Economics 110
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Probability Distributions Homework Problems *Key*

1. A federal agency is studying food stamp fraud. Based on past information, the agency statistician has determined that approximately 8% of food stamps spent in a particular geographic area are spent fraudulently. Given that, what is the probability that, of the next twenty food stamp purchases made at a grocery store in this area, none will be used fraudulently? What is the probability that no more than 4 will be used fraudulently?

Use the discrete binomial formula to show that P(X = 0) = 0.1886 or 18.86%. Calculate the cumulative distribution for 0 – 4 to show that there is a likelihood of 0.9817 or 98.17% that no more than four will be used fraudulently.

2. A student takes a multiple choice examination and guesses on each question. If there are four possible answers for each question, what is the likelihood that s/he will pass the examination, given that a passing grade is 70%?

Assume that the exam has 10 questions. The probability of getting one right by guessing is 0.25 and s/he must have 7 or more correct answers to pass then examination. Use the discrete binomial formula to show that the cumulative probability of having 6 or fewer correct scores is approximately 0.9965 or 99.65%. This means that the probability of a passing score is 1 – 0.9965 = 0.0035 or 0.35%.

3. The probability that a patient dies after a heart operation in a particular hospital is .1. What is the probability that exactly two of the next eight patients will not recover? How likely is it that at most one patient will not recover? Use EXCEL to calculate this frequency distribution. Calculate the mean, median, and mode for the distribution. Is it symmetric or skewed? If skewed, which way?

Use the discrete binomial to show, P(X = 2) = 0.1488 or 14.88%. The descriptive statistics for the frequency distribution are: arithmetic mean = 0.11; median = 0.005; and the mode does not exist. This means that the distribution has a positive skew (mean > median).

4. You and one other person are participating in an auction to purchase a tract of land. You believe that the other bidder will bid somewhere between $10,000 and $15,000, but really can't estimate the value of the land to her otherwise. The auctioneer has announced that the highest bid over $10,000 will be accepted. Is the selling price a discrete or continuous random variable? What is

the likelihood that your bid will be accepted, if you bid $12,000? How about $14,000. If you want to be 90% certain of getting the property, how much should you bid?

This is a continuous uniform distribution with a = $10,000 and b = $15,000, so f(x) = 1/(15,000 – 10,000) = 0.0002 for values within the range of a to b. If you bid $12,000, your bid will be accepted, if the other bid is lower than this. The likelihood of a bid less than $12,000 is ($12,000 - $10,000) x 0.0002 = 0.4 or 40%. For a bid of $14,000, it is 0.8 or 80%. To be 90% certain that you will win, you want to make a bid such that the probability of a lower bid is 90%, i.e., solve for the value of "y" such that:

(y - $10,000) x 0.0002 = .9. This implies that your bid should be $14,500.