

Ticalc

# Ticalc

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*Spreadsheets are exceptionally useful tools: for calculating, modeling, or predicting. This program creates a spreadsheet of ample size (26 rows by 14 columns). For the TI-99/4A with Extended BASIC.*

"Ticalc" is an electronic spreadsheet program for the TI-99/4A computer with Extended BASIC. Electronic spreadsheets, useful and popular programs, allow the user to answer a multitude of "what if" questions in areas such as budgeting, sales projections, cost estimating, scheduling, and more.

Spreadsheets allow you to enter a set of values and calculation rules for a given application, such as budgeting. The program will then calculate the projections, estimates, totals, or whatever, based on the calculation rules. Changing one or more of the original values results in a complete recalculation of the figures. The special utility of spreadsheet programs lies in their ability to do, in a few seconds, what a human—with pencil, paper, and calculator—would need hours, or even days, to do.

## **Program Requirements**

Before explaining how to use Ticalc, let's establish the ground rules for the program. First, it requires at least a 16K TI-99/4A with Extended BASIC. Although the Ticalc spreadsheet is 26 rows by 14 columns, with 16K of memory built into the TI console, you are limited to roughly 150 "slots." For example, you could have a spreadsheet that is 12 × 12, 15 × 10, 20 × 7, or 10 × 14. You will find this adequate for almost all applications. Those of you who have the 32K memory expansion can use the complete 26 × 14 spreadsheet. When using the program, you should leave the ALPHA LOCK key depressed.

Spreadsheets can be saved and loaded from tape. If you have a disk drive, you can change the OPEN statements in lines 1950 and 2000 accordingly. The use of a printer is optional, but the program does provide the option of making a printout of your results.

The Ticalc spreadsheet is 26 rows by 14 columns (see Figure 1). The rows of the spreadsheet are defined by the letters A–Z. The columns are defined by A–N. Note that any slot in the spreadsheet is referred to by row and column. For example, slot CD would be the entry at row 3, column 4; AF would be row 1, column 6. It's important that you keep this sequence in mind.

The TI-99/4A is not capable of displaying the entire  $26 \times 14$  array. What will appear on your screen is a  $10 \times 3$  "window" on the spreadsheet. Just as looking into different windows of a house shows different things, the computer's window shows different "views" of the spreadsheet, depending on where the window is positioned. A window's position is defined by its top-left slot. Looking again at Figure 1, notice that the shaded area marked A is the  $10 \times 3$  spreadsheet window at AA (remember, row and column). The shaded area marked B is the window at IH. By moving the window, the entire 364-slot spreadsheet is accessible 30 slots (a window) at a time.

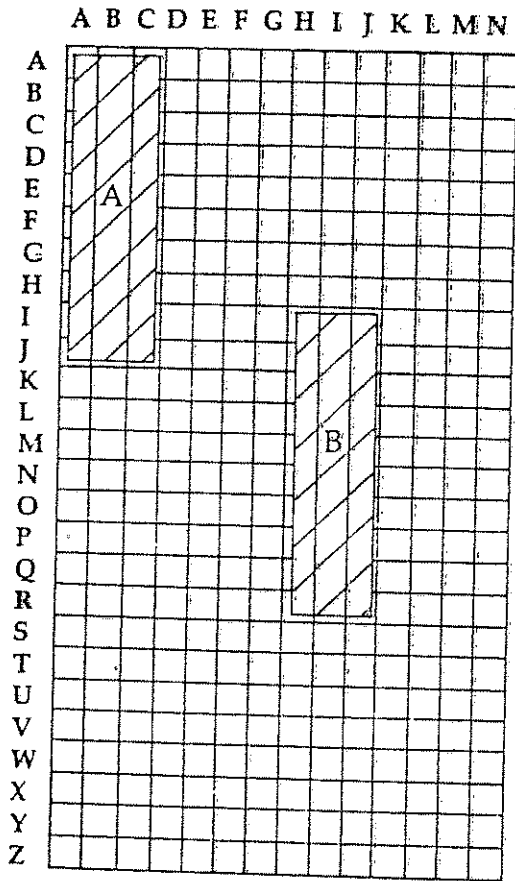
The best way to demonstrate Ticalc is by example. You should spend a few minutes getting acquainted with the command summary shown in Table 1. Also, you might want to examine the list of major program variables shown in Table 2. The following paragraph will detail a somewhat simplistic scenario for our demonstration.

### Starting a Business

We are starting a small manufacturing business and want to estimate our net profit or loss for the first four months. We are anticipating sales of \$2,700 the first month and a 10 percent growth rate for each succeeding month. Space is being leased for \$800 a month, and there are two employees making a total of \$1,200 a month. Cost for materials is based on sales and is expected to be 30 percent, while utilities are expected to run at roughly 5 percent of sales.

When the program begins, it displays the window with a HOME position of AA. That is, it is displaying rows A through J and columns A, B, and C. The COMMAND  $\rightarrow$  prompt is displayed, and the program is awaiting your reply. Since the first thing we want to do is enter spreadsheet data, reply INSERT. This places the cursor (actually two sprites at line 860) at the top-left slot in the window, in this case AA. The prompt

**Figure 1: Windows on the Spreadsheet**



asks for an INSERT COMMAND?. Figure 2 shows the data we plan to enter (refer to it as we go along). As you can see, there isn't any data for AA, so we press X(↓) to move the cursor down to CA.

At this point we want to place the label SALES in the CA slot, so we press L. The prompt then asks us what the label is and we type SALES. When we press ENTER, the label is placed in CA. We then press X(↓) again to get to DA and enter the label RENT. Continue this for all the labels in column A. Then use the arrow keys (really E, S, D, and X) to place the cursor at AB, where you enter the label JANUARY. Then move the cursor down to CB.

This slot is to be the amount of our first month's sales, so press N for numeric value. The prompt asks for the number; respond 2700 and press ENTER. Do the same for RENT at DB and SALARY at EB. At FB we come to the first calculation, so press C. Remember that material costs are expected to be 30 percent of monthly sales. Therefore, we need to multiply SALES by .30. The .30 will have to be stored as a value in a "workfield" outside the main body of the spreadsheet. We will arbitrarily make this BJ and make a note to ourselves to add the value after finishing the main portion of the spreadsheet. So, the calculation becomes JANUARY SALES (CB)\*.30(BJ) or CB\*BJ. Refer to Table 3 for examples of valid calculations. An error detection routine enforces valid syntax.

We then position the cursor at GB, which is January utility costs. This is similar to material costs, and we make a note to store the 5 percent figure at CJ. Press C and then enter CB\*CJ. The cursor is then positioned at IB, which is the slot for total January expenses. This is again a calculation, so press C. Enter the calculation command SUMCOLDG, which means sum this column starting at row D (RENT) and ending with row G (UTILITY) and place the result in this slot. The cursor is then placed at JB, which is the NET PROFIT/LOSS for January. This is simply SALES (CB) minus TOTAL EXPENSES(IB) or CB-IB.

Next, position the cursor at AC and enter the February label. When you position the cursor at February SALES, you'll see that you no longer have a number, but rather a calculation. Sales are assumed to be 10 percent greater than each previous month, so make a note to store 1.10 at AJ and enter the calculation CB\*AJ, which is January SALES\*1.10. The remainder of the column is entered in a manner similar to the entries for January, adjusting for the proper row/column designators.

At this point, all the slots for the window being displayed have been entered, so you'll need to move the window. First press Q to exit from INSERT mode. When the command prompt is displayed, enter HOME and press ENTER. When asked for row and column, enter AD. The window will be moved to view rows A through J, columns D, E, and F. Type INSERT and press ENTER to get back into INSERT mode. The columns for March and April can now be entered as were the columns for January and February. Column F, the total columns of the calculation, is a little different. The SUMROWBE

88 Figure 2. Example Spreadsheet

	A	B	C	D	E	F	G	H	I	J
A		JANUARY	FEBRUARY	MARCH	APRIL	-TOTAL-	% SALES			1.10
B										.30
C	SALES	2700	CB*AJ	CC*AJ	CD*AJ	SUMROWBE				.05
D	RENT	800	800	800	800	SUMROWBE	CF%DF			
E	SALARY	1200	1200	1200	1200	SUMROWBE	CF%EF			
F	MATERIAL	CB*BJ	CC*BJ	CD*BJ	CE*BJ	SUMROWBE	CF%FF			
G	UTILITY	CB*CJ	CC*CJ	CD*CJ	CE*CJ	SUMROWBE	CF%GF			
H										
I	TOT EXP	SUMCOLDG	SUMCOLDG	SUMCOLDG	SUMCOLDG	SUMCOLDG	CF%IF			
J	NET +/-	CB-IB	CC-IC	CD-ID	CE-IE	CF-IF	CF%JF			

command tells Tlcalc to total the row starting at column B (January) and ending at column E (April), and place the result in the current slot.

We have again filled the window being displayed, so press Q to exit INSERT mode. Typing the HOME command and then AG gives us slot AG in the top left of the screen. Type INSERT again and enter the calculation rules to give each expense, the total expense, and net as a percent of sales. Finally, exit (Q), HOME on AJ, INSERT, and enter the worksheet values for AJ, BJ, and CJ. Type Q to get back to command mode. At this point, you've completed your working copy (MODE1) of the spreadsheet.

### Procedures

Now you can use the CALC command to calculate the result of the working copy. The calculation will take anywhere from a few seconds to a few minutes, depending on the size of the working copy and the number of calculations. When the calculation is complete, the program will automatically go into MODE2 and set the HOME row and column to AA. You can then view the results by moving the window, using the HOME command. Figure 3 shows the results from the sample. If you want to see the calculation that gave a particular result, you can type MODE1 to see the original working copy as shown in Figure 2. Typing MODE2 will return you to the "result copy." This is particularly useful in finding errors.

**Figure 3. Printout of Example Worksheet Results**

	JANUARY	FEBRUARY	MARCH	APRIL	-TOTAL-	% SALES
SALES	2700	2970	3267	3593.7	12530.7	
RENT	800	800	800	800	3200	25.53
SALARY	1200	1200	1200	1200	4800	38.3
MATERIAL	810	891	980.1	1078.11	3759.21	30
UTILITY	135	148.5	163.35	179.68	626.53	4.99
TOT EXP	2915	3039.5	3143.45	3257.79	12385.74	98.64
NET +/-	-215	-69.5	123.55	335.91	144.96	1.15

### The Daisychain Effect

Anytime Tlcalc encounters a calculation it cannot complete when in its calculation mode, it will fill the current slot with all \*. This kind of error is usually caused by one of two conditions. The first is when a calculation refers to a slot which is not defined as a number or calculation. For example, if our

sample had a calculation CB\*AH, the result would be an error because slot AH has no value. If a slot contained a label, the same error would occur. The second type of error occurs when a current calculation points to a slot that contains a calculation which previously contained an error. In this case, the current calculation is correct, but the calculation it refers to must be corrected. This type of error tends to have a daisychain effect.

All calculations are taken to a maximum of two decimal places. There is no provision for rounding. Also, all calculations are carried out in row/column sequence. That is, AA is processed first, then AB, AC, AD, then BA, BB, BC, and BD. This is very important to understand since errors will be generated if you reference a slot which has not yet been processed. For example, if slot AC contains the calculation AB\*BC, an error will occur since BC has not yet been processed. Thus, the selection of AJ, BJ, and CJ for workfields is not as arbitrary as it first appears.

### Printing and Saving

You can print the result of the calculation by using the PRINT command. It will print all rows for the beginning and ending columns you specify. Figure 3 was produced by PRINTing for columns A through G. You may have to adjust the OPEN command at line 2070 for your particular printer.

You may save a spreadsheet or load one from tape. Note that if you load a spreadsheet from tape, only the working copy is loaded. You will have to issue the CALC command to compute a result copy.

The usefulness of Ticalc may be demonstrated by using our sample. If, after the first month, there were any deviations from the assumptions made at the outset, or if you wanted to see what a higher or lower sales figure would do, you would merely need to change the desired variable(s) and recalculate.

**Table 1. Ticalc Command Summary**

Command	Action
HOME	Aligns the Ticalc window to the desired row/column.
INSERT	Places Ticalc in INSERT mode; defaults to MODE1 (see subcommands below).
MODE1	Displays the working copy; automatic for INSERT.
MODE2	Displays the result copy; automatic after CALC command.



CALC	Calculates the results for the values and calculations in the working copy; invokes MODE2 at completion.
LOAD	Load a spreadsheet from tape.
SAVE	Save a spreadsheet to tape.
PRINT	Print spreadsheet.
EXIT	<i>Quit Program</i>

### INSERT Subcommands

#### Subcommands Action

+(S)	Move cursor left.
-(D)	Move cursor right.
↑(E)	Move cursor up.
↓(X)	Move cursor down.
L	Indicates a label is to be placed in the current cursor position.
N	Indicates a numeric value is to be placed in the current cursor position.
C	Indicates a calculation is to be placed in the current cursor position.
Q	Quit; return to command mode.

**Table 2. Major Program Variables**

Variable	Use
A\$(r,c)	Working copy array
B\$(r,c)	Result copy array
COMMS	Command entered
ROW	Row shown at top left of window
COL	Column shown at top left of window
RCS	A through Z values
MODE	MODE1 or MODE2 indicator
LOCS	Row/column desired by HOME command
R	Loop control—row
C	Loop control—column
X	Row DISPLAY AT position
Y	Column DISPLAY AT position
SR	Cursor row position
SC	Cursor column position
L\$	Label entered
N\$	Number entered
C\$	Calculation entered
RM	Highest row number used
CM	Highest column number used
RLIM	Row limit for display window
CLIM	Column limit for display window

### Table 3. Valid Ticalc Calculations

OPERATORS +, -, \*, /, %

SUMROWXY Where X is the beginning column and Y is the ending column

SUMCOLXY Where X is the beginning row and Y is the ending row

#### Examples

AB\*CG

AL-AI

EF+AH

BC/CA

AB+CB\*BC

AB+CB+CA      Processed left to right

CB/AB-CH

SUMROWCF

SUMCOLAH

