Problem Set

1. Some M&M's® are "defective." For example, a defective M&M® may have its *M* missing, or it may be cracked, broken, or oddly shaped. Is the probability of getting a defective M&M® higher for peanut M&M's® than for plain M&M's®?

   Gloriann suggests the probability of getting a defective plain M&M® is the same as the probability of getting a defective peanut M&M®. Suzanne does not think this is correct because a peanut M&M® is bigger than a plain M&M®, and therefore has a greater opportunity to be damaged.

   a. Simulate inspecting a plain M&M® by rolling two number cubes. Let a sum of 7 or 11 represent a defective plain M&M® and the other possible rolls represent a plain M&M® that is not defective. Do 50 trials, and compute an estimate of the probability that a plain M&M® is defective. Record the 50 outcomes you observed. Explain your process.

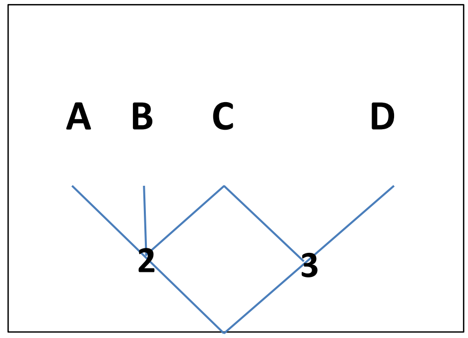
   b. Simulate inspecting a peanut M&M® by selecting a card from a well-shuffled deck of cards. Let a one-eyed face card and clubs represent a defective peanut M&M® and the other cards represent a peanut M&M® that is not defective. Be sure to replace the chosen card after each trial and to shuffle the deck well before choosing the next card. Note that the one-eyed face cards are the king of diamonds, jack of hearts, and jack of spades. Do 20 trials, and compute an estimate of the probability that a peanut M&M® is defective. Record the list of 20 cards that you observed. Explain your process.

   c. For this problem, suppose that the two simulations provide accurate estimates of the probability of a defective M&M® for plain and peanut M&M's®. Compare your two probability estimates, and decide whether Gloriann's belief is reasonable that the defective probability is the same for both types of M&M's®. Explain your reasoning.

2. One at a time, mice are placed at the start of the maze shown below. There are four terminal stations at A, B, C, and D. At each point where a mouse has to decide in which direction to go, assume that it is equally likely for it to choose any of the possible directions. A mouse cannot go backward.

   In the following simulated trials, L stands for left, R for right, and S for straight. Estimate the probability that a mouse finds station C where the food is. No food is at A, B, or D. The following data were collected on 50 simulated paths that the mice took.

LR	RL	RL	LL	LS	LS	RL	RR	RR	RL
RL	LR	LR	RR	LR	LR	LL	LS	RL	LR
RR	LS	RL	RR	RL	LR	LR	LL	LS	RR
RL	RL	RL	RR	RR	RR	LR	LL	LL	RR
RR	LS	RR	LR	RR	RR	LL	RR	LS	LS



   a. What paths constitute a success, and what paths constitute a failure?
   b. Use the data to estimate the probability that a mouse finds food. Show your calculation.
   c. Paige suggests that it is equally likely that a mouse gets to any of the four terminal stations. What does your simulation suggest about whether her equally likely model is believable? If it is not believable, what do your data suggest is a more believable model?
   d. Does your simulation support the following theoretical probability model? Explain.
      i. The probability a mouse finds terminal point A is 0.167.
      ii. The probability a mouse finds terminal point B is 0.167.
      iii. The probability a mouse finds terminal point C is 0.417.
      iv. The probability a mouse finds terminal point D is 0.250.