Storing and Retrieving Register Contents From Program Control

By Rena Gillis

The following Miles Per Gallon Program demonstrates one important feature of the TI-95 Procalc™, the ability to store data within the unit. Once stored, the data registers can be recalled within program control to be updated and, consequently, stored back to the unit’s memory system or 8K RAM.

The first menu is used to recall the registers that have been stored in the memory file portion of the unit. In addition to recalling the proper registers, flags are set, as needed, to direct the calculator to return those registers to memory under the proper name. As you can see after LBL FR and LBL SC, CLR instructions are included to ensure that 0’s are in the display, directing the calculator to pick up the registers starting at 000. Anytime you want to pull a set of registers from the memory or 8K RAM, you need to “load” the starting register number to the display prior to the GET command. Immediately after the GET command, you see the file name, starting with the “+” character.

The next menu, LBL M1, begins the real “meat and potatoes” of the program. This is where the user can display (F1) previous data or begin computation with new data. F2 is used to enter the new mileage to the calculator. F3 is used to input the number of gallons just purchased. F4 is used to execute all computation, updating all of the registers with the new material and storing the registers to the memory file portion of the unit.

As you can see in step 0203, a CLR keystroke has been entered to clear all numbers from the display. Flag 1 is tested. If the flag has been set at LBL FR, program control will go to the program section (LBL F1) that will store the necessary registers under the appropriate name (in this case +MG). Please note that before the PUT command, number 0008. is displayed. This notation in the form of nnn.ss (n = number of registers. s = starting at register number) informs the calculator that it is to put a total of 8 registers, starting at register #000, to the file named +MG. Since the display had been cleared of any numerical value, 008. would be accepted as 008.00. If, in your particular case, you wanted to store 13 registers starting at register 4 to a file named +AA, you would need a command of 013.04 PUT +AA in your program (page 8-22 of the TI-95 Programming Guide).

To begin using this program, you must store the following registers and files to the memory file space in your unit: FILE for vehicle #1, +MG, vehicle #2, +M2. Registers for both vehicles are:

A Old mileage
B New mileage
C # of gallons purchased
D Miles driven between gas purchases
E Current MPG
F Frequency register (0 at beginning)
G Summation register for miles driven
H Summation register for MPG

The use of this method is limited only by your imagination. With this technique, you can update statistical values, a checkbook balance, experimental data on a scientific project, or even individual stock market purchases!

000 LBL CR DFN CLR CFG
0006 'ENTER VEHICLE #'1
0021 DFN F1:#1 @BFR
0028 DFN F2:#2 @MSC
0035 DFN F3:ESC@SEC HLT
0043 LBL FR CLR SF @01
0049 GET +MG GTL GO
0056 LBL SC CLR GET +M2
0064 LBL GO FIX @1
0069 LBL M1
0072 DFN F1:DSP@DS
0079 DFN F2:NEW@NW
0086 DFN F3:GAL@GGL
0093 DFN F4:CP@GCP
0100 DFN F5:BGN@BCR HLT
0108 LBL EC CLR DFN CLR
0114 FIX 9 RTN
0117 LBL NW IF=B GTL NE
0125 STO A RTN
0128 LBL GL STO C RTN
0134 LBL CP RCL A
0140 RCL B = STO D ST+ G
0147 INC F PAU / RCL C =

Letter From The Editor

Welcome to the third issue of Programmable Calculator News. In this issue we cover topics such as Storing and Retrieving Register Contents on the TI-95 Procalc™ and Student’s T Distribution on the TI-74 Basicalc™. We’ve included programs, too, that will allow you to determine your biorhythm cycles or test your codebreaking skills. For a complete listing of programs, please refer to the table of contents.

Several readers have submitted programs for possible publication in future issues. If you have an application you’d like to share with our readers send it to:
Programmable Calculator News
P.O. Box 53
Lubbock, TX 79408

When you write, please tell us which programs you’ve found most helpful as well as topics you’d like to see presented in future issues.

In This Issue:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store and Retrieve Register Contents</td>
<td>TI-95 2</td>
</tr>
<tr>
<td>More Than 5 User-Defined Functions?</td>
<td>TI-95 3</td>
</tr>
<tr>
<td>Biorhythms</td>
<td>TI-95 3</td>
</tr>
<tr>
<td>Test Flag 52</td>
<td>TI-95 4</td>
</tr>
<tr>
<td>Polar to Rectangular in Basic</td>
<td>TI-95 5</td>
</tr>
<tr>
<td>Breakeven Analysis</td>
<td>TI-74 5</td>
</tr>
<tr>
<td>Binomial Distribution</td>
<td>TI-74 6</td>
</tr>
<tr>
<td>Student’s T Distribution</td>
<td>TI-74 6</td>
</tr>
<tr>
<td>Codebreaker (a game)</td>
<td>TI-74 6</td>
</tr>
<tr>
<td>The ‘Name Table Full’ Error Correction</td>
<td>TI-74 7</td>
</tr>
<tr>
<td>The TI-74 Technical Data Manual</td>
<td>TI-74 7</td>
</tr>
</tbody>
</table>
More Than 5 User-Defined Functions Per Program on The TI-95?

By Rena Gillis and Patrick Hicks

The TI-95 Procalc can be programmed to have more than 1 menu, and there are several methods to obtain more than 5 definable functions in your programs. The following program illustrates the use of one method-linked menus.

The first set of functions converts cubic feet of water to pounds, pounds of water to cubic feet, pounds of water to gallons and gallons of water to pounds. Since this is a conversion program, the first label, M1, is followed by CLR to eliminate any values or old messages in the display (pg 2-9 of the TI-95 User's Guide).

The F5 key has been defined as an arrow key and passes control to label M2, the next menu label, which has some new features. Since not all functions have been defined (i.e., F3 and F4), we need to clear all notations found over the function keys by using the DFN CLR command (pg 4-23 of the TI-95 Programming Guide) or the previous definitions will remain when the new menu is displayed.

The second set of functions converts cubic feet to cubic inches and cubic inches back to cubic feet. The F5 key, again, has an arrow over it, causing control to pass back to the first menu, label M1.

The following program contains print statements which will allow printing on the PC-324 printer. If no printer is used, the prompts will appear in the display.

0000 'CONVERSIONS' PRT
0012 PAU CLR 'ENTER VAL'
0023 'UE' PRT PAU
0027 lBl M1
0030 DFNF1:CF# @ C#
0037 DFNF2:#CF@#C#
0044 DFNF3:#>G@#G#
0051 DFNF4:G# >@G#
0058 DFNF5:'->@M2 HlT
0066 lBl M2 DFNF1R
0071 DFNF1:CFi@Ci
0078 DFNF2:Icf@If
0085 DFNF5:-->@M1 HlT

Each person’s “good” and “bad” days are said to be patterned in part by physical, emotional and intellectual biorhythm cycles which start at birth and continue throughout life. As shown in the diagram, “good” days are when the curve is above the horizontal line; days below the line are “bad” days. Crossover days are “critical” days.

Because these curves are continuous, any given day will fall somewhere within one of the repeating cycles. For example, day 33 in the diagram is 33 (or 0) days into the 33-day intellectual cycle, 5 days into the 28-day emotional cycle and 10 days into the 23-day physical cycle.

The amplitude of each cycle may be expressed as a value between -1 and 1, where -1 is the low point, 0 the critical point and 1 the high point of the curve. Using this program, you can determine your position in the biorhythm cycles on any given day simply by entering your birthdate and the current date.

From a brief description, it is easy to see that the biorhythm cycles of two people are apt to match exactly only if they are born on the same day. The relative match of one per-
son's "ups and downs" to another's is called biorhythm compatibility.

Now, use the program to see if the way your day has gone matches your biorhythm indicators. Or check your biorhythm compatibility with a friend or relative, or someone you particularly like or dislike. The results may prove interesting, or at least fun.

*Borported from the TI Programmable 58/59 Leisure Library, copyright 1977 by Texas Instruments.

## Biorhythms on the TI-95

By Rena Gillis

The following program will calculate an individual's position within the biorhythm cycle. It's designed to work with a printer, printing prompts, entries and responses. If no printer is available, your TI-95 will display both prompts and responses.

Begin by loading the program into your calculator and pressing RUN. Next, press F5 to clear memories. If you are calculating biorhythms for your biorhythm indicators. Or check your biorhythm compatibility with a friend or relative, or someone you particularly like or dislike. The results may prove interesting, or at least fun.

<table>
<thead>
<tr>
<th>Program Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTER BIRTHDAY</td>
</tr>
<tr>
<td>MMDD.YYYY</td>
</tr>
<tr>
<td>912.1951</td>
</tr>
<tr>
<td>ENTER TODAY DATE</td>
</tr>
<tr>
<td>MMDD.YYYY</td>
</tr>
<tr>
<td>608.1988</td>
</tr>
<tr>
<td>DAYS OLD</td>
</tr>
<tr>
<td>13419.</td>
</tr>
<tr>
<td>PHYSICAL CYCLE</td>
</tr>
<tr>
<td>DAYS INTO CYCLE</td>
</tr>
<tr>
<td>10.</td>
</tr>
<tr>
<td>% THRU CYCLE</td>
</tr>
<tr>
<td>43.4</td>
</tr>
<tr>
<td>EMOTIONAL CYCLE</td>
</tr>
<tr>
<td>DAYS INTO CYCLE</td>
</tr>
<tr>
<td>7.</td>
</tr>
<tr>
<td>% THRU CYCLE</td>
</tr>
<tr>
<td>25.</td>
</tr>
<tr>
<td>INTELLECTUAL CYCLE</td>
</tr>
<tr>
<td>DAYS INTO CYCLE</td>
</tr>
<tr>
<td>21.</td>
</tr>
<tr>
<td>% THRU CYCLE</td>
</tr>
<tr>
<td>63.6</td>
</tr>
</tbody>
</table>

## Test Flag 52

By Rena Gillis

If you are trying to convert a TI-59 program to use on the TI-95 or desire to find the inverse of some function, this project can be done on the TI-95 with little difficulty. The TI-59 provided A thru E as definable function keys. To obtain an A' to E' function, the user, after programming the body of the program appropriately, would press the 2ND KEY and the A thru E function key as applicable. The TI-95 offers a similar function using the [INV] and testing for flag 52 at the direct label program location.

In our example, we have a Celsius to Kelvin conversion above function F1. To get the inverse of this, or Kelvin to Celsius, the user would press the [INV] then the Fl key. This keystroke will send the calculator to Label KC. The first steps after the label, however, will 'turned on' (the INV key pressed before a function key), control will go to label KC. Please note that the calculator will not automatically take the inverse of the original conversion. The pro-
grammer needs to program the steps necessary to compute that conversion at the prescribed label.

Function keys F3 to F5 illustrate how to load C through E and obtain the prime functions as used in TI-59 programs by using this same logic. (Test flag 52 is discussed in the TI-95 Programming Guide on page C-8.)

```
0000 'FLAG 52' PAU CLR
0009 LBL MI CLR 'ENTER
0019 VALUE'
0024 DFNF F3:C>KK
0031 DFNF F2:D>CBS
0038 DFNF F3: C GCC
0045 DFNF F4: D ADD
0052 DFNF F5: E BEE HLT
0060 LBL CK TF 52 GTO KC
0068 +273= Chr223 'KE'
0079 'VIN' COL16 MRG= RTN

0110 LBL GC TF 52 GTO GC
0118 *231= 'CUBIC IN'
0123 COL 16 MRG = RTN
0137 LBL GC /231= ' FAL'
0140 COL 16 MRG = RTN
0153 LBL CC TF 52 GTO C
0161 CLR 'ENTER VOLTS'
0173 BRK STO A RTN
0177 LBL DD TF 52 GTO D'
0185 CLR 'ENTER RESISTA'
0199 'NCE'BRK STO C RTN
0206 LBL EE TF 52 GTO E'
0214 RCL A / RCL C = 'I'
0221 'A)= COL 16 MRG =
0229 RTN
0230 LBL C' CLR ' ENTER
0240 'AMPS' BRK STOB RTN
0245 LBL 0' RCLB / RCLC = 'E(V)=
0254 RTN
```

Using this program you can find:
Number of units required to generate a given Gross Profit
Gross Profit from the sale of a given number of units
Total Cost to produce a given number of units
Total Revenue from the sale of a given number of units
Number of units where the Breakeven Point occurs

Input:
- VC - Variable cost per unit
- FC - Fixed Costs
- UP - Unit Price
- Plus either of the following:
  - GP - Gross Profit
  - U - Number of units sold

Output:
- Number of units where the Breakeven Point occurs
  - If Gross Profit was entered: Number of units to generate a given Gross Profit
  - If units sold were entered: Gross Profit from the sale of a given number of units
  - Total Costs to produce a given number of units
  - Total Revenue from the sale of a given number of units

For example:
- FC = $1000, VC/Unit $.50
- UP = $2.50, U = 800
- Gross Profit = $600
- Total Cost = $1400
- Total Revenue = $2000
- Breakeven Point = 500 units

```
TI-74 Breakeven Analysis

Using this program you can find:
Number of units required to generate a given Gross Profit
Gross Profit from the sale of a given number of units
Total Cost to produce a given number of units
Total Revenue from the sale of a given number of units
Number of units where the Breakeven Point occurs

Input:
- VC - Variable cost per unit
- FC - Fixed Costs
- UP - Unit Price
- Plus either of the following:
  - GP - Gross Profit
  - U - Number of units sold

Output:
- Number of units where the Breakeven Point occurs
  - If Gross Profit was entered: Number of units to generate a given Gross Profit
  - If units sold were entered: Gross Profit from the sale of a given number of units
  - Total Costs to produce a given number of units
  - Total Revenue from the sale of a given number of units

For example:
- FC = $1000, VC/Unit $.50
- UP = $2.50, U = 800
- Gross Profit = $600
- Total Cost = $1400
- Total Revenue = $2000
- Breakeven Point = 500 units

5!BREAKEVEN ANALYSIS
10 INPUT "Var. Cost/Unit?";VC
20 INPUT "Fixed Cost?";FC
30 INPUT "Unit Price?";UP
40 INPUT "Units Sold?";U
50 INPUT "Gross Profit?";GP
60 PRINT "Breakeven Point=";N:
70 IF U THEN PRINT "Gross Profit=U+FC=":PAUSE
80 IF GP THEN PRINT "Units Needed=":N;
90 IF U THEN PRINT "Total Cost=":N;FC+VC*U:
100 IF U THEN PRINT "Total Revenue=":N;UP:
110 END
```

Polar to Rectangular in Basic

By Rena Gillis

I have been asked how you would enter a Polar to Rectangular or Rectangular to Polar conversion in DEGree mode on the TI-74 Basicalc. The function is available in the calculator mode on the TI-74 but must be programmed for use in the BASIC mode.

The following small program can be inserted in your larger program or stored elsewhere for easy recall. Lines 610 to 641 comprise the menu for this program. A "1" or "2" answer will direct execution to the proper portion of the program. After completing the computation, control goes back to the menu of this program.

If you're adding this program to a larger program with several small unrelated programs, you might want the control to go back to the main menu.

```
600!polar/rectangular conversions
610 PRINT "1r-1p?":PAUSE 2
620 PRINT "2P-1r?":PAUSE 2
630 INPUT "your choice?(rp-1,pr-2)";N:IF N>0 AND N<3 THEN 641
640 PRINT "# outside accepted parameters":PAUSE 3:GOTO 610
650 INPUT "INPUTX ";X:INPUT "INPUTY ";Y:R=SQR(X^2+Y^2)
661 IF X=0 THEN 667
662 O=ATN(Y/X)
663 IF O=0 AND X=0 THEN 667
664 IF O=0 AND X<0 THEN O=-180:GOTO 670
665 IF O=0 AND X>0 THEN O=180:GOTO 670
666 IF X>0 AND Y=0 THEN O=90:GOTO 670
667 IF X<0 AND Y=0 THEN O=-90:GOTO 670
668 IF X>0 AND Y>0 THEN O=90:GOTO 670
669 IF X<0 AND Y<0 THEN O=-90:GOTO 670
670 PRINT "r";R:"theta";O:PAUSE:GOTO 610
675 INPUT "r";R:INPUT "theta";O:X=R*COS(O):Y=R*SIN(O)
690 PRINT "x";X:"y";Y:PAUSE:PRINT "h";
```

Polar and Rectangular Coordinates

\[ \begin{align*}
(1,1) \text{ rectangular} & \quad (\frac{\sqrt{2}}{2}, \text{ polar}) \\
\theta &= 45^\circ \\
\end{align*} \]
Binomial Distribution

This program may be used on your TI-74 to calculate the following probabilities for n trials of an experiment:

- Probability of exactly k successes = \( F(K;N,P) = F \)
- Probability of k or fewer successes = \( PR(K;N,P) = PR \)
- Probability of more than k successes = \( Q = 1 - PR \)

The mean and standard deviation of a binomially distributed population are also calculated.

Input:
- \( N \) - Number of trials
- \( P \) - Probability of successes
- \( K \) - Number of successes

Output:
- \( M \) - Mean
- \( S \) - Standard deviation
- \( F \) - Probability of k successes
- \( PR \) - Probability of k or fewer successes
- \( Q \) - Probability of more than k successes

For example:
A true/false quiz consists of 10 questions. A student bases his/her answers on the outcome of a coin toss (i.e., "heads" = true, "tails" = false).

What is the probability that the student will pass (at least 70%)?

\( N = 10 \)
\( P = .5 \)
\( K = 6 \)

\( Q \) (Probability of passing) = .171875

```
100 REM BINOMIAL DISTRIBUTION
110 PAUSE ALL
120 INPUT "N? "; N
130 INPUT "P? "; P
140 INPUT "K? "; K
150 Q=1-P
160 PR=Q"N
170 F=PR
180 FOR E=O TO K-1
190 F=F*(\(N-E\)*P)/((E=1)*Q))
200 PR=PR+F
210 NEXT E
220 Q=1-PR
230 U=N*P
240 T=1-P
250 S=SQR(U*T)
260 PRINT "M=\(U\)
270 PRINT "S=\(S\)
280 PRINT "F=\(F\)
290 PRINT "PR=\(PR\)
300 PRINT "Q=\(Q\)
310 END •
```

Student's T Distribution

This program may be used on your TI-74 to calculate the area of the curve to the left of the t-statistic. The shape of the curve is determined by the value input for the degrees of freedom.

Input:
- \( DF \) - Degrees of freedom
- \( T \) - T-statistic

Output:
- \( P \) - Area to the left of the t-statistic

For example:
DF = 7; T = -2.3
P = .972504524

```
100 REM student's t-distribution
110 PAUSE ALL
120 INPUT "GUESS?"; G
130 IF G<0 THEN S=-1
140 F=1"2
150 X=M/\(M+F\)
160 FOR N=1 TO 4
170 C(N)=INT(RND*9+1)
180 IF F(C(N))=1 THEN 160 ELSE F(C(N))=1
190 C(0)=C(0)*10+C(N)
200 NEXT N
210 PRINT "M=\(C(0)\)
220 PRINT "S=\(C(1)\)
230 PRINT "F=\(C(2)\)
240 PRINT "PR=\(C(3)\)
250 PRINT "Q=\(C(4)\)
260 PRINT "GUESS? \("; G
100 DIM C(4),F(9)
110 RANDOMIZE:PAUSE ALL
120 FOR N=1 TO 4
130 C(N)=INT(RND*9+1)
140 IF F(C(N))=1 THEN 130 ELSE F(C(N))=1
150 C(0)=C(0)*10+C(N)
160 NEXT N
170 INPUT "GUESS? \("; G
```

Codebreaker

This is a TI-74 game in which the player attempts to break a four-digit code. The code contains no zeros, and no digit is repeated.

Even with these restrictions, there are 3024 possible codes. Therefore, you must carefully analyze the information supplied by the program following each four-digit trial.

The program will prompt your entry by displaying "GUESS," and after your trial is entered, the TI-74 will indicate:
A. The number of digits present in the guess that are also present in the codenumber.
B. The number of correct numbers that are also correctly positioned.
C. A display of "Correct!" when the trial matches the codenumber.

Assume: the codenumber = 1234

```
GUESS = 2976 - 1 correct number;
0 in the correct place.
GUESS = 3274 - 3 correct numbers; 2 in the correct place.
GUESS = 2134 - 4 correct numbers; 2 in the correct place.
GUESS = 1234 - Correct!
```

To escape before finding the correct codenumber, simply enter "QUIT" rather than a 4-digit guess.

```
100 DIM C(4),F(9)
110 RANDOMIZE:PAUSE ALL
120 FOR N=1 TO 4
130 C(N)=INT(RND*9+1)
140 IF F(C(N))=1 THEN 130 ELSE F(C(N))=1
150 C(0)=C(0)*10+C(N)
160 NEXT N
170 INPUT "GUESS? \("; G
```
'Name Table Full' Error Correction

by Patrick Hicks

Variable names used in TI-74 Basicalc programs are stored in the calculator name table which accommodates 95 entries. Your Basicalc system will recognize variables entered as names even if the variables are not contained in a program. For example, if you enter:

```
X = 5 [ENTER]
10 TEMPS$ = "JOHN DOE" [ENTER]
```

both 'X' AND 'TEMPS$' are stored in the name table. If the total of miscellaneous names inadvertently entered and variables in your program exceeds 95 entries, you may be surprised to find that, upon program execution, you receive a 'Name Table Full' error.

Clearing the table of nonprogram variable names is a simple process. First, unplug the CI-7 Cassette Interface if attached to your TI-74 and enter this command:

```
SAVE "I" [ENTER]
```

Your calculator will attempt to save a file to cassette tape. Press [ENTER] in response to the prompts displayed and, momentarily, the unit will return the following message:

**Programmable Calculator News**

*Moving?*

Programmable Calculator News is normally mailed bulk rate and is not forwarded by the Postal Service.

To be certain that you receive the next edition, please send the label from this issue along with your new address to:

Prog. Calculator News
P.O. Box 53
Lubbock, TX 79408
As always, we request that you purchase Texas Instruments products and accessories at a retailer in your area. If you are unable to locate a specific item, phone 1-800-842-2737.

Free Newsletter
If you’re not on our mailing list or would like to send the newsletter to a friend, complete the following:

(please print clearly)

Name ____________________________
Address __________________________
City _____________________________
State __________ Zip _____________

Calculator owned:
☐ TI-95  ☐ TI-74  ☐ Other

Mail to:
Programmable Calculator News
P.O. Box 53
Lubbock, TX 79408

TI-95 Procalc and TI-74 Basicalc are trademarks of Texas Instruments Incorporated.

Learn BASIC Guidebook

The TI-74 Learn Basic Guidebook is an easy-to-read self-teaching manual designed to aid you in understanding and using your TI-74 Basicalc. Written for nonprofessional programmers, it offers step-by-step examples, practical problems and review tests on topics such as Beginning Programming, Editing Programs, Subprograms, and Using Memory Cartridges.

To order, send $9.99 plus $3.00 shipping and handling to:
Programmable Calculator News
P.O. Box 53
Lubbock, TX 79408

TI makes NO WARRANTY as to programs contained in this newsletter, which are supplied “AS IS.”

Programming Questions or Problems? Phone our technical hotline at 806-741-2663.

As always, we request that you purchase Texas Instruments products and accessories at a retailer in your area. If you are unable to locate a specific item, phone 1-800-842-2737.

Texas Instruments
P.O. Box 53
Lubbock, Texas 79408

Programmable Calculator News is a periodic publication. Printed in the U.S. Copyright 1988 by Texas Instruments.