

Name: _____

Group _____

1) A quality assurance engineer of a company that manufactures TV sets inspects finished products in lots of 100. He selects 5 of the 100 TV's at random and inspects them thoroughly. In fact 6 of the 100 TVs in the current lot are actually defective. The engineer is interested in determining the number of defective TVs that she finds in the lot.

a) What is a success in this story? What is a failure?

b) Explain in words what X is in this story. What values can it take?

c) Why is this a Hypergeometric distribution? What are the parameters?

d) What is the PMF of X ?

e) What is the probability that the engineer finds exactly 1 defective TV?

f) What is the probability that the engineer finds at least 1 defective TV?

g) Given that the engineer finds at least 1 defective TV, what is the probability that she finds exactly 2 defective TVs?

h) What is the expected number of defective TVs?

i) What is the standard deviation of the number of defective TVs?

2) Dr. I.M.A. Genius has developed an experimental vaccine for an allergy to cat fur. He needs to test it out on some people to make sure it works. He has a list of 4000 people from his clinic, and 1250 of those have an allergy to cat fur. His receptionist randomly calls in 50 different people from his list, and he checks how many of them have cat fur allergies.

- a) Explain in words what X is in terms of this story. What values can it take?
- b) Why is this a Hypergeometric situation? What are the parameters?
- c) What is the expected number of people and variance in this sample who have cat fur allergies?
- d) What is the probability that exactly 20 of the people in his sample have cat fur allergies? You may have to use Wolfram Alpha to solve it.
- e) What would be a good approximation to use in this situation? What are the parameters?
- f) Why is the approximation valid?
- g) What is the approximate probability that 20 of the people in his sample have cat fur allergies?
- h) What is the approximate expected number of people and variance in this sample who have cat fur allergies?
- i) Compare the probabilities, expected values and variances between the calculations using the hypergeometric distribution and the approximation, would you consider the approximation appropriate. Why or why not? (Please use a table for the comparison.)"

3) You are going on a trip with some friends, and you need to rent 4 large cars to get all of you to the beach. There are 15 SUVs and 10 minivans on the lot. The rental car dealer will pick 4 cars at random. You are hoping to get SUV's because you think they look more stylish.

a) What is a success in this story? What is a failure?

b) Explain in words what X is in terms of this story. What values can it take?

c) Why is this a Hypergeometric situation? What are the parameters?

d) What is the probability you get 3 SUV's?

e) Given that you get at least 1 SUV, what is the probability you get at least 3 SUV's?

f) What is the expected number of SUVs you will get?

g) What is the standard deviation in the number of SUVs you will get?

h) What is the expected number of minivans you will get?

i) What is the standard deviation in the number of minivans you will get?

4) For each of the following stories, calculate the approximate population size if possible. If it is not possible to calculate the population size, state why.

a) To try to determine the number of Roseate Spoonbills in Tippecanoe county, a ornithologist captures 40 of them in April and tags them. In May, she captures 32 of them and finds 11 tags. What is the population of Roseate Spoonbills in the county?

b) To try to determine the number of squirrels on Purdue's campus, a student captures 10 of them at 8 am, tags the squirrels that he captured and releases them at the Union. 10 minutes later, he captures 10 more animals at the Union and finds that 9 of the animals have tags. What is the population of squirrels on campus?

c) To try to determine the number of catfish that are in the northwest part of the Wabash, a graduate student uses a fishing pole to catch 50 catfish from Tapawingo Park. She then tags them and returns them to the river. The next day, she drives Attica (~20 miles from Lafayette along the Wabash) and catches 20 catfish using the same fishing pole. She finds that 2 of them have tags. What is the population of catfish in the Wabash in northwest part of the river?

5) In which of the following stories is a binomial approximation to the hypergeometric valid? Please explain your answer

a) At Holloway Gymnasium, there are 2000 fans attending a volleyball game of Purdue vs. Rutgers. The probability that a person attending the game from Rutgers is 1%. What is the probability that out of 110 randomly selected fans, 2 root for Rutgers?

b) At the Brea Mall (Brea, California), there are approximately 200 specialty stores. (The Tippecanoe Mall only has approximately 110 stores.) On a particular day, the probability that store in the mall does NOT have a sale is 1%. What is the probability that out of 8 stores in the fall, that 2 of them do NOT have sales?

6) I have 6 chocolate chunk granola bars, 10 raspberry granola bars, and 8 chocolate chip granola bars. I grab five bars without looking. As I am a chocolate lover, I am interested in the number of bars that I grab that contain chocolate.

a) What is the probability that I grab exactly two bars that contain chocolate?

b) What is the probability that I grab fewer than 2 bars that contain chocolate?

c) What is the expected number of chocolate granola bars that I grab?

d) What is the standard deviation of the number of chocolate granola bars that I grab?

7) Henry has 10 pants: 4 dress slacks and 6 jeans. In a hurry while getting ready for a trip, he asks his kids to throw 3 pants in a suitcase for him without specifying which kind of pants he needs.

a) What is the probability the kids correctly throw in 2 pairs of dress slacks and 1 pair of jeans?

b) What is the probability the kids throw in 2 pairs of jeans and 1 pair of dress slacks?

c) Are the probabilities in parts a and b the same? Do they add up to 1? Should they add up to 1? Why or why not?