

Answer any four questions taking two from each Section

SECTION: A

1 (a) What is central tendency? Write down the measures of central tendency. 2.75

(b) For non-zero positive observations show that $AM \geq GM \geq HM$ (Notations are usual). 3

(c) The daily profit of 100 shops in a market are distributed as follow: 3

Profits (in lac Tk)	50-60	60-70	70-80	80-90	90-100
No. of Shops	18	32	24	16	10

$$\text{Calculate mean, median and mode. } \bar{x} = \frac{\sum f_i x_i}{n}, \text{ Median} = L + \frac{f_1}{f_1 + f_2} \times h$$

2 (a) Define coefficient of variance (c.v). Why do you prefer coefficient of variation instead of standard deviation? 2.75

(b) For two observations, show that standard deviation is the half of the range. $x_i = a + hy_i$ 3

(c) Show that variance is independent of origin but not of scale. $S_x^2 = h^2 S_y^2$ $\bar{x} = a + 3hy$ 3

3 (a) Define probability, probability function and probability density function. $x_i - \bar{x}$ = 2.75

(b) State and prove Baye's theorem. 3

(c) Two unbiased dice are tossed simultaneously. What is the probability of getting a total of point 6 or even numbers from both the dice? 3

SECTION: B

4 (a) Define Binomial distribution. Write down few of its properties. 2.75

(b) Find mean, variance and coefficient of skewness (β_1) of Poisson distribution. 3

(c) If electricity power failures occur according to a Poisson distribution with an average of 3 failures every twenty weeks, calculate the probability that there will not be more than one failure during a particular week. 3

5 (a) What is correlation? Write down the properties of correlation. 2.75

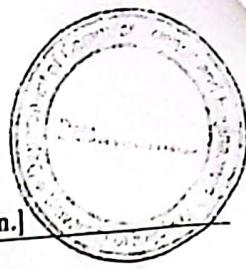
(b) Derive the correlation coefficient and interpret it. 3

(c) If X and Y are independent then show that they are uncorrelated. 3

6 (a) Define null hypothesis and alternative hypothesis. ✓ 2.75

(b) Describe how will you test the null hypothesis $H_0: \mu = \mu_0$ vs. $H_1: \mu \neq \mu_0$. ✓ 3

(c) Distinguish between normal test and t-test. 3



Section A

1. (a) What is meant by dispersion? What are the important measures of dispersion? 2.75
 (b) If \bar{x} and s denote respectively the mean and standard deviation of a set of n observations, show that $\bar{x}\sqrt{(n-1)} \geq s$. 3
 (c) Calculate the mean and variance of the first n natural numbers. 3
2. (a) Define with example event, mutually exclusive event and sample space. 2.75
 (b) State and prove the additive law of probability for two events. 3.5
 (c) Three events A_1, A_2 and A_3 are mutually exclusive and their union is the sample space S . If $P(A_1) = \frac{3}{2}P(A_2), P(A_2) = 2P(A_3)$, then find $P(A_1), P(A_2)$ and $P(A_3)$. 2.5
3. (a) Define binomial distribution. 2.75
 (b) If X is distributed as binomial, show that mean \geq variance. 3
 (c) Let three unbiased coins are tossed at a time. What is the probability that (i) no head, (ii) at least two heads will appear? 3

Section B

4. (a) How do you distinguish between correlation and regression? 2.75
 (b) Show that correlation coefficient is independent of change of origin and scale of the variables. 3
 (c) Calculate the rank correlation coefficient from the following data on hourly sales (x) and expenses (y) of 10 stores 3
- | | | | | | | | | | | |
|-----|----|----|----|----|----|----|----|----|----|----|
| x | 50 | 50 | 55 | 60 | 65 | 65 | 65 | 60 | 60 | 60 |
| y | 11 | 13 | 14 | 16 | 16 | 15 | 15 | 14 | 13 | 13 |
5. (a) What is a scatter diagram? What are the uses of scatter diagram? 2.75
 (b) Discuss the principles of least square method. 3
 (c) Estimate the parameters of the simple linear regression model using ordinary least square method. 3
6. (a) Define (i) parameter and (ii) level of significance. 2.75
 (b) Prices of shares in (Tk.) of a company on the different days in a month were found to be 66, 65, 69, 70, 69, 68, 71, 63, 64, and 68. Test whether the mean price of shares in the month is 65 or not (critical value at 5% level of significance is 2.26). 3
 (c) The mean yields (in gm) of two sets of plots and their standard deviation are given below. Test the hypothesis that whether the difference in the mean yields of the two set of plots is significant or not. 3

Set of 40 plots

Mean yield/plot 1259

Standard deviation 31

Set of 60 plots

1243

28

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n} + \frac{s_2^2}{n}}}$$

Answer any four questions taking two from each group**PART: A**

- 1 (a) Define location and dispersion. Among the measures of location, which one is best and why? 2.25
 (b) Let $AM = \text{arithmetic mean}$, $GM = \text{geometric mean}$ and $HM = \text{harmonic mean}$. Then show that $AM \geq GM \geq HM$. 3.5
 (c) Given below is the marks obtained by students in a certain subject. Compute AM , GM and HM of the marks. 3
 10, 10, 35, 40, 42, 47, 49, 50, 51, 63, 63, 77, 78, 78, 80.
- CSE
- 2 (a) Define event and probability of an event. 2
 (b) State and prove Bayes theorem. 3
 (c) In a bolt factory machines A, B and C manufacture respectively 25%, 35% and 40% of the total. Of their output 5, 4, 2 percent are defective bolts. A bolt is drawn randomly from the product and is found to be defective. What are the probabilities that it was manufactured by machine A, B and C? 3.75
- 3 (a) Define random variable, joint density function and marginal density function. For two constants a and b , prove that $E(aX+b)=aE(X)+b$ 5
 (b) Define normal distribution. Find its mean and variance. 3.75

PART: B

- 4 (a) Define Spearman's rank correlation coefficient. Show that Spearman's rank correlation coefficient can be expressed as $\rho_s = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2-1)}$. 5
 (b) The marks achieved by the 1st year students of CSE department in 2015 of their following courses Statistics and Mathematics as 3.75
- | | | | | | | | | | |
|-------------|----|----|----|----|----|----|----|----|----|
| Statistics | 28 | 32 | 26 | 31 | 34 | 20 | 16 | 21 | 33 |
| Mathematics | 25 | 31 | 30 | 22 | 27 | 26 | 29 | 33 | 32 |
- Find the rank correlation coefficient between the courses.
- 5 (a) Define null hypothesis, alternative hypothesis, simple hypothesis and composite hypothesis. 2.75
 (b) Describe different steps for testing a single mean. 3
 (c) What do you mean by type-I and type-II error? Among them which one is more serious and why? 3

- 6 (a) Define contingency table. For 2×2 contingency table show that $\chi^2 = \frac{N(ad - bc)^2}{(a+b)(a+c)(c+d)(b+d)}$ 3.75
- (b) How would you test the independence of hair color and eye color of persons from the following table at 5% level of significance where $\chi^2_{0.05} = 3.84$. 2.5

Eye color	Hair color		Total
	Black	Not Black	
Black	40 (✓)	60 (✓)	100
Not Black	50 (✓)	50 (✓)	100
Total	90	110	200

- (c) The diameters of steel shafts produced by a certain manufacturing process should have a mean of 0.255 inches. The diameter is known to have a standard deviation of $\sigma = 0.0001$ inch. A random sample of 10 shafts has an average diameter of 0.2545 inches. Set up an appropriate hypothesis on the mean and test at 5% level of significance, where $Z_{0.025} = 1.96$. 2.5

University of Rajshahi
Department of Computer Science and Engineering
 B. Sc. (Engg.) Part-I, Even Semester, Examination 2015
Course: STAT1211 (Statistics for Engineers)
Full Marks: 35 **Time: 2 Hours**

[Answer any four questions taking two from each group]

Part A

1. a) What are the characteristics of a good measure of central tendency? 2
- b) What is median? How do you calculate it for the grouped data? When do you prefer it to the arithmetic mean? 3.75
- c) If \bar{x} and S denote the mean and standard deviation of x_1, x_2, \dots, x_n , then show that $\bar{x}\sqrt{(n-1)} \geq S$. 3
2. a) What do you mean by dispersion? Define Coefficient of variation and explain why this is sometimes preferred to the standard deviation as a measure of dispersion. 4.25
- b) The following is the distribution of drug addicted people by age coming to the hospital for treatment: 4.5

Class interval Of ages	18-22	22-26	26-30	30-34	34-38
No. of people	7	10	18	8	7

Calculate mean, mode and standard deviation.

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3. a) What do you mean by probability of an event? 2
- b) State and prove the multiplicative law of probability for two events. 2.75
- c) Write down the probability mass function of binomial distribution. Let a random variable X follows binomial distribution. Find the mean and variance of X . 4

Part B

4. a) What do you mean by Pearson correlation coefficient? 2
- b) Prove that the coefficient of correlation between two variables is independent of the origin and scale of measurement of the variables. 2.75
- c) Suppose an engineer makes the following measurements on temperature (T) and pressure (P) within a closed tank containing a fixed amount of gaseous product. 4

T (K)	298	301	302	310	312	323	337	341	349
P (atm)	1.2	1.3	1.5	1.7	1.8	2.0	2.1	2.3	2.8

Calculate the correlation coefficient between T and P and interpret it.

5. a) What do you understand by linear regression?

b) Find the least square estimates of the parameters α and β of the regression model 2.75

$$y_i = \alpha + \beta x_i + e_i, \quad i = 1, 2, \dots, n$$

c) Suppose the weight (X) in kilograms and the distance (Y) in meters required to stop from a speed of 20 miles per hour, for a random sample of 10 different models of similar motorcycles are given below: 5

Weight (X)	314	317	320	326	331	339	346	354	361	369
Distance (Y)	13.9	14.0	13.9	14.1	14.0	14.3	14.1	14.5	14.5	14.4

i). Draw a scatter diagram for X and Y . Does the relationship look linear?

ii). Fit the regression line of Y on X and interpret the slope and intercept.

iii). Predict the expected stopping distance for a motorcycle that's weight is 360 kilograms.

6. a) What do you mean by statistical hypothesis? Discuss the different steps of hypothesis testing. 3

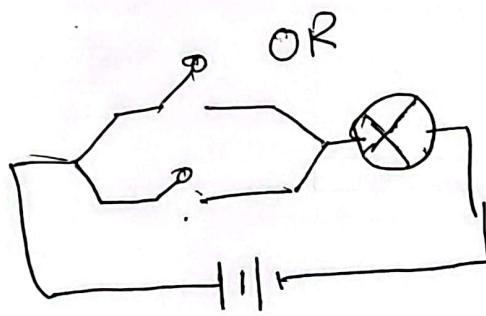
b) Differentiate the following pairs of concepts:

i). Null hypothesis and alternative hypothesis.

ii). Simple hypothesis and composite hypothesis.

iii). Type I error and Type II error.

c) A random sample of 15 men from a large community yields a mean height of 66.4 inches. The value of S (standard deviation) calculated from the sample is 3.1 inches. Do the data support the hypothesis that the mean height of men in the community is 65.0 inches? ($t_{0.05, 14} = 2.145$) 2.75



$$0 \ 0 = 0$$

$$0 \ 1 = 1$$

$$1 \ 0 = 1$$

$$1 \ 1 = 1$$



$$0 \ 0 = 0$$

$$0 \ 1 = 0$$

$$1 \ 0 = 0$$

$$1 \ 1 = 1$$

2

Answer Four questions taking Two from each part

Part-A

~~1)~~ What do you mean by central tendency? Why do we study dispersion? What are the absolute measures of dispersion? 2.75

~~2)~~ For two positive observations x and y show that $\Delta M \geq GM \geq HM$. When does the equality hold? 3

~~3)~~ Calculate mean and variance using the given data. 3

Mid Value (x)	5	10	15	20	25	30	35	40	45	50
Frequency (f)	1	4	15	31	49	22	25	12	5	3

~~a)~~ Define probability of an event with example. 2

~~b)~~ State and prove the additive law for three not mutually exclusive events. 3.75

~~c)~~ A card is drawn from a pack of 52 cards. What is the probability that the card is either spade or king? 3

~~9.~~ a) Define a random variable. A joint density function of two random variables X and Y is given below 3

$$f(x,y) = k(2x+y); 2 < x < 6, 0 < y < 5 \\ = 0; \text{ otherwise}$$

~~b)~~ Find the constant k . Property of TEC Library
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~~c)~~ Define mathematical expectation. For two constants a and b , prove that 2.75

$$(i) E(aX + b) = aE(X) + b \quad (ii) V(aX+b) = a^2V(X)$$

~~c)~~ Define Binomial distribution. Find the mean and variance of Binomial distribution. 3

Part-B

~~a)~~ What is a scatter diagram? 2

~~b)~~ What is coefficient of correlation? Show that correlation coefficient is independent of changes of origin and scale of measurement. 3.75

~~c)~~ Calculate correlation coefficient between the heights (in cm) and weights (in kg) of 10 students given below: 3

Height	150	155	157	160	162	165	168	172	175	180
Weight	55	58	60	61	65	62	74	75	80	89

~~a)~~ How do you distinguish between correlation and regression? 2

~~b)~~ Discuss the concept of rank correlation. Show that Spearman's rank correlation coefficient is given by 3.75

$$\rho = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

~~c)~~ Estimate the regression equation of Y on X for the given data: 3

Family members (X)	4	7	3	8	5	4	6
Expenditure on food in Taka (Y)	160	80	75	90	140	80	150

~~6.a)~~ Define (i) Statistical Hypothesis, (ii) level of significance and (iii) critical region. (rejection) 2.75

~~b)~~ Let x_1, x_2, \dots, x_n be a random sample come from normal distribution with mean μ and variance σ^2 , then 3

describe the test procedure of the hypothesis

(i) $H_0: \mu = \mu_0$ vs $H_1: \mu \neq \mu_0$, where σ is known

(ii) $H_0: \mu = \mu_0$ vs $H_1: \mu \neq \mu_0$, where σ is unknown

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2}$$

~~c)~~ A random sample of 15 men from a community yields a mean height of 67.6 inches. The value of standard deviation from the sample is 3.4 inches. Do the data support the hypothesis that the mean height of men in that community is 65.8 inches? ($t_{0.05, 14} = 2.145$) 3

[N.B. Answer any FOUR questions taking at least TWO each part.]

Part-A

1. (a) What do you mean by Statistics? What are the graphical methods of representing statistical data? Discuss any one of them. 3.75

(b) What is central tendency? What are its measures? Write down the characteristics of a good measure of central tendency. 3

(c) For the following frequency distribution calculate median with graphically: 2

Class interval	13-15	15-17	17-19	19-21	21-23
Frequency	3	7	12	6	3

2. (a) Define with examples: equally likely outcome and complementary event. If $P(A)=0.35$, $P(B)=0.75$ and $P(A \cap B)=0.20$, find the values of $P(A \cup B)$ and $P(A \cap B^c)$. 3

(b) What do you mean by conditional probability? State and prove the multiplicative law of probability. 3.75

(c) The probability that doctor D will diagnose Cancer correctly is 65%. The probability that a patient will die by his correct diagnosis is 30% and the probability of death by wrong diagnosis is 75%. A patient of doctor D, who had Cancer, died. What is the probability that his Cancer was diagnosed correctly? 2

(a) Distinguish between discrete and continuous random variables. Define probability density function (pdf) and cumulative distribution function (cdf) of a random variable. 2.75

(b) The random variable X has the following probability function: 3

x	1	2	3	4
p(x)	0.1	0.3	0.4	0.2

Find $P(X \geq 2)$, $P(X < 3)$, $E(X)$ and $V(X)$.

(c) What is Poisson distribution? Find the mean and variance of this distribution and hence show that the mean and variance of Poisson distribution are equal. 3

Part-B

4. (a) Define positive correlation, negative correlation and zero correlation. 3.5
 If $y = -\frac{ax+c}{b}$ then prove the correlation coefficient between x and y is -1 if signs of a and b are alike and $+1$ if they are different. 3
- (b) Show that correlation coefficient lies between -1 and $+1$ 2.25
- (c) The height (X) and weight (Y) of a person in a locality are given below:
- | | | | | | |
|-----------------|----|----|----|-----|-----|
| X (in inches) | 60 | 55 | 59 | 62 | 70 |
| Y (in lbs.) | 82 | 90 | 95 | 106 | 135 |
- Find the correlation coefficient between X and Y and comment.
5. (a) What is the meaning of a regression line? Why are there two regression lines in a bivariate distribution? 1.75
- (b) Let the linear regression line of Y on X be $Y_i = \alpha + \beta X_i + \varepsilon_i$; $i=1, 2, \dots, n$. Discuss the estimation method of α and β . Also, show that correlation coefficient is the geometric mean of the regression coefficients. 4
- (c) Fit a straight line of price on supply to the following data by applying the method of least squares: 3
- | | | | | | |
|---------------------|-----|-----|----|-----|----|
| Supply, X : | 85 | 89 | 90 | 93 | 96 |
| Price (in Tk.), Y | 127 | 115 | 98 | 100 | 95 |
- Also, find the predicted price when supply is 80.
6. (a) What do you understand by hypothesis testing of significance? What types of errors may occur in hypothesis testing? Explain. 3
- (b) Let X_1, X_2, \dots, X_n be a random sample from a normal population with mean μ and variance σ^2 . Describe the test procedure to test the hypothesis $H_0: \sigma^2 = \sigma_0^2$ against $H_1: \sigma^2 \neq \sigma_0^2$. 3
- (c) From a random sample of 15 values we calculate an estimate 5.2 for the variance of the population. Does the result support the hypothesis that the population variance is 8.5? 2.1
 [At 5% level of significance the critical values of the test statistic are 5.63 (lower) and 26.12 (upper)]

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2} \quad s=?$$

University of Rajshahi

Department of Computer Science and Engineering

B. Sc. (Hons) Part-I Examination-2011

Course: CSE 108R (Elementary Statistics and Probabilities)

Full Marks: 50

Time: 3 Hours

[Answer any Five of the following questions]

1. a) Distinguish between i) variable and attributes, ii) group data and ungroup data, iii) frequency curve and frequency polygon, iv) Ogive and Pie chart, and v) Primary data and Secondary data. 10
- * b) Discuss the concept of central tendency of data. Which measure of central tendency is better than others and why? 4
- * c) Let us consider that x_1, x_2, \dots, x_n be n real and positive numbers. Then show that $AM \geq GM \geq HM$, where notations are of usual assumptions. When it will be $AM = GM = HM$. 6
3. a) Explain what is meant by dispersion. Name the measures of variable for dispersion. For two numbers x_1 and x_2 , show that standard deviation is half of the range. 4
- b) Variances of age of four subsets of a population are 25, 27, 30, and 33 years² while the corresponding sizes of the sub-population are 150, 145, 140, and 140 respectively. Find the age variance of the total population. 6
4. a) Define skewness and kurtosis of a frequency distribution. Graphically show i) positively skewed, ii) negatively skewed, and iii) symmetric frequency distributions along with positions of mean, mode and median. 7
- b) Discuss the role of variance on the shape characteristic of a frequency distribution. 3
5. a) What is probability of an event? When three events A, B and C are said to be i) mutually exclusive?, ii) Pair-wise independent? And iii) Completely independent? 4
- b) For any two events A and B, show that $P(A \cap B) = P(A) P(B/A)$
Extend this results for three and four events. Convert all these results for independent events. 6
6. a) What do you mean by Bose Einstein statistic? Where it is used? 2
- b) State and prove chebyshev's inequality. 4
- c) Suppose X is the number scored in a throw of a fair die. Then show that the chebyshev's inequality gives $\Pr[|X-\mu| > 2.5] < 0.17$, where μ is the mean of X. 4
7. a) Define a random variable. Distinguish between a discrete and a continuous random variable. Give examples. 3
- b) Write down the probability mass function of Poisson variate. Find the mean and the variance of Poisson distribution. Show that it tends to normal distribution under certain conditions. 7
8. a) Define normal distribution. Find its moment generating function. 3
- b) Show that all odd ordered moment of normal distribution vanishes. 3
- c) Find the value of β_1 and β_2 for normal distribution and comment on the shape of the distribution. 4

~~10~~
H.W.

Statistics.

→
30.09.19
Monday.

Height of father (in inch): 58 60 61 65 55

Height of son (in inch): 59 59 62 63 60

① Find the Karl-Pearson co-efficient of correlation.

Solution:

x	y	xy	x^2	y^2
58	59	3422	3364	3481
60	59	3540	3600	3481
61	62	3782	3721	3844
65	63	4095	4225	3969
55	60	3300	3025	3600
$\sum x =$ 299	$\sum y =$ 303	$\sum xy =$ 18139	$\sum x^2 =$ 17935	$\sum y^2 =$ 18375

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\sum x^2 - \frac{(\sum x)^2}{n}} \sqrt{\sum y^2 - \frac{(\sum y)^2}{n}}}$$

$$= 0.7287$$

(Ans)