

STATISTICS PROGRAMS
for the
PC-2 POCKET COMPUTER

ALFAGRAFICS

© 1982 by ALFAGRAFICS, San Diego, CA 92138

Reproduction of the content of this book, in any manner,
without express permission of the publisher, is prohibited.
No liability is assumed with respect to the use of the
information herein.

Trademark credits:

PC-2 POCKET COMPUTER is a trademark of
Tandy Corp./Radio Shack.

CONTENTS

Introduction		4
PROGRAMS		
I. Distributions		
Continuous distributions		
1. NORMAL DISTRIBUTION	(341 steps)	8
2. CHI SQUARE DISTRIBUTION	(588 steps)	10
3. t DISTRIBUTION	(866 steps)	12
4. F DISTRIBUTION	(999 steps)	14
DISCRETE TESTS	(716 steps)	
5. Combinations		16
6. Binomial		16
7. Fisher exact		16
II. Data Analysis		
DICHOTOMIES	(1134 steps)	
8. 2x2 Tables		18
9. 2 Group Designs		18
ANALYSIS OF VARIANCE (randomized groups designs)		
10. Equal or unequal groups; one factor	(776 steps)	20
11. Two factor design, equal group sizes	(916 steps)	22
12. Two factor design, unweighted means	(1733 steps)	24
MULTIPLE CORRELATION		
13. From raw data	(1405 steps)	26
14. From correlations	(763 steps)	28
III. Utility Programs		
15. ALPHABETIZE	(479 steps)	30
16. SCORE DISTRIBUTIONS	(862 steps)	32
17. QUIZ AVERAGES	(989 steps)	34
18. GRADE AVERAGES	(1187 steps)	36
19. SCORE AVERAGES	(681 steps)	38

INTRODUCTION

Two university level statistics professors and an internationally known measurement specialist have combined their talents to write these USER FRIENDLY programs for ALFAGRAFICS. Between them, these scientists have over sixty years' experience, and have served as reviewers and/or members of the editorial boards of some of the most prestigious journals in their respective fields. They have also authored many original articles in the field of statistics and behavioral science.

The programs in this book are designed primarily for the research worker in behavioral science, and secondarily for the teacher in these fields. The programs may be divided into three main classes.

The first class of programs are the distribution function programs, #1 through #7. They have been written with the primary goal of being as accurate as possible. Thus, the direct and inverse normal, chi square, t, and F distributions are written so that the obtained probabilities will be in error no more than one unit in the ninth decimal place. Within the limitation of accuracy, the programs were written to execute rapidly. The equations for the direct distributions are based primarily on equations in the U.S. Department of Commerce Handbook of Mathematical Functions, edited by Abramowitz and Stegun (Vol. 55 of the Applied Mathematics Series.) The inverse functions are based on Newton's Method, and on other approximation methods developed by the authors. Thus, the inverse distributions are considerably more accurate than those generally found on much larger computers.

The second class of programs are the data analysis programs, #8 through #14. These encompass the most common one and two factor randomized groups Analysis of Variance designs and Multiple Regression designs. Statistics based on 2x2 tables , such as chi square, and the contingency, phi, and tetrachoric correlation coefficients, and statistics based on two groups, such as

the t test, and the point biserial and biserial correlation coefficients, are also included.

The third class of programs are general utility programs of use to the instructor; #15 through #19. These include a program for alphabetizing a list of names, a program for determining the frequencies, centile equivalents, and normalized T scores for a set of raw scores, a program for finding the average or weighted average per cent correct on a series of examinations, the average or weighted average of a set of raw or converted scores, and the average or weighted average of a set of letter grades. These programs can be used in setting up classes, averaging grades, and determining relative standing of class members, as well as in providing feedback to students.

The program for averaging letter grades can also be used to determine a student's grade point average. The program is set up on a standard 4.0 grade point system, but provision is made so that the program easily converts to any other grade point system, simply by entering the number of points for a "C" and the number of points for an "A" when prompted by the computer.

Seventeen of the nineteen programs were written so that they can be run without the use of any peripherals whatsoever -- i. e. - with the basic pocket computer, without extra memory and without printer or tape recorder. Many of the programs contain an option that allows you to print out the results on your command, in the event you have a printer. Even those programs which don't print the results can be easily modified to provide hard printed copy at the printer simply by replacing the "PRINT" statements with "LPRINT" statements.

All of the programs have been tested in various ways; such as entering problems from standard texts and checking the results given by the computer against those given in the text; entering distribution values and checking the results against standard tables, and even occasionally by checking the computer results against work done by hand.

As might be expected, often when discrepancies were found, it turned out to be the hand-worked examples that were in error. In fact, we even found a few errors in standard texts!

The Analysis of Variance programs and Multiple Regression programs follow the terminology found in most standard textbooks. However, in writing the programs, the texts used most directly were: Myers, Jerome L., Fundamentals of Experimental Design, 3rd ed., Allyn and Bacon, 1979; and McNemar, Quinn, Psychological Statistics, 4th ed., Wiley, 1969.

The layout of the programs is very simple. The left hand page gives the equations, purposes of the program, etc., and gives a worked example for each possible use of the program. The right hand page gives a printout of the program.

This is the first edition of these programs, so naturally there should be ample room for improvement. If you can think of any additional information, prompts, etc., that you would like to see incorporated in the programs, please feel free to write ALFAGRAFICS, and we will try to incorporate your suggestions in future editions. If we incorporate your suggestions, we will give you credit, and also give you a copy of the revised programs.

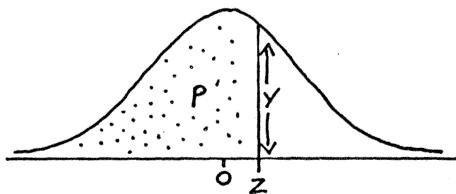
If you can think of ways to increase the speed and accuracy of the programs, or to increase the speed without sacrificing accuracy, we would like to hear from you. If we use your suggestions, we will give you credit in our next revision, and will also send you a complimentary copy of the revised book.

Incidentally, our book is being revised constantly. We originally had sixteen programs, and these have now been extended to nineteen. We are writing new programs all the time. We will try to keep you informed regarding any new programs that become available. Also, we would be happy to hear about any types of programs you would like us to write. We want to be as helpful to our customers as we can.

We hope the programs that follow will be useful to you.
Happy computing !

NORMAL DISTRIBUTION:

Direct and Inverse.



$$Y = f(z) = \frac{e^{-z^2/2}}{\sqrt{2\pi}}; P = P(z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z^2/2} e^{-t^2/2} dt$$

$$\text{Computation: } P(z) = \frac{1}{2} + f(z) \sum_{n=0}^{\infty} \frac{z^{2n+1}}{1 \cdot 3 \cdot 5 \cdots (2n+1)}$$

EXAMPLES:

DIRECT; given $z=1.18$, find P and Y. (#1 through #8 below.)INVERSE; given $P=.975$, find z and Y. (#9 through #14 below.)

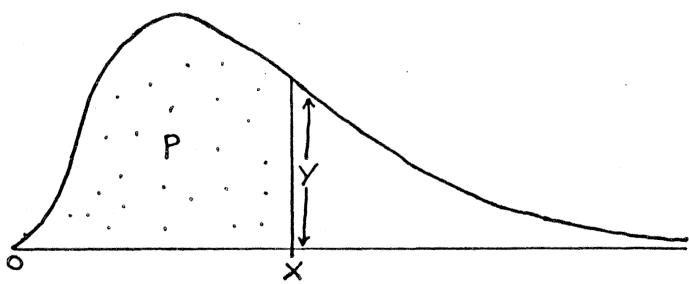
#	INPUT	READOUT	#	INPUT	READOUT
1	<u>DEF Z</u>	NORMAL DISTRIBUTION:			
2	<u>ENTER</u>	DIRECT(D) OR INVERSE(I):			
3	<u>D ENTER</u>	Z=			
4	<u>1.18 ENTER</u>	P(1.18)=8.809998925E-01			
5	<u>Y ENTER</u>	1.988631194E-01			
6	<u>Z ENTER</u>	1.18			
7	<u>P ENTER</u>	8.809998925E-01			
8	<u>1-P ENTER</u>	1.190001075E-01			
9	<u>DEF Z</u>	NORMAL DISTRIBUTION:			
10	<u>ENTER</u>	DIRECT(D) OR INVERSE(I):			
11	<u>I ENTER</u>	P=			
12	<u>.975 ENTER</u>	Z=1.959963984			
13	<u>Y ENTER</u>	5.84450701E-02			
14	<u>P ENTER</u>	9.749999999E-01			

Program listing.

MEMORY
CONTENTS

10:Y=EXP (-Z*Z/2)	A
/SQRT(2*PI)	B
20:W=Z:N=1:D=Z:U=	C
Z*Z	D used
30:N=N+2:D=D*U/N:	E
W=W+D	F
40:IF ABS D<1E-9	G
THEN 60	H
50:GOTO 30	I
60:W=W*Y:P=W+.5	J
70:RETURN	K
80:INPUT "P=";Q	L
90:Z=(Q-.5)/.4	M
100:GOSUB 10	N used
110:Z=Z+(Q-P)/Y	O
120:IF ABS (Q-P)>1	P area below z
E-9THEN 100	Q desired P
130:PRINT "Z=";Z	R
140:GOTO 210	S
150:"Z":CLEAR :	T
PRINT "NORMAL	U used
DISTRIBUTION:"	V
160:INPUT "DIRECT(W used
D) OR INVERSE(X
1)":A\$	Y ordinate at z
170:IF A\$="I"THEN	Z z score
80	
180:INPUT "Z=";Z	
190:GOSUB 10	
200:PRINT "P(";Z;"	
")=";P	
210:END	A\$ -- used

CHI SQUARE DISTRIBUTION: direct and inverse.



Density: $y = f(x) = \frac{x^{(v/2-1)}}{2^{(v/2)} \Gamma(\frac{v}{2}) e^{(v/2)x}}$; where v =degrees of freedom

Integral: $P = P(x) = \frac{2^x}{\sqrt{v}} f(x) \left[1 + \sum_{k=1}^{\infty} \frac{x^k}{(v+2)(v+4)\cdots(v+2k)} \right]$.

EXAMPLES:

DIRECT: given 4 degrees of freedom and chi square=8.1, find P and Y. (#1 through #6 below.)

INVERSE: given 3 degrees of freedom, and P=.95, find chi square and Y. (#7 through #12 below.)

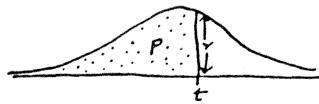
#	INPUT	READOUT	#	INPUT	READOUT
1	DEF X	CHI SQUARE DISTRIBUTION:			
2	ENTER	DEGREES OF FREEDOM?			
3	4 ENTER	DIRECT(D) OR INVERSE(I):			
4	D ENTER	CHI SQUARE=			
5	8.1 ENTER	P(8.1)=9.120170084E-01			
6	Y ENTER	3.528030865E-02			
7	DEF X	CHI SQUARE DISTRIBUTION:			
8	ENTER	DEGREES OF FREEDOM?			
9	3 ENTER	DIRECT(D) OR INVERSE(I)?			
10	I ENTER	P=			
11	.95 ENTER	CHI SQUARE=7.814727896			
12	Y ENTER	2.240889241E-02			

Program listing.	MEMORY CONTENTS
10:A=U/2:B=A-1:C=	A used
X/2	B used
20:Y=X^B/(2^A*EXP	C used
C)	D
30:IF U>1THEN 50	E used
40:Y=Y/√π:GOTO 16	F used
0	G used
50:IF A-INT A=0	H used
THEN 70	I used
60:A=B:GOTO 130	J
70:B1=1	K
80:FOR I=1TO B	L
90:B1=B1*I	M
100:NEXT I	N
110:Y=Y/B1:GOTO 16,	O
0	P P(x)
120:B=B-1:A=A*B	Q desired P(x)
130:IF B=.5THEN 15	R
0	S
140:GOTO 120	T
150:Y=Y/A/√π	U
160:G=1:H=0:E=1:F=	Vdegrees of fr.
U:Z=0	W
170:E=E*X:F=F+2	X chi square
180:G=G*F	Y ordinate
190:Z=Z+E/G	Z used
200:IF Z=HTHEN 220	A\$ - used
210:H=Z:GOTO 170	B1 - used
220:F=(Z+1)*2*X/U*	
Y	
230:RETURN	

T DISTRIBUTION: direct and inverse.

Degrees of freedom = df = v

$$\text{Density} = Y = f(t) = \frac{\Gamma(\frac{v+1}{2})(1 + \frac{t^2}{v})^{-\frac{v+1}{2}}}{\sqrt{\pi v} \Gamma(\frac{v}{2})}$$



$$\text{Define: } \theta = \tan^{-1}\left(\frac{t}{\sqrt{v}}\right)$$

$$* \text{ For even df: } P = \frac{1}{2} \pm \frac{\sin \theta}{2} \left\{ 1 + \frac{1}{2} \cos^2 \theta + \dots + \frac{1 \cdot 3 \cdots (v-3)}{2 \cdot 4 \cdots (v-2)} \cos^{v-2} \theta \right\}$$

$$* \text{ For df=1: } P = \frac{1}{2} \pm \frac{\theta}{\pi}$$

* For df ≠ 1 and odd:

$$P = \frac{1}{2} \pm \left(\frac{\theta}{\pi} + \frac{\cos \theta}{\pi} \left[\sin \theta \left\{ 1 + \frac{1}{3} \cos^2 \theta + \dots + \frac{1 \cdot 3 \cdots (v-3)}{2 \cdot 4 \cdots (v-2)} \cos^{v-3} \theta \right\} \right] \right)$$

* Note: the t sign is + for positive t,
and - for negative t.

EXAMPLES:

DIRECT: given 8 df and t=2.1, find P. (#1 through #5 below.)

INVERSE: given 7 df and P=.975, find t. (#6 through #10 below.)

#	INPUT	READOUT	#	INPUT	READOUT
1	<u>DEF S</u>	STUDENTS t:			
2	<u>ENTER</u>	DEGREES OF FREEDOM:			
3	8 <u>ENTER</u>	DIRECT(D) OR INVERSE(I):			
4	D <u>ENTER</u>	t=			
5	2.1 <u>ENTER</u>	P=9.655312379E-01			
6	<u>DEF S</u>	STUDENTS t:			
7	<u>ENTER</u>	DEGREES OF FREEDOM:			
8	7 <u>ENTER</u>	DIRECT(D) OR INVERSE(I):			
9	I <u>ENTER</u>	P=			
10	.975 <u>ENTER</u>	t=2.364624248			

Program listing.

```

50:G=1:F=1:A=1:E=
     0
60:X=ATN (T/SQRT):C
     =COS X^2
70:IF U/2-INT (U/
     2)=0 THEN 120
80:B=2*X/SQRT:IF U=G
     THEN 120
90:G=U-1:D=3
100:E=E+2:IF E=G
     THEN 180
110:F=F*D/D*C:A=A+
     F:D=D+2:GOTO 1
     00
120:G=U:D=1
130:E=E+2:IF E=G
     THEN 160
140:F=F*D/E*C
150:A=A+F:D=D+2:
     GOTO 130
160:Z=SIN X*A:GOTO
     190
170:Z=B:GOTO 190
180:Z=2/SQRT*COS X*
     SIN X*A+B
190:P=.5+Z/2
200:RETURN
320:IF U=1 THEN 440
330:IF U=2 THEN 460
340:G=1
350:K=(U+1)/2-1
360:G=G*K/(K-.5)
370:K=K-1
380:IF K>=1 THEN 36
     0
390:IF U/2-INT (U/
     2)=0 THEN 420
400:G=G/SQRT
410:GOTO 470
420:G=G*SQRT/2
430:GOTO 470
440:G=1/SQRT

```

MEMORY
CONTENTS

A	used
B	used
C	used
D	used
E	used
F	used
G	used
H	
I	
J	
K	used
L	
M	
N	
O	
P	calculated P
Q	desired P
R	used
S	
T	t (or -t)
U	
V	df
W	given t value
X	used
Y	f(t) = Y
Z	used
A\$	used

F DISTRIBUTION: direct and inverse.

Let:

$V_1 = df_1 = \text{the numerator degrees of freedom}$,
 $V_2 = df_2 = \text{the denominator degrees of freedom}$,

$F = \text{the obtained } F \text{ value.}$

Define:

$$X = \frac{V_2}{V_2 + V_1 F}$$

For V_1 even: $Q = X^{\frac{V_1}{2}} \left[1 + \frac{V_2}{2} (1-X) + \dots + \frac{V_2(V_2+2)\dots(V_2+V_1-4)}{2\cdot 4 \dots (V_2-2)} (1-X)^{\frac{V_1-2}{2}} \right]$

For V_2 even: $Q = (1-X)^{\frac{V_2}{2}} \left[1 + \frac{V_1}{2} (X) + \dots + \frac{V_1(V_1+2)\dots(V_1+V_2-4)}{2\cdot 4 \dots (V_2-2)} (X)^{\frac{V_2-2}{2}} \right]$

For V_1 & V_2 Odd: define $\theta = \tan^{-1} \left(\sqrt{\frac{V_1 F}{V_2}} \right)$.

$$A(V_2) = \begin{cases} \frac{2}{\pi} \left\{ \theta + \sin \theta \cos \theta \left[1 + \frac{2}{3} \cos^2 \theta + \dots + \frac{2 \cdot 4 \dots (V_2-3)}{3 \cdot 5 \dots (V_2-2)} \cos^{V_2-3} \theta \right] \right\}; V_2 > 1 \\ \frac{2\theta}{\pi}; V_2 = 1 \end{cases}$$

$$B(V_1, V_2) = \begin{cases} \frac{2(\frac{V_1-1}{2})!}{\sqrt{\pi} \Gamma(\frac{V_1}{2})} \sin \theta \cos^{V_2} \theta \left[1 + \frac{V_2+1}{3} \sin^2 \theta + \dots + \frac{(V_2+1)(V_2+3)\dots(V_2+V_1-4)}{3 \cdot 5 \dots (V_1-2)} \sin^{V_1-3} \theta \right]; V_1 > 1 \\ 0; V_1 = 1 \end{cases}$$

$$Q = 1 - A(V_2) + B(V_1, V_2).$$

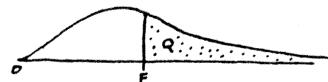
EXAMPLES

Direct: given $df_1=6$, $df_2=8$, and $F=3.97$; what is Q ?

(Answer: see steps 1 through 6 below.)

Inverse: given $df_1=3$, $df_2=7$ and $Q=.05$; what is F ?

(Answer: see steps 7 through 12 below.)



#	INPUT	READOUT	#	INPUT	READOUT
1	[DEF] F	F DISTRIBUTION			
2	[ENTER]	df 1 =			
3	6 [ENTER]	df 2 =			
4	8 [ENTER]	DIRECT(D) OR INVERSE(I)			
5	D [ENTER]	F =			
6	3.97 [ENTER]	Q = 0.038348359			
7	[DEF] P	F DISTRIBUTION			
8	[ENTER]	df 1 =			
9	3 [ENTER]	df 2 =			
10	7 [ENTER]	DIRECT(D) OR INVERSE(I)			
11	I [ENTER]	Q =			
12	.05 [ENTER]	F = 4.346831384			

Program listing.

MEMORY CONTENTS

```

10:R=C/2-INT (C/2
    )
20:S=E/2-INT (E/2
    )
30:IF R=0THEN 60
40:IF S=0THEN 80
50:GOTO 190
60:I=E/(E+C*F):
    GOSUB 110
70:GOTO 170
80:I=1-E/(E+C*F)
90:K=E:E=C:C=K:
    GOSUB 110
100:Q=1-(I^(E/2))*J:GOTO 460
110:J=1:K=E:L=2:M=
    1
120:IF C=2THEN 160
130:M=M*K*(1-I)/L
140:J=J+M:K=K+2:L=
    L+2
150:IF L<CTHEN 130
160:RETURN
170:Q=(I^(E/2))*J
180:GOTO 460
190:U=J(C*F/E):T=
    ATN U
200:IF E<>1THEN 23
    0
210:A=2*T/L
220:GOTO 310
230:J=1:J=2:K=3
240:L=COS T*COS T
250:IF E=3THEN 300
260:M=1
270:M=M*K*L/K
280:I=1+M:J=J+2:K=
    K+2
290:IF K<ETHEN 270
300:A=(T+(SIN T)*(COS T)*1)*2/L
310:I=1:J=E+1:K=3
320:L=SIN T*SIN T
330:M=1
340:IF C<>1THEN 36
    0
350:B=0:GOTO 450
360:IF C=3THEN 400
370:M=M*K*L/K
380:I=1+M:J=J+2:K=
    K+2
390:IF K<CTHEN 370
400:N=(E-1)/2:O=E/
    2-1:P=2/L
410:IF E=1THEN 440
420:P=P*N/O:N=N-1:
    O=O-1
430:IF N>0THEN 420
440:B=1*P*SIN T*(COS T)^E
450:Q=1-A+B
460:RETURN
470:INPUT "Q=";X
480:F1=0:S1=1:F=1
490:GOSUB 10
500:F2=F:S2=Q:F=F1
    +(F2-F1)*(X-S1)
    /(S2-S1)
510:GOSUB 10
520:F1=F2:S1=S2
530:IF ABS (Q-X)>1
    E-9THEN 500
540:PRINT "F=";F
550:GOTO 650
560:"F":PRINT "F D
    ISTRIBUTION"
570:CLEAR :RADIAN
580:INPUT "df1=";C
590:INPUT "df2=";E
600:INPUT "DIRECT(
    D) OR INVERSE(
    I)";A$
610:IF A$="I"THEN
    470
620:INPUT "F=";F
630:GOSUB 10
640:PRINT "Q=";Q
650:END

```

A	used
B	used
C	used
D	
E	used
F	F value
G	
H	
I	used
J	used
K	used
L	used
M	used
N	used
O	used
P	used
Q	tail area, Q
R	used
S	used
T	used
U	
V	
W	
X	desired Q
Y	
Z	
F1	used
S1	used
F2	used
S2	used
A\$	used

DISCRETE TESTS: combinations; binomial; Fisher's exact test.

[DEF] C Combinations: $N^C_R = \frac{N!}{R!(N-R)!}$

[DEF] B Binomial: $P(R) = {}^N_C_R P^R (1-P)^{N-R}$

[DEF] F Fisher's exact test: $P(A) = \frac{[(A+C)^C_A][(B+D)^C_B]}{N^C_{(A+B)}}$; A is the smallest cell.

A	B	A+B
C	D	C+D
A+C	B+D	N

EXAMPLES:

Combinations: What is the number of combinations of 200 objects taken four at a time? (#1 - 4 below.)

Binomial: On each trial of an ESP experiment, the subject must indicate which of three cards is the chosen one ($P=1/3$). What is the probability of 6 out of ten correct choices by chance? Six or more out of ten? (#5 - 11 below.)

Fisher's exact test: What is the probability of the data in Table 1 below? What is the probability of an outcome that extreme or greater? (#12 - 19 below.)

Table 1

A=2	B=7
C=8	D=3

#	INPUT	READOUT	#	INPUT	READOUT
1	[DEF] C	COMBINATIONS:	14	[ENTER]	A=
2	[ENTER]	N=	15	2 [ENTER]	B=
3	200 [ENTER]	R=	16	7 [ENTER]	C=
4	4 [ENTER]	$NCR = 64684950$	17	8 [ENTER]	D=
5	[DEF] B	BINOMIAL:	18	3 [ENTER]	$P(A=2)=3.215051205E-02$
6	[ENTER]	N=	19	[ENTER]	$P(A<=2)=3.488925938E-02$
7	10 [ENTER]	P=			
8	1/3 [ENTER]	R=			
9	6 [ENTER]	$P(6)=5.690189502E-02$			
10	[ENTER]	$P(6 \text{ or more})=$			
	*execute step 11 to display answer	7.656353196E-02			
11	F [ENTER]	7.656353196E-02			
12	[DEF] F	FISHER EXACT TEST:			
13	[ENTER]	(A=SMALLEST CELL)			

Program listing.

```

10:C=1;A=N:B=R
20:IF B>(A-B)THEN
    LET B=(A-B)
30:IF B=0THEN 70
40:C=C*A/B
50:A=A-1:B=B-1
60:IF B>0THEN 40
70:RETURN
110:N=W+X+Y+Z:R=X+
    Z:GOSUB 10
120:D=C:N=W+X:R=X:
    GOSUB 10
130:E=C:N=Y+Z:R=Z:
    GOSUB 10
140:RETURN
210;"C":PRINT "COM
    BINATIONS"
220:INPUT "N";N
230:INPUT "R";R
240:GOSUB 10
250:PRINT "NCR=";C
260:END
310;"B":PRINT "BIN
    OMIAL"
320:INPUT "N";N
330:INPUT "P";P
340:INPUT "R";R
350:GOSUB 10
360:F=C*P^R*(1-P)^
    (N-R)
370:PRINT "P(";R;""
    )=";F
380:S=R
390:R=R+1
400:GOSUB 10
410:F=F+C*P^R*(1-P)
    ^N-R)
420:IF R<NTHEN 390
430:PRINT "P(";S;""
    OR MORE)=";F
440:END
510;"F":PRINT "FIS
    HER EXACT TEST
    :"
520:PRINT "(A=SMAL
    LEST CELL)"
530:INPUT "A";W
540:INPUT "B";X
550:INPUT "C";Y
560:INPUT "D";Z
570:GOSUB 110
580:P=C*X/D
590:PRINT "P(A=";W
    ;")=";P
600:U=W
610:IF U=0THEN 700
620:W=W-1
630:X=X+1
640:Y=Y+1
650:Z=Z-1
660:GOSUB 110
670:P=P+C*E/D
680:IF W>0THEN 620
690:PRINT "P(A)=";
    U;")=";P
700:END

```

**MEMORY
CONTENTS**

A	used
B	used
C	used
D	used
E	used
F	
G	
H	
I	
J	
K	
L	
M	
N	used
O	
P	used
Q	
R	used
S	used
T	
U	
V	used
W	used
X	used
Y	used
Z	used

DICHOTOMIES: 2x2 Tables, and 2 Group Designs.

DEF X -- 2X2 TABLES: When frequencies A, B, C, D, arranged as in Table 1 when possible, are entered, this program computes the chi square for association, X²; chi square with Yates' correction, YATES X²; the fourfold point, or phi coefficient, PHI; the contingency coefficient, R(C); and the tetrachoric correlation coefficient, estimated using the cosine-pi method, R(TET).

Table 1:

-		+
+	A	B
-	C	D

DEF G -- 2 GROUPS: When the frequencies of Y-values for each X group, arranged as in Table 2, are entered as prompted, this program computes the group means, M₁, M₂; group standard deviations, SD₁, SD₂; combined mean, MT; combined standard deviation, based on N rather than N-1, SD(N)T; point biserial correlation coefficient, R(PB); biserial correlation coefficient, R(B), and t-test for the difference between the group means, T. When all scores are entered for one group, enter the value "-1". Note: the number of cases in group 1 = c: the number in group 2 = f: the degrees of freedom for t = c+f-2.

X GROUP:

EXAMPLES:

Analyze the data in TABLE 2.
(see steps below.)

Assume A=100, B=150, C=180, D=90.

Analyze these data.
(see steps below.)

Y SCORE:	1 (-):	2 (+):
10	0	2
9	0	3
8	1	5
7	4	7
6	3	4
5	8	10
4	5	9
3	0	1
2	2	0
1	1	1

TABLE 2

#	INPUT	READOUT	#	INPUT	READOUT
1	DEF X	2X2 TABLES	18	-1 ENTER	GROUP 2, # 1 =?
2	ENTER	A=	19	1 ENTER	F(1)=?
3	100 ENTER	B=	20	1 ENTER	GROUP 2, # 2 =?
4	150 ENTER	C=	21	2 ENTER	F(2)=?
5	180 ENTER	D=	22	0 ENTER	GROUP 2, # 3 =?
6	90 ENTER	X 2 = .37.14285714	--	ENTER REMAINING GROUP 2 DATA ---	
7	ENTER	YATES X 2 = .36.07759083	23	10 ENTER	F(10)=?
8	ENTER	PHI = .2.672612419E-01	24	2 ENTER	GROUP 2, # 11 =?
9	ENTER	R(C) = .2.5819858597E-01	25	-1 ENTER	M1=.9535333333
10	ENTER	R(TET) = .4.048576233	26	ENTER	S01=1,.706233244
11	DEF G	2 GROUPS:	27	ENTER	M2=.5,.952380952
12	ENTER	GROUP 1, # 1 =?	28	ENTER	SD2=2.011580873
13	1 ENTER	F(1)=?	29	ENTER	MT=.5,.590909091
14	1 ENTER	GROUP 1, # 2 =?	30	ENTER	SD(N)=1,.938269087
15	2 ENTER	F(2)=?	31	ENTER	R(PB)=2.467058516E-01
--	ENTER REMAINING GROUP 1 DATA ---		32	ENTER	R(B)=3.161312659E-01
16	8 ENTER	F(8)=?	33	ENTER	T=2.036597197
17	1 ENTER	GROUP 1, # 9 =?			

Program listing.

```

10: "X":CLEAR :
PRINT "2X2 TAB
LES:"
20: INPUT "A="; A,
B="; B, "C="; C,
D="; D
30: N=A+B+C+D:U=B*
C-A*D:V=(A+B)*
(C+D)*(A+C)*(B
+D)
40: X=N*U*U/U:K=
SQR (X/(N+X)):
P=U/SQR U
50: Y=N*(ABS U-N/2
)*(ABS U-N/2)/
U
60: IF A*B*C*D=0
THEN 80
65: DEGREE
70: T=COS (180/((
SQR (B*C/A*D)+
1))):GOTO 90
80: T=SIGN P
90: PRINT "X^2="; X
100: PRINT "YATES X
^2="; Y
110: PRINT "PHI="; P
120: PRINT "R(C)=";
K
130: PRINT "R(TET)=
"; T
140: END
210: Y=EXP (-Z*Z/2)
/Z/(2*PI)
220: U=Z:N=1:O=Z:U=
Z*Z
230: N=N+2:O=0*U/N:
U=U+O
240: IF ABS O<1E-9
THEN 260
250: GOTO 230
260: U=U*Y:P=U+.5
270: RETURN
300: "G":CLEAR :
PRINT "2 GROUP
S:"
320: WAIT 0
330: I=1
340: PRINT "GROUP 1
, "#;"I;" =";
350: INPUT Y:CLS
360: IF Y=-1THEN 40
0

```

```

370: PRINT "F("; Y;
)=";
380: INPUT W:CLS
390: A=A+W*Y: B=B+W*
Y*Y: C=C+W: I=I+
1: GOTO 340
400: I=1
410: PRINT "GROUP 2
, "#;"I;" =";
420: INPUT Y:CLS
430: IF Y=-1THEN 47
0
440: PRINT "F("; Y;
)=";
450: INPUT W:CLS
460: D=D+W*Y: E=E+W*
Y*Y: F=F+W: I=I+
1: GOTO 410
470: G=A/C: H=B-A*A/
C: H=SQR (H/(C-
1))
480: J=D/F: K=E-D*D/
F: K=SQR (K/(F-
1))
490: L=(A+D)/(C+F):
M=(B+E)-(A+D)*
(A+D)/(C+F): M=
SQR (M/(C+F))
500: Q=C/(C+F): Z=(Q
-.5)/.4
510: GOSUB 210
520: Z=Z+(Q-P)/Y
530: IF ABS (Q-P)>1
E-9 THEN 510
535: R=(J-G)*SQR (C
*F)/(C+F)/M
540: S=R*SQR (P*(1-
P))/Y
550: T=R*SQR (C+F-2
)/SQR (1-R*R)
560: WAIT
570: PRINT "M1="; G
580: PRINT "SD1="; H
590: PRINT "M2="; J
600: PRINT "SD2="; K
610: PRINT "MT="; L
620: PRINT "SD(N)T="
"; M
640: PRINT "R(PB)="
; R
650: PRINT "R(B)="
S
660: PRINT "T="; T
670: END

```

**MEMORY
CONTENTS**

A used
B used
C used
D used
E used
F used
G used
H used
I used
J used
K used
L used
M used
N used
O used
P used
Q used
R used
S used
T used
U used
V used
W used
X used
Y used
Z used

ANALYSIS OF VARIANCE: equal or unequal groups; one factor.

This program computes analysis of variance summary statistics for a design having a single factor, A, with k levels, and either the same or different numbers of subjects, n(k), at the k treatment levels. This program lists the degrees of freedom (df), sums of squares (SS), mean squares (MS), and F ratios where appropriate for each source of variance (SV). Terminology follows Myers, Fundamentals of Experimental Design, 3rd ed., Allyn and Bacon, 1979.

FIRST EXAMPLE:

In the example below we have k=4 levels of A, with n=3 subjects at level A(k).

Levels:			
A ₁	A ₂	A ₃	A ₄
2	6	7	2
0	7	9	3
1	8	8	1

Summary Table from output below:

	SV	df	SS	MS	F
Total	11	119			
A	3	111	37	37	
S/A	8	8	1		

SECOND EXAMPLE:

In the example below we have k=3 levels of A, with n=4 subjects at A(1), n=2 subjects at A(2), and n=2 subjects at A(3).

Levels:		
A ₁	A ₂	A ₃
5	1	0
3	3	2
3		
1		

Summary Table from output below:

	SV	df	SS	MS	F
Total	7	17.5			
A	2	5.5	2.75	1.15	
S/A	5	12.0	2.40		

#	INPUT	READOUT	#	INPUT	READOUT
1	ENTER A	ONE FACTOR ANOVA:	17	ENTER A	ONE FACTOR ANOVA:
2	ENTER	NUMBER OF GROUPS?	18	ENTER	NUMBER OF GROUPS?
3	4 ENTER	EQUAL N? (Y/N):	19	3 ENTER	EQUAL N? (Y/N):
4	Y ENTER	5 OBJECTS PER GROUP?	20	N ENTER	SUBJECTS IN GP#1=?
5	3 ENTER	SCORE #1, GROUP #1=?			-- - enter data as prompted -- - -
6	2 ENTER	SCORE #2, GROUP #1=?	21	2 ENTER	TOTAL DF= 7
-- - enter data as prompted -- -			22	ENTER	DF(A)= 2
7	3 ENTER	SCORE #3, GROUP #4?	23	ENTER	DF(S/A)= 5
8	1 ENTER	TOTAL DF = 11	24	ENTER	TOTAL SS= 17.5
9	ENTER	DF(A)= 3	25	ENTER	SS(A)= 5.5
10	ENTER	DF(S/A)= 8	26	ENTER	SS(S/A)= 12
11	ENTER	TOTAL SS = 119	27	ENTER	MS(A)= 2.75
12	ENTER	SS(A)= 111	28	ENTER	MS(S/A)= 2.4
13	ENTER	SS(S/A)= 8	29	ENTER	F=1.145833333
14	ENTER	MS(A)= 37			
15	ENTER	MS(S/A)= 1			
16	ENTER	F= 37			

Program listing.

MEMORY
CONTENTS

10: "A":CLEAR :	250: GOSUB 330	A sum of x
PRINT "ONE FAC	260: NEXT J	B sum of x ²
TOR ANOVA:"	270: GOTO 370	C used
20: WAIT 0	280: A(J, 0)=A(J, 0)+	D MS(A)
30: INPUT "NUMBER	X	E MS(S/A)
OF GROUPS?"; K	290: A(J, 1)=A(J, 1)+	F
40: DIM A(K, 2)	X*X	G Total N
50: INPUT "EQUAL N	300: A(J, 2)=A(J, 2)+	H
?(Y/N)"; A\$	1	I used
60: IF A\$="N" THEN	310: G=G+1	J used
170	320: RETURN	K # of groups
70: INPUT "SUBJECT	330: A=A+A(J, 0)	L
S PER GROUP?";	340: B=B+A(J, 1)	M
N	350: C=C+A(J, 0)*A(J	N S's per gp.
80: FOR J=1 TO K	, 0)/A(J, 2)	O
90: FOR I=1 TO N	360: RETURN	P
100: PRINT "SCORE #	370: WAIT	Q
"; I"; GROUP #	380: PRINT "TOTAL D	R
"; J; "=";	F="; G-1	S
110: INPUT X:CLS	390: PRINT "DF(A)="	T
120: GOSUB 280	; K-1	U
130: NEXT I	400: PRINT "DF(S/A)	V
140: GOSUB 330	="; G-K	W
150: NEXT J	410: PRINT "TOTAL S	X used
160: GOTO 370	S="; B-A*A/G	Y
170: FOR J=1 TO K	420: PRINT "SS(A)="	Z
180: PRINT "SUBJECT	; C-A*A/G	DIM A(k, 2)
S IN GROUP #";	430: PRINT "SS(S/A)	A\$ used
J; "=";	="; B-C	
190: INPUT N:CLS	440: D=(C-A*A/G)/(K	
200: FOR I=1 TO N	-1)	
210: PRINT "SCORE #	450: PRINT "MS(A)="	
"; I"; GROUP #	; D	
"; J; "=";	460: E=(B-C)/(G-K)	
220: INPUT X:CLS	470: PRINT "MS(S/A)	
230: GOSUB 280	="; E	
240: NEXT I	480: PRINT "F="; D/E	
	490: END	

ANALYSIS OF VARIANCE: two factor design, equal group sizes.

This program computes analysis of variance summary statistics for a design having a first factor, A, with a levels, a second factor, B, with b levels, and the same number of subjects, N, in each treatment group. This program lists the degrees of freedom (df), sums of squares (SS), mean squares (MS), and F ratios, where appropriate, for each source of variance (SV). Terminology follows Myers, Fundamentals of Experimental Design, 3rd ed., Allyn & Bacon, 1979.

EXAMPLE:

In the example below we have a=2 levels of A, b=3 levels of B, and N=3 subjects in each treatment.

Example Data:			Summary Table derived from the output below:					
A ₁	B ₁	A ₁ B ₂	A ₁ B ₃	SV	df	SS	MS	F
A ₁	B ₁	A ₁ B ₂	A ₁ B ₃	Total	17	160		
0	1	4		A	1	8	8	4
1	3	5		B	2	100	50	25
2	5	6		AB	2	28	14	7
A ₂	B ₁	A ₂ B ₂	A ₂ B ₃	S/AB	12	24	2	
2	0	7						
3	1	9						
4	2	11						

#	INPUT	READOUT	#	INPUT	READOUT
1	DEF A	ANOVA 2E:	15	ENTER	SS A = 8
2	ENTER	# PER GROUP?	16	ENTER	SS B = 100
3	3 ENTER	LEVELS OF A?	17	ENTER	SS AB = 28
4	2 ENTER	LEVELS OF B?	18	ENTER	SS S/AB = 24
5	3 ENTER	#1 IN A(1)B(1)?	19	ENTER	MS A = 8
6	0 ENTER	#2 IN A(1)B(1)?	20	ENTER	MS B = 50
7	-- ENTER ALL DATA AS PROMPTED --		21	ENTER	MS AB = 14
8	9 ENTER	#3 in A(2)B(3)?	22	ENTER	MS S/AB = 2
9	11 ENTER	TOTAL DF = 17	23	ENTER	F(A) = 4
10	ENTER	DF A = 1	24	ENTER	F(B) = 25
11	ENTER	DF B = 2	25	ENTER	F(AB) = 7
12	ENTER	DF AB = 2			
13	ENTER	DF S/AB = 12			
14	ENTER	SS TOTAL = 160			

Program listing.

MEMORY CONTENTS

10: A":CLEAR	310: O=G/A/N-C*C/A/	A levels of A
20:PRINT "ANOVA 2	B/N	B levels of B
E:"	320: P=E/N-M-O-C*C/	C used
30:WAIT 0	A/B/N	D used
40: INPUT "#PER GR	330: Q=D-E/N	E used
OUP?";N	340: S=M/(A-1)	F used
50: INPUT "LEVELS	350: T=Q/(B-1)	G
OF A?";A	360: U=P/((A-1)*(B-	H
60: INPUT "LEVELS	1))	I
OF B?";B	370: V=Q/A/B/(N-1)	J used
70: DIM A(A,B),B(A	380: WAIT	K used
,B)	390: PRINT "TOTAL D	L SS total
80:FOR J=1TO A	F=";A*B*N-1	M SS A
90:FOR K=1TO B	400: PRINT "DF A=";	N # per group
100:FOR J=1TO N	A-1	O SS B
110:PRINT "#";J;"1"	410: PRINT "DF B=";	P SS AB
N A(";J;")B(";	B-1	Q SS S/AB
K;")";	420: PRINT "DF AB="	R
120:INPUT X:CLS	; (A-1)*(B-1)	S MS A
130:A(J,K)=A(J,K)+	430: PRINT "DF S/AB	T MS B
X	=";A*B*(N-1)	U MS AB
140:B(J,K)=B(J,K)+	440: PRINT "SS TOTA	V MS S/AB
XX	L=";L	W
150:NEXT J	450: PRINT "SS A=";	X used
160:C=C+A(J,K)	M	Y
170:D=D+B(J,K)	460: PRINT "SS B=";	Z
180:E=E+A(J,K)*A(J	O	DIM A(A,B)
,K)	470: PRINT "SS AB="	DIM B(A,B)
190:A(J,0)=A(J,0)+	;P	
A(J,K)	480: PRINT "SS S/AB	
200:A(0,K)=A(0,K)+	=";Q	
A(J,K)	490: PRINT "MS A=";	
210:NEXT K	S	
220:NEXT J	500: PRINT "MS B=";	
230:FOR J=1TO A	T	
240:F=F+A(J,0)*A(J	510: PRINT "MS AB="	
,0)	;U	
250:NEXT J	520: PRINT "MS S/AB	
260:FOR K=1TO B	=";U	
270:G=G+A(0,K)*A(0	530: PRINT "F(A)=";	
,K)	S/U	
280:NEXT K	540: PRINT "F(B)=";	
290:L=D-C*C/A/B/N	T/U	
300:M=F/B/N-C*C/A/	550: PRINT "F(AB)="	
B/N	;U/V	
	560:END	

ANALYSIS OF VARIANCE: two factor design, unweighted means.

This program computes analysis of variance summary statistics for a design having a first factor, A, with a levels, a second factor, B, with b levels, and a different number, N, of subjects in each treatment group. This program lists the degrees of freedom (DF), sums of squares, (SS), mean squares (MS), and F ratios, where appropriate, for each source of variance (SV). Results are either displayed or printed, depending on the operator's choice. Terminology follows Myers, Fundamentals of Experimental Design, 3rd ed., Allyn & Bacon, 1979.

EXAMPLE:

In the example below we have a=2 levels of A, b=3 levels of B, and a different N (2 or 3) in different treatment groups.

Example Data:

A ₁	B ₁	A ₁ B ₂	A ₁ B ₃
0	1	4	
1	5	5	
2		6	

A ₂	B ₁	A ₂ B ₂	A ₂ B ₃
2	0	7	
4	1	9	
2		11	

PRINTOUT: →

```
=====
UNWEIGHTED MEANS
=====
DEGREES OF FREEDOM
TOTAL: 15
A: 1
B: 2
AB: 2
S/AB: 10
=====
SUMS OF SQUARES
TOTAL: 54.666666666
A: 2.666666667
B: 33.333333333
AB: 9.333333333
S/AB: 9.333333332E-01
=====
MEAN SQUARES
A: 2.666666667
B: 16.666666667
AB: 4.666666667
S/AB: 9.333333332E-01
=====
F RATIOS
A: 2.857142858
B: 17.857142856
AB: 5.000000001
```

#	INPUT	READOUT	#	INPUT	READOUT
1	DEF A	UNWEIGHTED MEANS:			
2	ENTER	LEVELS OF A?			
3	2 ENTER	LEVELS OF B?			
4	3 ENTER	PRINT RESULTS?(Y/N)			
5	Y ENTER	NUMBER IN A(1)B(1)?			
6	3 ENTER	#1 IN A(1)B(1)=?			
7	0 ENTER	#2 IN A(1)B(1)=?			
	-- ENTER ALL DATA AS PROMPTED --				
8	9 ENTER	#3 IN A(2)B(3)=?			
9	11 ENTER				
	-- SEE PRINTOUT ABOVE --				

Program listing.

```

10;"A":WAIT :          310:NEXT K           660:LPRINT "A:";S
  PRINT "UNWEIGH      320:L=D-C*A/B      670:LPRINT "B:";T
  TED MEANS ":"       330:M=F-B-C*C/A/B     680:LPRINT "AB:";U
  CLEAR :WAIT 0        340:O=G-A-C*C/A/B     690:LPRINT "S/AB:";
20:INPUT "LEVELS      350:P=L-M-O          ;OW
  OF A?";A           360:FOR I=1TO A      700:LPRINT "-----"
30:INPUT "LEVELS      370:FOR J=1TO B      710:LPRINT "F RATI
  OF B?";B           380:Q=Q+(A(I,J)-1)    OS"
  40:DIM A(A,B),B(A   390:E=E+1/A(I,J)      720:LPRINT "A:";S*
  ,B),C(A,B),D(A   400:W=W+A(I,J)-1      W/O
  ,B),E(A,B)         410:NEXT J      730:LPRINT "B:";T*
50:INPUT "PRINT R    420:NEXT I      740:LPRINT "AB:";U
  ESULTS? (Y/N)"     430:Q=Q*E/A/B      *W/Q
  ;BS               440:S=M*(A-1)      750:LPRINT "-----"
60:FOR J=1TO A      450:T=0/(B-1)      760:GOTO 940
70:FOR K=1TO B      460:U=P*(A-1)/(B-1)
80:PRINT "NUMBER      )      770:WAIT :PRINT "T
  IN A(";J;")B("     470:IF B$="N"THEN      OTAL DF=";A*B+
  ;K;")=";      780:PRINT "DF(A)="      W-J
90:INPUT N:CLS      480:LPRINT "=====      790:PRINT "DF(B)="      ;A-1
100:FOR J=1TO N     490:LPRINT " UNWEI      800:PRINT "DF(AB)="      ;B-J
110:PRINT "#";I;      GHED MEANS"      810:PRINT "DF(S/AB"
  IN A(";J;")B("      500:LPRINT "-----      )=";W
  ;K;")=";      510:LPRINT "DEGREE      820:PRINT "TOTAL S
120:INPUT X:CLS      S OF FREEDOM"      S=";M+O+P+Q
130:A(J,K)=A(J,K)+  520:LPRINT "TOTAL:      830:PRINT "SS(A)="      ;M
  1      530:LPRINT "A:";A-      840:PRINT "SS(B)="      ;O
140:D(J,K)=D(J,K)+  540:LPRINT "B:";B-      850:PRINT "SS(AB)="      ;P
  X      550:LPRINT "AB:";(      860:PRINT "SS(S/AB"
150:E(J,K)=E(J,K)+  560:LPRINT "S/AB:"      )=";Q
  XX*      570:LPRINT "-----      870:PRINT "MS(A)="      ;S
160:NEXT J      580:LPRINT "SUMS O      880:PRINT "MS(B)="      ;T
170:B(J,K)=D(J,K)/      F SQUARES"      890:PRINT "MS(AB)="      ;U
  A(J,K)      590:LPRINT "TOTAL:      900:PRINT "MS(S/AB"
180:(J,K)=E(J,K)      ";M+O+P+Q      )=";OW
  -D(J,K)*D(J,K)      600:LPRINT "A:";M
  /A(J,K))<(A(J,      610:LPRINT "B:";O
  K)-1)      620:LPRINT "AB:";P
190:(J,K)=S(C(J,K)      630:LPRINT "S/AB:"      910:PRINT "F(A)="      ;S*W/Q
200:C=C+B(J,K)      640:LPRINT "-----      920:PRINT "F(B)="      T*W/Q
210:D=D+B(J,K)*B(J      650:LPRINT "MEAN S      930:PRINT "F(AB)="      ;U*W/O
  ,K)      QUARES"      940:END
220:B(J,0)=B(J,0)+      )      950:END
  B(J,K)      960:END
230:B(0,K)=B(0,K)+      )      970:END
  B(J,K)      980:END
240:NEXT K      990:END
250:NEXT J      1000:END
260:FOR J=1TO A      1010:END
270:F=F+B(J,0)*B(J      1020:END
  ,0)      1030:END
280:NEXT J      1040:END
290:FOR K=1TO B      1050:END
300:G=G+B(0,K)*B(0      1060:END
  ,K)      1070:END

```

MEMORY CONTENTS

A	levels of A
B	levels of B
C	used
D	used
E	used
F	used
G	used
H	
I	used
J	used
K	used
L	used
M	SS(A)
N	used
O	SS(B)
P	SS(AB)
Q	SS(S/AB)
R	
S	MS(A)
T	MS(B)
U	MS(AB)
V	
W	DF(S/AB)
X	
Y	
Z	
B\$	used
DIM:	
	A(A,B)
	B(A,B)
	C(A,B)
	D(A,B)
	E(A,B)

MULTIPLE CORRELATION: from raw data.

This program computes the constant, $b(0)$, and regression weights, $b(1)$ through $b(k)$, for k predictors, using the method of least squares. The coefficient of multiple determination, R^2 , the multiple correlation, R , and the beta weights, $B(1)$ through $B(k)$, are also computed. The procedures follow those given in McNemar, Psychological Statistics, 4th ed.

EXAMPLE

Find the b-weights, beta weights, coefficient of determination, and multiple correlation for predicting Y from X_1 and X_2 in the table below. (see steps 1 - 16 below.)

Table 1
Two Predictors and One Criterion
for 8 subjects

Subject:	X_1 :	X_2 :	Y :
1	18	28	19
2	19	29	15
3	16	24	10
4	20	39	40
5	18	35	21
6	19	31	35
7	19	35	27
8	17	30	18

#	INPUT	READOUT	#	INPUT	READOUT
1	DEF L	MULTIPLE R:	9	30 ENTER	$Y(8):?$
2	ENTER	NUMBER OF CASES:	10	18 ENTER	$b(0) = .73.64539009$
3	8 ENTER	NUMBER OF PREDICTORS:	11	ENTER	$b(1) = 3.680851065$
4	2 ENTER	$X(1,1):?$	12	ENTER	$b(2) = 9.432624112E-01$
5	18 ENTER	$X(1,2):?$	13	ENTER	$R^2 = .715697359$
6	28 ENTER	$Y(1):?$	14	ENTER	$R = 8.459889828E-01$
7	19 ENTER	$X(2,1):?$	15	ENTER	$B(1) = 4.629854038E-01$
8	--- enter data as prompted ---		16	ENTER	$B(2) = 4.396016806E-01$

Program listing.

MEMORY
CONTENTS

```

10:"L":PRINT "MUL
      TIPLE R:";
      CLEAR
20:INPUT "NUMBER
      OF CASES:";N
30:INPUT "NUMBER
      OF PREDICTORS:
      ";U
40:DIM X(U+1),S(U
      +1),T(U),A(0,U
      +1),R(U,U+1),U
      (U+1)
50:X(0)=1
60:FOR I=1TO N
70:FOR J=1TO U
80:WAIT 0
90:PRINT "X(";I;""
      ,";J;");"
100:INPUT X(J):CLS
110:NEXT J
120:PRINT "Y(";I;""
      );"
130:INPUT X(U+1):
      CLS
140:FOR K=0TO U
150:FOR L=0TO U+1
160:A(K,L)=A(K,L)+
      X(K)*X(L)
170:S(K)=A(K,U+1)
180:NEXT L
190:NEXT K
200:S(U+1)=S(U+1)+
      X(U+1)*Y(U+1)
210:NEXT I
220:FOR J=1TO U
230:FOR I=1TO U
240:R(I,J)=N*A(I,J)
      -A(1,0)*A(0,J)
      )
250:R(I,J)=R(I,J)/
      (N*A(I,J)-A(1
      ,0)*A(0,J))
260:R(I,J)=R(I,J)/
      (N*A(J,J)-A(J
      ,0)*A(0,J))
270:NEXT J
280:NEXT I
290:FOR I=1TO U
300:U(I)=A(1,I)-A(
      1,0)*A(0,I)/N
310:U(I)=U(I)/(N-1
      )
320:NEXT J
330:FOR I=1TO U
340:R(I,U+1)=N*A(I
      ,U+1)-A(0,U+1)
      *A(1,0)
350:R(I,U+1)=R(I,U
      +1)/((N*S(U+1))
      -S(0)*S(U))
360:R(I,U+1)=R(I,U
      +1)/((N*A(I,1)
      -A(1,0)*A(0,1))
      )
370:NEXT I
380:U(U+1)=S(U+1)-
      S(0)*S(0)/N
390:U(U+1)=U(U+1)/
      (N-1)
400:FOR J=1TO U
410:T(I)=A(0,I)
420:NEXT I
430:FOR I=0TO U
440:J=I
450:IF A(J,1)<>0
      THEN 500
460:J=J+1
470:IF J<=UTHEN 45
      0
480:PRINT "NO UNIQ
      UE SOLUTION"
490:GOTO 800
500:FOR K=0TO U+1
510:B=A(I,K)
520:A(I,K)=A(J,K)
530:A(J,K)=B
540:NEXT K
550:Z=1/A(I,1)
560:FOR K=0TO U+1
570:A(I,K)=Z*A(I,K
      )
580:NEXT K
590:FOR J=0TO U
600:IF J=ITHEN 650
610:Z=-A(J,1)
620:FOR K=0TO U+1
630:A(J,K)=A(J,K)+
      Z*A(I,K)
640:NEXT K
650:NEXT J
660:NEXT I
665:WAIT
670:FOR I=0TO U
680:PRINT "b(";I;""
      )=";A(I,U+1)
690:NEXT I
700:P=0
710:FOR I=1TO U
720:P=P+A(I,U+1)*(
      S(I)-T(I)*S(0)
      )
730:NEXT I
740:R=S(U+1)-S(0)*
      S(0)/N
750:Z=R-P
760:L=N-U-1
770:I=P/R
780:PRINT "R^2=";I
790:PRINT "R=";I
792:FOR I=1TO U
794:PRINT "B(";I;""
      )=";A(I,U+1)*(
      U(I)/U(U+1))
795:NEXT I
800:END

```

MULTIPLE CORRELATION: from correlations.

This program computes beta weights, $B(1)$ through $B(k)$, the coefficient of multiple determination, R^2 , the the multiple correlation, R , for a set of k predictors with a criterion. Terminology follows McNemar, Psychological Statistics, 4th ed. Wiley.

EXAMPLE:

Find the beta weights, coefficient of determination, and multiple correlation for predicting Y from the four predictors given in Table 1 below. (see READOUT below for answers.)

Table 1
Predictor - Criterion Intercorrelations

	X ₂	X ₃	X ₄	Y
X ₁	.562	.401	.197	.465
X ₂		.396	.215	.583
X ₃			.345	.546
X ₄				.365

#	INPUT	READOUT	#	INPUT	READOUT
1	DEF L	MULTIPLE R FROM RS:	6	.365 ENTER	B(1)=1.040544441E-01
2	ENTER	NUMBER OF PREDICTORS:	7	ENTER	B(2)=3.703100075E-01
3	4 ENTER	R(1,2):?	8	ENTER	B(3)=0.302217668
4	.564 ENTER	R(1,3):?	9	ENTER	B(4)=1.606195275E-01
	ENTER DATA AS PROMPTED ----		10	ENTER	R 2=4.879130251E-01
5	.546 ENTER	R(4,Y):?	11	ENTER	R=.698507713

ALPHABETIZE: a list of 100 or fewer names.

This program has three sub-programs:

DEF L -- allows entering up to 100 names of 16 letters and spaces each.

DEF A -- alphabetizes the names and lists them on the printer.

[DEF C -- allows correction of a specified name.

EXAMPLE:

Enter and alphabetize these names: JONES FRANK

JONES FRANK

ABRAHAMS NOF

ABRAHAMS NORMAN

3

2
BONES ERONK

3

GRAFT RICHARD

No! You Dummy! You've misspelled two names! Correct them!

Printout: 1 ABRAHAMS NORMAN
 2 GRAF RICHARD
 3 JONES FRANK

That's much better!

Program listing.

MEMORY
CONTENTS

```

10:"L":CLEAR
20:DIM A$(100):
    WAIT
30:PRINT "LIST OF
    NAMES"
40:WAIT 0
50:N=0
60:PRINT "#";N+1;
    ":";
70:INPUT A$(N+1):
    CLS
80:N=N+1
90:GOTO 60
100:END
110:"A":CLS :PRINT ,
    "ALPHABETIZE"
120:M=N
130:M=INT (M/2)
140:IF M=0THEN 280
150:K=N-M
160:J=1
170:I=J
180:L=I+M
190:IF A$(I)<A$(L)
    OR A$(I)=A$(L)
    THEN 250
200:T$=A$(I)
210:A$(I)=A$(L)
220:A$(L)=T$
230:I=I-M
240:IF I>=1THEN 18
    0
250:J=J+1
260:IF J>KTHEN 130
270:GOTO 170
280:FOR I=1TO N
290:LPRINT ":";I
300:LPRINT A$(I)
310:NEXT I
320:END
400:"C":WAIT :
    PRINT "EDIT NA
    MES:"
410:INPUT "NUMBER
    TO BE CHANGED?
    ";I
420:INPUT "CORRECT
    ED NAME:",A$(I)
    )
430:END

```

SCORE DISTRIBUTIONS: orders scores; determines frequencies, centiles, and T scores.

If we enter a set of N scores, this program arranges the scores in order from high to low, and presents the score, X, and the frequency, F, centile value, C, and normalized T score, T, for each score.

EXAMPLE:

Find the frequency distribution, centiles, and T scores for this set of ten scores: 9, 7, 8, 10, 9, 8, 9, 10, 8. (See steps below.)

Table derived from the output below:

Score:	Frequency:	Centile:	T score:
10	2	90	63
9	4	60	53
8	3	25	43
7	1	5	34

Mean = 8.7 : Standard Deviation = 9.49

STEP #	INPUT	READOUT
1	DEF S	SCORE DISTRIBUTIONS:
2	ENTER	HOW MANY SCORES?
3	10 ENTER	SCORE # 1?
4	9 ENTER	SCORE # 2?
5	7 ENTER	SCORE # 3?
--- Enter all scores as prompted ---		
6	10 ENTER	SCORE # 10?
7	8 ENTER	X=10: F=2: C=90: T=63
8	ENTER	X=9: F=4: C=60: T=53
9	ENTER	X=8: F=3: C=25: T=43
10	ENTER	X=7: F=1: C=5: T=34
11	ENTER	MEAN = 8.7
12	ENTER	SD = 9.486832981E-01

Program listing.

MEMORY CONTENTS

10: "S":PRINT "SCO	320:GOSUB 550	A used
RE DISTRIBUTIO	330:PRINT "X=";B(I)	B used
NS":CLEAR	;";F=";C(I);"	C used
20:INPUT "HOW MAN	;C=";C;"T=";T	D used
Y SCORES?";N	340:S=S+C(I)	E mean
30:DIM A(N),B(N),	350:NEXT I	F SD
C(N)	360:GOSUB 700	G
40:WAIT 0	370:END	H
50:FOR I=1TO N	400:Y=(EXP (-Z*Z/2	I used
60:PRINT "SCORE#")*/S(2*PI))	J
;I;"=";	410:U=1:M=0:W=0	K used
70:INPUT A(I):CLS	420:U=2*M+1	L
80:NEXT I	430:V=U\U	M used
90:FOR I=1TO N-1	440:D=Z\U/U	N# of scores
100:FOR K=1TO N-1	450:W=W+D	O
110:X=A(K)	460:IF ABS D<1E-9	P used
120:Y=A(K+1)	THEN 490	Q used
130:IF X>YTHEN 16	470:M=M+1	R
0	480:GOTO 420	S used
140:A(K)=Y	490:W=W\Y	T used
150:A(K+1)=X	500:P=W+.5	U used
160:NEXT K	510:RETURN	V used
170:NEXT I	550:Z=(Q-.5)/.4	W used
180:K=1	560:GOSUB 400	X used
190:B(K)=A(1)	570:Z=Z+(Q-P)/Y	Y used
200:FOR I=1TO N	580:IF ABS (Q-P)>1	Z used
210:IF A(I)<>B(K)	E-9THEN 560	DIM A(N):
THEN 240	590:T=INT (50.5+10	raw scores
220:C(K)=C(K)+1	*Z)	DIM B(N):
230:GOTO 270	600:RETURN	ordered scores
240:K=K+1	700:FOR I=1TO N	DIM C(N):
250:B(K)=A(I)	710:A=A+A(I)	frequencies
260:C(K)=1	720:B=B+A(I)*A(I)	
270:NEXT I	730:NEXT I	
280:WAIT	740:E=A/N	
290:FOR I=1TO K	750:F=B-A*N/N	
300:C=INT (100*(N-	760:F=J(F/(N-1))	
S-C(I)/2)/N+.5	770:PRINT "MEAN=";	
)	E	
310:Q=(N-S-C(I)/2)	780:PRINT "SD=";F	
/N	790:RETURN	

QUIZ AVERAGES: computes the average or weighted average per cent correct for several quizzes.

DEF M -- This program is used first, to enter the number of quizzes, total points on each quiz, and, at the user's option, the different weights for each quiz.

DEF G -- Upon entering the quiz scores for a student, this program averages the scores and prepares a printout that may be given to the student. Note: if a student misses a quiz, you may enter "-1" for the missing score, and the program will compute the average percent only for the quizzes that were taken. If different weights were used, the weights are stored in S(0, 1) through S(0, K).

EXAMPLES:

A class has taken three quizzes with total points of 20, 50, and 40 respectively. Martha Alf has scores of 20, 45, missing. Compute her average score. (See steps below and printout at right.)

A class has three quizzes with total points of 30, 50, and 80 respectively. The third quiz gets double weight.

Richard Graf has scores of 20, 40, and 75. What is his weighted average? (See steps below and printout at right.)

MARTHA ALF			
Q #:	SCORE/MAX:	%	
1	20/ 20	100	
2	45/ 50	90	
3	-1/ 40	-1	

QUIZ AVERAGE:			
95.0000%			

RICHARD GRAF			
Q #:	SCORE/MAX:	%	
1	20/ 30	67	
2	40/ 50	80	
3	75/ 80	94	

WEIGHTED AVERAGE:			
83.5417%			

S(0, 1)	1
S(0, 2)	1
S(0, 3)	2

STEP #	INPUT	READOUT
1	DEF M	QUIZ TOTALS:
2	ENTER	HOW MANY QUIZZES ?
3	3 ENTER	DIFFERENT WEIGHTS?(Y/N)
4	N ENTER	QUIZ 1 TOTAL: ?
5	20 ENTER	QUIZ 2 TOTAL: ?
6	50 ENTER	QUIZ 3 TOTAL: ?
7	40 ENTER	
8	DEF G	AVERAGES:
9	ENTER	NAME:
10	MARTHA ALF ENTER	SCORE # 1: ?
11	20 ENTER	SCORE # 2: ?
12	45 ENTER	SCORE # 3: ?
13	-1 ENTER	(see printout)
14	DEF M	QUIZ TOTALS:
15	ENTER	HOW MANY QUIZZES ?
16	3 ENTER	DIFFERENT WEIGHTS?(Y/N)
17	Y ENTER	QUIZ 1.0000 TOTAL: ?
18	30 ENTER	QUIZ 1.0000 WEIGHT: ?
19	1 ENTER	QUIZ 2.0000 TOTAL: ?
20	50 ENTER	QUIZ 2.0000 WEIGHT: ?
21	1 ENTER	QUIZ 3.0000 TOTAL: ?
22	80 ENTER	QUIZ 3.0000 WEIGHT: ?
23	2 ENTER	
24	DEF G	AVERAGES:
25	ENTER	NAME:
26	RICHARD GRAF ENTER	SCORE # 1: ?
27	20 ENTER	SCORE # 2: ?
28	40 ENTER	SCORE # 3: ?
29	75 ENTER	(see printout)

Program listing.

MEMORY CONTENTS

```

10:"M":CLEAR :
WAIT :PRINT "Q
UIZ TOTALS:"
20:INPUT "HOW MAN
Y QUIZZES?";K
30:DIM S(1,K),B(K
),T(K),P(K)
40:INPUT "DIFFERE
NT WEIGHTS?(Y/
N)";A$
50:WAIT 0
60:IF A$="Y"THEN
130
70:FOR I=1TO K
80:PRINT "QUIZ";I
;"TOTAL:";
90:INPUT S(1,I):
CLS
100:S(0,I)=1
110:NEXT I
120:GOTO 190
130:FOR I=1TO K
140:PRINT "QUIZ";I
;"TOTAL:";
150:INPUT S(1,I):
CLS
160:PRINT "QUIZ";I
;"WEIGHT:";
170:INPUT S(0,I):
CLS
180:NEXT I
190:END
200:"G":WAIT :
PRINT "AVERAGE
S:"
210:INPUT "NAME:";
B$
215:WAIT 0
220:FOR J=1TO K
230:PRINT USING "#
##";"SCORE #";
J;":";
240:INPUT B(J):CLS
250:NEXT J
260:FOR J=1TO K
270:IF B(J)=-1THEN
310
280:T(J)=B(J)/S(1,
J)
290:P(J)=T(J)*100
300:GOTO 330
310:T(J)=-1
320:P(J)=-1.5
330:NEXT J
340:S=0:T=0
350:FOR J=1TO K
360:IF T(J)=-1THEN
390
370:S=S+S(0,J)
380:T=T+T(J)*S(0,J
)
390:NEXT J
400:A=T/S
410:LPRINT -----
-----
420:LPRINT B$
430:LPRINT -----
-----
440:LPRINT "Q #: S
CORE/MAX: %"
450:LPRINT -----
-----
460:FOR J=1TO K
470:LPRINT USING "
###";J;" ";B(
J);"/";S(1,J);
" ";USING "##
##";P(J)+.5
480:NEXT J
490:LPRINT -----
-----
495:IF A$="Y"THEN
545
500:LPRINT "QUIZ A
VERAGE:"
510:LPRINT USING "
###.####";A*1
00+.00005;"%"
520:LPRINT -----
-----
530:WAIT
540:END
545:LPRINT "WEIGHT
ED AVERAGE:":
GOTO 510

```

GRADE AVERAGES

This versatile program will average a set of letter graded tests. You may either assign the same weight to each test, or assign different weights to different tests. Also, you may either have the results displayed by the PC-2, or printed.

The program can also be used to find a student's grade point average (GPA). To compute the student's GPA, let "grade" be the course grade, and "weight" be the number of units for the course.

GPA is computed using a standard system in which A=4, B=3, C=2, D=1 and F=0. If your school system uses different values, simply enter the value in your system for an A, and the value in your system for a C, when prompted by the PC-2. This will automatically convert the GPA to your system. You may not use plus and minus grades; and in fact, some systems don't allow them. However, they are included in the program in case you want them. Enter "X" after all grades have been entered.

EXAMPLES

1 - A class has seven equally weighted exams. John Smith has grades A+, B+, A-, A, B, C, and B-. What is John's average grade? (See first printout and steps below.)

2 - A freshman, Jane Doe, has taken these courses her first semester: Chemistry; A; five units: Zoology; B; four units: English; C; three units: Art; B; three units. What is Jane's GPA? (See second printout and steps below.)

3 - The school is converting to a new system in which A=6, B=4, C=2, D=0, and F=-2. What is Jane's GPA under the new system? (See third printout and steps below.)

Printout #1
JOHN SMITH
=====

#	GRADE	WEIGHT
1	A+	1
2	B+	1
3	A-	1
4	A	1
5	B	1
6	C	1
7	B-	1

GPA = 3.285714287
AVERAGE GRADE=B+
=====

Printout #2
JANE DOE
=====

#	GRADE	WEIGHT
1	A	5
2	B	4
3	C	3
4	B	3

GPA = 3.133333333
AVERAGE GRADE=B
=====

Printout #3
JANE DOE
(A= 6, C= 2)
=====

#	GRADE	WEIGHT
1	A	5
2	B	4
3	C	3
4	B	3

GPA = 4.266666666
AVERAGE GRADE=B
=====

#	INPUT	READOUT	#	INPUT	READOUT
1	DEF G	GRADE AVERAGES:	17	5 ENTER	GRADE # 2=?
2	ENTER	EQUAL WEIGHTS?(Y/N)		-- enter grades and weights (units) --	
3	Y ENTER	PRINT RESULTS?(Y/N)	18	3 ENTER	GRADE # 5=?
4	Y ENTER	STANDARD GPA?(Y/N)	19	X ENTER	see printout #2
5	Y ENTER	NAME:			
6	JOHN SMITH ENTER	GRADE # 1=?	20	DEF G	GRADE AVERAGES:
7	A+ ENTER	GRADE # 2=?	21	ENTER	EQUAL WEIGHTS?(Y/N)
	-- enter grades as prompted --		22	N ENTER	PRINT RESULTS?(Y/N)
8	B- ENTER	GRADE # 8=?	23	Y ENTER	STANDARD GPA?
9	X ENTER	see printout #1	24	N ENTER	VALUE FOR A=
			25	6 ENTER	VALUE FOR C=
10	DEF G	GRADE AVERAGES:	26	2 ENTER	NAME:
11	ENTER	EQUAL WEIGHTS?(Y/N)	27	JANE DOE ENTER	GRADE # 1=?
12	N ENTER	PRINT RESULTS?(Y/N)	28	A ENTER	WEIGHT 1=?
13	Y ENTER	STANDARD GPA?(Y/N)	29	5 ENTER	GRADE # 2=?
14	Y ENTER	NAME:		-- enter grades and weights (units) --	
15	JANE DOE ENTER	GRADE # 1=?	30	3 ENTER	GRADE # 5=?
16	A ENTER	WEIGHT 1=?	31	X ENTER	see printout #3

Program listing.

MEMORY
CONTENTS

```

10: "G":WAIT :
PRINT "GRADE A
VERAGES:":
CLEAR
20: INPUT "EQUAL W
EIGHTS?(Y/N)";
A$
30: INPUT "PRINT R
ESULTS?(Y/N)";
B$
40: INPUT "STANDAR
D GPA?(Y/N);C
$
50: IF C$="Y"THEN
    70
60: INPUT "VALUE F "
OR A%;"Y,"VALU
E FOR C%;"Z
70: DIM T$(30)*2, T
   (30), W(30), G$((
   15)*2
80: G$(1)="F-";G$((
   2)="F";G$(3)=""
   F+";G$(4)="D-"
   ;G$(5)="D"
90: G$(6)="D+":G$((
   7)="C-";G$(8)="
   "C";G$(9)="C+"
   ;G$(10)="B-"
100: G$(11)="B";G$((
   12)="B+":G$(13
   )="A-";G$(14)=
   "A";G$(15)="A+
   "
105: INPUT "NAME:";
N$
110: J=1
120: WAIT 0
130: PRINT "GRADE #"
   ";J;" =";
140: INPUT T$(J):
CLS
150: IF T$(J)="X"
   THEN 240
160: FOR I=1TO 15
170: IF T$(J)=G$(I)
   THEN LET T(J)=
   I
180: NEXT I
190: IF A$="N"THEN
   210
200: W(J)=1:GOTO 23
   0
210: PRINT "WEIGHT
   ";J;" =";
220: INPUT W(J);CLS
230: J=J+1:GOTO 130
240: FOR K=1TO J-1
250: S=S+T(K)*W(K)
260: W=W+W(K)
270: NEXT K
280: IF C$="Y"THEN
   320
290: A=S/W:C=INT (A
   +.5)
300: B1=(Y-Z)/6:A1=
   Y-14*B1:B=A1+A
   *B1
310: GOTO 330
320: A=S/W:B=A/3-2/
   3:C=INT (A+.5)
330: IF B$="Y"THEN
   400
340: WAIT
345: PRINT N$
350: FOR K=1TO J-1
360: PRINT "#";K;
   :";T$(K);"(;"W
   (K);")"
370: NEXT K
380: PRINT "GPA=";B
390: PRINT "AVERAGE
   GRADE=";G$(C
   ):GOTO 510
400: LPRINT N$
405: IF C$="N"THEN
   GOSUB 520
410: LPRINT "=====
   ====="
420: LPRINT "#; GR
   ade: WEIGHT:"
430: LPRINT "-----
   -----"
440: FOR K=1TO J-1
450: LPRINT K;TAB 6
   ;T$(K);TAB 12;
   W(K)
460: NEXT K
470: LPRINT "-----
   -----"
480: LPRINT "GPA=";
   B
490: LPRINT "AVERAG
   E GRADE=";G$(C
   )
500: LPRINT "=====
   ====="
510: END
520: LPRINT " (A="
   ;Y;"; C%;"Z;")
   ":RETURN

```

SCORE AVERAGES

This program can be used to find the average, or weighted average, of a set of raw scores, T scores, or other types of converted scores. Teachers often prefer to use T scores, since they give each test the same effective weight. T scores can be obtained using the program SCORE DISTRIBUTIONS.

Note: after entering the last test score, enter a score of "-1". The program will then compute the desired average. Note also: you may either print out the results, or read them from the computer display, at your option.
EXAMPLES:

A student, Mary Smith, has test scores of 35, 45, 46, and 44. What is her average score? (See steps and printout below.)

A class has three quizzes and a final. The final receives twice as much weight as a quiz. David Atwater has quiz T scores of 64, 70, and 59, and a final exam T score of 64. What is his weighted T score average? (See steps and printout below.)

MARY SMITH:

#:	SCORE:	WEIGHT:
1	35	1
2	45	1
3	46	1
4	44	1

SCORE AVERAGE:
42.5

DAVID ATWATER:

#:	SCORE:	WEIGHT:
1	64	1
2	70	1
3	59	1
4	64	2

SCORE AVERAGE:
64.2

STEP #	INPUT	READOUT
1	DEF S	SCORE AVERAGES:
2	ENTER	EQUAL WEIGHTS ?(Y/N)
3	Y ENTER	PRINT RESULTS ?(Y/N)
4	Y ENTER	NAME:
5	MARY SMITH ENTER	SCORE # 1 = ?
6	35 ENTER	SCORE # 2 = ?
7	45 ENTER	SCORE # 3 = ?
8	46 ENTER	SCORE # 4 = ?
9	44 ENTER	SCORE # 5 = ?
10	-1 ENTER	(See printout above.)
11	DEF S	SCORE AVERAGES:
12	ENTER	EQUAL WEIGHTS ?(Y/N)
13	N ENTER	PRINT RESULTS ?(Y/N)
14	Y ENTER	NAME:
15	DAVID ATWATER ENTER	SCORE # 1 = ?
16	64 ENTER	WEIGHT 1 = ?
17	1 ENTER	SCORE # 2 = ?
18	70 ENTER	WEIGHT 2 = ?
19	1 ENTER	SCORE # 3 = ?
20	59 ENTER	WEIGHT 3 = ?
21	1 ENTER	SCORE # 4 = ?
22	64 ENTER	WEIGHT 4 = ?
23	2 ENTER	SCORE # 5 = ?
24	-1 ENTER	(See printout above.)

Program listing.

MEMORY
CONTENTS

10: 'S':WAIT :	200:A=S/W	A used
PRINT "SCORE A	210:IF B\$="Y"THEN	B
VERAGES:";	290	C
CLEAR	220:WAIT	D
20:INPUT "EQUAL W	230:PRINT C\$;" :	E
EIGHTS?(Y/N)";	240:FOR K=1TO J-1	F
9\$	250:PRINT "#";K;"	G
30:INPUT "PRINT R	;" ;S(K);"(;"W	H
ESULTS?(Y/N)";	(K);")"	I
B\$	260:NEXT K	J used
40:DIM S(50),W(50)	270:PRINT "AVERAGE	K used
)	=";A	L
50:INPUT "NAME:";	280:GOTO 420	M
C\$	290:LPRINT C\$;" :	N
60:WAIT 0	300:LPRINT "=====	O
70:J=1	=====	P
80:PRINT "SCORE #	310:LPRINT "#: SC	Q
";J; "=";	ORE: WEIGHT:"	R
90:INPUT S(J):CLS	320:LPRINT "-----	S used
100:IF S(J)=-1THEN	330:FOR K=1TO J-1	T
160	360:LPRINT K;TAB 6	U
110:IF A\$="N"THEN	;S(K);TAB 12;W	V
130	(K)	W used
120:W(J)=1:GOTO 15	370:NEXT K	X
0	380:LPRINT "-----	Y
130:PRINT "WEIGHT"	390:LPRINT "SCORE	Z
;J; "=";	AVERAGE:"	A\$ - used
140:INPUT W(J):CLS	400:LPRINT "";A	B\$ - used
150:J=J+1:GOTO 80	410:LPRINT "=====	C\$ - used
160:FOR K=1TO J-1	420:END	DIM:
170:S=S+S(K)*W(K)		S(50), W(50)
180:W=W(K)		
190:NEXT K		

