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| **NEPAL COLLEGE OF INFORMATION TECHNOLOGY**  **Assessment** | |
| Semester: FALL | Year: 2014 |
| Level: Bachelor | Full Marks: 100 |
| Program: BEIT/SE | Pass Marks: 45 |
| Subject: Probability and Queuing Theory | Time: 3 hrs |
| *Candidates are required to give their answers in their own words as far as practicable.*  *The figures in the margin indicate full marks* | |

**Attempt all the questions.**

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| 1. | a. | A bag contains 8 white counters and 3 black counters. Two counters are drawn one after another without replacement. Find the probability of drawing i) two white counters ii) at least one black counter iii) one white and one black counters. 7 |
|  | b. | In a factory, Machine A produce 30% of the total output, machine B produce 25% and Machine C produce the remaining 45% of the output. From the past experience, it has been found that 1%, 2% and 3% of the output from machine A, B and C respectively. Suppose an item was drawn from the day’s production and was found to be defective. Find the probability that a defective item chosen at random was produced by machine A, B and C respectively. 8 |
| 2. | a. | The number of hardware failure of a computer system in a week of operation has the following probability mass function.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Number of failures | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | Probability | 0.18 | 0.28 | 0.25 | 0.18 | 0.06 | 0.04 | 0.01 |  1. Find the expected number of failures in a week. 2. Find the variance of the number of failures in a week. 7 |
|  | b. | The joint probability density function of two dimensional random variable (X,Y) is given by    Determine  The constant K  Examine whether X and Y are independent.  Find mean and variance of X and Y.  Find the covariance between X and Y. 8 |
| 3. | a. | Suppose that 1000 disintegrations from a sample were registered over the course for an hour. What is the probability that in 5 seconds (i) no disintegrations and (ii) more than 2 disintegrations will be observed? 7 |
|  | b. | Last year, the B.E. students of a campus scored marks in Probability and Queuing Theory, which are distributed normally with mean 72 and standard deviation 6. This year 300 students are appearing in this paper.   * 1. Estimate the number of students who scores more than 80 marks.   If 50 is the pass mark, estimate the number of students who |
| 4. | a. | A ski lift is designed with a load limit of 10,000 lbs. It claims a capacity of 50 persons. If the weights of all persons using lift have a mean of 190 lbs and sd of 25 lbs, what is the probability that a random group of 50 persons will exceed the load limit? 7  OR  How many times would you have to toss a fair coin in order to be at least 95% sure that the relative frequency of turning up of a head is within 0.01 of the theoretical probability ½. |
|  | b. | A Company has a percentage of customers whose accounts are always overdue, and some customers never pay, thereby becoming bad debts. The company's experience is a bad debt. Each month the account receivable manger reviews each account and classifies it as 0-month, 1-month, 2-months, paid-up, or bad debt. From the last month's data, he has provided the following transition probability matrix on the state of the accounts.    Suppose an account is 0-month old, obtain the expected number of months it will be i) 1-months ii) 2-months iii) keep alive. Also find the probability that currently 0,1 and 2 months old account become bad debts 8 |
| 5. | a. | Given the transition probability matrix of a Markov chain below; obtain the matrix of n step transition probabilities and then find the two step transition probabilities. 7 |
|  | b. | The average rate of arrival of customers in a supermarket is 10 every 30 minute. The average time taken by the cashier to list and calculate the customer purchases is 2.5minutes. Suppose that arrivals are assumed to follow poission process and service the follows exponential list? Calculate the OC for thus model. Find the prob. that queue size exceeds 6 customers 8 |
| 6. | a. | In a factory, the customers have to pass through three counters. The customers buy coupons at the first counter, select and collect the snacks at the second counter and collect tea at third counter. The server at each counter takes on an average 1.5 minutes although the distribution of service time is approximately Poisson at an average rate of 6 per hour. Find the average time a customer spends waiting in cafeteria. Also find the most probable time spent in getting the service. 7 |
|  | b. | A supermarket has two girls ringing up sales in the counters. Let the service time for each customer be exponential with mean 4 minutes and people arrive in the queue in fashion at the rate of 10 an hour. Find performance measure of this queue. 8 |
| 7. | Write Short Notes on : (5 ×2 = 10)   1. Chebyshev’s inequality 2. Kendall notation and markov chain 3. Random variable and Mathematical expection | |