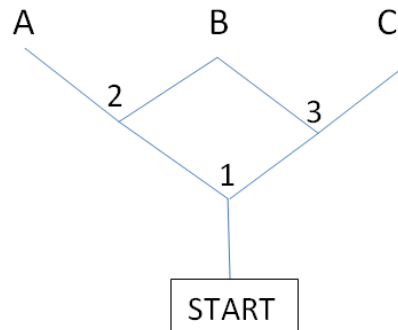


## Problem Set

1. A mouse is placed at the start of the maze shown below. If it reaches station B, it is given a reward. At each point where the mouse has to decide which direction to go, assume that it is equally likely to go in either direction. At each decision point 1, 2, 3, it must decide whether to go left (L) or right (R). It cannot go backward.

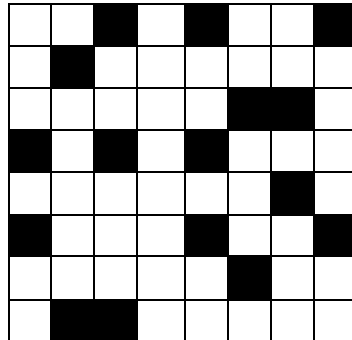


- a. Create a theoretical model of probabilities for the mouse to arrive at terminal points A, B, and C.
- List the possible paths of a sample space for the paths the mouse can take. For example, if the mouse goes left at decision point 1 and then right at decision point 2, then the path would be denoted LR.
  - Are the paths in your sample space equally likely? Explain.
  - What are the theoretical probabilities that a mouse reaches terminal points A, B, and C? Explain.
- b. Based on the following set of simulated paths, estimate the probabilities that the mouse arrives at points A, B, and C.

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

- c. How do the simulated probabilities in part (b) compare to the theoretical probabilities of part (a)?

2. Suppose that a dartboard is made up of the  $8 \times 8$  grid of squares shown below. Also, suppose that when a dart is thrown, it is equally likely to land on any one of the 64 squares. A point is won if the dart lands on one of the 16 black squares. Zero points are earned if the dart lands in a white square.



- For one throw of a dart, what is the probability of winning a point? Note that a point is won if the dart lands on a black square.
- Lin wants to use a number cube to simulate the result of one dart. She suggests that 1 on the number cube could represent a win. Getting 2, 3, or 4 could represent no point scored. She says that she would ignore getting a 5 or 6. Is Lin's suggestion for a simulation appropriate? Explain why you would use it, or if not, how you would change it.
- Suppose a game consists of throwing a dart three times. A trial consists of three rolls of the number cube. Based on Lin's suggestion in part (b) and the following simulated rolls, estimate the probability of scoring two points in three darts.

324	332	411	322	124
224	221	241	111	223
321	332	112	433	412
443	322	424	412	433
144	322	421	414	111
242	244	222	331	224
113	223	333	414	212
431	233	314	212	241
421	222	222	112	113
212	413	341	442	324

- The theoretical probability model for winning 0, 1, 2, and 3 points in three throws of the dart as described in this problem is:
  - Winning 0 points has a probability of 0.42.
  - Winning 1 point has a probability of 0.42.
  - Winning 2 points has a probability of 0.14.
  - Winning 3 points has a probability of 0.02.

Use the simulated rolls in part (c) to build a model of winning 0, 1, 2, and 3 points, and compare it to the theoretical model.