



## Probability and statistics past question

Probability and Queuing Theory (Pokhara University)



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POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2014

Programme: BE

Full Marks: 100

Course: Probability and Statistics

Pass Marks: 45

Time : 3hrs.

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Attempt all the questions.*

1. a) Represent the following data by means of histogram, frequency curve and polygon. 7

Salaries	300-310	310-320	320-330	330-350	350-370	370-400
No. of Workers	7	19	28	15	12	12

- b) The first two groups have 100 items with mean 45 and variance 49. If the combined group has 250 items with mean 51 and variance 130, find the mean and standard deviation of the second group. 8
2. a) A problem of statistics is given to three students A, B and C where chance of solving it is  $\frac{1}{2}$ ,  $\frac{3}{4}$  and  $\frac{2}{3}$  respectively. If they independently solve it, what is the probability that 7

- All can solve the problem
- None can solve the problem
- Problem can be solved
- Exactly one can solve the problem.

- b) State and prove Baye's theorem for conditional probability. 8

3. a) A random variable X has the following probability function. 7

$$X: \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7$$

$$F(X): \quad 0.1 \quad K \quad 0.2 \quad 2k \quad 0.3 \quad K$$

Find the value of K and calculate mean and variance.

- b) Customers arrive at complaint department of a store at the rate of 3 per hour. If arrivals follow a Poisson distribution, calculate the probability that 8

- No customer will arrive in an hour,

- ii. Two or three customers will arrive in an hour.  
 iii. At least three customers will arrive in an hour.
4. a) In a normal distribution 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution.  
 b) 400 orange are taken from a large consignment and 50 are found to be bad. Estimate the percentage bad orange in the consignment and assign 95% confidence limits.
5. a) A sample poll of 100 voters chosen at random from all voters in a given district indicated that 55% of them were in favor of a particular candidate. Find the 95% confidence limits for the proportion of all the voters in favour of this candidate.  
 b) The average weekly wages of a sample of 200 workers in industry A was Rs. 1150 with standard deviation of Rs. 100. The weekly wages of a sample of 300 workers in industry B was Rs. 1000 with standard deviation of Rs. 50. Can we consider the weekly wages paid by industry A is higher than those paid by industry B? (Use level of significance  $\alpha = 0.05$ ).
6. a) The sales figure of an item in eight shops before and after advertisement is given as:

Before	70	65	48	72	80	92	98	100
After	72	70	53	75	84	95	105	104

Test whether advertisement was effective at 5% level of significance.

- b) The following table gives the age X and blood pressure Y of 10 women.
- |   |     |     |     |     |     |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| X | 56  | 42  | 36  | 47  | 49  | 42  | 60  | 72  | 63  | 55  |
| Y | 147 | 125 | 118 | 128 | 145 | 140 | 155 | 160 | 149 | 150 |
- i. Find correlation coefficient between age and pressure.  
 ii. Fit a regression equation of X on Y.

7. Write short notes on: (Any two)
- a) Binomial distribution and condition required for binomial distribution.  
 b) P-value and Critical value.  
 c) Central limit theorem and joint probability distribution.  
 d) Coefficient of determination.

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*The figures in the margin indicate full marks.*

*Attempt all the questions.*

- a) The daily wages of workers of a factory are given below:

Wages (Rs.)	300-310	310-320	320-330	330-350	350-370	370-410
No. of workers	8	10	20	18	16	12

- i. Construct a histogram and frequency polygon for the data.
- ii. Draw an ogive for the data and estimate the median age.

- b) The lives of two models(A and B) of refrigerators in a recent survey are shown below:

Life(No. of years)	No. of refrigerators	
	Model A	Model B
0-2	5	2
2-4	16	7
4-6	13	12
6-8	7	19
8-10	5	9
10-12	4	1

- i. What is the average life of each model of these refrigerators?
- ii. Which model has greater uniformity?

- a) The following are the numbers of minutes that a person had to wait for the bus to work on 15 working days,

10, 1, 13, 9, 5, 9, 2, 10, 3, 8, 6, 17, 2, 10, 15

Draw a box plot and interpret the result.

- b) A student knew only 60% of the questions in a test each with 5 answers. He simply guessed while answering the test. What is

probability that he knew the answer to a question given that he answered it correctly?

3. a) Suppose the time it takes a data collection operator to fill out an electronic form for a database is uniformly distributed between 1.5 and 2.2 minutes.

- i. What is the mean and variance of the time it takes an operator to fill out the form?
- ii. What is the probability that it will take less than two minutes to fill out the form?
- iii. Determine the cumulative distribution function of the time it takes to fill out the form.

- b) In an examination, 30% of the candidates obtained marks below 40 and 10% of candidates got above 75 marks. Assuming that the marks are normally distributed, find mean and standard deviation of the distribution.

4. a) In a certain city, the daily consumption of electric power (in millions of kilowatt-hours) can be treated as a random variable having a gamma distribution with  $\alpha = 3$  and  $\beta = 2$ . If the power plant of this city has a daily capacity of 12 millions kilowatt hours. What is the mean of this gamma distribution? What is the probability that this power supply will be inadequate on any given day?
- b) The probability density function of two random variables X & Y is given by:

$$f(x, y) = \frac{1}{8} (4 - x - y), \quad 0 < x < 2, 0 < y < 2 \\ = 0, \text{ otherwise}$$

Find:

- i. The marginal distribution of X and Y.
  - ii.  $P(X \geq 1, Y \geq 1)$
  - iii. Are X and Y dependent or independent?
5. a) A manufacturer of electronic calculators takes a random sample of 1200 calculators and finds that there are eight defective units.
- i. Construct a 95% confidence interval on the population proportion.
  - ii. Is there evidence to support a claim that the fraction of

defective units produced is 1% or less?

- b) The following random samples are measurements of the heat producing capacity (in millions of calories per 100kg) of specimens of coal from two mines, 8

Mine 1: 82 81 83 80 83

Mine 2: 72 78 79 81 79 78

Use the 0.01 level of significance to test whether the difference between the means of these two mines is significant.

- i. a) The quantity demanded of a certain product before advertisement and after advertisement is given below. 7

Before advertisement	50	40	45	50	60	70	35	38	60	70
After advertisement	55	41	51	51	55	75	50	54	70	78

Is the advertisement effective? Test at 5% level of significance.

- b) An instructor is interested in finding out the relationship between the number of students absent in school (y) and the day temperature (x). A random sample of 10 days was used for the study. The following table gives the record of the study. 8

Temperature(x)	10	20	25	30	40	45	50	55	59	60
No. of absent students(y)	8	7	5	4	2	3	5	6	8	9

Find the regression equation to estimate the no. of students absent in the school when the temperature is 65. Also fund the standard error of estimate.

Write short notes on: (Any two) 2×5

- a) P-value and critical value.
- b) Characteristics of normal distribution.
- c) Probability Sampling.

14-S, P00b

**POKHARA UNIVERSITY**

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*Attempt all the questions.*

1. a) The test scores of the students in probability and statistics are listed below. Construct a stem-and leaf plot of the scores. 7

92	78	73	89	98	89	83	75	83	94
99	69	71	96	67	81	73	88	86	82
63	73	76	82	84	89	92	95	78	87

Also, find the lowest score of the best 25% of the students.

- b) Lives of two models A & B of objects in a recent survey are: 8

Life	0 -2	2-4	4-6	6-8	8-10	10-12
Model A	5	16	13	7	5	4
Model B	2	7	12	19	9	1

Which model has greater uniformity?

2. a) In a company, there are 4 Civil engineers, 5 IT officers and 6 finance officers. A committee of 3 members has to be formed from random selection. What is the probability that committee consists of 7

- i. All civil engineers.
- ii. One civil engineer.
- iii. At least one civil engineer.

- b) State Bayes' Theorem. In a certain recruitment test, there are multiple choice questions. There are 4 possible answers to each question and of which one is correct. An intelligent student knows 80% of the answer. If intelligent student gets the correct answer, what is probability that he is guessing? 8

3. a) A marksman firing bullets at a target and probability of hitting the target at any trial is 0.7. Find probability that his seventh shot is his fourth hit. 5

- b) The time (in hours) required to repair a machine is exponentially distributed with parameter  $\lambda = \frac{1}{3}$ . What is the probability that the repair time exceeds 3 hours. Also find the probability that machine will required within 3 hours.

- c) Batteries last an average of 60 days with standard deviation of 10 days. Sixty batteries are bought. What is the probability that

i. Mean life of all 60 batteries exceeds 61 days.

ii. Mean life differs from 60 days by more than 3 days,

4. a) The length of time (in minutes) that a certain lady speaks on the telephone is found to be random phenomenon, with a probability function specified by the probability density function  $f(x)$  as:

$$f(x) = \begin{cases} Ae^{-\frac{x}{5}}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

- i. Find the value of A.  
 ii. What is the probability that the number of minutes that she will talk over the phone is more than 10 minutes?  
 iii. Find the mean and variance of talk time on the telephone.

- b) The joint probability density function of two dimensional random variable  $(X, Y)$  is given by

$$f(x, y) = \begin{cases} \frac{1}{8}(6-x-y), & 0 < x < 2, \quad 2 < y < 4 \\ 0; & \text{otherwise} \end{cases}$$

Determine:

- i. Marginal probability density function of X and Y.  
 ii. Find conditional probability density of Y given  $X=x$ .  
 iii. Examine whether X and Y are independent.

5. a) A population consists of the value 7, 6, 8, 4, 10. Prove that sample mean of size 3 is unbiased estimator of the population mean.
- b) An IQ test was administered to 7 persons before and after they were trained. The results are given below:

Candidates	I	II	III	IV	V	VI	VII
IQ before training	130	135	120	133	142	137	126
IQ after training	138	131	130	135	146	146	138

Test whether the training is designed properly.

6. a) A social study group wants to determine views expressed by people that there is too much violence on television in these days. It is noted that 70% of 2000 men selected at random believed so, 60% of 4000 women selected at random also believed that there is too much violence on television. The group wants to test whether there is a significant difference in the viewers of men as compared to views expressed by women.

7

b) The following table given the age x and blood pressure y of 10 women.

8

X	56	42	36	47	49	42	60	72	63	55
Y	147	125	118	128	145	140	155	160	149	150

- Find correlation coefficient between age and pressure. Also find coefficient of determination and interpret it.
- Fit a regression equation that best describe the above data.

7. Write short notes on: (Any two)

2×5

- Criteria of good estimator.
- Box and Whisker Plot.
- Properties of normal distribution.

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1. a) The following table shows length of eighty bally bridge :

8

68	84	73	82	68	90	62	88	76	93
73	79	75	73	60	93	71	59	85	75
61	65	88	87	74	62	95	78	63	72
66	78	75	75	94	77	69	74	68	60
96	78	82	61	75	95	60	79	83	71
79	62	89	97	78	85	76	65	71	75
65	80	67	57	88	78	62	76	53	74
86	67	73	81	72	63	76	75	85	77

With the reference of above table.

- Construct the grouped frequency distribution having class width 10.
- Draw less than ogive and more than ogive in same graph and hence locate median.
- By the help of less than ogive find the number of bridge having length less than 65 meter.

- b) The lives of two models ( A and B ) of refrigerators in a recent survey are shown below:

7

Life ( No. of Years )	No. of refrigerators	
	Model A	Model B
0-2	5	2
2-4	16	7
4-6	13	12
6-8	7	19
8-10	5	9
10-12	4	1

- i. What is the average life of each model of these refrigerators?  
ii. Which model has greater uniformity?
2. a) Two production plants, A and B, make wire cables that are sent to a common distributor. 40% of the cables sent to the distributor come from Plant A, and the remaining 60% from Plant B. Among the cables produced at Plant A, 95% meet the strength specifications; among the cables produced at Plant B, 98% meet the strength specification.
- i. The distributor selects one cable at random from among all cables in stock. If the cable selected is found to meet the strength specifications, what is the probability that the cable was produced at Plant A?
- ii. Let A be the event that a cable is manufactured at Plant A; similarly, B be the event that a cable is manufactured at Plant B. Let Y be the event that a cable meets the strength specifications; and let N be the event that a cable does not meet the strength specifications. (i) Are events A and Y independent? Give reasons.
- b) The HAL Corporation wishes to improve the resistance of its personal computer to disk driver and key board failures. At present, the design of computer is such that disk-drive failures occurs only one third as often as keyboard failures. The probability of simultaneous disk-drive and key board failures is 0.05.
- i. If the computer is 80% resistant to disk-drive and/or keyboard failure, how low must the disk-drive failure.
- ii. If the keyboard is improved so that it fails only twice as often as the disk-drive( and the simultaneous failure probability is still 0.05), Will the disk drive failure probability from part (I) yield a resistance to disk-drive and /or keyboard failure higher or lower than 90%.
3. a) On the average how many time must a dice thrown until one get a 6?  
b) Harley Davidson, director of quality control for the Kyoto Motor company, is conducting his monthly spot check of automatic transmission. In this procedure, 10 transmissions are removed from the pool of components and are checked for manufacturing defects. Historically, only 2% of the transmissions have such flaws. (Assume that flaws occur independently in different transmission)

- i. What is the probability that Harley's sample contains more than two transmissions with manufacturing flaws?
- ii. What is the probability that none of the selected transmission has any manufacturing flaws?
- c) Busses arrive at a specified stop at 15-minute intervals starting at 7A.M. That is, they arrive at 7, 7:15, 7:30, 7:45, and so on. If a passenger arrives at the stop at a time that is uniformly distributed between 7 and 7:30, find the probability that he waits.
- i. Less than 5 minutes for a bus
  - ii. At least 12 minutes for a bus
4. a) Unisys.com is one of the most frequented business to business websites; assume that the length of a visit on the Unisys websites is distributed as a normal random variable with a mean of 65.7 minutes and a standard deviation of 15 minutes.
- i. What is the probability that a randomly selected visit will last more than 90 minutes?
  - ii. Only 20% of the visits will last less than how many minutes?
- b)  $f(x,y) = \begin{cases} 4xy, & 0 < x < 1, 0 < y < 1 \\ 0 & \text{otherwise} \end{cases}$
- i. Verify that  $f(x,y)$  is a p.d.f.
  - ii. Find the marginal probability density function of X and Y.
  - iii. Find whether X and Y are independent or not.
5. a) In a certain factory there are two independent processes manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120grams with standard deviation of 12 grams, while the corresponding figures in a sample of 400 items from the other process are 124 and 14. Test whether two mean weights differ significantly or not at 10% level of significance.
- b) From a population of 540, a sample of 60 individuals is taken. From this sample, the mean is found to be 6.2 and standard deviation 1.368.
- i. Find the estimated standard error of the mean.
  - ii. Construct 96% confidence interval for mean.
- c) A machine is used to cut wheels of cheese into blocks of specified weight. On the basis of long experience it has been observed that the wt. of the blocks is normally distributed with a standard deviation of

0.3 kg. The machine is currently set to cut the block of wt. 12kg. A sample of 9 blocks is found to have an average block of wt. 12.25 kg. Set-up the null hypothesis and determine whether it is a one tailed or two tailed test. Use the critical value approach to determine whether the cutting machine needs to be recalibrated?

6. a) A study reported in the article "The Effects of Water Vapour Concentrations on the Rate of Combustion of an Artificial in Humid Air Flow" (Combustion and Flame) give data on

$x$  = temperature of nitrogen oxygen mixture (1000 degree F) under the specified conditions

$y$  = oxygen diffusivity.

Summary quantities are:

$$n = 9,$$

$$\sum x = 12.6$$

$$\sum y = 27.68$$

$$\sum x^2 = 18.24$$

$$\sum y^2 = 93.344$$

$$\sum xy = 40.968.$$

- i. Calculate correlation coefficient between  $x$  and  $y$ , and interpret your answer
- ii. Fit a regression equation of  $y$  on  $x$ .
- iii. Find coefficient of determination and interpret it

- b) ABC Physical Fitness claims that completion of their weight loss programme will result in a weight loss. To test this claim, SIX persons were selected at random and they were put through the weight loss programme and weights before and after the programme recorded. Test the claim of fitness center at  $\alpha=0.05$ . The weights in pounds in six persons recorded before and after the programme are as follows.

Person	1	2	3	4	5	6
Weight (before)	145	200	160	185	164	175
Weight (after)	143	190	165	183	160	176

7. Write short notes on: (Any two)

- a) Criteria of good estimator
- b) Error in hypothesis testing
- c) Application of Probability and statistics in engineering

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*Attempt all the questions.*

1. a) For a computer controlled lathe whose performance was below par, 7 workers record the following causes and their frequencies:

Power fluctuation	6
Controller not stable	22
Operator error	13
Worn tool not replaced	2
Other	5

Construct Pareto chart.

- i. What percentage of the cases are due to an unstable controller?
- ii. What percentage of the cause is due to either unstable controller or operator error?
- b) A random sample was taken of the thickness of insulation in 8 transformer windings, and the following thicknesses (in millimeters) were recorded:

18	21	22	29	25	31	37	38	41	39
44	48	54	56	56	57	47	38	35	36
29	37	32	42	43	40	48	36	37	37

- i. Prepare a stem-and leaf display for these data.  
ii. Prepare a box plot for these data.

2. a) An oil exploration company currently has two active projects, one in 7 Asia and the other in Europe. Let  $A$  be the event that the Asian project is successful and  $B$  be the event that the European project is successful. Suppose that  $A$  and  $B$  are independent events with  $P(A) = 0.4$  and  $P(B) = 0.7$ .

- i. If the Asian project is not successful, what is the probability that the European project is also not successful? Explain your reasoning.
- ii. What is the probability that at least one of the two projects will be successful?
- iii. Given that at least one of the two projects is successful, what is the probability that only the Asian project is successful?
- b) Three road construction firms, X, Y and Z, bid for a certain contract. From past experience, it is estimated that the probability that X will be awarded the contract is 0.40, while for Y and Z the probabilities are 0.35 and 0.25. If X does receive the contract, the probability that the work will be satisfactorily completed on time is 0.75. For Y and Z these probabilities are 0.80 and 0.70.
- What is the probability that the work will be completed satisfactorily?
  - It turns out that the work was done satisfactorily. What is the probability that Y was awarded the contract?
3. a) Suppose that X is a random variable, whose probability density function is given by,
- $$f(x) = C(4x - 2x^2), \quad 0 < x < 2$$
- $$= 0, \quad \text{otherwise}$$
- Determine the value of C.
  - Determine the cumulative distribution function of X.
  - Find  $P(X > 1)$ .
- b) In an examination 15% of the candidates got first class (60% marks or above), while 40% failed (securing below 40% marks). Assuming the marks to be normally distributed, estimate the mean and standard deviation.
4. a) Six dice are thrown 729 times. How many times do you expect at least three dice to show a five or six? 15%
- b) The magnitude of earthquakes recorded in Sindhupalchowk of Nepal during the year 2072 can be modeled as having an exponential distribution with mean 4.5, as measured on the Richter scale. Suppose that the magnitude of earthquakes striking the region has a gamma distribution with  $\alpha = 1.5$  and  $\beta = 3$ .
- What is the mean magnitude of earthquakes striking the

- region? 5
- ii. What is the probability that the magnitude an earthquake striking the region will exceed 5.0 on the Richter scale?
- iii. What is the probability that an earthquake striking the regions will fall between 5.0 and 6.0 on the Richter scale?
- c) The life time of semiconductor laser has a log-normal distribution with  $\mu = 10$  hrs and  $\sigma = 1.5$  hrs. 5
- What is the probability that the life time exceeds 10,000 hrs?
  - What life time is exceeded by 99% of laser?
5. a) In a certain factory there are two independent processes manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120grams with standard deviation of 12 grams, while the corresponding figures in a sample of 400 items from the other process are 124 and 14. Test whether two mean weights differ significantly or not at 10% level of significance. 5
- b) From a population of 540, a sample of 60 individuals is taken. From this sample, the mean is found to be 6.2 and standard deviation 1.368.
- Find the estimated standard error of the mean.
  - Construct 96% confidence interval for mean.
- c) ABC Physical Fitness claims that completion of their weight loss programme will result in a weight loss. to test this claim, 6 persons were selected of random and they were put through the weight loss programme and weights before and after the programme recorded. Test the claim of fitness centre at 0.05 level of significance. The weights in pounds in six persons recorded before and after the programme are as follows. 5
- | Persons         | 1   | 2   | 3   | 4   | 5   | 6   |
|-----------------|-----|-----|-----|-----|-----|-----|
| Weight (before) | 145 | 200 | 160 | 185 | 164 | 175 |
| Weight (after)  | 143 | 190 | 165 | 183 | 160 | 176 |
6. a) In the United States, during the fall harvest season Pumpkin are sold in the large quantities at the farm stands. Often instead of weighing the Pumpkin prior to sale, the farm stand operators will just places the 10

Pumpkin in the appropriate circular cutout on the counter. When asked why this was done one farmer replied, " I can tell the weight of the pumpkin from its circumference". To determine whether this was really true; a sample of 8 Pumpkin's circumference and weights were measured:

Circumference (cm)	50	55	54	52	37	52	53	47
Weight (gram)00	12	20	15	17	50	10	15	14

- i. Develop the estimating linear regression equation to predict the weight of the pumpkin that is 60 cm in circumference.
- ii. Calculate correlation coefficient between circumference and weight of the pumpkin and interpret it.
- b) It is known that 5% of the screws manufactured by an automatic machine are defective. If a sample of 20 screw is selected at random, find the probability that the sample contains:
  - i. exactly two defective screws
  - ii. at least two defective screws.
- 7. Write short notes on: (Any two)
  - a) Characteristics of good estimator
  - b) Error in hypothesis testing
  - c) Application of statistics in engineering.

सूलम लैसनये सप्लायर्स एण्ड फॉटोकॉमी रिमिक्स  
चालकमानी, ललितपुर १८४७९८५९८२  
NCIT College

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*Attempt all the questions.*

बालकुमारी, ललितपुर ९८४९५९९५९२  
NCIT College

1. a) From the following frequency distribution,

Income (Rs 000)	0-10	10-20	20-30	30-40	40-50	50-60
No. of Persons	5	10	18	23	7	6

Conduct an ogive that will help you to find the number of persons having income:

- i. Less than Rs. 35000
- ii. Between Rs. 20000 and Rs. 50000
- iii. More than Rs. 25000

- b) An analysis of monthly wages paid to the workers in two firms A and B belonging to the same industry gives the following results: (use population)

	Firm A	Firm B
No. of workers	500	600
Average monthly wages (Rs)	186	175
Variance of distribution of wages (Rs)	81	100

- i. Which firm, A or B has a larger wage bill?
- ii. In which firm, A or B is there greater variability in individual wages?
- iii. Calculate (a) the average monthly wages (b) the variance of the distribution of wages, of all the workers in the firm A and B taken together.

2. a) State and prove Bayes Theorem of probability.

- b) From a group of 3 Nepalese, 4 Indian and 5 Americans, a subcommittee of four persons are selected randomly. Find the probability that the subcommittee will consist of

7

8

5

5

- i. 3 Nepalese and 1 Indian  
 ii. 1 Nepalese, 1 Indian and 2 Americans  
 iii. 4 Americans
- c) A manufacturing firm produces steel pipes in three plants with daily production volume of 500, 1000 and 2000 units respectively. According to the past experience, it is known that the fraction of defective outputs produced by the three plants are respectively 0.005, 0.008 and 0.010. If pipe is selected from a day's total production and found to be defective. From which plant the defective pipe is expected to have been produced? 5
3. a) An appliance dealer sells different models of freezers having 13.5, 15.9 and 19.1 cu.ft. of storage space purchased by the next customer to buy a freezer and  $p(x)$  be the p.m.f. given below as:
- |        |      |      |      |
|--------|------|------|------|
| $X;x$  | 13.5 | 15.9 | 19.1 |
| $P(x)$ | 0.2  | 0.5  | 0.3  |
- i. Compute  $E(X)$  and  $V(X)$   
 ii. If the price of a freezer having capacity  $x$  cubic feet is  $25x - 8.5$ , what is the expected price paid by the next customer to buy a freezer?  
 iii. What is the variance of the price  $25x - 8.5$  paid by the next customer?
- b) The joint probability density function of two continuous random variables
- $$f(x, y) = Axy; \quad 0 < x < 1, \quad 0 < y < x$$
- i. Find  $A$   
 ii. Find marginal density function of  $X$  and  $Y$   
 iii. Find conditional density function of  $Y$  given  $X=x$  and conditional density function of  $X$  given  $Y=y$   
 iv. Check for independence of  $X$  and  $Y$
4. a) From a lot of 10 items containing 3 defectives a sample of 4 items is drawn at random. Let the random variable  $X$  denote the number of defective items in the sample. Answer the following:
- i.  $E(X)$   
 ii.  $V(X)$   
 iii. The probability distribution of  $X$ .



- b) In a certain examination test 2000 students appeared in statistics. The average deviation was 5%. How many students do you expect to obtain more than 60% marks? What are the minimum marks of the top 100 students? Assume that the marks are normally distributed. 5
- c) The length of time (in seconds) that a user views a page on website before moving to another page is log-normal random variable with parameters  $\mu = 0.5$  and  $\sigma^2 = 1$ .  
 i. What is the probability that a page is viewed for more than 10 second?  
 ii. What is the length of time 50% of user view the page?  
 iii. What is the mean and standard deviation of the time until a user moves from the page? 5
5. a) The accompanying data on cube compressive strength (MPa) of concrete specimens appeared in the article "Experimental Study of Recycled Rubber-Filled High-Strength Concrete" 7  
 112.3, 97.0, 92.7, 86.0, 102.0, 99.2, 95.8, 103.5, 89.0, 86.7  
 Suppose the concrete will be used for a particular application unless there is strong evidence that true average strength is less than 100 MPa. Should the concrete be used?
- b) Hotel's manager in Kathmandu wants to know the hotel's average daily registration. The following table presents the numbers of guest registered each of 27 randomly selected days. Calculate the sample mean, standard errors of mean and 95% confidence limits of population mean. 8
- |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|
| 61 | 57 | 53 | 60 | 64 | 57 | 54 | 58 | 63 |
| 61 | 50 | 59 | 50 | 60 | 57 | 58 | 62 | 63 |
| 60 | 54 | 54 | 61 | 51 | 53 | 62 | 57 | 60 |
6. a) A social study group wants to determine if people think that there is too much violence on television in these days. 70% of 2000 men selected at random believed so 60% of 4000 women selected at random also believed that there is too much violence on television. The group wants to test if there is a significant difference in the viewers of men as compared to views expressed by women. Test the hypothesis at  $\alpha=0.05$ . 7
- b) Shear stress ( $y$ ) and rate of shear ( $x$ ) can be measured for a liquid in a viscometer. For 12 pairs of values the data can be summarized as 8

P2S-16S 3

## POKHARA UNIVERSITY

Level: Bachelor  
 Programme: BE  
 Course: Probability and Statistics

Semester: Fall

Year : 2017  
 Full Marks: 100  
 Pass Marks: 45  
 Time : 3hrs.

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Attempt all the questions.*

1. a) Following data represents the tensile strength of steel-rod manufactured by company A located at Biratnagar. 8

65	36	49	84	79	56	28	43	67	36
43	78	37	40	68	72	70	55	62	82
88	50	60	56	57	46	39	57	22	65
59	48	76	74	80	69	51	40	56	45
35	21	62	52	63	32	86	64	53	34

Construct a frequency distribution and represent the data by means of Cumulative frequency curve. Identify the median and first quartile from the curve. Also interpret the result of 1<sup>st</sup> quartile.

- b) From the following distribution of mark of 500 students of a college, find the minimum pass marks, if only 20% of student had failed and also the minimum marks obtained by the top 25% of the students. 7

marks	0-20	20-40	40-50	50-60	60-80	80-100
No. of students	50	100	150	90	60	50

2. a) State bayes theorem. In a class of 75 students, 15 students were considered to be very intelligent, 45 as medium and rest below the average. The probability that a very intelligent student fails in examination is 0.005, the medium student failing has probability 0.05 and corresponding probability for a below average is 0.15. If a student is known to have passed the examination, what is the probability that

- he is below the average?
- b) A coin is tossed until a head appears. What is expectation of number of tosses required?
3. a) A sample of 600 mobiles of a certain Brand is tested to find the length of Battery. After each full charge, produced result of average 12 hours and standard deviation of 4.5 hours. Assuming the data to be Normally distributed, find the number of mobiles that are expected to have life after each full charge:
- More than 15 hours
  - Between 10 and 14 hours
  - Top 10% performer (on the bases of battery life)
- b) The quality control manager at a light bulb factory needs to estimate the mean life of a large shipment of light bulbs. The process standard deviation is known to be 100 hours. A random sample of 64 light bulbs indicated a sample mean life of 350 hours.
- Obtain the standard error of the mean and interpret its meaning
  - Set up 95% confidence interval of the true population mean life of bulbs in this shipment
  - Do you think that manufacturer has the right to state the light bulbs last an average of 390 hours?
4. a) The length of time (in minutes) that a certain lady speaks on the telephone is found to be random phenomenon, with a probability function specified by the probability density function  $f(x)$  as:
- $$f(x) = Ae^{-x/5} \quad \text{for } x \geq 0$$
- $$= 0 \quad \text{otherwise}$$
- Find the value of A
  - What is the probability that she will talk over the phone is:
    - More than 10 minutes
    - Less than 5 minutes
    - Between 5 and 10 minutes
- b) Joint probability distribution of random variables X and Y is given by
- $$f(x,y) = k(6-x-y), \quad 0 < x < 2, 2 < y < 4$$
- $$= 0 \quad \text{otherwise}$$

Find:

- i. the constant k
- ii. Marginal density function of X and Y
- iii.  $E(X)$  and  $V(X)$
- iv. Are X and Y independent?

5. (a) The National Bureau of standard has previously reported the value of Selenium (Se) in NBS orchard leaves to be 0.080. A random sample of size  $n=6$  gives the following determinations:

0.072	0.073	0.080	0.078	0.088	0.080
-------	-------	-------	-------	-------	-------

Does the data contradict the previously reported value?

- b) In a factory, 2% fans were found defective in a lot of 2000 fans and in another factory, 2.5% fans were found defective in a lot of 3000 fans. Do you find that the fans in the second factory are significantly inferior compared to the fans in the first factory (use  $\alpha = 5\%$ )?

6. (a) Suppose that the service life of a semiconductor is a random variable having exponential distribution with  $\lambda = \frac{1}{50}$  hours. Find the probability that such a semiconductor will still be operating condition after 100 hours.

- b) The following are the heights in centimeter and the weights in kilogram of 10 men:

Height	162	168	174	176	180	180	182	184	186	186
Weight	65	65	84	63	75	76	82	65	80	81

- i. Develop the estimating regression equation of weight on height.
- ii. Find the coefficient of determination and interpret it. Also find standard error of the estimate.

7. Write short notes on: (Any two)

- a) Coefficient of determination
- b) Probability and non probability sampling
- c) Errors in hypothesis testing

PAS

# POKHARA UNIVERSITY

Level: Bachelor      Semester: Spring      Year : 2017  
 Programme: BE      Full Marks: 100  
 Course: Probability and Statistics      Pass Marks: 45  
 Time : 3hrs.

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Attempt all the questions.*

1. a) Over a period of 40 days the percentage relative humidity in a vegetable storage building was measured. Mean daily values were recorded as shown below: 7

60	63	64	71	67	73	79	80	83	81
86	90	96	98	98	99	89	80	77	78
71	79	74	84	85	82	90	78	79	79
78	80	82	83	86	81	80	76	66	74

- i. Prepare a stem-and leaf display for these data. Show the leaves sorted in order of increasing magnitude on each stem.  
ii. Draw a box plot for these data and interpret the data in practical manner.

- ~~Q1 Q2~~ b) The temperature in a chemical reactor was measured every half hour under the same conditions. The results were  $78.1^{\circ}\text{C}$ ,  $79.2^{\circ}\text{C}$ ,  $78.9^{\circ}\text{C}$ ,  $80.2^{\circ}\text{C}$ ,  $78.3^{\circ}\text{C}$ ,  $78.8^{\circ}\text{C}$ ,  $79.4^{\circ}\text{C}$ . Calculate the mean, median, lower quartile, upper quartile standard deviation and coefficient of variation. 8

2. a) A problem of statistics is given to three students A, B and C where chance of solving it is  $\frac{1}{2}$ ,  $\frac{3}{4}$  and  $\frac{2}{3}$  respectively. If they independently solve it, what is the probability that 7

- i. All can solve the problem
- ii. None can solve the problem
- iii. Problem can be solved
- iv. Exactly one can solve the problem

- b) State and Prove Baye's theorem for conditional probability. 8

3. a) A random variable X has the following probability function. 7

X:	2	3	4	5	6	7
F(X):	0.1	K	0.2	2K	0.3	K

Find the value of K and calculate mean and variance.

- b) Customers arrive at complaint department of a store at the rate of 3 per hour. If arrivals follow a Poisson distribution, calculate the 8

- probability that
- No customer will arrive in a hour
  - Two or three customers will arrive in an hour
  - At least three customers will arrive in an hour
4. a) In an examination 15% of the candidates got first class (60% marks or above), while 40% failed (securing below 40% marks). Assuming the marks to be normally distributed, estimate the mean and standard deviation.
- b) If two random variables have the joint probability density function.  
 $F(x,y) = \frac{2}{3} (x+2y); 0 < x < 1, 0 < y < 1$
- Find marginal density function of X & Y
  - Find the conditional density of X given that  $Y=y$
  - Are X and Y independent
5. a) A random sample of 8 envelopes is taken from letter box of a post office and their weights in gms are found to be 12.1, 11.9, 12.3, 11.9, 12.1, 12.4, 12.1 and 11.5. Find 99% fiducial limits for the mean weight of envelopes received at that post office.
- b) What is P-value? In a factory 2% fans were found to be defective in a lot of 3000 fans, and in another factory 3% fans were found to be defective in a lot of 2500 fans. Do you find that the fans in secondary factory are significantly inferior compared to the fans in the first factory? (Use  $\alpha = 0.05$ )
6. a) An I.Q. test was administered to 5 persons before and after they were trained. The results are given below
- | Candidates         | 1   | 2   | 3   | 4   | 5   |
|--------------------|-----|-----|-----|-----|-----|
| IQ Before Training | 110 | 120 | 123 | 132 | 125 |
| IQ After Training  | 120 | 118 | 125 | 136 | 121 |
- Is training effective at 5% level of significance?
- b) The following table gives the age X and blood pressure Y of 10 women.
- | X | 56  | 42  | 36  | 47  | 49  | 42  | 60  | 72  | 63  | 55  |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Y | 147 | 125 | 118 | 128 | 145 | 140 | 155 | 160 | 149 | 150 |
- Find correlation coefficient between age and pressure
  - Fit a regression equation of X on Y
7. Write short notes on: (Any two)
- Characteristics of good estimator
  - Error in hypothesis testing
  - Confidence Interval

**POKHARA UNIVERSITY**

Level: Bachelor  
 Programme: BE  
 Course: Probability and Statistics

Semester: Fall

Year : 2018  
 Full Marks: 100  
 Pass Marks: 45  
 Time : 3hrs.

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Attempt all the questions.*

$$K = 1 + 3.322 \log n$$

*int. 1-5 K.*

1. a) An investigator wants to study the speed of cars at Araniko highway and he collected the speed of 30 vehicles and speed were, 7

35, 37, 42, 45, 47, 48, 50, 55,  
 67, 70, 75, 80, 90, 95, 94, 48,  
 55, 60, 71, 63, 70, 65, 80, 55,  
 40, 35, 36, 85, 79, 30.

i. Present the above data in stem and leaf display.

ii. Construct continuous frequency distribution using Struge's rule and construct the cumulative curve and find median speed, speed of first 25% vehicles, speed of first 75% vehicles and also compute the percentage of vehicles whose speed lies between 40 to 70 km.

- b) The lives of two models (A and B) of refrigerators in a recent survey are shown below 8

Life (No. of years)	No. of refrigerators	
	Model A	Model B
0-2	5	2
2-4	16	7
4-6	13	12
6-8	7	19
8-10	5	9
10-12	4	1

- i. What is the average of each model of these refrigerators?  
 ii. Which model has greater uniformity?
2. a) The contents of urns I, II and III are as follows:  
 1 white, 2 black and 3 red balls; 2 white balls, 1 black and 1 red ball  
 and 4 white, 5 black and 3 red balls. One urn is chosen at random and  
 two balls are drawn. They happen to be white and red. What is the  
 probability that they come from urns, I, II or III?
- b) Define axiomatic approach of probability. In a certain locality of town, a survey of 600 women about the fuels for cooking revealed that 230 use kerosene oil, 175 women use electricity and 40 women use both. Find the probability that a woman selected uses:
- At least one of the fuel
  - Neither of the fuel
  - Kerosene oil only
  - Electricity only
  - Exactly one
- c) In Bharatpur city, the daily consumption of electric power can be treated as a random variable having a gamma distribution with  $\alpha=3$  and  $\beta=2$ . If the power plant of this city has daily capacity of 12 million kilowatt hours, what is the probability that this power supply will be inadequate on any given day?
3. a) The number of accidents in a year attributed to taxi driver in a city is Poisson distribution with mean 3. Out of 1000 taxi drivers, find approximately the number of drivers with: i) More than 3 accidents in a year and ii) Less than 2 accidents
- b) Diameters of bolts produced by a particular machine are normally distributed with mean 0.760 cm and standard deviation 0.012 cm. Specifications call for diameters from 0.720 cm to 0.780 cm.
- What percentage of bolts will meet these specifications?
  - What percentage of bolts will be smaller than 0.730 cm?
4. a)  $f(x,y) = 4xy$ , if  $0 < x < 1, 0 < y < 1$   
                   = 0, otherwise
- Verify that  $f(x,y)$  is a p.d.f.
  - Find the marginal probability density function of X and Y.
  - Find whether X and Y are independent or not.

b) How do you distinguish point estimation from interval estimation? What are the characteristics of good estimator, explain it. 7

5. a) The quality control Engineer at a light bulb factory needs to estimate the average life of a large shipment of light bulbs. The process standard deviation is known to be 100 hours. A random sample of 64 light bulbs indicated a sample average life of 350 hours. 7

- Calculate the standard error of mean.
- Set up a 95% confidence limits for the true average life of light bulbs in this shipment.

b) A study shows that 16 of 200 tractors produced on one assembly line required extensive adjustment before likely they could be shipped, while same was true for 14 of 400 tractors produced on another assembly line. At the 0.05 level of significance, does this support claim that the second production line does superior work? 8

6. a) A random sample of 10 boys had the following I.Q. Scores. 70, 120, 110, 101, 88, 83, 95, 107, 100, 98. Do these data support the assumption of a population mean I.Q. scores of 100? 7

b) An engineering student has a summer job with the forestry service. He measured the tree trunk diameters ( $x$  in inches) and related them to the age of the tree ( $y$  in years). The following information was obtained: 8

$$n = 6, \sum x = 21, \sum x^2 = 91, \sum y = 26, \sum y^2 = 142.52, \sum xy = 113.8$$

- Find the regression equation of  $y$  on  $x$  and estimate the age of the tree whose diameter is 4 inches.
- Find the correlation coefficient between  $x$  and  $y$  and interpret the result in practical manner.
- Determine coefficient of determination and interpret the result.
- Compute the standard error of the estimate.

7. Write short notes on: (Any two) 2x5

- Types of errors in hypothesis testing and procedure of testing of hypothesis
- Central limit theorem
- Probability mass function and probability density function

2x2e<sup>2</sup>

**POKHARA UNIVERSITY**

Level: Bachelor  
 Programme: BE  
 Course: Probability Statistics

Semester: Spring

Year : 2018  
 Full Marks: 100  
 Pass Marks: 45  
 Time : 3 hrs.

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Attempt all the questions.*

1. a) The following data set represents the number of new computer accounts registered during ten consecutive days. 7  
 43, 37, 50, 51, 58, 105, 52, 45, 45, 10.  
 i. Compute the mean, median and standard deviation.  
 ii. Draw a box and whisker plot and identify whether it is skewed or not.
- b) After the implementation of an economic program to uplift the economic condition of a community following information were found. 8

Monthly income (Rs 000)	4-6	6-8	8-10	10-12	12-14	14-16	16-18
After the plan (no of families)	8	65	37	15	15	5	5

Construct an ogive to find

- i. Find the number of families whose monthly income is between Rs. 8,000 to Rs. 14,000.  
 ii. Find the number of families whose monthly income is above Rs. 12,000.
2. a) A firm has 80% of its service calls made by a contractor and 10% of these calls result in customer complaints. The other 20% of the service calls are made by their own employees, and these calls have a 5% complaint rate. Find the probability of a complaint. Also, using Bayes theorem to find the probability that a complaint was from a customer whose service was provided by the contractor. 8  
 b) Three bags contain 3 video cards and 2 network cards, 5 video cards and 6 network cards, 2 video cards and 4 network cards respectively. 7

One card is drawn from each urn. Find the expected number of video cards.

3. a) Messages arrive at an electronic message center at random times, with an average of 9 messages per hour.
- What is the probability of receiving at least five messages during the next hour?
  - What is the probability of receiving exactly five messages during the next hour?
- b) The average diameter of a sample of 1000 pipes is 2.6 inches and standard deviation is 0.55. Assuming that the diameter of pipes is normally distributed. Find the number of pipes of diameter
- Greater than 2 inches.
  - Between 2 and 3.1 inches
- c) A continuous random variable  $X$  has the following density function.
- $$f(x) = kx^2 \text{ for } 0 \leq x \leq 1$$
- $$= 0 \text{ otherwise}$$
- Find the value of  $k$ .
  - $P(0 < X < 0.7)$
  - $E(X)$
4. a) In a random sample of 300 households in a city 223 have computer. Set an approximate 95% and 99% limits to the true value of proportion of households with computer in the whole city.
- b) A random sample of 200 bolts manufactured by machine A and of 100 bolts manufactured by machine B showed 19 and 5 defective bolts respectively. Test the hypothesis that machine B is performing better than A at 5% level of significance.
5. a) The sales data of steel for a steel factory in six shops before and after a special promotional campaign are as under:

Shops	A	B	C	D	E	F
Before campaign	53	28	31	48	50	42
After campaign	58	29	30	55	56	45

Can the campaign be judged to be a success? Test at 5% level of significance.

- b) Describe the importance of sampling. Two types of drugs were used on 5 and 7 patients for reducing their weight. Drug A was imported

and drug B indigenous. The decrease in the weight after using the drugs for six months was as follows:

Drug A	12	13	11	14	10		
Drug B	9	12	14	15	10	9	8

Is there a significant different in the efficiency of two drugs?

- a) A firm administers a test to sales trainees before they go into the field. The management of the firm is interested in determining the relationship between the test scores and the sales made by the trainees at the end of one year in the field. The following data were collected for 14 sales personnel who have been in the field one year.

Salesperson	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Test Scores (X)	26	37	24	45	26	50	28	30	40	34	29	30	43	38
Number of unit sold (y) (in thousand)	9	14	8	18	10	19	11	13	17	15	13	16	20	17

Calculation shows that

$$\sum X = 480 \quad \sum X^2 = 17296$$

$$\sum Y = 200 \quad \sum Y^2 = 3044$$

$$\sum XY = 7215$$

- Find the correlation coefficient between the test scores and number of units sold.
  - Assuming a linear relationship, use the least squares method to find the regression equation and interpret the meaning of y-intercept and slope.
  - Compute the residual for salesperson 9.
  - Compute coefficient of determination.
- b) Represent by means of histogram.

Wage	10-15	15-20	20-25	25-30	30-40	40-60	60-80
No of workers	7	19	28	15	12	12	8

5

2×5

7. Write short notes on: (Any two)
- Characteristics of good estimator.
  - Error in hypothesis testing
  - Correlation and regression analysis

# POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2019

Programme: BE

Full Marks: 100

Course: Probability and Statistics

Pass Marks: 45

Time : 3hrs.

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Attempt all the questions.*

1. a) The weight of (in lbs) of 40 students in a class are follows. 7

138	172	145	147	150	119	158	152
168	142	157	147	102	144	165	136
164	163	128	135	126	150	146	148
145	125	146	153	138	156	173	140
135	149	140	144	132	154	142	135

i) Construct a frequency distribution with suitable class interval

ii) Construct a less than Ogive.

- b) The lives of two models(A and B) of refrigerators in a recent survey are shown below: 8

Life(years)	No. of Model A	No. of Model B
0-2	5	2
2-4	16	7
4-6	13	12
6-8	7	19
8-10	5	9
10-12	4	1

i) What is the average life of each model of these refrigeration's?

ii) Which model has greater uniformity?

2. a) Define axiomatic approach of probability. A problem in statistics is given to three students A, B and C whose chances of solving it are  $1/3$ ,  $1/4$  and  $1/5$  respectively. Find the probability that, 7

- i. The problem will be solved.
- ii. Only one of them can solve the problem.
- iii. None of them will solve the problem.
- iv. A solves it but B and C cannot.

- v. All three students A, B and C can solve the problem.
- b) Customers are used to evaluate preliminary product designs. In the past, 95% of highly successful products received good reviews, 60% of moderately successful products received good reviews, and 10% of poor products received good reviews. In addition, 40% of products have been highly successful, 35% have been moderately successful, and 25% have been poor products.
- What is the probability that a product attains a good review?
  - If a new design attains a good review, what is the probability that it will be a highly successful product?
3. a) A r.v. X has following probability distribution:
- | X    | 2   | 3 | 4   | 5  | 6   | 7 |
|------|-----|---|-----|----|-----|---|
| P(x) | 0.1 | K | 0.2 | 2k | 0.3 | K |
- Find the value of k
  - Find  $E(x)$  and  $V(x)$ .
  - Find the distribution function of X.
- b) A two dimensional r.v. (XY) have following probability density function:

$$f(x, y) = \frac{2}{3}(x + y) \quad 0 < x < 1, 0 < y < 1$$

- Find marginal p.d.fs of X and Y individually.
  - Find Conditional pdf of X given  $Y=y$
  - Check whether X and Y are independent or not.
4. a) The number of accident in a year attributed to taxi driver in a city is poisson distribution with mean 3. Out of 1000 taxi driver, find approximately the number of taxi drivers with i)more than 3 accidents in a year) less than 2 accidents in a year.
- b) In an examination, 15% of the student got marks more than 60 and 40% of the students got marks less than 40. Assuming the marks to be normally distributed, find mean and standard deviation of the marks of the students.

5. a) The manufacturer of the Energy-saver furnace claims a mean energy efficiency of at least 0.83. A sample of 21 Energy-saver furnaces gives a sample mean of 0.81 and sample standard deviation of 0.060. Data show approximately a normal distribution. Test whether the manufacturer's claim can be rejected at the 5% level of significance. 7
- b) The strength of steel wire made by an existing process is normally distributed with a mean of 1250 and a standard deviation of 150. A batch of wire is made by a new process, and a random sample consisting of 25 measurements gives an average strength of 1312. Assume that the standard deviation does not change. Is there evidence at the 1% level of significance that the new process gives a larger mean strength than the old? 8
6. a) Scraps of iron were selected on the basis of their densities,  $X$ , and their iron contents,  $Y$ , were measured. The results were as follows: 8
- |  |
|--|
| $X: 2.8 \ 2.9 \ 3.0 \ 3.1 \ 3.2 \ 3.2 \ 3.2 \ 3.3 \ 3.4$ |
| $Y: 27 \ 23 \ 30 \ 28 \ 30 \ 32 \ 34 \ 33 \ 30$          |
- i) Find the relationship between their densities and their iron content.  
ii) Find the regression equation of  $y$  on  $x$  by the method of least squares.
- b) A population consists of five members 2,3,6,8 and 11. 7
- i. Draw all possible sample of size 2 that can be drawn from the population without replacement.  
ii. Find mean and variance of population.  $E(X)$   
iii. Find the mean of sampling distribution of means and show that it is equal to the population mean.
7. Write short notes on: (Any two) 2×5
- a) Source of data and its types.  
b) Normal distribution and its characterises.  
c) Criteria of good estimator.

# POKHARA UNIVERSITY

Level: Bachelor  
Programme: BE  
Course: Probability and Statistics

Semester: Spring

Year : 2019  
Full Marks: 100  
Pass Marks: 45  
Time : 3hrs.

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Attempt all the questions.*

- 1 a) From the following frequency distribution,

Obtained marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of students	5	10	17	24	9	6	4

Construct an ogive that will help you to find the number of students securing marks:

- i) Less than 35 marks
- ii) Between 20 and 50 marks
- iii) More than 25 marks

- b) The life of two model A and B of refrigerators in a recent survey shown below:

Life (No. of years)	Model A	Model B
0-2	5	2
2-4	16	7
4-6	13	12
6-8	7	19
8-10	5	9
10-12	4	1

- i) What is the average life of each model of these refrigerators?
- ii) Which model has greater uniformity and why?

- 2 a) From a group of 3 Nepalese, 4 Indians and 5 Americans a sub-committee of 4 persons are selected at randomly. Find the probability that the sub-committee will consists i) 3 Nepalese and 1 Indian ii) 1 Nepalese, 1 Indian and 2 American iii) 4 American
- b) In a certain factory machines I, II and III are all producing springs of the same length. of their production machines I, II and III produces 2%, 1% and 3% defective springs respectively. of the total production of springs in

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the factory, machines I produces 35%, machines II produces 25% and machine III produces 40%. If one spring is selected at random from the total springs produced in a day, find

- the probability that it is defective
- the conditional probability that it was produced by machine III.

- 3 a) The following table presents a discrete probability distribution associated with the daily demand for a product.

Number demand per day (X)	10	20	30	40	50	Total
P(X)	0.08	0.24	0.28	0.3	0.1	1

- Determine the mean daily demand
- What is the standard deviation of daily demand?

- b) Suppose that the random variables X and Y have the joint p.d.f.

$$f(x, y) := \begin{cases} kx(x-y) & 0 < x < 2 \quad -x < y < x \\ 0 & \text{otherwise} \end{cases}$$

- Evaluate the constant k

- Find the marginal probability density function X and Y

- Find the conditional probability distribution of Y given X=x.

- 4 a) In an examination 15% of the candidates got first class (60% marks or above), while 40% failed (securing below 40% marks). Assuming the marks to be normally distributed, estimate the mean and standard deviation.

- b) An experiment succeeds twice as often as it fails. Find the chance that in the next six trials there will be at least 4 successes. (Binomial distribution).

- 5 a) A random sample of 100 articles selected from a batch of 2000 article shows that the average diameter of the article is 0.354 with standard deviation 0.048. Find the 95% confidence interval for the average of batch of 2000 articles.

- b) In a certain factory there are two independent processes manufacturing the same item. The average weight in a sample of 250 items produced from one process is found to be 120 grams with standard deviation of 12 grams, while the corresponding figures in a sample of 400 items from the other process are 124 and 14. Test whether two mean weights differ significantly or not at 10% level of significance.

- 6 a) ABC Physical Fitness claims that completion of their weight loss programme will result in a weight loss. To test this claim, SIX persons were selected at random and they were put through the weight loss programme and weights before and after the programme recorded. Test the claim of fitness centre at  $\alpha=0.05$ . The weights in pounds in six persons recorded before and after the programme are as follows.

Person	1	2	3	4	5	6
Weight (before)	145	200	160	185	164	175
Weight (after)	143	190	165	183	160	176

- b) An engineering student has a summer job with the forestry service. He measured the tree trunk diameters ( $x$  in inches) and related them to the age of the tree ( $y$  in years). The following information was obtained:

$$n=6, \sum X=21, \sum Y=26, \sum X^2=91, \sum Y^2=142.52, \sum XY=113.8$$

- Find the regression equation of  $y$  on  $x$  and estimate the age of the tree whose diameter is 4 inches.
- Find the correlation coefficient between  $x$  and  $y$  and interpret its meaning.
- Determine coefficient of determination and interpret it.
- Compute standard error of the estimate.

7 Write short notes on: (Any two)

- Criteria of a good estimator
- Application of statistics in engineering
- Assumptions for binomial distribution

2x5

# POKHARA UNIVERSITY

Level: Bachelor  
 Programme: BE  
 Course: Probability and Statistics

Semester: Fall

Year : 2020  
 Full Marks: 100  
 Pass Marks: 45  
 Time : 3 hrs.

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Attempt all the questions.*

- a) From the following distribution of 500 students of a college find the marks if only 20% students had failed and also minimum marks obtained by the top 25% of the students. 7

Marks	0-20	20-40	40-50	50-60	60-80	80-100
No. of students	50	100	150	90	60	50

Also represent the data by histogram so locate the mode.

- b) The nine measurements that follow are furnace temperatures recorded on successive batches in a semiconductor manufacturing process (units are): 8  
 953, 950, 948, 955, 951, 949, 957, 954, 955.

i. Calculate the sample mean, sample variance, and standard deviation.

ii. Construct a box plot of the data.

a) The contents of urns I, II and III as follows: 7

1 white, 2 black and 3 red balls.

2 white, 1 black and 1 red balls.

4 white, 5 black and 3 red balls ~

One urn is chosen at random and two balls drawn. They happen to be white and red. What is the probability that they came from urn II.

- b) A company produces machine components which pass through an automatic testing machine. 5% of the components entering the testing machine are defective. However, the machine is not entirely reliable. If a component is defective there is 4% probability that it will not be rejected. If a component is not defective there is 7% probability that it will be rejected. 8

i) What fraction of all the components are rejected?

ii) What fraction of the components rejected are actually not defective?

iii) What fraction of those not rejected are defective?

3. a) Let  $X$  be a continuous random variable with p.d.f.

$$\begin{aligned} P(x) &= ax & ; & 0 \leq x \leq 2 \\ &= a & ; & 2 \leq x \leq 4 \\ &= ax+3a & ; & 4 \leq x \leq 6 \\ &&& \text{Otherwise} \end{aligned}$$

- i. Determine the constant 'a'.
- ii. find  $p(X \leq 1.5)$  and  $p(1.5 \leq X \leq 2.5)$
- iii. Obtain  $E(X)$ . ~~mean~~

b) Joint probability distribution of  $X$  and  $Y$  is given by;

$$f(x,y) = 4xy e^{-(x^2+y^2)} : x > 0, y \geq 0$$

- i) Test whether  $X$  and  $Y$  are independent or not?
- ii) Find the conditional density of  $X$  given  $Y=y$ .
4. a) The number of accident in a year attributed to taxi driver in a city is poisson distribution with mean 3. Out of 1000 taxi driver, find approximately the number of taxi drivers with i) more than 3 accidents in a year) less than 2 accidents in a year.
- b) In an examination, 25% of the student got marks more than 80 and 30% of the students got marks less than 45. Assuming the marks to be normally distributed, find mean and standard deviation of the marks of the students.
5. a) What do you mean by unbiased estimator? Consider a population of 5 units with 4, 2, 10, 6 and 8. Show that sample mean of size 2 is unbiased estimator of population mean.
- b) The quantity demanded of a certain product before advertisement and after advertisement is given below:

Before	50	54	60	58	52	48	53
After	52	56	58	62	55	52	53

Is advertisement effective? Test at 5% Level of significance.

6. a) A manufacture of gun powder has developed a new powder which is designed to produce a muzzle velocity equal to 3000 ft/sec. seven shells are loaded with the charge and muzzle velocities measured. The resulting velocities are as follows: 3005, 2935, 2965, 2905, 2995 and 3905. Does these data present sufficient evidence to indicate that the average velocity differs from 3,000 ft/sec?

b) The following tables gives the ages and blood pressure of 10 women.

Age(X)	56	42	36	47	49	42	60	72	63	55
Blood Pressure(Y)	147	125	118	128	145	140	155	160	149	150

- i) Find the coefficient of determination and interpret it.
- ii) Find the regression equation Y on X.
- iii) Find the standard error.
- iv) Estimate the blood pressure of a women whose age is 45 years.

Write short notes on: (Any two)

2×5

- a) Applications of statistics in engineering
- b) Binomial distribution and condition to apply
- c) Sampling and estimation with criteria of good estimator

2020 Fall - P4S

**POKHARA UNIVERSITY**

Level: Bachelor

Semester: Fall

Year : 2021

Programme: BE

Full Marks: 100

Course: Probability and Statistics

Pass Marks: 45

Time : 3hrs.

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Attempt all the questions.*

1. a) From the following frequency distribution.

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Obtained Marks	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. Of students:	7	12	19	26	11	8	6

Construct an ogive that will help you the answer to find the number of students securing marks.

- i. Less than 45 marks.
  - ii. Between 30 and 70 marks.
  - iii. More than 35 marks.
- b) The life of two model A and B of polythene bags in a recent survey shown below.

8

Bursting pressure (in lb.)	No. of Polythene bags	
	A	B
5-10	2	9
10-15	9	11
15-20	29	18
20-25	44	32
25-30	11	17
30-35	5	13

- i. What is the average life of each model?
- ii. Which model has greater uniformity and why?

2. a) From a group of 4 engineers, 2 physicists and 3 economists, 3 persons are selected at randomly. Find the probability that:
- Consist of each kind.
  - 1 engineer and 2 economists
  - At least one physicist.
- b) State Baye's theorem and discuss its applications. The probability that the person has COVID is 0.03. PCR tests are available to determine whether the person actually has COVID. If COVID actually present, the probability that the PCR test will give a positive result (indicating that disease is present) is 0.09. If COVID is not actually present, the probability of a positive test result (indicating that it is present) is 0.02. What is the probability that COVID is actually present if a positive result has occurred (indicating the disease is present)?

3. a) A Random variable X had the following probability function.

X	-2	-1	0	1	2
P(X)	0.2	K	0.4	2k	k

- Find the value of K
  - $E(X)$ ,  $E(4X+5)$ ,  $\text{Var.}(X)$  and  $\text{Var}(4X+5)$
- b) An experiment succeeds twice as often as it fails. Find the chance that in the next six trials there will be at least 4 successes. (Binomial distribution)
4. a) In an examination 15% of the candidates got first class (60% marks or above), while 40% failed (securing below 40% marks). Assuming the marks to be normally distributed, estimate the mean and standard deviation.
- b) If two random variables have the joint probability density function,
- $$F(x,y) = \frac{2}{3} (x+2y); 0 < x < 1, 0 < y < 1.$$
- Find marginal density function of X & Y.
  - Find the conditional density of X given that  $Y=y$ .
  - Are X and Y independent.

5. a) A random sample of size 64 has been drawn from a population with standard deviation 20. The mean of the sample is 80. Calculate 95% confidence limits for the population mean. How does the width of the confidence interval change if sample size is 256 instead?
- Theory of estimation*

- b) 1000 articles from factory A are examined and found 97% of good quality, 1500 similar articles from factory B are found only 98% of good quality. Would you conclude that products of factory B are superior to those of factory A. Test the hypothesis at  $\alpha = 5\%$ . 8

6. a) An I.Q. test was administrated to 5 persons before and after they were trained. The results are given below: 7

Candidates:	I	II	III	IV	V
IQ before training:	110	120	123	132	125
IQ After training:	120	118	125	136	121

Test at 5% level of significance that the training was success.

- b) A chemical company wishing to study the effect of extraction time on the efficiency of an extraction operation obtained the data as follows: 8

Extraction time in minute (x): 27, 45, 41, 19, 35, 39, 19

Extraction efficiency in % (y): 57, 64, 80, 46, 62, 72, 52

- Find the regression equation of y on x and estimate the y if x=40
- Find the coefficient of correlation between x and y
- Determine coefficient of determination and interpret it.
- Compute standard error of estimate.

7. Write short notes on: (Any Two)

2×5

- Error in hypothesis testing
- Probability and non-Probability Sampling
- Application of statistics in engineering

PPS-2023 F

Q. N. 3 The joint probability distribution of a pair  $(x,y)$  of random variables is given by  
the following table.

2+2+4+2

		x	1	2	3
y	1	1/16	2/16	2/16	
	2	2/16	3/16	1/16	
	3	3/16	1/16	1/16	

Find i) the marginal probability density of  $x$  ii) the conditional probability distribution of  $x|y=1$  iii)  $E(x)$ ,  $E(Y)$ ,  $V(X)$  and  $\text{Cov}(X,Y)$  iv)  $F(1.3)$ ,  $F(2.2)$

Q. N. 4 Write the assumptions for t - test. The heights of six randomly selected sailors are in inches: 63, 65, 68, 69, 71, and 72. Those of 10 randomly selected soldiers are 61, 62, 65, 66, 69, 69, 70, 71, 72, and 73. Construct 95% confidence interval for difference of two population means. Test the hypothesis that the height of sailors are, on average, taller than soldiers. Use  $\alpha = 0.05$ .

10

Q. N. 5 Define Karl Pearson's correlation coefficient and way out the technique of interpreting its value. The following table presents the heights in inches of fathers ( $X$ ) and heights in inches of their sons ( $Y$ ).

10

X: 65 66 67 67 68 69 70 72  
Y: 67 68 65 68 72 72 69 71

Fit regression equation of  $Y$  on  $X$  and  $X$  on  $Y$ , also estimate the value of  $Y$  when  $X = 74$  inches.

#### Section - B: (1×20=20)

Q. N. 6 a) Write down the criteria of good estimator. The population consists of value of 1, 2, 3, 6, 8. Prove that sample mean of size 3 is unbiased estimate of population mean. (without replacement)

10

b) Describe the importance of sampling and hypothesis in the field of engineering. The sales data of steel for a steel factory in six shops before and after a special promotional campaign are as under:

10

Shops	A	B	C	D	E	F
Before campaign	53	28	31	48	50	42
After campaign	58	29	30	55	56	45

Can the campaign be judged to be a success? Test at 5% level of significance?