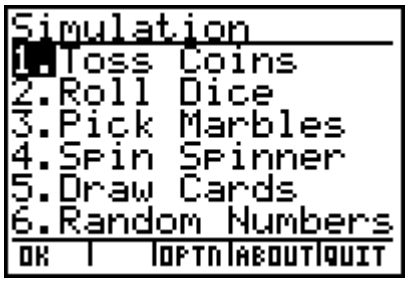
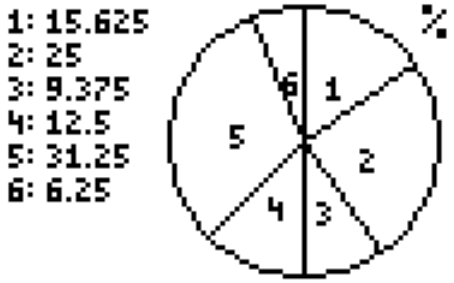
Middle School Magic with the TI-73





14th International T^3 Conference
Calgary, Canada
March 16, 2002
Session 200
9:45-11:15 MacLeod A3

Presented by
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Volusia County Schools

MIDDLE SCHOOL MAGIC WITH THE TI-73

Capabilities of the TI-73 allow the investigation of data through a variety of statistical plots including pictographs, pie charts, bar charts, histograms, boxplots, and scatterplots. This technology encourages students to design experiments, make conjectures, collect data, analyze data, and interpret the results. In addition, this technology allows students to run simulations, repeated experiments that resemble an actual situation. Ownership of the data holds the student's interest as well as provides a connection with the world around us.

CD Survey- Familiarity with Lists

Students should survey their class about something of interest to them. Students will explore fractions, decimals, and percents. As well as create both a circle and a bar graph. This example is a survey where the students were given the names of 6 groups with popular CD's on the market. Each student was asked to vote for his or her top choice. The table below represents the data from the 32 students in the class.

Popular CD Groups	Number of Students	Fraction of Students	Percentage of Students
311	5		
Blink-182	8		
Creed	3		
Beastie Boys	4		
Backstreet Boys	10		
DMX	2		

1. Complete the table.
2. Enter the data into lists.
3. Create a circle graph
4. Create a bar graph

Questions to consider:

- Which graph is a better way to present the data that you collected and why?
- If your class had 120 students, how many would you expect to prefer Blink-182?
- Are there other displays of the data that would make more sense?
- Create your own survey and present the data in a display.

Probability: Used to predict how often something is likely to happen.

Experimental Probability: Gather data through observations, experiments, or simulations.

- Probability is expressed as a number from 0 to 1, inclusive
- It can be represented by a decimal, fraction, or percent)
- An impossible event has a probability of 0
- An event that must occur has a probability of 1

$$P(Event) = \frac{\textbf{Number of favorable outcomes}}{\textbf{Total number of possible outcomes}}$$

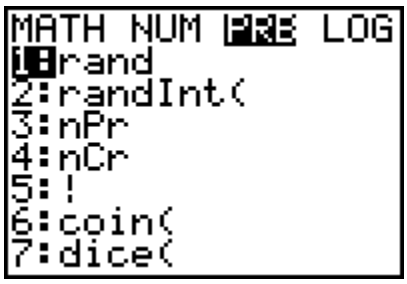
Simulation: A repeated experiment that resembles the actual situation. Methods or procedures for exploring and understanding the behavior of complex processes by doing

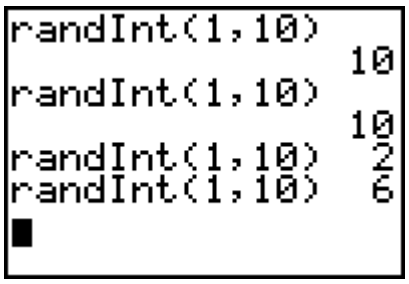
Ten Different Pokeman Cards offered in Cheerios-Collect All Ten!

In this activity on probability, the student will simulate the purchase of cereal boxes to determine how many they have to buy to get all ten Pokeman cards. The chance for obtaining each piece is equal.

1. Generate random numbers (1 through 10) to simulate which card is received in each purchase.

Choose MATH , move the cursor right to PRB. Choose 2:randInt(and this command will be pasted on the home screen. Follow with 1,10). This will create a random integer between 1 and 10 inclusive. Each different number will represent a different card. Continue to press ENTER and each press will represent the purchase of a box of cereal.





The syntax for the **randInt (**lower, upper, [,numtrials])

(You can use the Probability Simulation APP –see Technology Hints I, pages 8-10, to generate picking the cereal boxes)

APPS choose 3: Prob Sim ENTER , choose 6.Random Numbers (The top row of keys becomes 'soft keys' in an APP), choose SET ZOOM , set Numbers: 6, Range: 1-10, Repeat: Yes, OK GRAPH , DRAW WINDOW, and again until you have generated the numbers 1-10 in your draws, count the number of boxes and record.

2. On average, how many boxes will you have to buy to get all ten? Stop counting once you get all ten and keep track of the results. Repeated trials are important, keep track of the number of boxes using a "tally sheet". Then take an average of the number of boxes. A histogram of the distribution of the number of boxes can be obtained from the data.

Class Data

Number of Boxes	Frequency
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20 etc.	

Individual Data

Pokeman Card	Number of purchases (Tallies)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

3. Each person will report the number of boxes they had to purchase based on the simulation.

4. Ask students to enter the class results in a list and calculate the class average.

5.
Questions to consider:
- What does the class average mean?
- If each box of cereal cost $2.99, how much would the average class have to spend to get all 10 cards?
- Design a problem similar to this and ask your group to report results to you.

Designing a Weighted Spinner using the Prob Sim APP

Design a circular spinner with 6 sections, specified colors and central-angle measurements:

COLOR	CENTRAL ANGLE	POINT VALUE
Yellow	**20°**	**6**
White	**80°**	**2**
Black	**95°**	**1**
Green	**50°**	**4**
Red	**35°**	**5**
Blue	**80°**	**3**

Determine the following from your experiment:

1. What is the probability that the spinner will land in each section.

2. If you spin this spinner 100 times, how many points can you expect to get per spin?

   In Prob Sim APP choose 4. Spin Spinner, choose SET ZOOM
   100
   Sections: 6
   Graph: Freq
   StoTbl: All
   ClearTbl: Yes
   Update: End
   Choose ADV WINDOW
   Set Prob column to proper decimal (20/360,80/360, etc.); choose OK GRAPH, OK GRAPH, SPIN WINDOW, to save into lists choose DATA TRACE, OK GRAPH, ESC Y=, YES Y=, QUIT GRAPH , YES Y=
   In order to count the number of times the spinner landed in each section, either Sort each section or use 2nd (STAT) LIST MATH; 7:sum(, then add SECT=1) etc. Out of the given trials, this number tells you how many times the spinner landed within that section.

3. Conduct a simulation of 100 spins. Calculate the average points per spin.

4. Find the class average.

Sample Activity from the TI Website- "Hello Dolly"

Generate data using experimental probability and the laws of heredity

TECHNOLOGY HINTS: TI-73

A: Keyboard Zones:

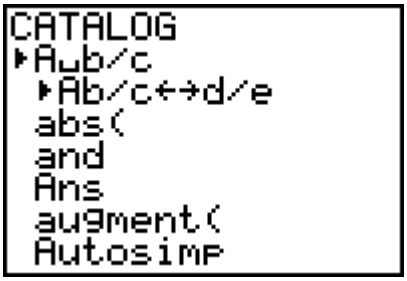
Graphing Keys
Editing Keys
Math Function Keys
Fraction Keys
Measurement Conversion Keys

Color Coded:

White Keys - Number Keys
Green (Bright) Keys - Right Side:
Common Math Operations
Across Top: Set Up and Display
Graphs, Plots, & Tables

Primary Function: White printing on Key
Secondary Function: Yellow printing above Key
Alpha Menu: 2nd MATH **(TEXT)**
ON - ON **OFF -** 2nd ON **(OFF)**
Lighten Cursor 2nd ß **- Darken Cursor** 2nd Ÿ
"Quit and Go Home" - 2nd MODE **(QUIT)**
Retrieving last input (entry): 2nd ENTER **(ENTRY)**
(Use up arrow and enter to select previous entries or answers)
Retrieving last answer: 2nd (-) **(ANS)**
Clearing the Home screen: CLEAR

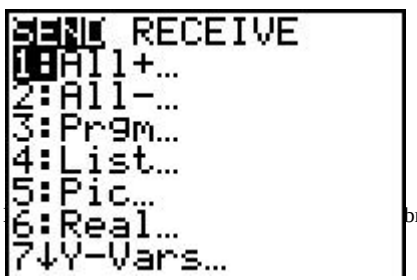
B: When you can't find it……use 2nd PRGM **(CATALOG)!**

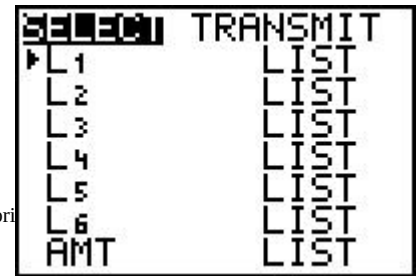


SetUpEditor can only be found under CATALOG. SetUpEditor allows you to choose which lists you would like to view in the LIST window.

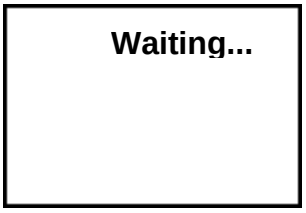
C: Calculator Linking:

Send: APPS 1:Link… - choose type 3:Prgm (Programs) or 4:LISTS
The objects will appear with an arrowhead. Use the directional keypad to move to selection and ENTER to select items. When all items have been selected, use ➢ to TRANSMIT. You cannot transmit successfully unless the receiving calculator is ready!





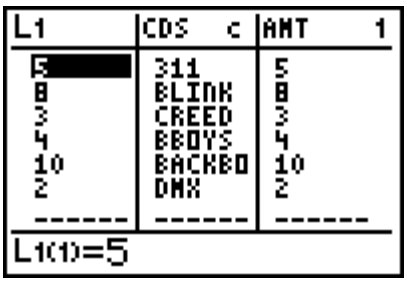
Receive: APPS 1:Link… ➢. Then press ENTER or 1:Receive to display the "waiting" message. This must be displayed on receiving unit before the sending unit initiates the transmit command.



If the DuplicateName message appears on the receiving unit, then the receiving unit already contains the item. You must choose to rename, overwrite the old item, omit the new item, or quit the process.

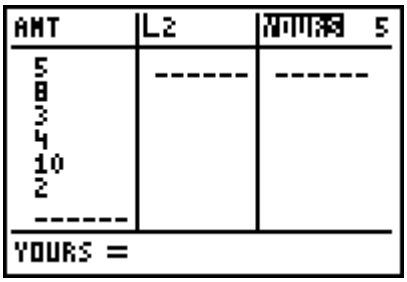
D: Entering numerical data in a list:

Choose LIST to view the lists. Move the cursor to the first position under the name of the list that you want to create. Begin entering the data, pressing ENTER after each entry. A single list may be cleared by positioning the cursor on top of the name, then CLEAR ENTER. All lists may be cleared at once 2nd 0 (MEM). 6: ClrAllLists



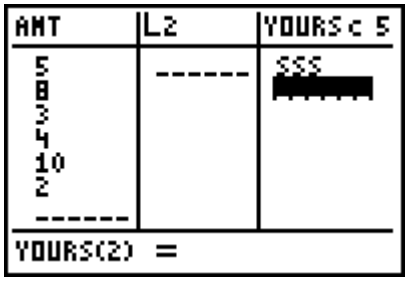
E: Naming your lists:

LIST,, then move the cursor to the top right of all of the lists on top of the first unamed list. Choose 2nd MATH (TEXT) and use the cursor to access the desired letters. Name = appears at the bottom of the screen. Type in the five letter (maximum) name that you would like associated with your data, then use your cursor to select DONE ENTER ENTER.



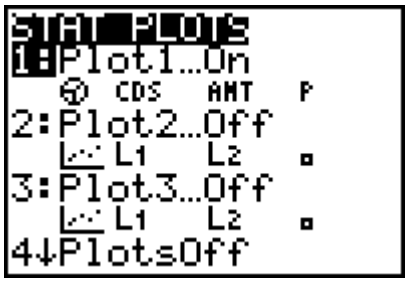
F: Entering categorical data in a list:

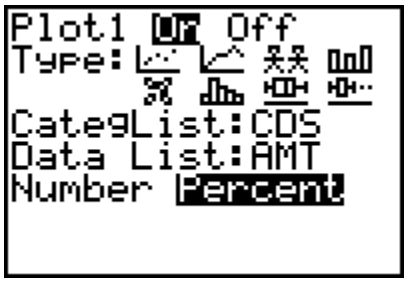
After naming the list use the cursor to move directly below the name of the list. Choose 2nd MATH (TEXT), first select " then the first category of your list. End with ". Select DONE ENTER ENTER . Note that a small c appears at the right of the name indicating that it is a categorical list. Once the first element is entered properly, quotes are not necessary for the rest of that list.

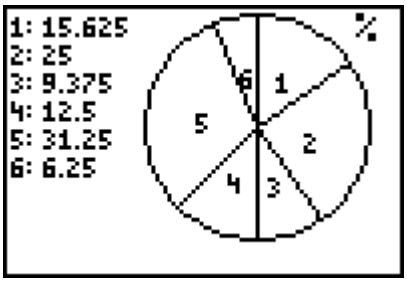


G: Creating Plots:

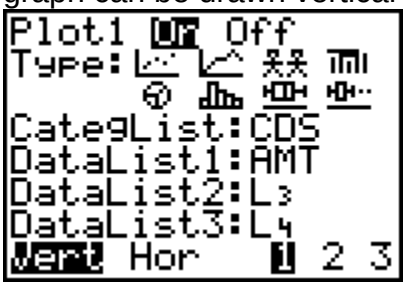
Select 2nd Y= (PLOT) ENTER ON and ENTER . Move the cursor down and to the right to select the 1st icon on the second row of types for a circle graph. GRAPH TRACE

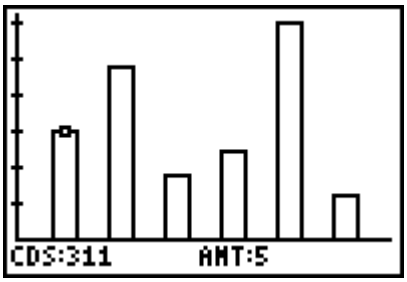




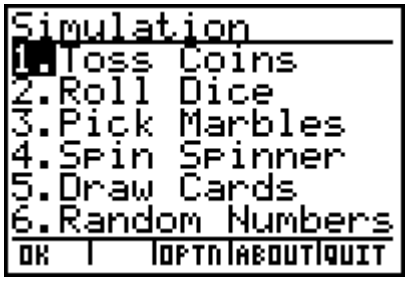


To make a bar graph select the fourth icon on the top row of types. Your bar graph can be drawn vertical or horizontal.





H: Using the Probability Simulation APP



1. Toss Coins

- Two-sided probability
- Coins can be Weighted
- Up to 3 coins at once
- Data can be stored into Lists
    - 'TOSS' toss number
    - 'C1', 'C2', 'C3' results for each coin
    - 'TOT' Total number of heads each trial
    - 'CUM' replaces 'TOT' if one coin is used

2. Roll Dice

- Dice can have 6, 8, 10, 12, or 20 sides
- Dice can be weighted
- Data can be stored into Lists
    - 'ROLL' Trial Number
    - 'D1', 'D2', etc. Results for each Die
    - 'Sum" Sum of the numbers on each die

3. Pick Marbles

- 2, 3, 4, or 5 types (colors) of marbles
- Set number of each color
- Replacement or not
- Data can be stored into Lists
    - 'PICK' Trial Number
    - 'A', 'B', 'C' etc. Contains Results, 1 If That Marble Chosen

4. Spin Spinner

- One spinner with 2 to 8 sections
- Sections can be weighted
- Data can be stored into Lists
    - 'SPIN' Trial Number
    - 'SECT' Number Of Section Where Spinner Stopped

5. Draw Cards

- Pick One Card At A Time
- 1, 2, or 3 decks
- Replacement or not
- 52 or 32 card deck
- Data can be stored into Lists
    - 'DRAW' Trial Number
    - 'VALUE' number on card
    - "SUIT" suit of card (1-heart, 2-club, 3-spade, 4-diamond)

6. Random Numbers

- 6 Random Numbers at once
- Numbers can be 0 to 99
- Each Set of Trial is shown
- Data can be stored into Lists
    - 'DRAW' Trial Number

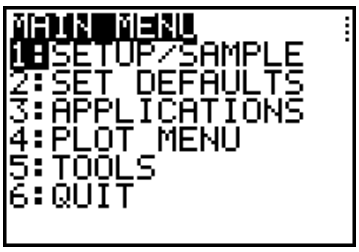
- ‘N1’, ‘N2’ etc. Numbers generated for each trial (6 lists)
- ‘TOT’ Sum of numbers for each trial
- ‘CUM’ Cumulative sum up to that trial

I: Using the CBR:

1. The CBR (Calculator-Based Ranger) is a sonic motion detector. The motion detector sends out an ultrasonic pulse. Objects should be between 0.5 meters and 6 meters for reliable measures.

2. Students can explore math/science relationships between distance, velocity, acceleration, and time using data collected from activities performed with the CBR and the RANGER program
3. Calculator models, such as The TI-73 has the RANGER program as an application.
4. Link the calculator to the CBR using the black link cord.
   Run the ranger program. APPS Choose 2: CBL/CBR ENTER
3:RANGER

   Both calculators will show the same screens at this point:



View / change settings
Change to default settings
Distance Match/Velocity Match/Ball Bounce
Plot options
Get CBR Data, Get Calc Data, Status, Stop/Clear

The CBR collects data and stores the data in LISTS L1, L2, L3, and L4

- L1 contains time data.
- L2 contains distance data.
- L3 contains velocity data.
- L4 contains acceleration data.

Resources for Middle School Activities

- *Connected Mathematics: What do you Expect?; Lappan, Ley, Fitzgerald, Friel, and Phillips; 2002; Prentice Hall*
- *Data Collection Activities for the Middle Grades with the TI-73, CBL, and CBR*; *;* Ellen C. Johnston and David A. Young;1998 Texas Instruments Inc.
- *Discovering Mathematics with the TI-73: Activities for grades 5 & 6*; Melissa Nast; 1998 Texas Instruments Inc.
- *Discovering Mathematics with the TI-73: Activities for grades 7 & 8;* Ellen C. Johnston; 1998 Texas Instruments Inc.