University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engg. Part-1 Even Semester, Examination-2016
Course: STAT-1211 (Statistics for Engineers)

Time: 2 Hours | Full Marks: 35

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=arithmetic mean, GM=geometric mean and HM=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.

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 2X2 contingency table show that 3.75

$$\chi^2 = \frac{N(ad-bc)^2}{(a+b)(a+c)(c+d)(b+d)}$$

(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		100
Not Black	50	50	
Total	90		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 ρ=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
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[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 $x_1, x_2, \ldots, x_n$, then show that 3
   $$\bar{x}\sqrt{(n-1)} \geq S.$$

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.

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.

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University of Rajshahi
Department of Computer Science & Engineering
B. Sc. Engineering Part-I Even Semester-2013
Course: STAT-1211 (Statistics for Engineers)
Marks: 35, Time: 2 hours
Answer Four questions taking Two from each part

Part-A

1.a) What do you mean by central tendency? Why do we study dispersion? What are the absolute measures ofdispersion? 2.75

b) For two positive observations x and y show that AM>= GM >=HM. When does the equality hold? 3

c) 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

2.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

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

$f(x,y) = k(2x+y)$; $2<x<6$, $0<y<5$

$= 0$; otherwise

Find the constant k.

b) Define mathematical expectation. For two constants a and b, prove that 2.75

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

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

Part-B

4.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

5.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

$$\rho = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)}$$

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. 2.75

b) Let $x_1, x_2, \ldots, x_n$ be a random sample come from normal distribution with mean μ and variance σ^2, then describe the test procedure of the hypothesis 3

(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

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

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Marks: 35, Time: 2 hours
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Part-A

1.a) What do you mean by central tendency? Why do we study dispersion? What are the absolute measures ofdispersion? 2.75

b) For two positive observations x and y show that AM>= GM >=HM. When does the equality hold? 3

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

Mid Value (x)	5	10	15	20	25	30	35	40	45	50
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Find the constant k.

b) Define mathematical expectation. For two constants a and b, prove that 2.75
(i) $E(aX + b) = aE(X) + b$ (ii) $v(aX+b) = a^2V(X)$

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

$$\rho = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)}$$

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. 2.75

b) Let $x_1, x_2, \ldots, x_n$ be a random sample come from normal distribution with mean μ and variance σ^2, then describe the test procedure of the hypothesis 3
(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

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

University of Rajshahi
Department of Computer Science and Engineering
B.Sc.Engg.(CSE) 1st Year Even Semester 2012
Course: STAT1211 (Statistics for Engineers)
Full Marks: 35 Time: 03 hours
[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. 3
   If $P(A)=0.35$, $P(B)=0.75$ and $P(A\cap B)=0.20$, find the values of $P(AUB)$ and $P(A\cap B^c)$
   (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

3. (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.

(b) Show that correlation coefficient lies between -1 and +1 3

(c) The height (X) and weight (Y) of a person in a locality are given below: 2.25

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 $Y_i=\alpha+\beta Y_i+\varepsilon_i;\ i=1,2,.....,n$. 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 $X_1,X_2,.....,X_n$ 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? 2.75
[At 5% level of significance the critical values of the test statistic are 5.63 (lower) and 26.12 (upper)]

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engg.(CSE) 1st Year 2nd Semester 2011
Course: STAT 1211 (Statistics for Engineers)
Time: 3 Hrs. Full Marks: 35
[N.B. Answer FOUR questions taking at least TWO from each part.]

Part A

1.a) For two positive observations, show that $AH=G^2$, where A=Arithmetic mean, H=Harmonic Mean, and G=Geometric mean. 1.75

b) "For two observations, standard deviation is the half of the range", – prove. 2

c) Calculate the mean, standard deviation and co-efficient of variation from the following data: 5

Class interval	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	2	5	7	13	21	16	8	3

2.a) Define with examples (i) sample space, (ii) event, and (iii) probability of an event. 3

b) If A and B are two events then prove that P(AUB)=P(A)+P(B)-P(AB). 2.75

c) Three events A, B and C are mutually exclusive and their union is the sample space Ω. If P(A)=(3/2)P(B), P(B)=2P(C), then find P(A), P(B) and P(C). 3

3.a) Define mathematical expectation of a random variable with example. 2

b) Given the following density function of the random variable X: 4

$f(x)=2(1-x)$; $0<x<1$

Find (i) E(x), (ii) E(3+5x), and (iii) V(x).

c) Find the mean and variance of binomial distribution. 2.75

Part B

4.a) What is scatter diagram? Discuss how it helps us in understanding the nature of relationship between two variables. 2.75

b) Define simple correlation coefficient, r. What does it measure? Prove that correlation coefficient is independent of both of change of origin and scale. 3

c) Given SS(X)=755, SS(Y)=654 and SP(X,Y)=655. Find r_{XY} and comment. 3

5.a) What is regression? 2

b) Consider a regression model of Y on X. derive the least squares estimates of the model parameters. 3

c) To study the tensile strength of a certain type of wire, the following pairs of observations were recorded, where X is the diameter in cm and Y is the mass supported in kg/cm. 3.75

X : 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4

Y : 14 26 50 56 42 98 82 88 134 124

Fit the regression model of Y on X for the above data. Find the predicted value of Y for X=2.8.

6.a) Define the terms: statistical hypothesis, critical region, Type-I error and Type-II error. 3

b) Suppose that X is a normal variate with mean μ and variance σ^2. Describe the test procedure to test the following hypothesis 2.75

$H_0 : \mu=\mu_0$

$H_1 : \mu\neq\mu_0$

c) The heights of 10 males in inches of a given locality are as follows: 3

70.2, 67.1, 62.5, 69.1, 70.2, 64.0, 64.6, 66.3, 61.7, 68.9

Is it reasonable to believe that average height is equal to 65 inches (The tabulated value of the test statistic at 5% level is 2.262)?