First Name: _____ Last Name: _____ Student ID: _____

Chapter 4: Intro to Probability Distribution, Uniform and Binomial Distribution

1. Given the following probability distributions, determine the expected values.

a)

x	$P(x)$
1000	0.25
100000	0.25
1000000	0.25
10000000	0.25

b)

x	$P(x)$
1	$\frac{1}{6}$
2	$\frac{1}{5}$
3	$\frac{1}{4}$
4	$\frac{1}{3}$
5	$\frac{1}{20}$

2. The tetrahedron is a perfectly symmetrical polyhedron with 4 faces (a cube is a perfectly symmetrical polyhedron with 6 faces).
   a) Graph the probability distribution for the sum rolled with two tetrahedron dice. (The sum in obtained by adding the two face-down numbers on each roll)
   b) Is this a discrete uniform distribution?
   c) Calculate the expected value for the sum of two tetrahedron dice.

3. A lottery has a $1 000 000 first prize, a $25 000 second prize, and five $1000 third prizes. A total of 2 000 000 tickets are sold.
   a) What is the probability of winning a prize in this lottery?
   b) If a ticket costs $2.00, what is the expected profit per ticket?

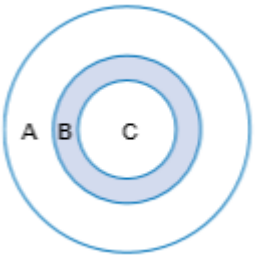
4. In a lottery, there are 2 000 000 tickets to be sold. The prizes are as follows:

Prize ($)	***Number of Prizes***
1 000 000	1
50 000	5
1 000	10
50	50

   What should the lottery operators charge per ticket to make a 40% profit?

5. A spinner with five regions is used in a game. The probabilities of the regions are $P(1) = 0.3, P(2) = 0.2, P(3) = 0.1, P(4) = 0.1, P(5) = 0.3$
   a) Sketch and label a spinner that will generate these probabilities.
   b) The rules of the game are as follows: If you spin and land on an even number, you receive double that number of points. If you land on an odd number, you lose that number of points. What is the expected number of points a player will win or lose?
   c) Sketch a graph of the probability distribution for this game.
   d) Show that this game is not fair. Explain in words.
   e) Alter the game to make it fair. Show mathematically that your version is fair.

6. Three concentric circles are drawn with radii of 8 cm, 12 cm, and 20 cm. If a dart lands randomly on this target, what are the probabilities of it landing in each region?



7. Which of the following situations can be modelled by a binomial distribution? Justify your answers.
   a) The first player in a free-throw basketball competition has a free-throw success rate of 88.4%. A second player takes over when the first player misses the basket.
   b) A farmer gives 12 of the 200 cattle in a herd an antibiotic. The farmer then selects 10 cattle at random to test for infections to see if the antibiotic was effective.
   c) A factory producing electric motors has a 0.2% defect rate. A quality-control inspector needs to determine the expected number of motors that would fail in a day's production.

8. Suppose that 5% of the first batch of engines off a new production line have flaws. An inspector randomly selects six engines of the first batch for testing.
   a) Graph the probability distribution for the number of flawed engines in the sample.
   b) What is the expected number of flawed engines in a sample of 6 engines of the first batch?

9. Ten percent of a country's population are left-handed.
   a) What is the probability that 5 people in a group of 20 are left-handed?
   b) What is the expected number of lefthanded people in a group of 20?

10. Suppose heads occurs 15 times in 20 tosses of a coin. Do you think the coin is fair? Explain your reasoning.

11. Pythag-Air-US Airlines has determined that 5% of its customers do not show up for their flights. If a passenger is bumped off a flight because of overbooking, the airline pays the customer $200. What is the expected payout by the airline if it overbooks a 240-seat airplane by 5%?