

# BUSINESS STATISTICS PROGRAM

BUSINESS STATISTICS

Cat. No. 26-3516



# INSTRUCTION MANUAL

Radio Shack<sup>®</sup>

TRS-80

POCKET  
COMPUTER  
SOFTWARE

TM

# **Business Statistics and Marketing**

**Radio Shack®**



A DIVISION OF TANDY CORPORATION  
FORT WORTH, TEXAS 76102

## **First Edition**

*Business Statistics and Marketing Program:*

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## Introduction

Business Statistics and Marketing is a data analysis system for use on the Radio Shack Pocket Computer. The system consists of seven programs for analyzing data, and one program (containing eight formulas) useful in making business decisions.

As with any computer system, very large (positive or negative) values and values containing many decimal places are subject to rounding errors. Additionally, some operations may magnify rounding errors. In most instances, the rounding error should be negligible. Be cautious when entering data values. This will help avoid erroneous output.

**Note:** All of the programs in your Business Statistics package should be loaded and run with your computer in the DEF mode.

You will load the programs using the CLOAD command, specifying the name of the particular program you want (names are listed at the end of this paragraph) and press **ENTER**. If your work requires frequent loading of different programs in this package, you might want to CSAVE some or all of the programs on separate cassette tapes (one program on each side). That way the computer will not have to read through all the programs ahead of the program that you want.

## Names (Names of programs on cassette tape)

FC	Forecasting
SV	Seasonal Variation
MA	Moving Average
NTF	N/t/F Distributions
DS	Descriptive Statistics
MR	Multiple Regression
GC	Gompertz Curve Analysis
MD	Management Decisions

## Forecasting

The Forecasting program uses a least-squares straight-line method to derive a regression equation that can be used for making predictions based on up to 100 measurements taken over a period of time. You may use any time interval (years, months, weeks, etc.), but the data must all be the same time unit and must be consecutive. Don't mix weeks and months. If there are any "missing" values, you may substitute the average of the intervals immediately before and after the one for which you do not have a measurement. The data is entered, in **order**, from first (oldest) period to last (most recent) period. Each measurement or observation is considered to have a reference period number called an "index". The first period will be referred to as index 0, the second as index 1, etc. The numbers are **not** entered into the computer — they are implicit and result from the order in which you input your data. The "period" numbers will be used for making predictions of data values for future observations.

Output from the program includes an estimate of the standard error of estimate, coefficients of the trend (prediction) line equation, and projected data values (when you input the index for the observation you want predicted).

## Instructions

Load the Forecasting program (**C** **L** **O** **A** **D** **"F C"** **ENTER**). Press **SHIFT** **SPC**. The computer will display: FORECASTING.

Press **ENTER** and the computer will ask, FIRST VALUE ?\_\_.

Enter the data value for your **first** period. The computer will ask, VALUE #2 ?\_\_.

Continue entering data values in order. When you have entered all the data, just press **ENTER** as the last value. the computer will display the number of data values entered = #of periods (# OF VALUES =20).

Press **ENTER** and the computer will beep three times and display the unbiased estimate of the standard error of estimate. S.E. EST = 1.09305E 00

Press **ENTER**. The slope of the trend line will be displayed. SLOPE = 1.23456E 00

Press **ENTER** and the computer will display the Y-intercept for the trend line. INTERCEPT = 1.33333E 01

Press **ENTER** again and the following message will appear: FORECASTING FOLLOWS.

Press **ENTER**. The computer will ask, INDEX ?\_\_.

To obtain a forecast (predicted value) for a future period (year, month, week, etc.) you must enter the number associated with that period. For example, if you entered data for 12 periods (coded 0 through 11), and want to predict the value of the 13th period type **12** and press **ENTER**. (Index number = desired period number **-1**.)

The computer will display the predicted value:  
FORECAST = 3.33333E 01

Press **ENTER**. You will be asked for another index number. When you are finished making predictions just press **ENTER**. The computer will beep three times and display the standard error of estimate.

To re-run the program (using new data), press **SHIFT SPC**.

## Sample Run

### Computer Displays:

FORECASTING  
(c) 1980 TANDY CORP.  
FIRST VALUE ?  
VALUE #2  
?  
VALUE #3  
?  
VALUE #4  
?  
VALUE #5  
?  
VALUE #6  
?  
VALUE #7  
?  
# OF VALUES = 6

(Calculate and beep)

S.E. EST. = 5.010463-01  
SLOPE = 1.12285E 00  
INTERCEPT = 6.76190E-01  
FORECASTING FOLLOWS  
INDEX ?

### You Type:

**8 ENTER**

**1 9 ENTER**

**2 8 ENTER**

**4 1 ENTER**

**4 4 ENTER**

**6 9 ENTER**

**ENTER**

**ENTER**

**ENTER**

**ENTER**

**ENTER**

**6 ENTER**

**Computer Displays:****You Type:**

FORECAST = 7.41333E 00

INDEX ?

1 0 ENTER

FORECAST = 1.19047E 01

INDEX ?

ENTER

(Beep)

S.E. EST + 5.01046E-01

**Caution:** Forecasting involves using historical data to predict future trends. You should be aware of the many factors which affect the actual values of future observations and use other information in conjunction with the output from this program.

## Seasonal Variation

This program calculates adjusted monthly or quarterly seasonal indexes using the ratio-to-centered-moving-average method. The data for two years (24 consecutive months of 8 consecutive quarters) are entered after which the seasonal indexes are displayed.

### Instructions

Load the Seasonal Variation program (**C****L****O****A****D** **"S****V****"** **ENTER**). Press **SHIFT** **SPC**. The computer will display, SEASONAL VARIATION.

Press **ENTER** and the computer will ask, MONTH/QUARTER (M/Q) ?\_\_

If the data is for months, enter an **M**. For quarterly data enter a **Q**. The computer will display, MONTH 1 or QUARTER 1 and will ask, DATA ?\_\_

Enter the data value for the first month or quarter. The computer will ask for data for 24 months or 8 quarters and will then begin calculations. It will take a while for all calculations to be completed. The computer will then beep three times and display, SEASONAL INDEXES FOLLOW.

Press **ENTER**. The computer will display, MONTH #1 or QUARTER #1.

Press **ENTER** again to view the seasonal index for that month or quarter. Continue pressing **ENTER** to obtain all 12 monthly or 4 quarterly indexes. After the last seasonal index is displayed the computer will beep three times and the seasonals can be viewed again.

To enter new data press **SHIFT** **SPC**.

### Sample Run

#### Computer Displays:

#### You Type:

SEASONAL VARIATION  
(c) 1980 TANDY CORP.  
MONTH/QUARTER (M/Q) ?  
QUARTER 1  
DATA ?  
QUARTER 2  
DATA ?  
QUARTER 3  
DATA ?  
QUARTER 4  
DATA ?  
QUARTER 5  
DATA ?  
QUARTER 6  
DATA ?  
QUARTER 7  
DATA ?

**Q** **ENTER**  
**1****2****6****.****0****0** **ENTER**  
**1****0****8****.****0****0** **ENTER**  
**1****4****4****.****5****3** **ENTER**  
**1****3****0****.****8****0** **ENTER**  
**1****1****9****.****7****5** **ENTER**  
**1****0****6****.****0****0** **ENTER**  
**1****5****1****.****2****0** **ENTER**



Computer Displays:

You Type:

QUARTER 8

DATA ?

1 3 3 . 0 0 ENTER

(Calculate and beep)

SEASONAL INDEXES FOLLOW

ENTER

QUARTER # 1

ENTER

0.957514

ENTER

QUARTER # 2

ENTER

0.840183

ENTER

QUARTER # 3

ENTER

1.151567

ENTER

QUARTER # 4

ENTER

1.050734

ENTER

SEASONAL INDEXES FOLLOW

## Moving Average

A data set consisting of up to 60 values can be averaged using this program. The number of data points comprising the moving average can be changed without having to re-enter the original data. All even-item moving averages are automatically centered by taking a 2-item moving total before averaging.

## Instructions

Load the Moving Average program (**C****L****O****A****D** **"****M****A****"** **ENTER**). Press **SHIFT** **SPC**. The computer will display, MOVING AVERAGE.

Press **ENTER** and the computer will display, DATA VALUE # 1 and will ask, ?\_\_.

Enter your first data value. The computer will again ask for a data value. Continue entering your data. Then, after the last value has been entered, press **ENTER**. The computer will display (for example), # OF VALUES = 24.

Press **ENTER** again. The computer will ask, # ITEMS IN AVG ?\_\_.

Enter the number of items (data values) you want to comprise the moving average. The computer will calculate the averages (this will take a while) and beep three

times. The following message will appear: MOVING AVERAGES FOLLOW.

Press **ENTER**. The computer will display (in the case of a 4 item moving average), AVERAGE FOR ITEM # 4.

Press **ENTER** again to view the value of the moving average for that item. Continue pressing **ENTER** to obtain all of the averages. After the last average has been displayed the computer will again ask, # ITEMS IN AVG ?\_\_.

If you want to change the number of items comprising the moving average, enter the appropriate value. If you want to calculate moving averages for a new set of data just press **ENTER** and the program will run again from the beginning.

## Sample Run

### Computer Displays:

MOVING AVERAGE  
(c) 1980 TANDY CORP.  
DATA VALUE # 1  
?  
DATA VALUE # 2  
?  
DATA VALUE # 3  
?  
DATA VALUE # 4  
?

### You Type:

**1****2** **ENTER**

**1****4****.****2** **ENTER**

**1****6****.****5** **ENTER**

**1****3** **ENTER**

**Computer Displays:**

DATA VALUE # 5

?

DATA VALUE # 6

?

DATA VALUE # 7

?

DATA VALUE # 8

?

DATA VALUE # 9

?

DATA VALUE # 10

?

DATA VALUE # 11

?

DATA VALUE # 12

?

# OF VALUES = 11

# ITEMS IN AVG ?

(Calculate and beep)

MOVING AVERAGES FOLLOW

AVG FOR ITEM # 3

14.23333333

AVG FOR ITEM # 4

14.56666667

AVG FOR ITEM # 5

15.63333333

**You Type:**

1 7 . 4 ENTER

1 1 . 7 ENTER

1 4 ENTER

1 6 . 7 5 ENTER

1 0 . 2 ENTER

1 4 . 5 ENTER

1 2 . 3 ENTER

ENTER

3 ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

**Computer Displays:**

AVG FOR ITEM # 6

14.03333333

AVG FOR ITEM # 7

14.36666667

AVG FOR ITEM # 8

14.15

AVG FOR ITEM # 9

13.65

AVG FOR ITEM # 10

13.81666667

AVG FOR ITEM # 11

12.33333333

# ITEMS IN AVG ?

**You Type:**

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

## Normal/t/F Distributions

Given a mean, standard deviation, and a value for X, this program will return the corresponding Z score, the value of the normal density function  $f(X)$ , the cumulative percentile  $P(X)$ , and the area under the normal curve between X and the mean. Any number of X values may be evaluated without having to re-enter the mean and standard deviation.

The program will calculate one-tail or two-tail probabilities for the t distribution given a t value and the degrees of freedom. Additionally, you may input an F-ratio value, the degrees of freedom in the numerator, and the degrees of freedom in the denominator and the computer will calculate the right-tail probability.

All calculations for the normal, t, and F functions are performed using standard approximation formulas.

## Instructions

Load the distributions program ( **CLOAD** **"N T F"** **ENTER** ). Press **SHIFT SPC**. The computer will display, NORMAL/T/F DISTRIBUTIONS.

Press **ENTER** and the computer will ask, WHICH DISTR (N.T.F) ? \_.

If you want to perform calculations using the normal distribution, enter an **N**, for the t distribution enter a **T**, for the F distribution enter an **F**. Depending on the distribution you have chosen, the computer will respond as follows:

### 1. Normal Distribution

The computer will ask, MEAN ? \_.

Enter the mean for your data (enter **0** for the standard normal distribution). The computer will ask, SD ? \_.

Enter the standard deviation for your data (enter **1** for the standard normal distribution). The computer will ask, X VALUE ? \_.

Enter a value of X from your data. The computer will display (for example), Z SCORE = 0.25000.

Press **ENTER** to obtain the value of the function at X.  $F(X) = 3.86668E-01$

Press **ENTER** again for the cumulative percentile,  $P(X)$ .  $\%ILE = 59.87085$ , and again to obtain the area under the normal curve between the X value and the mean (MU).  $AREA(MU,X) = 0.09870$

Press **ENTER**. The computer will ask for another X value. If you do not want to evaluate other values of X press **ENTER**. The computer will ask for a new mean. Enter the mean for the next normal distribution or just press **ENTER** to return to: WHICH DISTR (N,T,F) ? \_.

## 2. t Distribution

The computer will ask, 1 TAIL OR 2 TAIL ? \_.

Enter a **1** or a **2** to indicate the type of probability approximation you desire. The computer will ask, T VALUE ? \_.

Enter the value of t for which you want a probability estimate. The computer will ask, DF ? \_.

Enter the degrees of freedom associated with the t value. The computer will calculate the probability and display, PROB = 0.03724.

Press **ENTER** and the computer will ask for another t value. If you do not want to calculate another probability, just press **ENTER**. The computer will again ask, WHICH DISTR (N,T,F) ? \_.

## 3. F Distribution

The computer will ask, F VALUE ? \_.

Enter the value of the F-ratio. The computer will ask, DV 1 ? \_.

Enter the degrees of freedom in the numerator (lesser degrees of freedom). The computer will ask, DV 2 ? \_.

Enter the degrees of freedom in the denominator (greater degrees of freedom). The computer will display the probability estimate. PROB = 0.03150

## Sample Run

Computer Displays:

You Type:

NORMAL/T/F DISTRIBUTIONS

(c) 1980 TANDY CORP.

WHICH DISTR (N,T,F) ?

MEAN ?

SD ?

X VALUE ?

Z SCORE = 1.03846

F(X) = 2.32668E-01

%ILE = 85.04801

AREA(MU,X) = 0.35048

X VALUE ?

MEAN ?

WHICH DISTR(N,T,F) ?

1 TAIL OR 2 TAIL ?

T VALUE ?

**N** **ENTER**  
**4** **5** **.** **2** **ENTER**  
**1** **0** **.** **2** **ENTER**  
**5** **6** **ENTER**  
**ENTER**  
**ENTER**  
**ENTER**  
**ENTER**  
**ENTER**  
**T** **ENTER**  
**2** **ENTER**  
**2** **.** **4** **7** **ENTER**

**Computer Displays:**

1 DF ?  
PROB = 0.01760  
T VALUE ?  
WHICH DISTR (N,T,F) ?  
3 F VALUE ?  
DF 1 ?  
DF 2 ?  
PROB = 0.00080  
F VALUE ?

**You Type:**

3 5 ENTER  
ENTER  
ENTER  
F ENTER  
8 . 6 6 ENTER  
2 ENTER  
6 0 ENTER  
ENTER

## Descriptive Statistics

The descriptive statistics program will provide you with an overall picture of your data set. The data set can be grouped or ungrouped and can consist of up to 80 values. Output from the program includes sample statistics (sample size, mean, median, mode, sum, sum of squares, variance, standard deviation) and unbiased estimates of population parameters (variance, standard deviation).

### Instructions

Load the Descriptive Statistics program ( **C** **L** **O** **A** **D** **"** **D** **S** **"** **ENTER**). Press **SHIFT** **SPC**. The computer will display, DESCRIPTIVE STATISTICS.

Press **ENTER** and the computer will ask, GROUPED DATA (Y/N)? \_\_\_\_.

If you want to enter your data in grouped form enter a **Y**, otherwise enter an **N**. The computer will then ask, MEDIAN AND MODE (Y/N)? \_\_\_\_.

You may elect to skip the calculations for median and mode if you do not need these statistics. The program will run significantly faster if the median and mode calculations are skipped because the data will not have to be sorted. To skip the median and mode press **N**.

If you will be entering data in grouped form, the computer will ask, FREQ ? \_\_\_\_.

Enter the frequency (number of occurrences) for your first data value. The computer will then ask, VALUE ? \_\_\_\_.

Enter the data value corresponding to the frequency. The computer will continue asking for frequencies and data values. When all your data have been input press **ENTER**.

If you will be entering data as single values the computer will display, DATA VALUE # 1, and will ask, VALUE ? \_\_\_\_.

Enter your first data value. The computer will continue asking for data values. When all your data have been input press **ENTER**.

The computer will display (for example), # OF VALUES = 22.

Press **ENTER**. The computer will begin calculating statistics. This may take a while, especially if the median and mode are being obtained. The computer will beep three times and display, MEAN = 1.3768220E 02.

Press **ENTER** to obtain each sample statistic or population estimate. When all the results have been displayed the computer will beep three times and begin to display the results again. If you want to re-run the program for a new data set press **SHIFT** **SPC**.

## Sample Run

Computer Displays:

You Type:

DESCRIPTIVE STATISTICS

(c) 1980 TANDY CORP.

GROUPED DATA (Y/N) ?

MEDIAN AND MODE (Y/N) ?

FREQ ?

VALUE ?

FREQ ?

VALUE ?

FREQ ?

VALUE ?

FREQ ?

VALUE ?

FREQ ?

# VALUES = 8

Y ENTER

Y ENTER

3 ENTER

4 5 . 6 ENTER

2 ENTER

2 2 . 5 ENTER

1 ENTER

1 6 . 8 ENTER

2 ENTER

3 1 ENTER

ENTER

(Calculate and beep)

MEAN = 3.2575000E 01

SUM = 2.6060000E 02

SUMSQ = 9.6577500E 02

V(SMP) = 1.2072187E 02

SD(SMP) = 1.0987350E 01

V(EST) = 1.3796785E 02

SE(EST) = 1.1745971E 01

MEDIAN = 3.1000000E 01

MODE = 4.5600000E 01

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER

ENTER



## Multiple Regression

This program calculates regression statistics for a set of data employing one or two predictor variables using the least squares method for fitting a straight line. You can obtain predicted values on the dependent variable by entering values for the predictors. Output from the program with two independent variables includes the constant and regression weights for the prediction equation, and the coefficient of determination ( $R^2$ ). With one independent variable, the output is simply a product-moment correlation ( $r$ ) and the corresponding regression equation. The prediction equations are of the form:

$$Y' = a + bX \quad (\text{one independent variable) and}$$

$$Y' = a + b_1X_1 + b_2X_2 \quad (\text{two independent variables}).$$

## Instructions

Load the Multiple Regression program ( **C** **L** **O** **A** **D** **"** **M** **R** **"** **ENTER** ). Press **SHIFT** **SPC**. The computer will display, MULTIPLE REGRESSION.

Press **ENTER** and the computer will ask, # OF IV (1 OR 2)?\_\_.

Enter the number of independent variables. The computer will display SUBJECT # 1 and will ask, IV#1 ?\_\_.

Enter the value of the first predictor variable for the first subject (data point). If you specified two independent variables the computer will next ask for the value of the second predictor for your first subject. Then the computer will ask, DV ?\_\_.

Enter the value of the dependent variable for the subject. The computer will indicate that it is ready for data on the next subject and will ask for the value on IV#1. Continue entering data for each subject in your data set. To indicate that all of your data have been entered, just press **ENTER** when the computer asks for IV#1 for the next subject. The computer will display (for example), # OF SUBJECTS = 25.

Press **ENTER** and the computer will begin calculating the regression statistics. The computer will beep three times and display, STATISTICS FOLLOW.

Press **ENTER**. The constant (a) for the regression equation will be displayed. Continue pressing **ENTER** to obtain the regression weight (b) for each independent variable and the coefficient of determination ( $R^2$ ) or product-moment correlation coefficient ( $r$ ). The computer will then display, PREDICTIONS FOLLOW.

Press **ENTER** and the computer will ask, ENTER IV#1 ?\_\_.

Enter a value for the first predictor variable. If you are using two independent variables, the computer will ask for the value on the second predictor. Then the computer

will display the predicted value of Y based on the regression equation. For example,  $PRED\ Y = 3.0722561E\ 02$ .

Press **ENTER**. You will be asked for another value for IV#1. Continue to enter values on the predictor variables to obtain predicted values of Y. Then, when you are finished predicting, just press **ENTER** instead of entering a value. The computer will beep three times and again display, STATISTICS FOLLOW.

You may view the statistics again by pressing **ENTER** or run another set of data by pressing **SHIFT SPC**.

## Sample Run

### Computer Displays:

You Type:

MULTIPLE REGRESSION

(c) 1980 TANDY CORP

# OF IV (1 OR 2) ?

**2 ENTER**

SUBJECT # 1

IV#1 ?

**1 0 ENTER**

IV#2 ?

**4 ENTER**

DV ?

**8 0 ENTER**

SUBJECT # 2

IV #1 ?

**1 5 ENTER**

IV#2 ?

**7 ENTER**

DV ?

**1 0 3 ENTER**

SUBJECT # 3

IV#1 ?

**8 ENTER**

### Computer Displays:

IV#2 ?

DV ?

SUBJECT # 4

IV#1 ?

IV#2 ?

DV ?

SUBJECT # 5

IV#1 ?

# OF SUBJECTS = 4

(Calculate and beep)

STATISTICS FOLLOW

CONSTANT = 4.7158878E 01

COEF/IV#1 = 1.4299065E 00

COEF/IV#2 = 4.8847352E 00

R SQUARE = 0.998252

PREDICTIONS FOLLOW

ENTER IV#1 ?

ENTER IV#2 ?

PRED Y = 7.95669782E 01

ENTER IV#1 ?

STATISTICS FOLLOW

### You Type:

**3 ENTER**

**7 4 ENTER**

**2 0 ENTER**

**7 ENTER**

**1 1 0 ENTER**

**ENTER**

**ENTER**

**ENTER**

**ENTER**

**ENTER**

**ENTER**

**ENTER**

**9 ENTER**

**4 ENTER**

**ENTER**

**ENTER**

## Gompertz Curve Analysis

This program fits a set of data (up to 90 values) to a growth curve called the Gompertz curve. The formula for the curve is:  $y = ab^{c^x}$  and can be transformed into the logarithmic form:  $\log y = \log a + (\log b)c^x$ .

An unbiased estimate of the standard error of estimate and the constants ( $\log a$ ,  $\log b$ , and  $c$ ) are calculated by the program and displayed. Additionally, you can obtain "predicted" values of  $y$  for any value of  $x$ .

### Instructions

Load the Gompertz Curve program ( **C** **L** **O** **A** **D** **"G C"** **ENTER**). Press **SHIFT** **SPC**. The computer will display, GOMPERTZ CURVE ANALYSIS.

Press **ENTER** and the computer will ask, TOTAL N ?\_\_.

Enter the total number of values in your data set. The total **must** be a multiple of three for the approximation function to operate properly. If you input a value which is not a multiple of three, an error message will appear.

Next the computer will display, DATA SET # 1 and will ask, ?\_\_.

Your data must be entered in **order** and should represent values or measurements taken at approximately equal intervals in time. For use in the prediction section of the program each data value or measurement has an "index" which represents its position in the data set. The index of the first data value is 0, the index of the second value is 1, and so on. The index values are **not** entered into the computer but are implicit since you will be entering your data sequentially.

Enter your first data value. The computer will ask for more data. When the first third of your data have been entered the computer will display, DATA SET # 2 and VALUE # 1 will ask, ?\_\_.

Enter the next third of your data values. The computer will then ask for the last third. After all values have been entered the computer will display, ALL DATA ENTERED and will begin fitting the data. When calculations are complete the computer will beep three times and display the estimated standard error of estimate. S. E. EST = 1.255403E-01.

Press **ENTER** to obtain the other constants for the curve formula. Again press **ENTER**. The computer will display, PROJECTIONS FOLLOW and ask, INDEX # ?\_\_.

Enter the **index** value of the time (year, month, etc.) for which you want a projection (predicted  $y$  value). Remember that the first data value has an index of 0.

The computer will display the projection in the following manner. PROJ Y = 4.968762E 00.

Press **ENTER**. The computer will again ask for an index value. When you are finished obtaining projections just press **ENTER**. The computer will beep three times and begin listing the analysis results again.

If you want to fit a new set of data to the curve press **SHIFT** **SPC**.

## Sample Run

### Computer Displays:

### You Type:

GOMPERTZ CURVE ANALYSIS

(c) 1980 TANDY CORP.

TOTAL N ?

**1 2 ENTER**

DATA SET # 1

VALUE # 1

?

**4 3 ENTER**

VALUE # 2

?

**5 0 ENTER**

VALUE # 3

?

**5 5 ENTER**

VALUE # 4

?

**6 1 ENTER**

### Computer Displays:

DATA SET # 2

VALUE # 1

?

VALUE # 2

?

VALUE # 3

?

VALUE # 4

?

DATA SET # 3

VALUE # 1

?

VALUE # 2

?

VALUE # 3

?

VALUE # 4

?

ALL DATA ENTERED

(Calculate and beep)

S.E. EST = 1.245614E 01

LOG A = 2.878722E 00

LOG B = -1.310416E 00

C = 9.215897E-01

PROJECTIONS FOLLOW

INDEX # ?

PROJ Y = 2.436917E 02

INDEX # = ?

### You Type:

**7 8 ENTER**

**9 4 ENTER**

**1 2 2 ENTER**

**1 6 0 ENTER**

**1 7 3 ENTER**

**1 8 5 ENTER**

**1 9 2 ENTER**

**2 0 1 ENTER**

**ENTER**

**ENTER**

**ENTER**

**ENTER**

**1 2 ENTER**

**2 5 ENTER**

**Computer Displays:**

PROJ Y = 5.111704E 02

INDEX # ?

PROJ Y = 8.579146E 01

INDEX # ?

S.E. EST = 1.245614E 01

**You Type:**

**4** **ENTER**

**ENTER**

## Management Decisions

The management decisions program consists of eight subprograms representing formulas which can help in making business decisions. The subprograms include break-even analysis, optimum order quantity, make versus buy decisions, profit margin calculations, markup calculations, price elasticity of demand, manufacturing cost predictions based on a learning curve, and random sample selection. The formulas used in each of the subprograms are listed below. Further information on each topic may be found in textbooks which cover business statistics, managerial accounting, marketing, etc.

### Break-Even Analysis:

$$U = \frac{G + F}{P - V} \text{ where,}$$

- G = Gross profit desired (0 for breakeven point)
- F = Fixed costs
- V = Variable cost per unit produced
- P = Selling price of each unit
- U = Number of units which must be produced to attain the gross profit (if G is 0, then U is the break-even point).

**Optimum Order Quantity** (re-ordering whenever inventory is 0):

$$Q = \sqrt{\frac{2OD}{C}} \text{ where,}$$

- O = Cost per order (or cost of setting up a production run)
- D = Demand in units over a period of time
- C = Cost of carrying one unit in inventory for the same period of time (includes financing costs, etc.)
- Q = The optimum order size in units

### Make vs. Buy:

$$C = M + L + V + F \text{ where,}$$

- M = Direct cost of materials to produce one unit
- L = Direct cost of labor to produce one unit
- V = Variable costs per unit
- F = Fixed costs per unit (see note in text)
- C = Cost of producing one unit

$$A = P - C \text{ where,}$$

- P = Cost to purchase one unit
- C = Cost to produce one unit
- A = Net advantage per unit if produced instead of purchased (will be a negative value if purchasing costs less than producing)

## Profit Margin:

$$M = \frac{P}{S} * 100 \quad \text{where,}$$

- P = Net profit in dollars  
S = Total sales in dollars  
M = Profit margin on sales

**Notes:** If you input total assets in place of total sales, M will be your return on total assets.

If you enter net worth in place of total sales, M will be your return on net worth. This formula is also a handy way to calculate simple percentages.

## Markup:

$$M_1 = P - C \quad M_2 = \frac{M}{S} * 100 \quad M_3 = \frac{M}{C} \quad \text{where,}$$

- P = Selling price in dollars  
C = Cost in dollars  
M<sub>1</sub> = Markup in dollars  
M<sub>2</sub> = Markup as a percentage of selling price  
M<sub>3</sub> = Markup as a percentage of cost

**Note:** To determine an appropriate selling price for an item, enter the cost and various selling prices until the markup percentage falls into the desired range.

## Price Elasticity:

$$ED = \frac{\frac{D_Q}{(Q_N + Q_O)}}{2} \div \frac{\frac{D_P}{(P_N + P_O)}}{2} \quad \text{where,}$$

- Q<sub>N</sub> = Quantity sold at the new price  
Q<sub>O</sub> = Quantity sold at the old price  
D<sub>Q</sub> = Q<sub>N</sub> - Q<sub>O</sub>  
P<sub>N</sub> = New Price  
P<sub>O</sub> = Old Price  
D<sub>P</sub> = P<sub>N</sub> - P<sub>O</sub> where D<sub>P</sub> ≠ 0  
ED = Elasticity of demand

**Note:** If the old and new prices are the same, a division by zero error will result.

## Manufacturing Cost Curve:

$$R = 10 \left( \frac{\left( \log \frac{L}{F} \right) \log 2}{\log N} \right) \quad \text{where,}$$

- N = Number of units already produced  
F = Cost of producing the first unit  
L = Cost of producing the last (Nth) unit  
R = Learning Factor

$$C_j = F * j^{\left( \frac{\log R}{\log 2} \right)} \quad \text{where,}$$

- J = Future unit for which an estimated cost is desired  
 C<sub>j</sub> = Estimated cost of producing the Jth unit

## Random Sample:

$R_j = \text{INT}((F * 1101 - \text{INT}(F)) * \text{INT}(N) + 1.5)$  where,

N = Population size

F = Variable which changes value upon each iteration (execution of the formula) and initially set at .654321

R<sub>j</sub> = Pseudo-random number between 1 and N for the jth iteration (the formula is executed repeatedly until the desired number of random integers have been obtained)

**Note:** This formula will produce duplicate random integers. If you want to sample **without** replacement, disregard any duplicate numbers that are generated.

## Instructions

Load the Management Decisions program ( **C** **L** **O** **A** **D** **"** **M** **D** **"** **ENTER** ). Press **SHIFT** **SPC**. The computer will display, MANAGEMENT DECISIONS.

Press **ENTER**. The computer will beep three times and display, ENTER Y TO CHOOSE OPTION.

Continue pressing **ENTER**. When the procedure or analysis that you want appears on the display enter a **Y**. The program will transfer to the appropriate subprogram and will respond as follows.

### 1. Break-Even Analysis

The computer will ask, FIXED COSTS ?\_\_.

Enter the fixed costs of producing the item. The computer will ask, VAR COSTS ?\_\_.

Enter the variable costs for producing one unit. The computer will ask, PRICE ?\_\_.

Enter the selling price per unit. The computer will ask, PROFIT ?\_\_.

Enter the amount of profit you desire to realize by selling the item. If you want to find the break-even point enter **0**. The computer will display the number of units which must be sold for the amount of profit that you entered. # UNITS = 3275.

Press **ENTER** and the computer will ask, FIXED COSTS ?\_\_.

If you want to perform another break-even analysis, enter a value. If you want to re-run the program from the beginning press **SHIFT** **SPC**.



## 2. Optimum Order Quantity

The computer will ask, COST PER ORDER ?\_\_.

Enter the total cost for placing one order. The computer will ask, STORAGE COST ?\_\_.

Enter the amount it costs to carry one unit in inventory for one time period (e.g., one year). The computer will ask, DEMAND ?\_\_.

Enter your estimate of the demand, in units, for the item over the same time period. The computer will calculate the optimum order size and display, OPTIMUM QTY = 238.

Press **[ENTER]** and the computer will again ask for the cost per order. If you do not want to calculate another optimum order size press **[SHIFT]** **[SPC]**.

## 3. Make vs. Buy

The computer will ask, COST TO BUY ?\_\_.

Enter the cost of purchasing one unit. The computer will ask, MATERIAL ?\_\_.

Enter the direct cost of materials needed to produce one unit. The computer will ask, LABOR ?\_\_.

Enter the direct labor costs involved in producing one unit. The computer will ask VAR COSTS ?\_\_.

Enter the variable costs for producing one unit. The computer will ask, FIXED COSTS ?\_\_.

Enter the total fixed production costs allocable to the product. If those costs will be incurred whether or not the item is produced, and if there is no productive alternative for the use of the idle facilities, enter **[0]**.

The computer will display the cost to make one unit of the item (for example), MAKE COST \$ 2.54

Press **[ENTER]**. The computer will display the advantage of producing the item rather than purchasing it. ADVANTAGE \$ 0.28

If the displayed value is negative, it is more profitable to purchase the item. Press **[ENTER]** and the computer will again ask for the cost to buy. If you do not want to make another make vs. buy decision press **[SHIFT]** **[SPC]**.

## 4. Profit Margin Calculations

The computer will ask, NET PROFIT ?\_\_.

Enter your net profit and the computer will ask, SALES ?\_\_.

Enter your total sales, your total assets, or your net worth. The computer will reply (for example),  
PROFIT MARGIN = 8.23%.

The displayed value is your profit margin on sales, your return on total assets, or your return on net worth. You may also use the profit margin formula to solve simple percentage problems.

Press **[ENTER]**. The computer will again ask for your net profit. If you do not want to perform another profit margin calculation press **[SHIFT]** **[SPC]**.

## 5. Markup Calculations

The computer will ask, COST ?\_\_.

Enter your cost for the item. The computer will ask, PRICE ?\_\_.

Enter the selling price of the item and the computer will display (for example), MARKUP \$ 2.15

Press **[ENTER]**. The computer will display the markup as a percentage of selling price. 38.39% OF PRICE

Again press **[ENTER]**. The computer will display the markup as a percentage of cost. 62.31% OF COST

Press **[ENTER]** and the computer will again ask for

an item cost. If you do not want to calculate another markup press **[SHIFT]** **[SPC]**.

## 6. Price Elasticity of Demand

The computer will ask, FIRST PRICE ?\_\_.

Enter the "old" price of the item. The computer will ask, FIRST QTY ?\_\_.

Enter the number of units of the item which were sold at the old price. The computer will ask, PRICE ?\_\_.

Enter the price of the item after the first price change. The computer will ask, QTY ?\_\_.

Enter the quantity sold at the new price. The computer will calculate the elasticity of demand value and will display, E.D. = 2.473891525.

Press **[ENTER]**. The computer will ask for another new price and the corresponding quantity. If you want to find the elasticity for a different item press **[ENTER]** instead of entering a new price. The computer will again ask for the old price. When you are finished calculating elasticities press **[SHIFT]** **[SPC]**.

## 7. Manufacturing Cost Curve

The computer will ask, # UNITS MADE ?\_\_.

Enter the number of units that have been produced.  
The computer will ask, COST OF FIRST ?\_\_.

Enter the manufacturing cost of the first unit. The  
computer will ask, COST OF LAST ?\_\_.

Enter the cost of producing the last unit. The  
computer will calculate the learning factor and  
display, LEARNING FACTOR 0.945.

Press **ENTER** and the computer will ask,  
WHICH UNIT ?\_\_.

Enter the unit for which you want an estimate of  
production cost. The computer will display the  
projected cost as follows COST \$ 43.27.

Press **ENTER**. The computer will again ask,  
WHICH UNIT ?\_\_.

If you want to estimate production costs for a  
different product press **ENTER** and the computer  
will again ask, # UNITS MADE ?\_\_.

When you are finished using the production costs  
section of the program press **SHIFT SPC**.

## 8. Random Sample (Pseudo-random Integer Generator)

The computer will ask, POPULATION N ?\_\_.

Enter the total number of subjects or observations  
in your data set. The computer will display a random  
integer between 1 and N, inclusive. Continue  
pressing **ENTER** until you have obtained the  
desired number of random integers.

**Note:** The program will produce duplicate random  
numbers. If you want to sample **without** replace-  
ment simply disregard the duplicate numbers.

When you are finished selecting your sample press  
**SHIFT SPC**.

## Sample Runs

### Computer Displays:

MANAGEMENT DECISIONS

(c) 1980 TANDY CORP.

ENTER Y TO CHOOSE OPTION

BREAK-EVEN ANALYSIS ?

FIXED COSTS ?

VAR COSTS ?

PRICE ?

PROFIT ?

# UNITS = 1655

FIXED COSTS ?

You Type:

Y ENTER  
1 2 0 0 0 ENTER  
5 . 2 5 ENTER  
1 2 . 5 0 ENTER  
0 ENTER  
ENTER

MANAGEMENT DECISIONS

(c) 1980 TANDY CORP.

ENTER Y TO CHOOSE OPTION

BREAK-EVEN ANALYSIS ?

OPTIMUM ORDER QTY ?

COST PER ORDER ?

STORAGE COST ?

DEMAND ?

OPTIMUM QTY = 553

COST PER ORDER ?

ENTER  
Y ENTER  
3 5 . 1 4 ENTER  
3 . 1 0 ENTER  
1 3 5 0 0 ENTER  
ENTER

MANAGEMENT DECISIONS

(c) 1980 TANDY CORP.

ENTER Y TO CHOOSE OPTION

BREAK-EVEN ANALYSIS ?

OPTIMUM ORDER QTY ?

ENTER  
ENTER

### Computer Displays:

MAKE VS. BUY ?

COST TO BUY ?

MATERIAL ?

LABOR ?

VAR COSTS ?

FIXED COST ?

MAKE COST \$ 2.99

ADVANTAGE \$ 1.87

COST TO BUY ?

You Type:

Y ENTER  
4 . 8 6 ENTER  
1 . 6 0 ENTER  
 . 9 2 ENTER  
 . 4 7 ENTER  
0 ENTER  
ENTER  
ENTER

MANAGEMENT DECISIONS

(c) 1980 TANDY CORP.

ENTER Y TO CHOOSE OPTION

BREAK-EVEN ANALYSIS ?

OPTIMUM ORDER QTY ?

MAKE VS BUY ?

PROFIT MARGIN ?

NET PROFIT ?

SALES ?

PROFIT MARGIN = 38.97%

NET PROFIT ?

ENTER  
ENTER  
ENTER  
Y ENTER  
2 8 2 5 0 ENTER  
7 2 4 7 5 ENTER  
ENTER

MANAGEMENT DECISIONS

(c) 1980 TANDY CORP.

ENTER Y TO CHOOSE OPTION

BREAK-EVEN ANALYSIS ?

OPTIMUM ORDER QTY ?

MAKE VS BUY ?

PROFIT MARGIN ?

ENTER  
ENTER  
ENTER  
ENTER

**Computer Displays:**

MARKUP ?  
 COST ?  
 PRICE ?  
 MARKUP \$ 1.84  
 24.56% OF PRICE  
 32.56% OF COST  
 COST ?

MANAGEMENT DECISIONS  
 (c) 1980 TANDY CORP.  
 ENTER Y TO CHOOSE OPTION

BREAK-EVEN ANALYSIS ?  
 OPTIMUM ORDER QTY ?  
 MAKE VS BUY ?  
 PROFIT MARGIN ?  
 MARKUP ?

PRICE ELASTICITY ?  
 FIRST PRICE ?  
 FIRST QTY ?  
 PRICE ?  
 QTY ?

E.D. = 2.718639886

PRICE ?

QTY ?

E.D. = 3.730215828

PRICE ?

FIRST PRICE ?

**You Type:**

Y ENTER  
 5 6 5 ENTER  
 7 4 9 ENTER  
 ENTER  
 ENTER  
 ENTER

ENTER  
 ENTER  
 ENTER  
 ENTER  
 ENTER  
 Y ENTER  
 1 2 9 5 ENTER  
 3 5 6 ENTER  
 1 0 7 9 ENTER  
 5 9 0 ENTER  
 ENTER  
 9 9 5 ENTER  
 8 0 0 ENTER  
 ENTER  
 ENTER

**Computer Displays:**

MANAGEMENT DECISIONS  
 (c) 1980 TANDY CORP.

ENTER Y TO CHOOSE OPTION

BREAK-EVEN ANALYSIS ?  
 OPTIMUM ORDER QTY ?  
 MAKE VS BUY ?  
 PROFIT MARGIN ?  
 MARKUP ?

PRICE ELASTICITY ?  
 MFG COST CURVE ?

# UNITS MADE ?

COST OF FIRST ?

COST OF LAST ?

LEARNING FACTOR 0.993

WHICH UNIT ?

COST \$ 1164.29

WHICH UNIT ?

COST \$ 1161.78

WHICH UNIT ?

# UNITS MADE ?

MANAGEMENT DECISIONS

(c) 1980 TANDY CORP.

ENTER Y TO CHOOSE OPTION

BREAK-EVEN ANALYSIS ?  
 OPTIMUM ORDER QTY ?  
 MAKE VS BUY ?  
 PROFIT MARGIN ?

**You Type:**

ENTER  
 ENTER  
 ENTER  
 ENTER  
 ENTER  
 Y ENTER  
 2 0 0 ENTER  
 1 2 4 2 ENTER  
 1 1 8 0 ENTER  
 ENTER  
 8 0 0 ENTER  
 ENTER  
 1 0 0 0 ENTER  
 ENTER  
 ENTER

ENTER  
 ENTER  
 ENTER  
 ENTER

## Computer Displays:

MARKUP ?  
PRICE ELASTICITY ?  
MFG COST CURVE ?  
RANDOM SAMPLE ?  
POPULATION N ?  
415  
0  
137  
306  
POPULATION N ?

## You Type:

ENTER  
ENTER  
ENTER  
Y ENTER  
0 5 0 ENTER  
ENTER  
ENTER  
ENTER  
SHIFT SPC

## Appendix A — Backups

A Backup is a tape copy of a program and is an extremely effective method of insuring that an accident or equipment fault will not result in the loss of software. Your first action as owner of the Business Statistics and Marketing Package should be to make working copies of the original cassette(s) and then put the originals away in a safe place. Although it may be possible to make direct copies using two cassette recorders or on cassette duplicating equipment, the most RELIABLE method is to use the computer itself to make the Backups. Also, for frequently used programs, you may wish to put them on separate cassettes for easier loading. Here are step-by-step instructions for making a Backup:

1. Connect the Cassette Interface to the cassette recorder and install the computer in the Cassette Interface.
2. Place the cassette containing the program(s) to be copied in the recorder and either rewind the tape to the beginning or position the tape to a blank area just prior to the desired program. Place the recorder in the "PLAY" mode.
3. Turn on the computer, make sure that it is either in the DEF or RUN mode and type in:  
`CLOAD?"name"` ("name" is the name of the program to be copied).

4. When the program has been loaded into the computer and the cassette has stopped, remove the cassette and replace it with the cassette which is to receive the program copy. Either rewind the tape to the beginning or position it to the point where the copy is to start. You should leave about ten seconds of blank tape if the copy is to start at the beginning of the cassette or about five seconds of blank space if the copy is to follow another program on the same cassette. Place the recorder in the "RECORD" mode.

5. Make sure that the computer is in either the DEF or RUN mode and type in:

`CSAVE?"name"`

The recorder will start and record your program.

6. Now rewind the cassette to the blank space just prior to the program, put the recorder into the "PLAY" mode and type in:

`CLOAD?"name"`

This is the computer's verifying function and the recorder will start and compare the cassette copy with the program in the computer's memory. If the copy is good, the recorder will stop at the end of the program and the > prompt will re-appear on the display. If an error occurred during the verification, you'll get an error display such as: 5 . . . . .

If this happens, check the recorder volume setting and try the CLOAD? function once more. If you still get an error, the tape copy is probably bad and you should CSAVE the program once again and re-verify it. You may find that some brands of tape, especially the cheaper brands may not be of sufficient quality to insure reliable copying. Radio Shack Supertape or TRS-80 certified cassettes are recommended for best results.

7. Repeat Steps 1 through 6 for each program to be Backed-up.

8. Put the original cassettes away in a safe place and use them ONLY for making working copies.

## Appendix B — Maintenance

Maintenance of your Pocket Computer System is not difficult and attention to the simple points listed below should provide best reliability and satisfaction:

1. Keep your program cassettes in their boxes when not in use and don't expose them to extremes of temperature or magnetic fields. **NEVER** touch the exposed surface of the tape on the front edge of the cassette.

2. Clean and demagnetize the tape heads in the recorder at regular intervals. Follow the recommendations in the cassette recorder's manual.

3. Experience has shown that best program loading and saving reliability is achieved by operating the cassette recorder on batteries rather than AC.

4. Use only fresh alkaline type batteries in the recorder and Cassette Interface.

5. Always press the recorder's "STOP" key immediately after loading or saving a program. This will release the pressure on the rubber roller which pulls the tape so that the roller will not develop a permanent "flat" at the point of contact with the tape.

6. **ALWAYS** turn the computer OFF before installing it in, or removing it from the Cassette Interface.

7. After removing the computer from the Cassette Interface, be sure to re-install the protective plug to keep dirt out of the connector on the computer. Never touch the exposed contacts on the Cassette Interface.





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NOTE: Good data processing procedure dictates that the user test the program, run and test sample sets of data, and run the system in parallel with the system previously in use for a period of time adequate to insure that results of operation of the computer or program are satisfactory.

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10/03/80

The following errors were found in the Business Statistics and Marketing manual after it was printed.

On page 3, under the Sample Run, the "S.E. EST.=5.010463-01" should read "S.E. EST.=5.01046E-01"

On page 5, the forth sentence under "Seasonal Variation" should read "...secutive month OR 8 consecutive quarters)..."

On page 10, under Sample Run, the value give for SD? of 10.2, should be 10.4.

On page 27, the displayed value for a population sample of 650 should read as follows each time "ENTER" is pressed: 265,371,94,83 (instead of the value listed).

875-9059