

International Islamic University Chittagong
Department of Electrical and Electronic Engineering
B. Sc. Engineering in EEE
Semester End Examination, Spring 2023

Course Code: STAT 2303
Time: 2 hours 30 minutes

Course Title: Probability & Statistics
Full Marks: 50

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

Course Outcomes (COs) of the Questions	
CO1	Demonstrate understanding and descriptive statistics (Correlation, regression, probability, probability distribution) by practical application of quantitative reasoning and to the solution of engineering problems with data visualization. Also reflect on inferential statistics.
CO2	Will Be able to compute and interpret the results of correlation, regression and probability theory.

Bloom's Levels (BL) of the Questions						
Letter Symbols	C1	C2	C3	C4	C5	C6
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

1. a) Suppose you are given the following information:

Capital (in Million Taka)	50	58	62	65	70	74
Profit (in Thousand Taka)	12	16	18	22	25	28

(i) Find a regression equation of profit on capital. (ii) Estimate the probable profit when capital is 80 million. (iii) Find a correlation coefficient between capital and profit and comment.

CO2 C3 6
 - b) Fit a regression line of Blood Pressure (Y) on Age(X) for data of 8 people, are shown in the following table;

Blood Pressure (mmHg)	138	138	144	140	125	136	142	136
Age(Years)	60	34	72	48	35	36	71	25

(i) Estimate the regression line of Blood Pressure (Y) on Age(X) (ii) Also estimate Blood pressure (Y) for a 75 years old people.

CO1 C4, 4
CO2 C5
 2. a) Define probability. In a 2-child family (a) what is the probability that both are boys? (b) What is the conditional probability that both are boys given that first child is boy?

CO1 C3, 5
CO2 C5
 - b) Suppose there are 3 components in a system each having reliability 0.80. If at least 2 components must be needed to run the system then calculates the system reliability.

CO1 C3, 5
CO2 C5
- Or,
2. a) Explain Bayes' theorem. Three fair coin were tossed. Write down the sample space and evaluate the probabilities of the following cases: (i) at best 2 heads (ii) at least 2 heads and (iii) 2 heads

CO1 C3, 5
CO2 C5

- b) Three workers A, B and C worked in a company. They produced 60%, 25% and 15% production of a particular items per day. It was observed that they also produced defective items and they probability of defective items by them are 4%, 2% and 1% respectively. One item is selected at random and it was found to be defective. Determine the probability that it was produced by A?

CO1 C3, 5
CO2 C5

Part B

[Answer the questions from the followings]

- 3 a) The following table shows the experience (in year) of an employees in a company.

CO1 C4 5

Experience X	0	4	6	8	12
Probability P[X]	0.10	2k	2k	0.30	0.10

(i) Determine the value of k (ii) Find the probability of an employee has experience more than 7 years (iii) Find the probability of an employee has experience between 5 to 9 years and (iv) E(X), V(X), CV

- b) Failure of an electronics system occurs by two method A & B. If the number of failures follows binomial distribution and the probability of failure occurred by method A is 0.6 ($p=0.6=P[A]$). Now determine the probability that out of next 15 failures, find the probability (i) no failure will occur by method A, (ii) at most 02 failures will occur by method A.

CO1 C2, 5
C4

4. a) Define binomial distribution and explain it. Prove that in a binomial distribution mean is greater than its variance

CO1, C2, 5
CO2 C4

- b) Write down the important properties and conditions of a binomial distribution.

CO2 E 5

5. a) Define the following terms: null hypothesis, alternative hypothesis and statistical hypothesis.

CO1 C3 5
CO2

- b) Suppose a survey was conducted in a locality to study the relationships between profession and drug addiction and the following information were obtained:

CO1 C3 5
CO2

Professions	Drug addiction	
	Addicted	Not-addicted
Businessmen	15	35
Service holders	10	60
Students	25	50

Is there any relationships between profession and drug addiction? Test at 5% level of significant [Given $\chi^2_{2,5\%} = 5.99$ (tabulated value)]

Or,

- 5 a) What are the steps of a test procedure? An Electric company manufacture bulb whose lifetime is approximately normal distribution. From a random sample of size 15 bulbs has an average lifetime of 778 hours and sample standard deviation 46 hours. Use $\alpha=0.05$, test the hypothesis that $H_0: \mu=800$ hours against $H_A: \mu \neq 800$ hours.

CO1 C3 5
CO2

- b) Define Type-I and Type-II error. In a shop study, a set of data was collected to determine whether the proportion of defective produced by workers was the same for the day, evening or night shift worked. The following data were collected.

CO1 C3 5
CO2

Shift	Day	Evening	Night
Defectives	45	55	70
Non-defectives	905	890	870

Use 5% level of significance, test if there have any relationship between shifting worked with quality of products (Defective or Non-defective).

International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Autumn-2018

Course Code: STAT 2303

Time: 2 hours 30 minutes

Program: B.Sc. Engg. (EEE)

Course Title: Probability and Statistics

Full Marks: 50

Part A

[Answer any two questions from the followings; figures in the right margin indicate full marks.]

- 1(a). What is the difference between coefficient of determination and coefficient of correlation? 04
 If $r^2 = 0.65$ what does the coefficient of determination equal?
- 1(b). In a survey of insect life near a stream, a student collected data about the number of different insect species (y) that were found at different distances (x) in meters from the stream. 06

Distance (x)	17	8	39	11	17	33
Insect species (y)	11	19	2	14	9	3

(i) Using your scatter diagram, describe the correlation between the number of different insect species and the distance from the stream. (ii) Evaluate the equation of the regression line y on x for the above data. (iii) Estimate the number of insect species to be found 30 meters from the stream.

- 2(a). What is Spearman's Rank correlation coefficient? Mention its uses. Point out the properties of correlation coefficients. 04
- 2(b). A psychologist wanted to compare two methods X and Y of teaching. He selected a random sample of 12 students. He grouped them into 6 pairs so that the students in a pair have approximately equal scores on an intelligence test. In each pair, one student was taught by method X and the other by method Y and examined after the course. The marks obtained by them are tabulated below: 06

pair	1	2	3	4	5	6
X	24	39	19	30	27	17
Y	37	35	16	26	33	27

(i) Compute the correlation coefficient between the two sets of scores.
 Find the rank correlation coefficient and compare the two values.

- 3(a). The scores for eight students in accounting and statistics are as follows: 05

Accounting	23	23	47	17	10	43	6	28
Statistics	30	33	45	23	8	49	12	31

Compute the student's ranks in the two subjects and calculate Spearman rank correlation.

- 3(b). What is the use of studying regression? Distinguish between correlation and regression. 05
 Interpret the terms (i) $r = 0.99$; (ii) $r = -0.65$; (iii) $r^2 = 0.1$; (iv) $r = 1.78$

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Full Marks: 50

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(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

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CO2	Will Be able to compute and interpret the results of correlation and regression.

Bloom's Levels of the Questions						
Letter Symbols	R	U	App	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

1. a) Define correlation. Show the high positive, moderate positive, high negative and zero correlation graphically. The following data relate to advertising expenditure (in lakhs taka) and sales (in million taka) of an engineering firm;

Advertising expenditure (in Lakhs Taka)	10	15	20	22	24	25
Sales (in Million Taka)	15	20	25	24	30	30

Compute the correlation coefficient between advertising expenditures and sales. Comment on your results.

1. b) What are the basic differences between correlation and regression? A survey firm studying the relation between Kilowatt-hours (thousands) used the number of rooms of a flat in a residential area. A random sample of 8 flats have the following data;

Number of Rooms In a Flat	5	7	4	6	5	4	5	4
Kilowatt-hours (Thousand)	7	8	6	10	7	6	7	4

(i) Determine the regression line on Kilowatt-hours on the number of Rooms.

(ii) Determine the expected number of Kilowatt-hours for a 8-rooms flat.

2. a) Define probability, mutually exclusive events and independent events. If you toss a fair coin 3 times, write the all possible sample points in this experiment. **CO1 E 5**
2. b) Define Venn-diagram. In a company of 400 employees 220 are engineers, 240 are graduate, 180 Engineers are graduate. Show this information in a venn-diagram and identify the undergraduate Engineer marked with shaded area. **CO1 E 5**

Or,

2. a) State Bayes theorem. Compare between: (i) sample space and events; and (ii) mutually exclusive events and not mutually exclusive events. **CO1 E 5**
2. b) A computer center has 100 computers which are collected from three companies A, **CO1 E 5**

B, and C. The selected computers from these companies are 50, 30 and 20 respectively. The probabilities of trouble which is faced in these computers daily are 0.15, 0.20, and 0.25 respectively. One day during work a computer is found defective. What is the probability that it was collected from company C?

Part B

[Answer the questions from the followings]

3. a) Define probability, mutually exclusive events and independent events. Find the mean and variance from the following table; CO1 An 4

Experience of the employees in a Textile Company (in Year) : X	5	8	10	12	15
Probability :P(X=x)	0.20	0.35	0.25	0.15	0.05

3. b) Define mathematical expectation and variance. A random variable X has the following probability function CO2 E 6

Values of X :	1	2	3	4	5	6	7
P(x) :	k	2k	3k	4k	7k	2k	k

(i.) Find the value of k (ii). Evaluate (a) $P[X \leq 6]$ (b) $P[2 \leq X \leq 6]$ (c) $P[X > 7]$

(iii.) Calculate mean, standard deviation and coefficient of variation of X.

4. a) Define binomial distribution. A certain manufacturing process yield electrical fuses of which, in the long run 20% are defective which follows binomial distribution. Find the probability that in a sample of 9 fuses selected at random there will be (i) no defective (ii) at least one defective (iii) No more than one defective. CO1 U,An 4

4. b) Define Poisson Distribution with some examples. The number of Website visitors per hour follows Poisson distribution with parameter $m=4$. Find the probability that (i) No people visit the Website in a particular hour (ii) Exactly one visitor visit the Website. CO2 E 6

5. a) What do you mean by statistical hypothesis? Distinguish between one tailed test and two tailed test. CO1 Ap 4

5. b) Over the last five years the average score in the final exam of a course was 73 points. This semester a class with 28 students used a new textbook and the mean score in the final was 78.1 points with a standard deviation of 7.1. Did the class using the new text book do better at 1% level of significance? CO1 E 6

Or,

5. a) What are the steps of test procedure? An automobile company usually produces three-cylinder model car whose mean petrol consumption is 15 km/liter. But company launches a new four-cylinder car whose mean petrol consumption is claimed to be lower than that of existing auto engine. It is found that the mean consumptions of 20 sampled cars are 20 km/liters with an standard deviation 1.5 km/liter. Test for the hypothesis at 5% level of significant whether the new models petrol consumptions is equal to the existing model. (The tabulated t-value with 19 df is 2.093) CO1 Ap 4

5. b) The following data represent the blood sugar of a group of patients before (B) and after (A) a specific treatment; CO1 E,C 6

Blood Sugar (B)	14.2	14.6	15.6	12.0	13.8	15.5	18.0
Blood After (A)	10.0	09.5	11.0	10.2	08.6	10.2	15.6

(i) Now formulate the null hypothesis to test the treatment is successful or effective.

(ii) Write the test statistic to verify the effectiveness of the treatment.

(iii) Test the null hypothesis mentioned in (i) and comment.