

# Bachelor in Information Technology (BIT)

## Term-End Examination

June, 2007

### CSI-99 : STATISTICAL TECHNIQUES

Time : 3 Hours

Maximum Marks : 75

**Note :** Question 1 is **compulsory**. Answer any **three** questions from Q. 2 to Q. 5. Use of calculator is **not** allowed.

1. (a) Which of the following statements are true and which are false ? Justify your answer. 1×5=5
- (i) A town has two doctors X and Y operating independently. If the probability, that the doctor X is available is 0.9 and that for Y is 0.8, then the probability that at least one doctor is available, when needed is 0.98.
- (ii) The correlation coefficient is the arithmetic mean between the regression coefficients.
- (iii) The size of the variable which occurs most frequently is known as mean.
- (iv) The mean and variance of a Poisson distribution are equal.
- (v) If  $f(x) = kx^3$ ,  $0 < x < 1$  and 0 elsewhere, is a pdf, then  $k = 4$ .
- (b) Students of a class were given an aptitude test. Their marks were found to be normally distributed with mean 60 and standard deviation 5. What percentage of students scored more than 60 marks ? 3
- (c) Find the lower and upper control limits for  $\bar{X}$  chart and s-chart if  $n = 5$ ,  $\bar{X} = 15$ , and  $\bar{s} = 2.5$ . Take, for  $n = 5$ ,  $A_1 = 1.596$ ,  $B_3 = 0$  and  $B_4 = 2.089$ . 6
- (d) A box contains 2 black, 4 white, and 3 red balls. One ball is drawn at a time randomly from the box till all the balls are drawn from it. Find the probability that the balls drawn are in the sequence of 2 black, 4 white and 3 red. 5
- (e) Ten percent of screws produced in a certain factory turn out to be defective. Find the probability that in a sample of 10 screws chosen at random, exactly two will be defective. 5
- (f) A random variable x has the following probability function : 6

Values of x	- 2	- 1	0	1	2	3
p(x)	0.1	k	0.2	2k	0.3	k

- (i) Compute the value of k.
- (ii) Determine mean and variance.

2. (a) Customers arrive at a photocopying machine at an average rate of two every 10 minutes. The number of arrivals is distributed according to a Poisson distribution. What is the probability that there will be
- (i) no arrivals during any period of ten minutes ?
  - (ii) exactly one arrival during this time period ?
  - (iii) more than two arrivals during this time period ?
- (b) The chances that doctor A will diagnose a disease X correctly is 60%. The chances that a patient will die by his treatment after correct diagnosis is 40% and the chances of death by wrong diagnosis is 70%. A patient of doctor A, who had disease X, died. What is the probability that his disease was diagnosed correctly ?
- (c) A continuous random variable X that can assume values between  $x = 1$  and  $x = 3$  has a density function given by  $f(x) = \frac{1}{2}$ .
- (i) Show that the area under the curve is equal to 1.
  - (ii) Find  $P(2 < X < 2.5)$
  - (iii) Find  $P(X \leq 1.6)$ .
- (d) A committee consists of 9 students, two of which are from 1st year, three from 2nd year and four from 3rd year. Three students are to be removed at random. What is the chance that
- (i) the three students belong to different classes ?
  - (ii) two belong to the same class and third to the different class ?
  - (iii) the three belong to the same class ?

5

2

4

4

3. (a) Psychological tests of intelligence and of engineering ability were applied to 10 students. Here is a record of ungrouped data showing intelligence ratio (IR) and engineering ratio (ER). Calculate the co-efficient of correlation.

Student	A	B	C	D	E	F	G	H	I	J
IR	105	104	102	101	100	99	98	96	93	92
ER	101	103	100	98	95	96	104	92	97	94

5

- (b) The two regression equations of the variables x and y are  $x = 19.13 - 0.87y$  and  $y = 11.64 - 0.50x$ ,  
Find
- (i) mean of x's.
  - (ii) mean of y's, and
  - (iii) the correlation co-efficient between x and y.

5

- (c) A box A contains 2 white and 4 black balls. Another box B contains 5 white and 7 black balls. A ball is transferred from the box A to the box B. Then a ball is drawn from the box B. Find the probability that it is white.

5

4. (a) In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and SD of 60 hours. Estimate the number of bulbs likely to burn for 5
- (i) more than 2150 hours
- (ii) less than 1950 hours, and
- (iii) more than 1920 hours but less than 2160 hours
- [ You may use the following values :
- $\phi(1.833) = 0.4664$ ,  $\phi(1.33) = 0.4082$ ,  $\phi(2) = 0.4772$  ]
- (b) In a sample of 600 men from a certain city, 450 are found smokers. In another sample of 900 men from another city, 450 are smokers. Do the data indicate that the cities are significantly different with respect to the habit of smoking among men ? 5
- (c) What is a control chart ? Describe its use in controlling a process in an organisation. Also explain two different types of control charts. 5
5. (a) A machinist is making engine parts with axle diameter of 0.7 inch. A random sample of 10 parts shows mean diameter of 0.742 inch with a standard deviation of 0.04 inch. On the basis of this sample, would you say that the work is inferior ? 5
- [ The following values may be used  $t_{0.05, 9} = 2.262$ ,  $t_{0.05, 10} = 2.92$  ]
- (b) The breaking strengths of metal rods, produced by a certain company, have mean as 820 kg and standard deviation as 50 kg. When a new manufacturing process is adopted, it is claimed that the breaking strength can be improved. A sample of 100 rods is tested and the result indicates that the breaking strength is 840 kg. Can we support this claim at a 1% level of significance ? 5
- (c) Given a random variable X having a normal distribution with  $\mu = 50$ , and  $\sigma = 10$ , find the probability that X assumes a value between 45 and 62. 5
- [ You may use the following values :
- $\phi(z = 1.2) = 0.8849$ ,  $\phi(z = 0.5) = 0.3085$  ]

