

Cooperative Group Activities

1. Out-of-class activity Divide into groups of three or four and create a new carnival game. Determine the probability of winning. Determine how much money the operator of the game can expect to take in each time the game is played.

2. In-class activity Divide into groups of three or four and use coin flipping to develop a simulation that emulates the kingdom that abides by this decree: After a mother gives birth to a son, she will not have any other children. If this decree is followed, does the proportion of girls increase?

3. In-class activity Divide into groups of three or four and use actual thumbtacks to estimate the probability that when dropped, a thumbtack will land with the point up. How many trials are necessary to get a result that appears to be reasonably accurate when rounded to the first decimal place?

4. In-class activity Divide into groups of three or four and use Hershey's Kiss candies to estimate the probability that when dropped, they land with the flat part lying on the floor. How many trials are necessary to get a result that appears to be reasonably accurate when rounded to the first decimal place?

5. In-class activity Divide into groups of three or four and use a paper cup to estimate the probability that when dropped, the cup will land upside down, with the opening on the floor. How many trials are necessary to get a result that appears to be reasonably accurate when rounded to the first decimal place?

6. Out-of-class activity Marine biologists often use the *capture-recapture method* as a way to estimate the size of a population, such as the number of fish in a lake. This method involves capturing a sample from the population, tagging each member in the sample, then returning them to the population. A second sample is later captured, and the tagged members are counted along with the total size of this second sample. The results can be used to estimate the size of the population.

Instead of capturing real fish, simulate the procedure using some uniform collection of items such as BBs, colored beads, M&Ms, Fruit Loop cereal pieces, or index cards. Start with a large collection of such items. Collect a sample of 50 and use a magic marker to "tag" each one. Replace the tagged items, mix the whole population, then select a second sample and proceed to estimate the population size. Compare the result to the actual population size obtained by counting all of the items.

7. Out-of-class activity Divide into groups of three or four. First, use subjective estimates for the probability of randomly selecting a car and getting each of these car colors: black, white, blue, red, silver, other. Then design a sampling plan for obtaining car colors through observation. Execute the sampling plan and obtain revised probabilities based on the observed results. Write a brief report of the results.

8. In-class activity The manufacturing process for a new computer integrated circuit has a yield of $1/6$, meaning that $1/6$ of the circuits are good and the other $5/6$ are defective. Use a die to simulate this manufacturing process, and consider an outcome of 1 to be a good circuit, while outcomes of 2, 3, 4, 5, or 6 represent defective circuits. Find the mean number of circuits that must be manufactured to get one that is good.

9. In-class activity The *Monty Hall problem* is based on the old television game show *Let's Make a Deal*, hosted by Monty Hall. Suppose you are a contestant who has selected one of three doors after being told that two of them conceal nothing, but that a new red Corvette is behind one of the three. Next, the host opens one of the doors you didn't select and shows that there is nothing behind it. He then offers you the choice of *sticking* with your first selection or *switching* to the other unopened door. Should you stick with your first choice or should you switch? Divide into groups of two and simulate this game to determine whether you should stick or switch. (According to *Chance* magazine, business schools at such institutions as Harvard and Stanford use this problem to help students deal with decision making.)