. 

Load program from facing page
NOTE: Between steps 12 and 13, be sure to 

For this data: $\overline{Y}_0 = 84.5$, $\overline{Y}_1 = 102$, $S_Y = 11.877$, $r_{pb} = 0.787$, $t = 3.13$ (The "t" calculation indicates the significance of r_{pb}.)

NEXT PROBLEM:

1. 

CLEAR GROUP

2. Enter a Y_1: Σ nxx², and continue for all Y_1

3. 

CLEAR GROUP

4. Enter a Y_0: Σ nxx², and continue for all Y_0

5. START STOP, read $\overline{Y}_0$ in display

6. START STOP, read $\overline{Y}_1$

7. START STOP, read S_Y

8. START STOP, read r_{pb}

9. START STOP, read t, and return to step 1 for new data.

1	RCL n	21	ST n	41	−	61	1
2	1	22	+	42	1	62	÷
3	×	23	1	43	×	63	2
4	RCL n	24	RCL n	44	RCL n	64	RCL n
5	4	25	5	45	1	65	−
6	=	26	ST n	46	÷	66	1
7	ST n	27	+	47	RCL n	67	=
8	7	28	2	48	7	68	1/x
9	SD MEAN	29	RCL n	49	=	69	√
10	2ND FUNC	30	6	50	1/x	70	×
11	START STOP read $\overline{Y}_0$	31	ST n	51	√	71	RCL n
12	−	32	+	52	×	72	0
13	SD MEAN	33	3	53	RCL n	73	=
14	2ND FUNC	34	SD MEAN	54	8	74	START STOP read t
15	START STOP read $\overline{Y}_1$	35	START STOP read S_Y	55	=	75	 RUN LOAD
16	=	36	=	56	START STOP read r_{pb}	76	
17	CHG SIGN	37	ST n	57	ST n	77	
18	÷	38	8	58	0	78	
19	RCL n	39	RCL n	59	×	79	
20	4	40	1	60	−	80	

4013(033)

Statistician Micro Program

DATA TRANSFORMATION, SQUARE ROOT

It is often desirable to perform transformations on raw data, and then to consider the associated statistics. The transformation can be easily programmed. The following program treats a common transformation – The Square Root. Other procedures could be employed, using this program as a model.

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EXAMPLE: For the data: 105, 13, 29.3, 79.6, 51, find the SD and mean for both the raw data and its transform.

1. 1 GROUP 2 RUN CLEAR GROUP XY SET DP 3

2. LOAD Load program from facing page. Note: Change the group switch between steps 4 and 5.

3. START STOP

4. Enter next X_i START STOP . Repeat this step for all X_i.

5. SD MEAN , read 2.658, the SD of the transformed data

   2ND FUNC , read 7.065, the Mean of the transformed data

6. 1 GROUP 2 SD MEAN , read 37.228, the SD of the raw data

   2ND FUNC , read 55.580, the Mean of the raw data

NEXT PROBLEM:

1. 1 GROUP 2 CLEAR GROUP XY

2. Enter the data values, pressing START STOP after each

3. 1 GROUP 2 SD MEAN and 2ND FUNC for SD and Mean of the transformed data

4. 1 GROUP 2 SD MEAN and 2ND FUNC for the SD and Mean of the raw data.

Program Steps SQUARE ROOT TRANSFORMATION

	1	1	21		41		61	
	2	START STOP Enter X_1	22		42		62	
	3	Σ nxx²	23		43		63	
1 GROUP 2	4	√	24		44		64	
	5	Σ nxx²	25		45		65	
	6	RUN LOAD	26		46		66	
	7		27		47		67	
	8		28		48		68	
	9		29		49		69	
	10		30		50		70	
	11		31		51		71	
	12		32		52		72	
	13		33		53		73	
	14		34		54		74	
	15		35		55		75	
	16		36		56		76	
	17		37		57		77	
	18		38		58		78	
	19		39		59		79	
	20		40		60		80	

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SPEARMAN'S RANK-ORDER CORRELATION (rho)

An *estimate of the* relationship between two sets (X & Y) of ranked data can be obtained by calculating rho.

$$\text{rho} = 1 - \frac{6\Sigma D_i^2}{N^3 - N} \quad , \quad D_i = X_i - Y_i$$

X = ranked data item

Y = ranked data item

N = number of data pairs

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SPEARMAN (Rho)

EXAMPLE

To calculate rho when:

X	1	2	3	4	5	6
Y	2	3	1	5	4	6

1\. GROUP 1 2 CLEAR GROUP

2\. Enter X_i − Enter Y_i = Σ nxx²

Repeat step 2 for all X, Y pairs

3\. RUN LOAD Load program from facing page

rho = 0.771

NEXT PROBLEM

1\. GROUP 1 2 CLEAR GROUP

2\. Enter X_i − Enter Y_i = Σ nxx²

Repeat step 2 for all X, Y pairs

3\. START STOP , read rho in the display

For a new set of data, return to step 1.

Program Steps SPEARMAN (Rho)

1	RCL n	21	RUN LOAD	41		61	
2	1	22		42		62	
3	[illegible]	23		43		63	
4	3	24		44		64	
5	−	25		45		65	
6	RCL n	26		46		66	
7	1	27		47		67	
8	=	28		48		68	
9	2ND FUNC	29		49		69	
10	RCL n	30		50		70	
11	3	31		51		71	
12	×	32		52		72	
13	6	33		53		73	
14	÷	34		54		74	
15	2ND FUNC	35		55		75	
16	−	36		56		76	
17	1	37		57		77	
18	=	38		58		78	
19	CHG SIGN	39		59		79	
20	START STOP Read Rho'	40		60		80	

Statistician Micro Program

t-TEST, SAMPLE VERSUS POPULATION MEAN

Given a population mean (μ), this program yields a value for t forming a comparison with the sample mean ($\overline{X}$).

$$t = \frac{\overline{X} - \mu}{\sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N(N-1)}}}$$

$$= \frac{\overline{X} - \mu}{SD/\sqrt{N}} = \frac{\overline{X} - \mu}{S_{\overline{X}}}$$

$$df = N - 1$$

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t-TEST, SAMPLE VERSUS POPULATION MEAN

EXAMPLE: With μ = 100, what is t for 98, 105, 107, 106, 100?

1. GROUP 1 / 2   CLEAR GROUP   SET DP   3

2. Enter X_i, Σ nxx². Repeat step 2 for all X_i.

3. Enter μ

4. RUN / LOAD   Load program from facing page

   t = 1.805 , df = 4

NEXT PROBLEM:

1. CLEAR GROUP

2. Enter X_i, Σ nxx². Repeat step 2 for all X_i.

3. Enter μ, START STOP, read t; START STOP, read df

4. SD MEAN, read SD; 2ND FUNC, read $\overline{X}$. Return to step 1 for next problem.

1	CHG SIGN	21		41		61	
2	+	22		42		62	
3	SD MEAN	23		43		63	
4	2ND FUNC	24		44		64	
5	×	25		45		65	
6	RCL_n	26		46		66	
7	1	27		47		67	
8	√	28		48		68	
9	÷	29		49		69	
10	2ND FUNC	30		50		70	
11	=	31		51		71	
12	START STOP Read t	32		52		72	
13	RCL_n	33		53		73	
14	1	34		54		74	
15	−	35		55		75	
16	1	36		56		76	
17	=	37		57		77	
18	START STOP Read df	38		58		78	
19	RUN LOAD	39		59		79	
20		40		60		80	