

Name: \_\_\_\_\_

**Mathematics 110 - Fall 2005**  
**Lab Six - Probability**

**Exercise 1: Flipping Coins.**

- (a) If you flip a fair coin 50 times, about how many heads do you expect to see?
- (b) If you flip a fair coin 50 times, what is the longest streak (either of heads or of tails) you expect to see?
- (c) Now let's gather some real data. Flip a coin 50 times and list the sequence of results (H or T) in the space below.
  
- (d) How many heads came up?
- (e) How long was the longest streak (either of heads or of tails)?
- (f) Which of the following streaks do you think is more likely to occur?  
HHHHHHHHHH or HHTHTTTHTH
- (g) Write down all the possible sequences of results (H or T) if a coin is flipped 4 times.
  
- (h) If a coin is flipped 4 times, what is the probability of each of the following? Look at your answer to part (g) for help.
  - (i) all tails or all heads
  - (ii) 2 tails and 2 heads
  - (iii) exactly 1 tail or exactly 1 head
  - (iv) a streak of at least 3 consecutive tails or 3 consecutive heads
  - (v) heads on the second toss if the first toss was tails
- (i) If 2 sports teams are evenly matched, then the probability of either one winning a given game can be modelled by flipping a coin. Suppose two evenly matched teams play 4 games against one another. What is the probability of each of the following?
  - (i) a sweep (either team winning all 4 games)
  - (ii) a split (each team winning 2 games)
  - (iii) one team winning exactly 3 games
  - (iv) one team winning at least 3 games in a row
  - (v) team B winning the second game after losing the first game
- (j) How do your answers to (i) compare with those to (h)?
- (k) Suppose that girl and boy babies are equally likely to be born. If you are told that a family has two children and that (at least) one is a boy, what is the probability that the other is a boy?
  
- (l) Again suppose that girl and boy babies are equally likely to be born. If you are told that a family has two children and that the older one is a boy, what is the probability that the younger is a boy?

**Exercise 2: Rolling Dice.**

- (a) If two fair, 6-sided dice are rolled, how many possible pairings (1 and 1, 1 and 2, 2 and 1, ...) are there?
- (b) Fill in the table below with the probability (as a fraction) of obtaining each total shown when two fair 6-sided dice are thrown.

Total	2	3	4	5	6	7	8	9	10	11	12
Probability											

- (c) What is the sum of all your probabilities from part (b)?
  - (d) What is the probability of getting an even total? an odd total?
  - (e) What is the probability of getting a prime total? a non-prime total?
  - (f) In both (d) and (e) what was the sum of your answers? Why?
- (g) We can make fair dice out of any of the five Platonic solids. For example, we could label each of the faces of the dodecahedron with a number from 1 to 12. How many possible pairings will there be if the following combinations of dice are thrown?
- (i) tetrahedron and cube
  - (ii) dodecahedron and icosahedron
  - (iii) tetrahedron, cube, and octahedron
- (h) What is the probability of rolling each combination of dice below to obtain the total shown?
- (i) tetrahedron and cube to obtain a total of 3
  - (ii) dodecahedron and icosahedron to obtain a total of 32
  - (iii) tetrahedron, cube, and octahedron to obtain a total of 18
- (i) Craps is a game played with two 6-sided dice. If you roll a 7 or 11 on the first throw, you win; if you roll a 2, 3, or 12 on the first throw, you lose. If you roll any other total, you must continue rolling until you either roll a 7 (which means you lose) or again roll the total from your first throw (in which case you win).
- (i) What is the probability of winning on the first throw?
  - (ii) What is the probability of losing on the first throw?
  - (iii) If the initial throw is a 4, what is the probability of winning?
  - (iv) What is the probability of throwing an initial 4 and then winning?
  - (v) Repeat the previous question for the initial throws of 5, 6, 8, 9, and 10.
- (vi) What is the overall probability of winning this game?