Probably Not!

ID: 13726

Time required
45 minutes

Activity Overview

In this activity, students will find the theoretical probability of different male/female combinations in a family of kittens. They will compare the experimental results of a simulation to the theoretical probability.

Topic: Statistics & Data Analysis

- *Experimental and theoretical probability*

- *Bar graphs*

Teacher Preparation and Notes

- *It would be helpful if students have had some experience with naming and enter lists and setting up box plots.*

- *TI-Navigator is not required for this activity, but an extension is given for those teachers that would like to use it.*

- ***To download the student worksheet, calculator program, and TI-Navigator files, go to education.ti.com/exchange and enter "13726" in the keyword search box.***

Associated Materials

- *ProbablyNot_Student.doc*

- *COINFLIP.73p (program)*

- *ProbablyNot_LrnChk_TI73.edc*

Suggested Related Activities

To download the activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Probably Not! (TI-73 Explorer) — 4492*

- *Is What Should Happen What Will Happen? (TI-73 explorer) — 3706*

- *Hello Dolly (TI-73 explorer) — 4017*

- *The Candy Caper (TI-73 explorer) — 4225*

Problem 1 – Simulation – Experimental Probability

In this activity, students will explore the likelihood of Mikel having 5 female kittens. Since only female kittens will be calico, Hillary, Mikel's owner, wants to know the probability of Mikel having exactly 5 calico kittens. Students will use the coin toss function of the TI-73 to simulate this scenario.
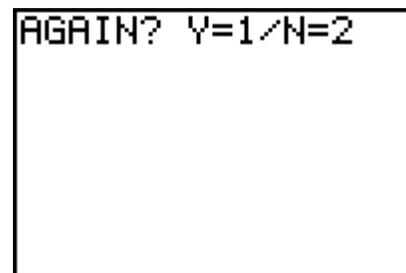
Questions 1–4

Students working in pairs will "flip" a coin 50 times and determine the gender of each kitten with heads being female and tales being male.

To simulate the coin toss, students will use the first option SIMULATION in the program **COINTOSS**. H represents heads, or a female, and T represents tails, or a male. After the trial is displayed, students need to press ENTER. The calculator will ask if they want to do another trial. They should press 1 ENTER to do another trial or 2 ENTER if they want to stop. Pressing 2 will exit them to the Home screen.

```
NO. OF FLIPS?5
                HTTHT
```

As students populate the data table they should realize which outcomes bare more likely than others. Help students find the experimental probability from the data they have collected. Each group may have a different probability.

```
AGAIN? Y=1/N=2
```

Note: This simulation can also be performed using the **coin()** command in the MATH > PRB menu.
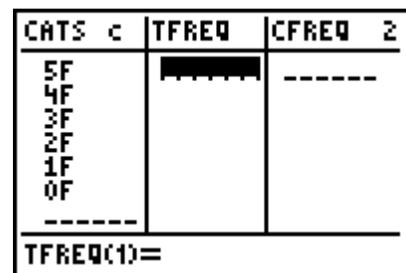
Problem 2 – The Class Data

After the pairs have concluded their simulations, collect all the class data for a large sample to analyze.

Question 5

Once all the groups have collected their data, combine the data to use as a class. T1 represents group 1, T2 is group 2 and so on.

Question 6

Students will use the program COINFLIP to set up the list editor. By selecting the second option ENTER DATA, the calculator will set up 5 lists, CATS, TFREQ, CFREQ, PROB, and PRED, in that order from left to right. For this question, they will input data for **TFREQ**, the team data, and **CFREQ**, the class data. The entries for CATS have already been done for them.

```
CATS  c |TFREQ |CFREQ  2
 5F     |██████|------
 4F     |      |
 3F     |      |
 2F     |      |
 1F     |      |
 0F     |      |
 -----  |      |
TFREQ(1)=
```

Question 7–9

Students will then compare the results they received to the complete data for the class. They should see similarities but may also see a better distribution with the class data.

Problem 3 – Creating Bar Graphs

Questions 10–12

Students will set up stat plots to visually see the data. The first plot, Plot1, will graph **CATS** as the category and **TFREQ** as the frequency. Plot2 should be set up for **CATS** and **CFREQ**.

To access and change the stat plot, press ⌷2nd⌷ ⌷Y=⌷ ⌷ENTER⌷. Use the arrow keys to highlight **On** and ⌷▥⌷. To select CATS, press ⌷2nd⌷ ⌷LIST⌷, move to CATS, and press ⌷ENTER⌷.

You will need to turn Plot1 off before viewing Plot 2. The students should be able to see similarities between the graphs.
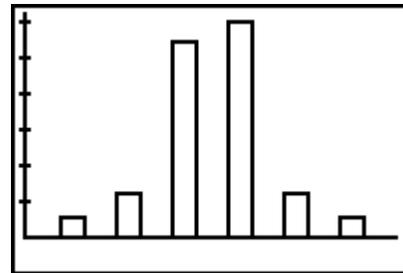
Problem 4 – Theoretical Probabilities

Finally, students will find all the possible combinations of male and female kittens. This will then be used to create a theoretical box plot to compare to their experimental box plot.

Question 13

You may want students to work in pairs to find all the possible combinations. If students are having difficulty with completing this question, you may want to share that there are 32 possible combinations. Students may conclude from the graphs they have seen that the 1st and 6th columns should be the same, and that the 2nd and 5th columns should be the same, and so on.

Questions 14–16

After determining all the possible combinations, students will enter the probability of each outcome as fractions in the list **PROB**. To enter the first probability, students should move to the first element of **PROB** and press ⌷1⌷ ⌷b/c⌷ ⌷3⌷ ⌷2⌷. They will see the fraction appear in the list.

Then, students will use a prediction list, **PRED**, to store predicted values that can be graphed with the class data. Multiply all the values of **PROB** by 1000 so the bars will be comparable to the class data and easily compared.

Extension – TI-Navigator™

1. Use **Screen Capture** throughout to monitor student progress.

2. Use **Quick Poll** to ask students questions throughout the lesson to assess student understanding. For example, for Question 14, you could ask students the probability of a specific outcome. You can also use **Quick Poll** to gather the different possible combinations and record them on the board as each student gives an answer.

3. Use the *ProbablyNot_LrnChk_TI73.edc* file to assess student understanding of the vocabulary in this lesson.

4. Use TI-Navigator to send the **CFREQ** list to students instead of each pair entering the data. This could save time and ensure that the lists are accurate.

**Solutions – student worksheet**

Problem 1

1. Answers will vary. Check students' work.

2. Answers will vary but all students should indicate that 2 and 3 females are the most frequent. This is happening most often because there are more ways to have 2 and 3 females appear.

3. Answers will vary but all students should indicate that 0 and 5 females are the least frequent. This is happening least often because there are very few ways for 0 and 5 females to occur.

4. Answer will vary. Check students' work to ensure answers match the data.

Problem 2

5. Answer will vary.

6. If the actual and estimate matched, the data would create a straight line where x = y.

7. Answers will vary. However, the larger the sample space the closer the probability will be to the theoretical probability of $\frac{1}{32}$.

8. Answers will vary. Question 7's answer should be closer to the theoretical probability than Question 3.

9. Answers will vary but 2 and 3 female kittens should occur the most often.

Problem 3

10. Graphs will depend on class data. A screen could resemble the screenshot at the right.

11. Answers will vary. The bars representing 2 and 3 should be the tallest. The bars representing 0 and 5 (the outside bars) should be the shortest.
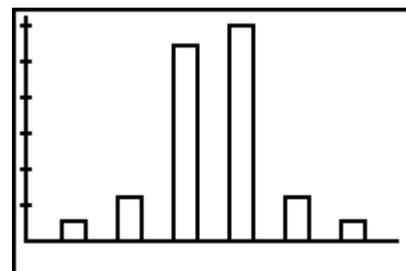
Problem 4

12. Students should comment on the maximum, minimum, median, and other summary statistics. References to actual numbers will be based on class data.

5 Females 1 Outcomes	4 Females 5 Outcomes	3 Females 10 Outcomes	2 Females 10 Outcomes	1 Female 5 Outcomes	0 Females 1 Outcomes
FFFFF	MFFFF	MMFFF	MMMFF	FMMMM	MMMMM
	FMFFF	FMMFF	FMMMF	MFMMM	
	FFMFF	FFMMF	FFMMM	MMFMM	
	FFFMF	FFFMM	FMFMM	MMMFM	
	FFFFM	MFMFF	MFMMF	MMMMF	
		MFFMF	MFFMM		
		MFFFM	MMFFM		
		FMFMF	MMMFF		
		FMFFM	MFMFM		
		FFMFM	MMFMF		

13. 32

14.

Kitten Families	Probability as a Fraction
5 females	$\frac{1}{32}$
4 females	$\frac{5}{32}$
3 females	$\frac{10}{32}$
2 females	$\frac{10}{32}$
1 female	$\frac{5}{32}$
0 females	$\frac{1}{32}$

15. The two bar graphs should be similar with the theoretical representation as perfectly symmetrical stair steps up and back down.

Class Data Transparency

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	Total
5F																
4F																
3F																
2F																
1F																
0F																