

Creative Programming for Young Minds



CREATIVE
PROGRAMMING INCORPORATED

Yellow All Stars



FUNCTION KEYS

Both the TI 99/4 and the TI 99/4A consoles come with keyboard overlays identifying special computer functions (BACK, BEGIN, QUIT, etc.). To access TI99/4A overlay functions, as well as any function or symbol that appears on the front of a key, hold down the FCTN key while pressing the appropriate function or symbol key.

The owner's manual enclosed with an applications software package may reference only the TI 99/4 function keys (SHIFT C for CLEAR, SHIFT R for REDO, etc.). Most Command Module, Diskette, and Cassette programs are compatible with both consoles; however, the keystroke sequences used in accessing the special functions of these programs differ somewhat for each keyboard.

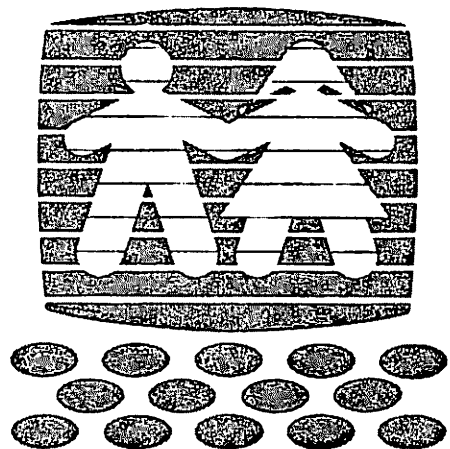
The following chart shows the relationship between the function keys on the TI 99/4 and the TI 99/4A for most software applications.

FUNCTION KEYS

<u>Name</u>	<u>TI 99/4</u> <u>Keys</u>	<u>TI 99/4A</u> <u>Keys</u>
AID	SHIFT A	FCTN 7
CLEAR	SHIFT C	FCTN 4
DELeTe	SHIFT F	FCTN 1
INSert	SHIFT G	FCTN 2
QUIT	SHIFT Q	FCTN =
REDO	SHIFT R	FCTN 8
ERASE	SHIFT T	FCTN 3
LEFT arrow	SHIFT S	FCTN S
RIGHT arrow	SHIFT D	FCTN D
DOWN arrow	SHIFT X	FCTN X
UP arrow	SHIFT E	FCTN E
PROC'D	SHIFT V	FCTN 6
BEGIN	SHIFT W	FCTN 5
BACK	SHIFT Z	FCTN 9
ENTER	ENTER	ENTER

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ALL STARS

The projects in this book are for those students who are ready for a challenge. The ones that want to use what they have learned. Those that wish to learn even more.

This book is designed to be used AFTER the yellow volume of CREATIVE PROGRAMMING for Young Minds.

Some of these projects will require that you do some research on your own before you can write programs that will solve them. To get this far, you have already shown that you are capable of good logical thinking and independent action.

So if you find a word like "amortization" that isn't in your vocabulary, find a dictionary. If you think you could write a solution to the project if only you knew how to use the command INKEY\$, look it up in a reference manual.

Remember, these are for the ALL STAR programmers!!!

COMPUTER ALL STARS

- * Begin each of your computer solutions with information that will identify your work. For example:

10 REM	***	JOHN DOE	***
20 REM	***	10 EAST STREET	***
30 REM	***	MONROE, IL 61920	***
40 REM	***	(217) 345-1872	***
50 REM	***	YELLOW ALL STARS: TRIANGLES	***
60 REM	***	APPLE II 48K	***

- * When your computer solution works, save it on tape or disk for future reference. Be sure to label it clearly.

- * COMPUTER ALL STARS are special people, so be sure that your projects reflect your creativity and thoroughness. If you can solve all 25 of these projects, you have become an ALL STAR Yellow programmer. And there are not many of those around!

CREATIVE PROGRAMMING FOR YOUNG MINDS

YELLOW ALL STARS

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EASY MATH

1

Your computer is very good with mathematics. It can do quite quickly many of the things that you spent hours memorizing in grade school.

Without using line numbers, try the following. (You will need to touch `ENTER` or `RETURN` after each line depending upon which computer you are using.)

PRINT 4+4

PRINT 2*(4+4)

PRINT 16/4

PRINT 2[↑]3 (On some computers use \wedge instead of [↑].)

PRINT SQR(16)

PRINT 16[↑].5

PRINT 16[↑](1/4)

PRINT 16[↑]1/4 (Notice this is NOT 16 raised to the 1/4 power! What is it?)

Now write a program that creates data for the following table. Have it display on the screen.

Number	*2	*3	[↑] 2	[↑] 3
1	2	3	1	1
2	4	6	4	8
3	6	9	9	27
4	8	12	16	64
⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮
10	20	30	100	1000

TABLE

Write a program that will calculate and display on the screen for integers from 1 to 12, the number, the square of the number and the square roots of the number. Display a table of three nicely spaced columns. Label each column appropriately.

NUMBERS

CREATE a program that will display the following:

1

22

333

4444

55555

666666

7777777

88888888

Do it with as few commands as possible.

STATUE of LIBERTY

Find out how to determine the amount of free memory your computer has available. Create a program that will display a picture of the Statue of Liberty. Try to use as much of the free memory as possible.

Record how much memory you used.



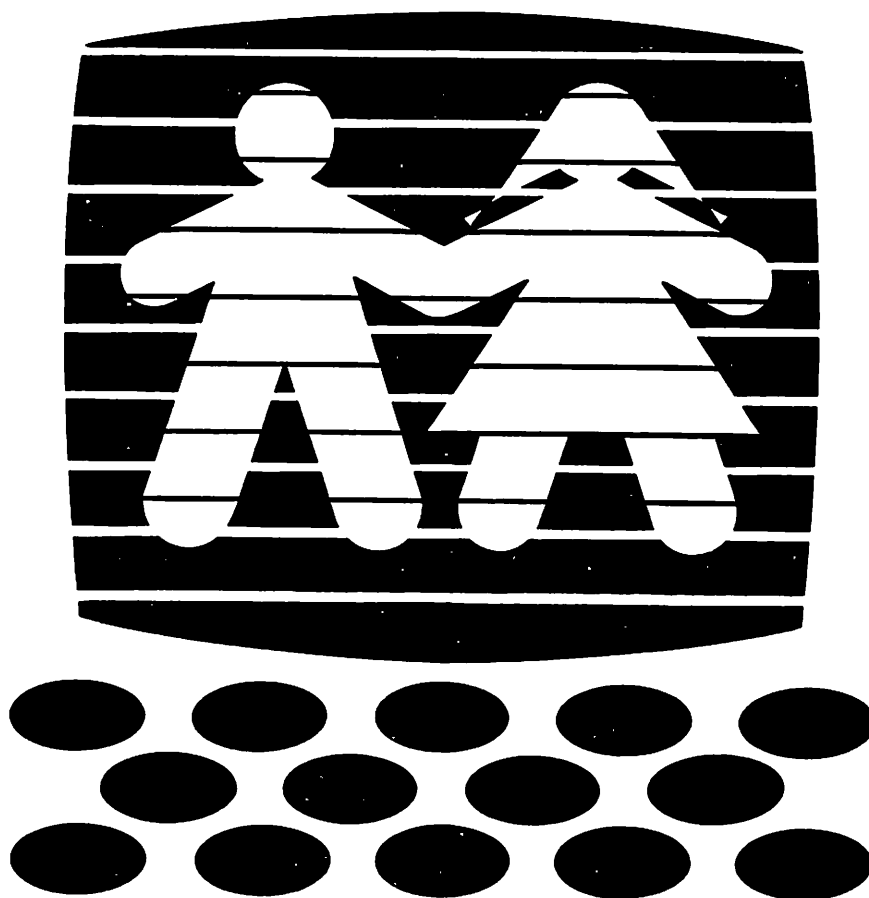
If you are proud of your Statue of Liberty, send us a copy of the LISTing along with a tape or disk with the program on it. Be sure to indicate on which microcomputer it will RUN, as well as your name and address.

Send to:

CREATIVE CREATIONS
604 Sixth Street
Charleston, IL 61920

LOGO

Can you create a graphic picture of our CREATIVE
logo?

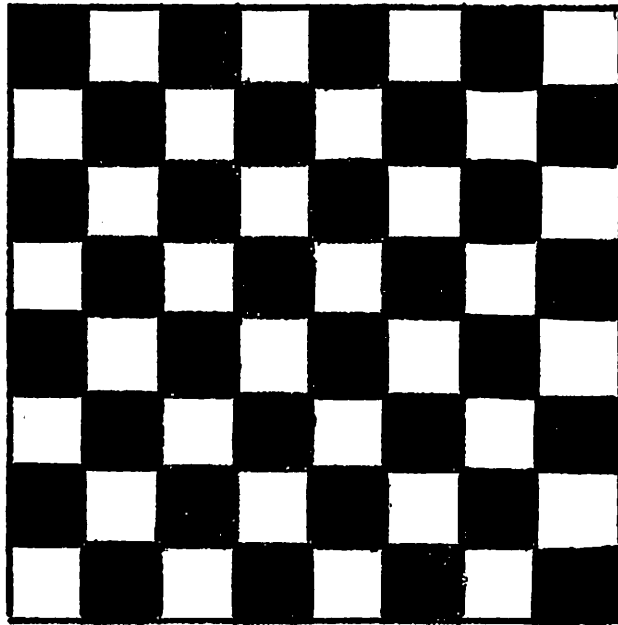


CAI

Computer Assisted Instruction is often called CAI .
It is usually a computer program that is designed to
assist you in learning something.

Can you write a program that will assist someone
in learning 20 spelling words? You choose the words,
but don't make them too easy.

\$\$



If you place a penny on the first white square of a checkerboard, 2 pennies on the second white square, 4 pennies on the third white square, 8 pennies on the fourth white square, 16 on the 5th, and so on until you reach the last white square, you would have a LOT of money!!!

- A. Write a computer program that would calculate how much money.
- B. How would you change your program if you used both black and white squares?
- C. How much more do you make by B than by A ? Use double precision arithmetic.

RANDOM

When you roll one die, only one of its six faces will face upward. If you roll it often enough, each of its six faces should face upward an equal or nearly equal number of times.

The chance that a given roll will produce a 6 is one out of six. If you roll a die 6000 times, about 1000 of those times, it should result in a 6.

When rolling two dice, each die is independent of the other. To obtain numbers from 2 to 12, the following combinations are possible

2	1:1					
3	1:2	2:1				
4	1:3	3:1	2:2			
5	1:4	4:1	2:3	3:2		
6	1:5	5:1	2:4	4:2	3:3	
7	1:6	6:1	2:5	5:2	3:4	4:3
8	2:6	6:2	3:5	5:3	4:4	
9	3:6	6:3	4:5	5:4		
10	4:6	6:4	5:5			
11	5:6	6:5				
12	6:6					

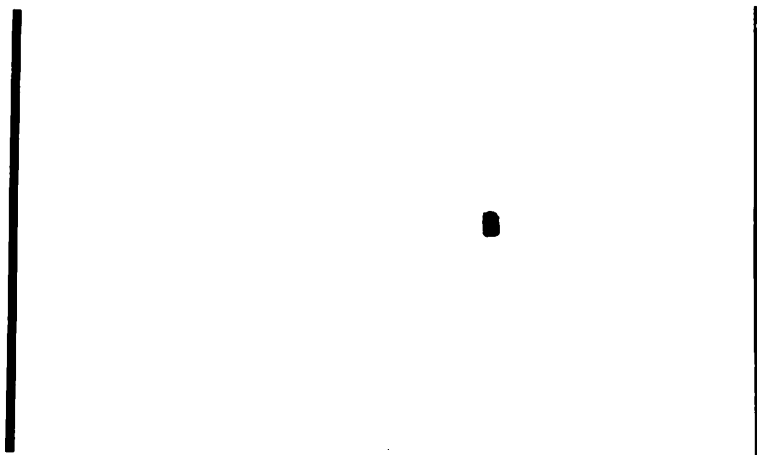
Create a program that "rolls" 3000 pairs of dice. Have the computer keep track of how many 1, 2, 3, etc. are rolled as well as the value shown on each pair. Have the computer print out the following: (with values included for columns 2 and 4)

RANDOM (2)

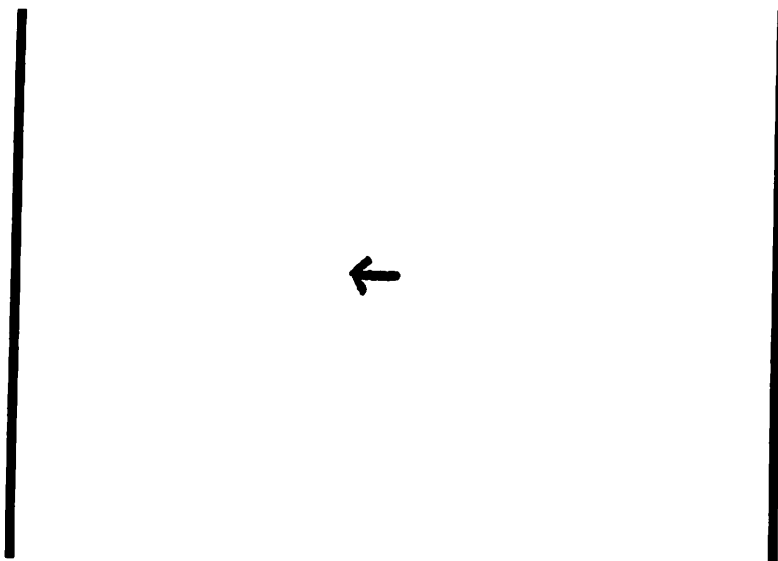
VALUE ON DIE	# TIMES ROLLED	VALUE OF PAIR	# TIMES ROLLED
1		2	
		3	
2		4	
		5	
3		6	
		7	
4		8	
		9	
5		10	
		11	
6	<hr/>	12	<hr/>
TOTAL		TOTAL	
# of Rolls =		# of Rolls =	

ZAP

Write a program that will cause a moving dot to bounce between the two walls.



Can you change the dot to an arrow that points the way it is going?



5/10/68

Your birthday is sometimes written as 5/10/68 (May 10, 1968).

Can you write a program that will ask for today's date, ask for your birth date and then:

- a) calculate your age.
- b) calculate how many days you have been alive.
- c) calculate on what day (Monday, Tuesday, etc.) you were born.

AUTHOR

Write a program that will allow a story to be displayed upon the screen. Provide graphics with your story. This could be a book report, a social studies report or perhaps a history report.

PLANETS

Write a program which will ask the user his or her weight, then print the equivalent weight on the surface of each of the planets in the solar system and on the moon. The ratio of an object's weight on each of the planets to its weight on earth is

MERCURY	0.27
VENUS	0.85
EARTH	1.00
MOON	0.16
MARS	0.38
JUPITER	2.64
SATURN	1.17
URANUS	0.92
NEPTUNE	1.12
PLUTO	UNKNOWN

This is also the ratio of the acceleration due to gravity for that planet. If the acceleration due to gravity on Earth is 9.8 meters/second², what will it be for each of the above?

PENNIES

If you and I each flip a penny, what are the chances that we will match? For instance, let's suppose that if they match either heads and heads or tails and tails, I get to keep them.

CREATE a program that will randomly "flip" the coins for you, and keep track of how many times each of us wins.

Get your program to run for 1000 "flips" and to print out how much you are ahead or behind.

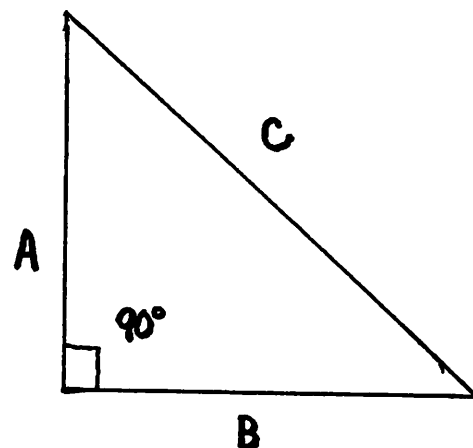
Get your program to run for N "flips" where N is INPUTed.

Alter it so that it will "flip" until you are X cents ahead where X is INPUTed. Have it count how many times it had to "flip", and display that value.

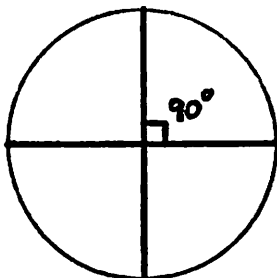
Label all displays.

TRIANGLES

The Pythagorean theorem states that if the two sides of a right triangle are A and B and the hypotenuse is C, then $C^2 = A^2 + B^2$.

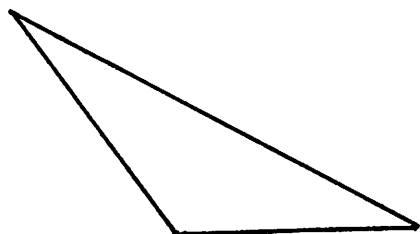
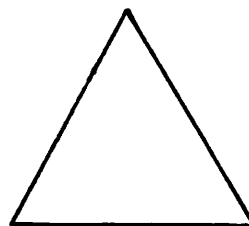


A right triangle is a three sided figure which has one angle equal to 90° or $\frac{1}{4}$ of a circle.



The hypotenuse is the long side opposite to the 90° angle.

An acute triangle is one where each of the three angles is less than 90° . (The sum of the three angles will equal 180° .)



An obtuse triangle is one where one of the angles is greater than 90° .

TRIANGLES (2)

Write a program that asks for the three sides of a triangle, A, B and C as input and then prints out either RIGHT TRIANGLE, ACUTE TRIANGLE, or OBTUSE TRIANGLE, depending on which it is, if it is a triangle.

Try the following values:

Get a ruler and draw each triangle to scale.

Does your program agree with your drawings?

A	B	C	#
3	4	5	(1)
4	4	4	(2)
3	4	7	(3)
2	1	5	(4)
1	6	4	(5)

Make any program changes necessary to handle the data.

Show your teacher how it works with ANY three numbers.

TREE SUM

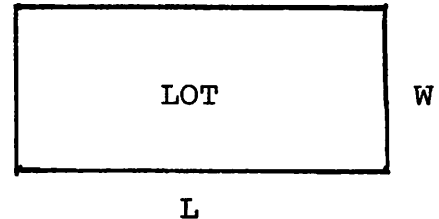
CREATE a program that asks for a seed number as input. Then have your computer display a tree of numbers on the screen. For example, suppose the number six is given as the seed number, the picture would look like this.

```
      6
    7   8
  9  10 11
12 13 14 15
16 17 18 19 20
    21
    216
```

Notice that the last number is the sum of all the other numbers used in the tree.

FENCE

If you want to find out how much fence is needed to enclose the lot on the right you would add the lengths of the four sides. The sum would be equal to the amount of fence needed. It could be written like this:



$$F = 2L + 2W \quad \text{or} \quad F = 2(L + W)$$

To find the area that is enclosed you would multiply the length by the width, or $A = L * W$

Your challenge is to create a program that will find out what L and W should be in order to enclose the most area when you know how much fence you have. This is called maximizing the area. When you have your program working, get it to calculate L and W for the following values of F.

F	L	W	A
---	---	---	---

200 ft

40 meters

800 miles

The area of a circle is $A = 3.14 * R^2$ where $R^2 = R * R$ while the distance around the circle (called the circumference or perimeter) is $C = 2 * 3.1416 * R$.

Change your program so that when the amount of fence is given it will calculate the best value of L, W, and A for a four-sided figure and the best R and A for a circle.

DEPOSITS

When you put money in a savings account it earns interest. This means the bank pays you for letting them use your money while it was deposited in their bank. How much they pay you depends on the following:

P = Principal (the amount you deposited)

T = Time (how many years you left the money in the bank)

R = Rate (the percentage they pay as interest for using your money one year)

I = Interest (the amount they pay for using your money)

$$I = P * R * T$$

This is how you can calculate the interest.

DEPOSITS (2)

- (1) If on January 1, 1982, you deposit \$100 in a bank that pays 5%, how much interest will be due you on January 1, 1983?

- (2) How much would be due if you asked for it on July 1, 1982?

- (3) On September 1, 1983?

Many banks add the interest to your account four times a year and then pay you interest on the interest. This is called compounded quarterly interest. Some banks add the interest to your account daily.

- (4) Write a program that asks you to INPUT the principal, rate, time in years, and whether the interest is compounded yearly, quarterly, or daily. Then have the program calculate the interest due you for the values you INPUTed.

INTEREST

If you deposit a penny a day into an account that pays 6% and compounds the interest daily, how much will you have in 5 years?

Write a program that asks you to INPUT the amount of your daily deposit (A), the rate of interest (R), and the number of years (Y) you do this.

Have it calculate the amount in your account (B=Balance) for any Y you request.

Try changing the amount you deposit daily.

What must you deposit daily to be a millionaire by the age of 40?

\$1,000,000

If you wish to have \$1,000,000 in tax free bonds by the time you are 45, how much do you have to save each year?

Write a program that will let you INPUT the following:

your age,

the average interest rate you expect your money
to earn,

the age by which you want \$1,000,000,

how often the interest will be added.

If the bonds pay 8% tax free, what will your annual
income be?

Look in the Wall Street Journal or call a broker to
find the current rate tax free bonds are paying.

BORROWING

Most persons who buy a car borrow money from a bank to do so. The bank lends the money (P) at an interest rate (R) for a time (T). You agree to make a monthly payment (MP) until you pay back to the bank the principal you borrowed plus the interest which is compounded monthly on the unpaid balance.

Write a program that will ask you to INPUT P,R,T, and MP, and will calculate what your car really cost you when you finance it. The total cost of paying for it on time is the purchase price plus all interest.

Try it for a \$6000 car at 15%. (You decide what monthly payment you wish to make.)

Try it for a house that costs \$40.000 at $14\frac{1}{2}\%$.

SHALL I ?

Take a look at the letter on the next page. As you can see, I am interested in borrowing money so that we can establish more CREATIVE PROGRAMMING CENTERS quickly. Write a computer program that will calculate what I need to know to make a wise decision. Remember that the banks calculate the interest monthly on the unpaid balance.

Present value of my loan	\$30,000
--------------------------	----------

Present interest rate	7.5%
-----------------------	------

80% of today's value	\$60,000
----------------------	----------

On a 25 year repayment plan, what will my monthly payment be if I:

(a) stay with my loan of \$30,000 at 7.5%

(b) refinance my home for \$60,000 at 11%

What will it cost me in interest by the time I get the new loan paid off in 25 years?

How much will it cost me to borrow \$30,000 by this method?

You will probably need to do some research before you start writing your program.

SHALL I? (2)

February 18, 1983

Mr. John Sutton
1950 Golf Road
Arlington Heights, IL 60005

RE: Loan #9075-4
Preferred Customer Interest Discount

Dear Mr. Sutton:

Our Board of Directors has recently approved a special program for you, an existing mortgage customer in good standing. Your particular loan account has been paid down well below the original loan amount and, therefore, provides an excellent means by which you could easily obtain cash.

As you know, present market interest rates are indeed relatively high. Up until now, these high current interest rates may have discouraged you from refinancing your home to secure cash...cash that may be needed for any one of many reasons in this inflated economy.

We are pleased to announce that our Board of Directors has approved a special loan program in which our existing customers who are in good standing would be offered loan terms far below current market rates. Present mortgage rates are well above 12% and, in many areas, rates exceed 13½%! If you are interested in refinancing the above-captioned loan, the new loan rate now offered to you is 11%.

We invite you to visit our office to discuss an easy and timely refinance loan which is only limited to 80% of today's value of your home.

Even though you are welcome to apply for up to 80% of today's value of your home, we have for matter of example considered a refinance of the above-captioned loan that would gross \$5,000 cash to you. If you were to refinance, your current loan balance would be paid in full with the proceeds of the new loan, the new loan would provide you with a gross of \$5,000 new cash, and the monthly payment on the new loan would be \$392.91 (principal and interest only @ 11% computed over a 25-year term, which is the maximum term on qualifying properties).

If you are interested in learning more about this very special offer made to our preferred customers, please contact me personally. We would be pleased to assist you in completing your application for this special refinance loan if you decide to take advantage of our offer to provide you with cash at below market rates.

Sincerely,

(Name omitted)

Vice President

CAR

A new car that I am considering costs \$6,549 and gets 32 miles per gallon of gas. The used car that I am considering costs \$2,700 and gets 15 miles per gallon of gas.

Both cars use gas that on the average costs \$1.43 a gallon. I will have to borrow the money at 18.5% in either case. I drive an average of 10,000 miles per year. Neglect the difference that may occur due to maintaining a used car as compared to a new car.

How soon will it cost me more to operate the used car than the new car? Create a program that will allow me to INPUT the cost of both cars, the price of gas, the mileage of each car, and the interest rate, so that I may use it for other car comparisons.

AVERAGES

Let's suppose you have seven test scores. Below are the scores.

Test 1	70
Test 2	80
Test 3	91
Test 4	78
Test 5	85
Test 6	95
Test 7	96

Number of Tests = 7 595 = Total Points

The 595 points is found by adding together the seven test scores. This is called the sum.

If you let T_1 = the score on the first test, and
 T_2 = the score on the second test, and
 T_3 = the score on the third test, and so on,
then you can write that for the seven tests.

$$\text{The sum} = T_1 + T_2 + T_3 + T_4 + T_5 + T_6 + T_7$$

This is written by mathematicians like this:

$$\text{SUM} = \sum_{i=1}^N T_i = T_1 + T_2 + T_3 + \dots + T_N$$

This shows that you will SUM all the values of T from
 $i = 1$ to $i = N$

Your computer can do this for you very nicely.

Just type:

PRINT 70 + 80 + 91 + 78 + 85 + 95 + 96 and then push ENTER

595 should appear!

OR you can write a program that will do it.

```
20 INPUT "HOW MANY NUMBERS DO YOU WISH TO SUM?";N
30 FOR I=1 TO N
40 PRINT "WHAT IS THE SCORE FOR TEST #";I;"?":INPUT S
50 SUM = SUM + S
60 NEXT I
70 PRINT "THE SUM IS";SUM;"."; "THERE WERE";N;"TEST SCORES."
```

To find the average of these test scores you need only divide 595 by 7; the SUM by the number (N). In shorthand notation it would look like this:

$$T_{av} = \frac{\sum_{i=1}^N T_i}{N} = \text{average (or MEAN)}$$

Or in your case: $T_{av} = \frac{595}{7} = 85$

For your computer program add this line:

```
75 PRINT:PRINT "THE AVERAGE IS";SUM/N;"."
```


AVERAGES (3)

Below are the points scored by two local basketball players during their season last year. Can you find the average for each of them?

<u>GAME</u>	<u>POINTS SCORED</u>	
	<u>A</u>	<u>B</u>
1	4	21
2	10	14
3	16	9
4	8	20
5	20	12
6	4	15
7	17	6
8	20	11
9	4	20
10	7	20
11	8	15
12	11	15
13	10	25
14	26	12
15	4	12
16	10	12
17	16	21
18	4	17
19	13	19
20	10	13

$$AP_A =$$

$$AP_B =$$

MOTION

These are the equations that may be used to describe motion:

General Definitions

$$\text{Velocity} = \frac{\text{Change in Distance}}{\text{Change in Time}} = \frac{CD}{CT}$$

$$\text{Acceleration} = \frac{\text{Change in Velocity}}{\text{Change in Time}} = \frac{CV}{CT}$$

Variables (Use these in creating your program.)

- DX = Distance (meters) in the X-direction
- DY = Distance (meters) in the Y-direction
- VX = Velocity (meters/second) in the X-direction
- VY = Velocity (meters/second) in the Y-direction
- OXV = Original velocity in the X-direction
- OYV = Original velocity in the Y-direction
- AX = Acceleration in the X-direction
- AY = Acceleration in the Y-direction
- T = Time
- CT = Change in time
- CV = Change in velocity
- CD = Change in Distance

Equations (Good when the acceleration is constant.)

$$DX = (OXV) * T + \frac{1}{2} * (AX) * T^2$$

$$VX = (OXV) + (AX) * T$$

$$DY = (OYV) * T + \frac{1}{2} * (AY) * T^2$$

$$VY = (OYV) + (AY) * T$$

MOTION (2)

For an object with zero acceleration
and zero original velocity, the following
would be true:

Given: $AX = 0$
 $OXV = 0$

For values of T from 0 seconds to 1.0 seconds make
a table of:

T	DX	OXV	AX	VX
---	----	-----	----	----

Where the change in time for each run (CT) is 0.1
second.

Is this what you would expect?

MOTION (3)

For a freely falling object, this would be true:

Given: $AY = 9.8 \text{ meters/second}^2$
 $OYV = 0$

For values of T from 0 second to 1.0 second,

where $CT = 0.1 \text{ second}$, make a table of:

DY	OYV	AY	VY	T
----	-----	----	----	---

This is what you would expect if you drop a small ball in your home.

Can you find out how much time is required for it to fall from your waist to the floor? Try it and see!

MOTION (4)

For an object that is freely falling while moving horizontally at constant velocity, such as a fast ball in baseball, this would be true:

Given: $AY = 9.8 \text{ meters/second}^2$
 $OYV = AX = 0$
 $OXV = 25 \text{ meters/second}$

For values of T from 0 second to 1.0 second, where

$CT = 0.1 \text{ second}$, make a table of:

DY	DX	OYV	OXV	AX	VX	VY	T
----	----	-----	-----	----	----	----	---

This would represent a very good pitcher throwing his fastball. How much time is required to get from the pitcher's mound to home plate?

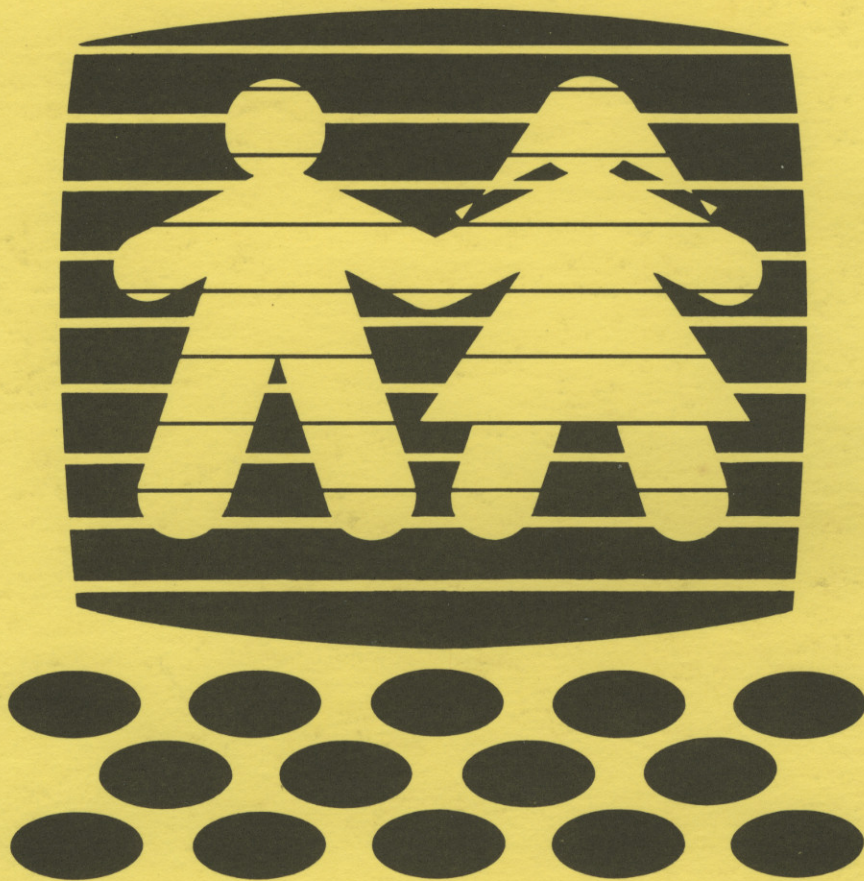
BINARY

Your computer is very good at handling binary (yes-no) decisions. It has a central processing unit (CPU) that will handle eight bits of yes-no information at a time.

For example: 1=ON 0=OFF

A		B		C
Eight bits		#		binary #
00000000	=	0	=	0
00000001	=	1	=	1
00000010	=	2	=	10
00000011	=	3	=	11
00000100	=	4	=	100
00000101	=	5	=	101
00000110	=	6	=	110
00000111	=	7	=	111
00001000	=	8	=	1000
00001001	=	9	=	1001

Can you write a program that will create columns B and C on your screen for B=0 to 255 ?



CREATIVE PROGRAMMING
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