**Probability #2 (by Hand and in R!)**

**#1 (By Hand)** In each case, explain why the random variable is discrete, but not binomial.

**a.** A woman buys a lottery ticket every week for which the probability of winning anything at all is 1/10. She continues to buy them until she has won three times. *X =* the number of tickets she buys.

**b.** A poker hand consists of 5 cards drawn from a standard deck of 52 cards. *X =* the number of aces in the hand.

**#2 (R!!)** For each of the following scenarios, a binomial random variable is involved. In each case, (1) specify values for *n=* number of trials and *p =* probability of success on one trial and(2)specify whether the desired probability is a cumulative probability or not*.* We will compute these probabilities using the R software. If you want a cumulative probability, the syntax for P(Xk) is pbinom(k,n,p). You must actually enter the values for k, n and p. If you want P(X=k), the syntax is dbinom(k,n,p).

**a.** It is known that 11% of all individuals are left-handed. A randomly selected sample of 100 individuals is taken. What is the probability that 5 or less of those people are left-handed?

*n* = *p* = Probability =

**b.** A computer is used to randomly select integer numbers from 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. This is repeated 500 times. What is the probability that the number 7 is picked 50 times?

*n* = *p* = Probability =

**c.** A student has not studied the material for a 20-question true-false test and simply guesses on each question. A passing grade is 70%; the desired probability is the probability that the student does not pass the test.

*n* = *p* = Probability =

**d.** Number of heads when flipping the same coin ten times, where there are equal chances for heads and tails. What is the probability that there are exactly five heads?

*n* = *p* = Probability =

**e.** X = Number of times a “5” is rolled when a fair six-sided die is rolled 12 times. What is the probability that that three or fewer “5”s occur?

*n* = *p* = Probability =

**f.** X = Number of allergy patients who experience drowsiness when a medication is given to 100 randomly selected allergy patients and 20% of all patients will experience drowsiness. What is the probability that X is more than 25 (not including 25)?

*n* = *p* = Probability =

**g.** A woman buys a daily number lottery ticket every day for year (not a leap year). She wins if she has picked the right number out of 1000 possibilities. X = the number of times she wins. What is the probability that the woman never wins?

*n* = *p* = Probability =

**#3 (By Hand and R!!)** Suppose that the yearly rainfall totals for a city in northern California follow a normal distribution, with mean of 18 inches and standard deviation of 6 inches. In each part, find a z-score and then find the desired probability using a normal curve table as an aid. Then redo the calculation with R in two ways – with the z-score and on the original scale. For a cumulative probability for a z-score, the syntax for P(Zk) is pnorm(k). The cumulative probability P(Xk) for a generic Normal RV with mean mu and standard deviation s can be found in R using pnorm(k,mu,s), where you’re entering numbers for mu and s. Report the value from R to five decimal places to see how it differs from the book.

**a.** Probability that the total rainfall in a year is less than 10 inches.

**b.** Probability that the total rainfall in a year is less than 21 inches.

**c.** Probability that the total rainfall in a year is greater than 30 inches.

**d.** What is the amount of rain such that only 20% of all years will experience more rainfall?

**#4 (By Hand and R!!)** Suppose that the amount that students at Lafayette slept last night is a normal random variable with mean μ = 7 hours and standard deviation σ = 1.5 hours.

**a.** Using R, find the cumulative probability for 9 hours.

**b.** Write a sentence interpreting the value found in the previous part that would be understood by somebody with no training in statistics.

**c**. Calculate a z-score (standardized score) for 9 hours. Round off the z-score to two decimal places.

**d.** Use the book’s normal curve table on the inside of the back cover to find this probability. If you don’t have a copy, one is posted on the Moodle page News Forum.

**e.** Using the book’s table, find the probability that a randomly selected student slept less than or equal to 6 hours last night. First find a z-score and then look up the cumulative probability in the table for that z-score.

z = Probability =

**f.** Use R to find the probability that you found in part e. Write the value exactly as R gives it.

**g.** What is the probability that a randomly selected student slept more than 6 hours last night?

**h**. What is the probability that a randomly selected student slept more than 10 hours last night. Solve using R to help you. Show any necessary work.

**i.** What is the probability that a randomly selected student slept 4 or less hours last night. Solve using the book’s table.

z = Probability =

**j.** Explain why the answers to parts h and i are the same.

**k.** What is the amount of sleep that only 2.5% of students sleep less than? What is the amount of sleep that only 9% of students sleep more than?