STAT 2606 E: Business Statistics I
Assignment 2
Due in Class Thursday, February 9, 2018

INSTRUCTIONS: For written questions, show all of your work. No credit will be given for answers without justification. Do not use MINITAB for a question unless it specifically says to do so.

1. Consider an experiment where we roll a single die and observe the number of dots. Thus, our sample space is $S = \{1, 2, 3, 4, 5, 6\}$. Suppose that the die is not fair and that $P(i) = k / i$ for $i = 1, 2, 3, 4, 5, 6$. What is the value of k?

2. The human resources department at a large company looked at the personnel records of all of its employees and found that 72% of its employees were married and 40% had a university degree. Further investigation found that 55% of its university graduates were married. Suppose that an employee is selected at random.

(A) What is the probability that the individual has a university degree and is married?

(B) What is the probability that the individual has a university degree or is married, or both?

(C) What is the probability that the individual has a university degree or is married, but not both?

(D) What is the probability that the individual does not have a university degree and is not married?

(E) If the individual is married, what is the probability they have a university degree?

(F) Are the events "having a university degree" and "being married" independent? Explain.

(G) Are the events "having a university degree" and "being married" mutually exclusive? Explain.

3. In order to determine insurance premiums, suppose that a car insurance company classifies policyholders into one of four classes: excellent risks, good risks, average risks, and bad risks. Their records indicate that the probability an excellent risk individual will be involved in a car accident over a one-year span is 0.02. The same probability for good, average, and bad risk individuals are, respectively, 0.05, 0.14, and 0.32. Of its policy holders, 8% are classified as excellent risks, 16% are classified as good risks, and 62% are classified as average risks. You may assume that car accidents are independent events.

(A) What proportion of all policyholders are involved in a car accident within a given one-year period? You must explicitly define all events.

(B) If a policyholder did not get into a car accident during 2010, what is the probability they are classified as (i) an excellent risk? (ii) a good risk? (iii) an average risk? (iv) a bad risk?

4. Which of the following represent probability distributions for some random variable X and which do not? Give the reason(s) for your answer in each case.

(A)

x	–2	0	4	7
$P(X = x)$	1/10	3/10	5/10	1/10

(B)

x	2	3	5	7
$P(X = x)$	–1/4	1/4	3/4	1/4

(C) $P(X = x) = x/6$ for $x = 0, 1, 2, 3$

(D) $P(X = x) = x/6$ for $x = -2, 0, 3, 5$

5. Suppose that the probability distribution of a random variable X can be described by the formula

$$P(X = x) = \frac{(2x-3)^2}{45} \text{ for } x = 0, 1, 2, 3, 4.$$

(A) Write out the probability distribution of X.

(B) Compute $\mu_X = E(X)$.

(C) Compute σ_X^2.

6. Suppose you are going to select a sample of 5 cards from a randomized standard deck of 52 cards. Let the random variable X represent the total number of diamonds that you obtain.

(A) If you sample the cards without replacement, what is the probability distribution of X? In this case, what is the probability that at most 2 of the cards will be diamonds?

(B) If you sample the cards with replacement, what is the probability distribution of X? In this case, what is the probability that at most 2 of the cards will be diamonds?

7. Employees of a local university have been classified according to gender and job type as shown below.

	Sex	
Job	Male (M)	Female (F)
Faculty (FA)	110	10
Salaried staff (SS)	30	50
Hourly staff (HS)	60	40

(A) If an employee is selected at random what is the probability that the employee is male?

(B) If an employee is selected at random what is the probability that the employee is male and salaried staff?

(C) If an employee is selected at random what is the probability that the employee is female given that the employee is a salaried member of staff?

(D) If an employee is selected at random what is the probability that the employee is female or works as a member of the faculty?

(E) If an employee is selected at random what is the probability that the employee is female or works as an hourly staff member?

(F) If an employee is selected at random what is the probability that the employee is a member of the hourly staff given that the employee is female?

(G) If an employee is selected at random what is the probability that the employee is a member of the faculty?

(H) Are gender and type of job mutually exclusive? Explain with probabilities.

(I) Are gender and type of job statistically independent? Explain with probabilities

8. MINITAB QUESTION: Suppose that $X \sim B(50, 0.4)$. Use MINITAB to simulate 30 values of X by typing in the following commands:

MTB > random 30 c1;|
SUBC > binomial 50 0.4.

(A) What percentage of your values are less than 20?

(B) What percentage of your values fall between 14 and 18 inclusive?

(C) MINITAB has a "cdf" command that computes $P(X \leq x)$ for each possible value of x. Enter the commands:

MTB > cdf;
SUBC > binomial 50 0.4.

Use the resulting output to compute $P(X < 20)$ and $P(14 \leq X \leq 18)$. How do these probabilities compare to the relative frequencies you observed in parts (A) and (B)?

(D) If you simulated 1,000 values of X, how many of them would you expect to be less than 20?