STA201: Elements of Statistics & Probability

Assignment 3-5

Marks = 30 + 3

1. **(a)** In a simultaneous throw of a pair of fair 6-sided dice, find the probability of getting:

(i) A sum of 8
(ii) A doublet (two dice landing on the same value)
(iii) A sum greater than 5
(iv) An odd number on one and an even number on the other

(b) A bag contains 30 balls numbered 1 through 30. Suppose drawing an even numbered ball is considered a 'Success'. Two balls are drawn from the bag with replacement. Find the probability of getting:

(i) Two successes
(ii) Exactly one success
(iii) At least one success
(iv) No successes

2. Assume that the chances of a patient suffering from high blood pressure is 60%. It is also assumed that a course of meditation reduces the risk of high blood pressure by 45% and prescription of certain drugs reduces its chances by 55%. At a time, a patient can choose any one of the two options with equal probabilities. It is given that after going through one of the two options, the patient selected at random does not suffer from high blood pressure. Find the probability that the patient chose a course of meditation?

3. A discrete random variable X has the following probability mass function

$$P(X = x) = \begin{cases} 2kx & x = 2, 4, 6 \\ k(x+2) & x = 8 \\ 0 & otherwise \end{cases}$$

where k is a constant

a) Show that $k = \frac{1}{34}$
b) Find the exact value of $P(4 < x \leq 8)$
c) Find the exact value of $P(2 < x < 4)$
d) What is the expected value of the random variable X?
e) What is the variance of the random variable X?
f) Determine $Var(5 - 3X)$

4. When traveling from Bangladesh to Vietnam, travelers need to first land at Kuala Lumpur, and then get on a connecting flight to Vietnam. The total time in transit Y in hours can be shown to have the following:

$$f(Y=y)=\begin{cases}\frac{1}{20}y & 0<y\leq 4\\ \frac{1}{30}(10-y) & 4<y\leq 10\\ 0 & otherwise\end{cases}$$

a) What is the probability that total transit time is at most 6 hours?
b) What is the probability that the transit time is either less than 3 hours or more than 7 hours?
c) What is the expected total transit time for travelers going from Bangladesh to Vietnam?
d) Determine the standard deviation in the total transit time.

5. In each of 4 races, the Democrats have a 60% chance of winning. Assuming that the races are independent of each other, what is the probability that:

a) The Democrats will win 0 races, 1 race, 2 races, 3 races, or all 4 races?
b) The Democrats will win at least 1 race.
c) The Democrats will win a majority of the races.

6. Suppose on average, Nepal experiences 6 earthquakes per year.

a) What is the mean number of earthquakes in Nepal in the first four month of a year?
b) What is the probability that there'll be 7 earthquakes in Nepal in the next two years?
c) What is the probability that there'll be at least 9 earthquakes in Nepal in 2021?

BONUS ASSIGNMENT

Use built-in R functions to solve the following problems- **Marks-3.0**

Q1. Create the following vector-

90, 178, 547, 453, 189, 377, 264, 333, 289, 391, 320, 300,210, 310, 121, 154, 248, 292, 368, 423

(i) Find mean, median, standard deviation of the above values (from question 1)

(ii) Find square root of all values

(iii) Sort the values

(iv) Find the length of the vector

(v) Find summation and product of all values

Q2. Create the following data frame-

Number of Rooms	kwh
12	9
9	7
14	10
6	5
10	8

(i) Find Pearson's correlation coefficient between two variables (Number of rooms & KWH)

(ii) Estimate the regression coefficients of a regression of KWH on Number of rooms.

(iii) Plot a scatter diagram of KWH against Number of rooms

Submission Guideline: Submit the code and output along with the assignment solutions at the end (hard/ soft copy). This will be counted as a bonus. Take help from R- tutorials shared with you.