Bachelor in Information Technology (BIT)

Term-End Examination

December, 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 calculators is allowed.*

1. (a) Fill in the blanks. *5×1=5*

(i) The probability of getting 2 or 3 or 4 from a throw of single dice is _____ .

(ii) An unbiased die is tossed twice, then the probability of obtaining the sum 6, is _____ .

(iii) The mean of the Binomial distribution with n observations and probability of success p is _____ .

(iv) $f(x) = kx$ in $0 < x < 1$ is a valid probability density function if $k =$ _____ .

(v) The area under the whole normal curve is _____ .

(b) Which of the following statements are true ? Give reasons for your answer. *5×1=5*

(i) If X is a binomial variable with parameter $n = 10$, $p = 1/4$, then its standard deviation is 2·25.

(ii) If the random variable x is uniformly distributed in [0, 3], then its p.d.f. is

$$f(x) = 3, \quad 0 \le x \le 3$$
$$= 0, \quad \text{elsewhere}$$

(iii) Chi-square distribution is continuous.

(iv) The probability that it will rain tomorrow is 0·40 and the probability that it will not rain tomorrow is 0·52.

(v) If a random variable x follows Poisson distribution such that

$$P(x = 1) = P(x = 2),$$

then the mean of the distribution is 2.

(c) Select the correct alternative. *5×1=5*

(i) The mode of the numbers

7, 7, 7, 9, 10, 11, 11, 11, 12 is

(A) 11

(B) 12

(C) 7

(D) 7 and 11

(ii) A buys a lottery ticket in which the chance of winning is 1/10; B has a ticket in which his chance of winning is 1/20. The chance that at least one of them wins is

(A) 1/200

(B) 29/200

(C) 30/200

(D) 170/200

(iii) If the mean of a Poisson distribution is m, the standard deviation of this distribution is

(A) m^2

(B) $\sqrt{m}$

(C) m

(D) None of these

(iv) If the correlation coefficient is 0, the two regression lines are

(A) parallel

(B) perpendicular

(C) coincident

(D) inclined at 45° to each other

(v) A coin is tossed 3 times. The probability of obtaining two heads will be

(A) $\frac{3}{8}$

(B) $\frac{1}{2}$

(C) 1

(D) 2

(d) 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

(e) The students in a class are selected at random, one after the other, for an examination. Find the probability p that the boys and girls in the class alternate if 5

(i) the class consists of 4 boys and 3 girls

(ii) the class consists of 3 boys and 3 girls

(f) The random variable X, representing the number of errors per 100 lines of software code, has the following probability distribution : 5

x	2	3	4	5	6
f(x)	0·01	0·25	0·4	0·3	0·04

Find the variance of X.

2. (a) The mean of five items of an observation is 4 and the variance is 5·2. If three of the items are 1, 2, and 6, then find the other two. 5

(b) A student takes his examination in four subjects P, Q, R, S. He estimates his chances of passing in P as 4/5, in Q as 3/4, in R as 5/6 and in S as 2/3. To qualify, he must pass in P and at least two other subjects. What is the probability that he qualifies ? 5

(c) In a bolt factory, machines A, B, and C manufacture 25%, 35%, and 40% of the total. Of their output 5%, 4% and 2% are defective bolts. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machines A, B or C ? 5

3. (a) Find the mean, variance, and standard deviation for the following data : 5

x_i	4	8	11	17	20	24	32
f_i	3	5	9	5	4	3	1

(b) Given below are the values of y for certain values of x. Find the equation of the regression line which describes the relation between x and y. Hence estimate the value of y when x = 24. 5

x	2	4	6	8	10	12	14	16	18	20
y	13	17	24	27	28	33	35	41	43	51

(c) Two students Anil and Ashima appeared in an examination. The probability that Anil will qualify the examination is 0·05 and that Ashima will qualify the examination is 0·10. The probability that both will qualify the examination is 0·02. Find the probability that 5

(i) Both Anil and Ashima will not qualify the examination

(ii) At least one of them will not qualify the examination, and

(iii) Only one of them will qualify the examination.

4. (a) A random variable x has the following probability function : 5

Values of x	– 2	– 1	0	1	2	3
p(x)	0·1	k	0·2	2k	0·3	k

(i) Find the value of k.

(ii) Calculate mean and variance.

(b) In a certain factory turning out razor blades, there is a small chance of 0·002 for any blade to be defective. The blades are supplied in packets of 10. Use Poisson distribution to calculate the approximate number of packets containing no defective, one defective and two defective blades respectively in a consignment of 10,000 packets. 5

(c) An underground mine has 5 pumps installed for pumping out storm water. The probability of any one of the pumps failing during the storm is $\frac{1}{8}$. What is the probability that 5

(i) at least 2 pumps will be working;

(ii) all the pumps will be working during a particular storm ?

5. (a) A manufacturer of sports equipment has developed a new synthetic fishing line that he claims has a mean breaking strength of 8 kilograms with a standard deviation of 0·5 kilogram. Test the hypothesis that $\mu = 8$ kilograms against the alternate that $\mu \neq 8$ kilogram if a random sample of 50 lines is tested and found to have a mean breaking strength of 7·8 kilograms. Use a 0·01 level of significance. 5

(b) Ten individuals are chosen at random from the population and their heights are found to be (in inches) 63, 63, 64, 65, 66, 69, 69, 70, 70, 71. Discuss the suggestion that the mean height in the universe is 65 inches given that for 9 degree of freedom the value of student's 't' at 0·05 level of significance is 2·262. 5

(c) Twelve dice were thrown 4096 times and a throw of 6 was reckoned as a success. The observed frequencies were as given below : 5

Number of successes	0	1	2	3	4	5	6	7	Total
Frequencies	447	1145	1181	796	380	115	24	8	4096

Find the value of χ^2 on the hypothesis that the dice were unbiased and hence show that the data is consistent with the hypothesis so far as the χ^2 test is concerned.