Name:

1) Suppose that we roll a 20-sided die until a '1' is rolled. Let X be the number of times it takes to roll the '1'.

a) Why is this a geometric distribution?

b) What is the PMF of X?

- c) What is the probability that it will take exactly 10 rolls?
- d) What is the expected number of rolls?
- e) What is the standard deviation of the number of rolls?
- f) If you decide in advance that you will roll the die 10 times, what is the probability that you will have exactly one '1'?

g) How are parts c) and f) different?

Group _____

- 2) Suppose that we roll a 8-sided die until a '5' is rolled. Let X be the number of times it takes to roll the '5'.
- a) What is the PMF of X?
- b) What is the probability that it will takes more than 7 rolls to roll the '5'?
- c) What is the probability that it will take no more than 7 rolls?
- d) What is the probability that it will take between 3 and 7 rolls (exclusive)?

e) Determine the number of rolls so that the person has a 90% or greater chance of rolling a '5'?

f) Assuming that it takes more than 10 rolls to roll the '1', find the probability that it will take more than 15 rolls to roll the '5'? (Do this problem in two different ways.)

3) Approximately 8.33% of men are colorblind. You survey men from a large population until you find one who is colorblind.

a) Explain in words what X is in this situation and what values can it can take.

b) Why is this a Geometric distribution situation? What is the parameter?

c) What is the probability you will have to survey at most 16 men until you find the first one who is colorblind?

d) What is the probability you will have to ask exactly12 men until you find the first one who is colorblind?

e) What is the expected value of X?

f) What is the variance of X?

g) Show the labeled graph of the mass for this story (you only need to plot every 5th point). I will include all of the points in the answer key. You may stop when your points look like they are on the x-axis on your scale.

h) Show the labeled graph of the CDF for this story (you may just place the points for every 5th point, however, you need to include the rest of the points in your calculation)? Use the same number points as in part g).

4) Michael reaches into a very large box and pulls out Lucky Charms. If percentages of the pieces are: 50% regular cereal, 6.25% each for hearts, starts, horseshoes, clovers, blue moons, pots of gold, rainbows, and red balloons, and he only wants blue moons. Let X be the number of individual pieces he has to pull out until he gets a blue moon.

a) What is the probability that X is more than 8?

b) What is the probability that X is at least 8?

c) What is the probability that X is less than 8?

d) What is the probability that X is at most 8?

e) What is the probability that X is between 4 and 8 inclusive?

f) What is the probability that X is between 4 and 8 exclusive?

g) How many pieces would he have to pull out until he has a 92% or greater chance of getting his first blue moon?

h) What is the expected number of the number of pieces that he has to pull out to get his first blue moon?

i) What is the standard deviation of the number of pieces has to pull out to get his first blue moon?

j) What would you have to change about this story to turn it into a Binomial question?

5) Prince Charming has to go around town asking if the glass slipper fits until he finds a woman whose foot fits properly in the slipper so that he will know who to marry. The probability of a glass slipper fitting a randomly selected woman is 0.12, and the probabilities are independent for the various women. Let X be the number of women he has to visit until he finds a woman who fits the shoes. Assume that there are an unlimited supply of eligible women in the town.

a) Given that he has already checked with 4 women without success, what is the probability he will still need to check with at least 5 more?

b) Given that he has already checked with 4 women without success, what is the probability he will succeed with the very next woman?

c) What is the expected number of women he will have to try?

d) What is the standard deviation of the number of women he will have to try?

e) If he takes an entourage with him everywhere he goes, and he has to pay the entourage \$100 for the day plus \$10 for every visit he makes, how much does he expect to pay if he does all his visits on one day?

f) What is the standard deviation of the cost of his entourage?

6) Show that P(X > a + b|X > b) = P(X > a) for a geometric distribution with P(S) = p and P(F) = q.