

# Number Sense, Reasoning and a TI-73/83/84 A Natural Partnership!

*More detailed documentation about how to operate each program is found on separate files for each program. The information on this handout is very much abbreviated.*

The detailed documentation and program files can be found at  
<http://a4a.learner.org/page/presentations>

## Interrupting Programs

Any program may be interrupted by pressing the **[ON]** key. Next, select “1: Quit” to return to the home screen.

If “2: Goto” is chosen, one will end up in the program’s code if the program is not locked. If this should happen, immediately press **[2nd]**-**[QUIT]**.

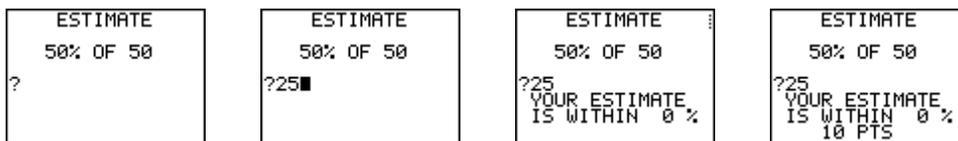
## DEFAULT

Several of the programs in this packet create custom lists and turn axes off. To restore the normal lists, as well as other default features of the calculator, this program should be executed before putting the calculators away. You can also run this program whenever the calculator doesn’t seem to be behaving as it should. DEFAULT does not clear any functions in the Y= editor; however, it does turn them off. It does not clear any data in any lists nor does it delete lists or programs. It is different from the calculator’s built in default program (**[2nd]****[MEM]** 7:Reset, 2:Defaults) in that it does not re-seed the random number generator with 0.

## ESTIPCNT, ESTIADD, ESTISUBT and ESTIMULT

The ESTI programs encourage estimation and mental math. This documentation will describe the ESTIPCNT Program in detail. The others operate in a similar manner.

The program ESTIPCNT is a drill on estimating the percent of a given number. The program randomly chooses a percent (1 – 100%) and a number (1 – 1000). The problem is displayed on the screen. The student must enter an estimate. If an input error is made, press **[CLEAR]**. Press **[ENTER]** and the **percent of error** will be displayed.



Press **[ENTER]** again and points will be awarded according to the following criterion:

- 10 pts: 0-5 % error**
- 5 pts: 5-10 % error**
- 3 pts: 10-15 % error**
- 1 pt: 15-20 % error**

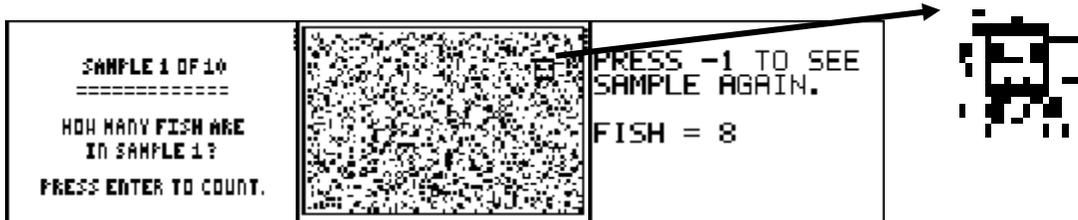
*(In the ESTIADD, ESTISUBT and ESTIMULT a bonus of 2 pts is earned if the answer is exact.)*

## FISH

The objective of FISHY WATERS is to determine the population of fish in a lake. This is done by examining buckets of random water samples to count the fish in each sample. The problem is how to use this information to estimate the number of fish. How many samples will you need to give an accurate estimate? How close is “good enough”?

The “lake” is the interior of a framed section of the window screen. Each darkened pixel in the interior represents 1 fish. A square frame represents the bucket. **The size of the interior of the bucket is 5 x 5 pixels. The size of the lake is 93 x 61 pixels.**

The set of screen shots below illustrates what the screens for a single sample look like. The student needs to observe carefully when counting the pixels inside the bucket. Can you count 8 fish in the sample below? Sometimes it is easier to count which pixels are missing in each row of the bucket.



After counting the student must press **ENTER** to access the input screen, input the fish count in the bucket, and press **ENTER** again. Once all the samples have been counted, the data can be examined by opening the List Editor.

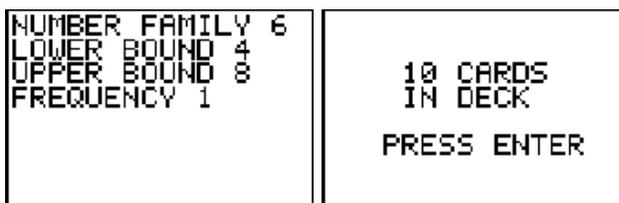
## FLASH

Fact Flash was created to aid students in achieving automaticity in memorizing the addition, subtraction, multiplication and division facts that give them difficulty. The student is able to build customized flash card decks in multiple ways, select the operation desired, and set the speed interval allowed to input the answer. However, the student is not hurried between each new card flashed, thus being able to alleviate tension.

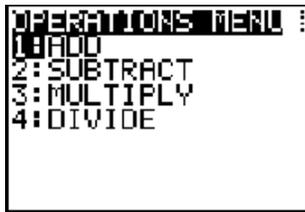
The program opens with the Main Menu. The student first needs to build a new deck. There are three ways a deck can be built.



Below is an example of building a deck using the Number Family Method. The following facts from the Six Family have been selected: (6,4) (4,6) (6,5) (5,6) (6,6) (6,6) (6,7) (7,6) (6,8) (8,6)



In the first screen, the 6, 4, 8 and 1 are inputs after each prompt, followed by **ENTER**. The flash cards (6,4) and (4,6) become 6+4 and 4+6 for addition; 10-4 and 10-6 for subtraction; 6x4 and 4x6 for multiplication; and 24/6 and 24/4 for division.



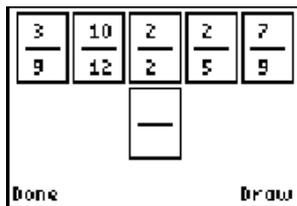
Once the deck has been built, the user can return to the Main Menu to select the operation and flash speed.

Now it is time to practice! The program will shuffle the deck so that the cards appear in a random order. The student needs to input the answer before the “Timed Out” message appears. However, please note that it is not the student’s answer that appears on the screen. The correct answer is the only answer that appears. The student can study this before pressing **[ENTER]** for the next card.

### FRLINUP

In Fraction Line Up the object is to get five fraction cards in either ascending (Lo-Hi) or descending (Hi-Lo) order. Equivalent fractions are not allowed!

When asked “Which deck do you want to use?”, any number may be entered. If you want all students to start with a deck of cards shuffled in the same order, then all students should enter the same number. If you would like to replay a shuffle, then record the deck number to use again. The deck consists of 78 fraction cards; one card for each fraction less than or equal to 1 for the denominators 2 through 12. For example, there are five cards with denominator of 5:  $1/5$ ,  $2/5$ ,  $3/5$ ,  $4/5$  and  $5/5$ .



After patiently waiting for the deck to be built, a screen will appear with five fraction cards displayed as well as a draw pile. Soft keys are used in this program. To draw a card, use the key below the word “Draw” on the screen; i.e. **[GRAPH]**. When all the cards are in order, one would choose “Done” by pressing **[Y=]**.

### GOLF

Golf will give students practice in estimating lengths and angles. The unit varies in length for each new hole. The angle measures range from  $0^\circ$  -  $360^\circ$ .

Enter any number whatsoever when asked what hole you want to play. The next screen wants to know how you want to measure angles:

- (1) Using Degrees going counter-clockwise from the positive X-axis (Math Angles);
- (2) Using Compass Headings where north is 0 degrees and east is 90 degrees; or
- (3) Using Radians going counter-clockwise from the positive X-axis

In the first screen the putter is standing at the crosshair and the box is the hole that the ball must roll into. In the upper left corner, the line segment indicates how long one unit of length is for that hole. If the ball rolls over the hole because the length estimate is too long, the ball will not drop into the hole.

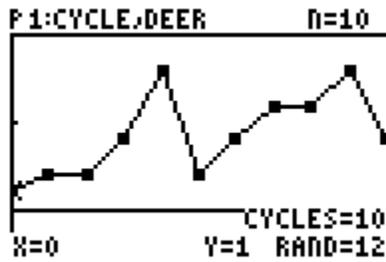
Notice that if the shot is missed, the second shot is taken from the original spot, not at the ball’s landing point as in the actual game of golf.

If one wants to take another look at the putting green when on the question screen, enter a negative number for either response.

## ODEER

This program is a model of a student activity from the Western Regional Environmental Education Council that simulates a predator/prey relationship. The survival of the deer depends upon various limiting factors in the environment (habitat) such as food, water, shelter, space, weather, and environmental pollution. These limiting factors contribute to the fluctuation in the size of the deer population from season to season.

After students have played the physical game for a while, they can continue to explore what happens when the initial conditions are varied or repeated.



The Program ODEER simulates the game. Initially the program asks for a value for the variable **rand** to seed the random number generator, the total number of students in the simulation (**N**), (i.e., the total number of deer and limiting factors together), the number of students who are deer initially, and the total number of cycles/years (**C**) to carry out the simulation. The X axis ranges from 0 to C and the Y axis ranges from 0 to N, with a scale of 5. The indicated Y value at X=0 represents the initial deer count.

## ORDER IN THE COURT!

The class is divided into teams of two to four students. One game sheet is given to each team. Four different types of game sheets are included; the easiest is the 2 X 2. All students write the same five-number expression in the Numerical Expression Box at the top of their paper. For example, the expression might be  $8*9+5-7*5$ .

Next the teacher gives the students several sets of conditions to write in the boxes marked TBA. The task for the students is to obtain the largest value in the class, the smallest value and, if used, the least absolute value (closest to zero) by inserting the conditions in the expression. **The numbers and operations must always be in the original sequence.** At the end of a pre-determined time period, each team should have one expression and its value written in every cell on their team response sheet.

Let's say that the first condition given was to insert one set of parenthesis and the second condition was to insert a negative sign and the squaring symbol. The screen shots below show several possibilities. Notice that the conditions cannot be mixed; i.e., in this example, one set of parenthesis AND a negative and a square cannot all be inserted in the same expression. However, if the second condition had been to insert one set of parenthesis, one negative and one square, then all three must appear in the expression.

First Condition

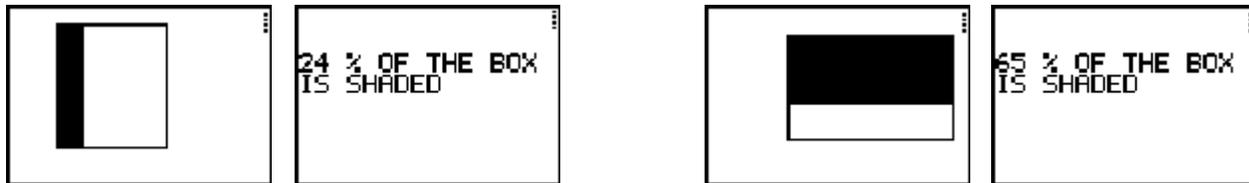
$8*9+(5-7)*5$	62
$8*(9+5)-7*5$	77
$(8*9+5)-7*5$	42
$(8*9+5-7)*5$	350
$8*(9+5-7*5)$	-168

Second Condition

$-8*9+5^2-7*5$	-82	$8*9^2+5-7*5$	688
$-8*9+5-7^2*5$	-312	$8*9+5-7^2*5$	322
$8*9^2+-5-7^2*5$	398	$8^2*-9+5-7*5$	-606
$8*9+5-7*-5^2$	252	$-8*9^2+5-7*5$	-678

## SHDBOXPR and SHDBOXQZ

Shade Box Practice and Shade Box Quiz are designed to help students to visually estimate the shaded portion of a rectangle as a part-to-whole ratio expressed as a decimal. When the program is executed, a random size rectangle is drawn which is then partially shaded a random amount. The program pauses to allow a student time to determine an estimate.



In the Shade Box Practice program students are given the opportunity to practice many problems. A student is only asked to make a mental estimate before feedback is given. No answers are actually entered into the calculator. The Shade Box Quiz program gives the student 5 problems (only three on the TI-73) and records the responses for later review. The estimates to five problems are saved in lists as well as how much each estimate differs from the actual ratio shaded and the average error per problem.

## TARGET

Target is a two-person game. A Start Number ( $N_1$ ) is selected randomly. Also a Target Range ( $T+- R$ ) is randomly determined. The object of the game is to estimate a factor by which to multiply  $N$  so that the product falls within the target range. If the factor the first player selects does not result in a product that falls in the given range, the **calculated product** becomes the new Start Number ( $N_2$ ). The Target Range remains the same. It is now the second player's turn to estimate a factor by which to multiply the new Start Number ( $N_2$ ). The game continues with players taking turns until the product falls within the given range.

The program randomly selects the target range and the beginning number. Only the number keys and the negative and decimal keys are operable when entering a response. The operation keys and arrow keys will not work. If an input error is made, press **CLEAR**.

At the end of the game the students may elect to review all the rounds by viewing the problems and responses stored in the calculator lists. Following the instructions on the screen to access the following lists:

TURN ( $L_1$ ):	Round
LBND ( $L_2$ ):	Lower boundary of Target Range
UBND ( $L_3$ ):	Upper boundary of Target Range
NUMBR ( $L_4$ ):	Start Number
FACTR ( $L_5$ ):	Estimated Factor
PROD ( $L_6$ ):	Product of Start Number and Estimated Factor which becomes the Start Number in the next round