Assignment-II

Probability and Statistics

ID	Name:	Section :

Q1. A biased coin has a probability of head on one toss equal to 0.7. If the coin tossed 13 times in succession, determine:

a. The probability of obtaining exactly 5 heads.
b. The probability of obtaining no more than seven heads.
c. The mean and standard deviation of the distribution.

Q2. On average, 6 traffic accidents per month occur at a certain intersection. What is the probability that in any given month at this intersection?

a. exactly 6 accidents will occur?
b. fewer than 5 accidents will occur?
c. at least 4 accidents will occur

Q3. A shipment of 9 similar microcomputers to a retail outlet contains 3 that are defective. If a college makes a random purchase of 2 of these computers,

Consider X= # of defective in the sample,:

a. Determine the different values of random variable X
b. Find the probability distribution of x ; f(x)
c. Find , $P(1 \le x \le 2), P(x \le 1), P(0 < x \le 2), f(2), f(5)$

Q4. For the given data

x	0	1	2
f(x)			

Find :a) Var(x) b) F (1) c) $P(1 \le x \le 2)$

Q5 The probability that a certain medication will cause a bad reaction in young children is 0.16. Find the probability that out of 15 children that receive the medication, at most 1 will have a bad reaction.

Q6 Suppose that the error in the reaction temperature in ^0C for a controlled laboratory experiment is a continuous random variable X having the probability density function:

$$f(x) = \begin{cases} \frac{x^2}{9} & , -1 < x < 2 \\ 0 & , \ otherwise \end{cases}$$

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a) Show that $\int_{-\infty}^{\infty} f(x)\,dx = 1$

b) Find $P(0 < X \leq 1)$

c) Find $P(0 < x < 3), P(x = 2), F(x), F(0.5)$

Q7. The probability density functions (continuous random variable) for a random variable X are defined as

$$f(x) = \begin{cases} c\exp(-8x), & x > 0 \\ 0, & \text{otherwise} \end{cases}$$

a. Find value of C.

Q8.A pharmaceutical lab states that a drug causes negative side effects in 8 of every 200 Patients. To confirm this affirmation, another laboratory chooses 8 people at random who have consumed the drug. What is the probability of the following events?

a. None of the four patients experience side effects.

b. At least three experience side effects.

c. What is the average number of patients that laboratory should expect to experience side effects if they choose 100 patients at random?

Q9.a) Consider a computer system with Poisson job-arrival stream at an average of 5 per minute. Determine the probability that in any one-minute interval there will be

i. 0 jobs;
ii. exactly 4 jobs;
iii. at most 6 arrivals.

b) It is known from the past experience that in a certain plant there are on the average of 5 industrial accidents per month. Find the probability that in a given year will be less than3accidents.

Q10.a) The heights of 1000 students are normally distributed with a mean of 174.5centimeters and standard deviation of 6.9 centimeters. Assuming that the heights are recorded to nearest half centimeter. How many of these students would you expect to haveheights?

a) Less than 160 centimeters
b) Between 171.5 and 182.0 centimeters inclusive
c) Equal to 175.0 centimeters
d) Greater than or equal to 188 centimeters

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b) The monthly income of 5000 workers at the Microsoft plant are distributed normally. Suppose the mean monthly income is $1250 and the standard deviation is $250.

a) What percentages of workers earn more than $1500 per month?
b) What percentages of workers earn less than $750 per month?
c) What percentage of the workers earn between $750 and $1500 per month?

Q11. A team of 3 is to be chosen from 3 boys and 4 girls. If X is the random variable "the number of girls in the team", find its prob: distribution and hense find Mean and variance.

b) Let X has the following probability distribution:

X	1	2	3	4	5
f(X)	0.2	0.3	0.2	0.2	0.1

Find E(X), Var(X) and probability function of $3X - 1$, X^2 and $X^2 + 2$. Also find $E(3X - 1)$, $E(X^2)$ and $E(X^2 + 2)$ and interpret the results.

Q12. On average, a major earthquake (Richter scale 6.0 or above) occurs 3 times a decade in a certain California county. Find the probability that

i) at least one major earthquake will occur within the next decade.

b) A 90% percent of the population subscribes to the Roman Catholic religion. In a random sample of 8 Quebecois find the probability that the sample contains

i) atmost three Roman Catholics.

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11.6 In a certain type of metal test specimen, the normal stress on a specimen is known to be functionally related to the shear resistance. The following is a set of coded experimental data on the two variables:

Normal Stress, x	Shear Resistance, y
26.8	26.5
25.4	27.3
28.9	24.2
23.6	27.1
27.7	23.6
23.9	25.9
24.7	26.3
28.1	22.5
26.9	21.7
27.4	21.4
22.6	25.8
25.6	24.9

(a) Estimate the regression line $\mu_{Y|x} = \beta_0 + \beta_1 x$.

(b) Estimate the shear resistance for a normal stress of 24.5.

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12.6 An experiment was conducted on a new model of a particular make of automobile to determine the stopping distance at various speeds. The following data were recorded.

Speed, v (km/hr)	35	50	65	80	95	110
Stopping Distance, d (m)	16	26	41	62	88	119

(a) Fit a multiple regression curve of the form $\mu_{D|v} = \beta_0 + \beta_1 v + \beta_2 v^2$.

(b) Estimate the stopping distance when the car is traveling at 70 kilometers per hour.

12.2 In *Applied Spectroscopy*, the infrared reflectance spectra properties of a viscous liquid used in the electronics industry as a lubricant were studied. The designed experiment consisted of the effect of band frequency x_1 and film thickness x_2 on optical density y using a Perkin-Elmer Model 621 infrared spectrometer. (*Source*: Pacansky, J., England, C. D., and Wattman, R., 1986.)

y	x_1	x_2
0.231	740	1.10
0.107	740	0.62
0.053	740	0.31
0.129	805	1.10
0.069	805	0.62
0.030	805	0.31
1.005	980	1.10
0.559	980	0.62
0.321	980	0.31
2.948	1235	1.10
1.633	1235	0.62
0.934	1235	0.31

Estimate the multiple linear regression equation

$$\hat{y} = b_0 + b_1 x_1 + b_2 x_2.$$

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