

ASSIGNMENT #7
STP 421, FALL 2000

NOTE: This assignment consists of 10 problems.

1. Pinworm infestation, commonly found in children, can be treated with the drug pyrantel pamoate. According to the *Merck Manual*, the treatment is effective in 90% of cases. Suppose that three children with pinworm infestation are given pyrantel pamoate.
 - a. Considering a success in a given case to be “a cure,” formulate the process of observing which children are cured and which children are not cured as a sequence of three Bernoulli trials.
 - b. Construct a table that displays the possible outcomes and probabilities for the three cases.
 - c. List the outcomes in which exactly two of the three children are cured.
 - d. Find the probability of each outcome in part (c). Why are those probabilities all the same?
 - e. Use parts (c) and (d) to determine the probability that exactly two of the three children will be cured.
 - f. Use part (b) to obtain the probability distribution of the random variable X , the number of children out of three that will be cured.
2. Use the formula for the PMF of a binomial random variable to solve part (f) of Problem 1.
3. According to the *Daily Racing Form*, the probability is about 0.67 that the favorite in a horse race will finish in the money (first, second, or third place). In the next five races, what is the probability that the favorite finishes in the money
 - a. exactly twice? b. exactly four times?
 - c. at least four times?
 - d. between two and four times, inclusive?
 - e. Determine the probability distribution of the random variable X , the number of times the favorite finishes in the money in the next five races.
 - f. Identify the probability distribution of X as right skewed, symmetric, or left skewed without consulting its probability distribution or drawing its probability histogram. Explain your answer.
 - g. Draw a probability histogram for X .
4. As reported by Television Bureau of Advertising, Inc., in *Trends in Television*, 84.2% of U.S. households have a VCR. If six households are randomly selected without replacement, what is the (approximate) probability that the number of households sampled that have a VCR will be
 - a. exactly four? b. at least four?
 - c. at most five?
 - d. between two and five, inclusive?

- e. Determine the (approximate) probability distribution of the random variable Y , the number of households of the six sampled that have a VCR.
- f. Strictly speaking, why is the probability distribution that you obtained in part (e) only approximately correct? What is the exact distribution called?
5. An American roulette wheel consists of 38 numbers, of which 18 are red, 18 are black, and 2 are green. When the roulette ball is spun, it is equally likely to land on any one of the 38 numbers. Use the binomial distribution to answer the following questions: In four plays at a roulette wheel, what is the probability that the ball lands on red
- a. exactly twice? b. at least once?
6. A previous Arizona state lottery, called *Lotto*, is played as follows: The player selects six numbers from the numbers 1–42 and buys a ticket for \$1. There are six winning numbers, which are selected at random from the numbers 1–42. To win a prize, a *Lotto* ticket must contain three or more of the winning numbers.
- a. Identify and determine explicitly the probability distribution of the random variable X , the number of winning numbers for a single ticket. Round your probabilities to seven decimal places.
- b. If you buy one *Lotto* ticket, determine the probability that you win a prize. Round your answer to three decimal places.
- c. If you buy one *Lotto* ticket per week for a year, determine the probability that you win a prize at least once in the 52 tries.
7. Sickle cell anemia is an inherited blood disease that occurs primarily in blacks. In the United States, roughly 15 of every 10,000 black children have sickle cell anemia. The red blood cells of an affected person are abnormal; the result is severe chronic anemia (inability to carry the required amount of oxygen), which causes headaches, shortness of breath, jaundice, increased risk of pneumococcal pneumonia and gallstones, and other severe problems. Sickle cell anemia arises in children who inherit an abnormal type of hemoglobin, called hemoglobin S, from both parents. If hemoglobin S is inherited from only one parent, then the person is said to have sickle cell trait and is generally free from symptoms. There is a 50% chance that a person who has sickle cell trait will pass hemoglobin S to an offspring.
- a. Obtain the probability that a child of two people who have sickle cell trait will have sickle cell anemia.
- b. If two people who have sickle cell trait have five children, determine the probability that at least one of the children will have sickle cell anemia.
- c. If two people who have sickle cell trait have five children, find the probability distribution of the number of those children who will have sickle cell anemia.
8. Suppose that a customer purchases four fuses from a shipment of 250, of which 94% are not defective. Let X denote the number of nondefective fuses obtained by the customer.
- a. Find and identify the probability distribution of X .
- b. Obtain and identify the approximating binomial distribution to the true distribution of X .

9. A sales representative for a tire manufacturer claims that the company's steel-belted radials get at least 35,000 miles. A tire dealer decides to check this claim by testing eight of the tires. If 75% or more of the eight tires he tests get at least 35,000 miles, he will purchase tires from the sales representative. If, in fact, 90% of the steel-belted radials produced by the manufacturer get at least 35,000 miles, what is the probability that the tire dealer purchases tires from the sales representative?
10. From past experience, the owner of a restaurant knows that, on the average, 4% of the parties making reservations do not show up. How many reservations can the owner take and still be at least 80% sure that all parties making a reservation will show up?