Nepal College of Information Technology

**Assessment**

Fall 2012

Program : IT Time : 3 hrs

Semester : Fall (III) FM : 100

Subject : Probability & Queuing Theory PM : 50

* *Candidates are requested to give their answer as far as practicable in their own words.*
* *The figure in the margin indicates the full marks*
* ***Attempt ALL question***

1. a. Suppose that the length in minutes of a phone call in a phone booth is exponentially distributed with parameter *λ = 1/10*. What is the probability that a person arriving at the phone booth will have to wait for (i) more than 10 minutes (ii) between 10 and 20 minutes and (iii) less than 15 minutes. Also find the mean and variance of the lengths of telephone calls. [8]

b. A variable has the uniform distribution with the *pdf* given by and 0 elsewhere. Compute P(X > 60) and P(20 < X < 40). [7]



2. a. Define a normal random variable. State, without proofs, the properties of such a random variable. [6]

b. The lengths of rods produced in a workshop follow a normal distribution with mean μ and variance 4. If it is known that 10% of the rods are less than 17.4 cm long, find the probability that a rod chosen at random will be between 19 and 22 cm long. [9]

3. a. What are the main elements distinguishing a stochastic process? Mention, with an example each, the various categories of the stochastic processes. [6]

b. Three calls arrive at a phone booth every half hour on the average. Find (i) P(no calls in an hour) (ii) P(3 calls in 15 minutes) and (iii) P(more than 2 calls in a 45 minute interval). [9]

4. a. There are two food stores A and B in a certain locality. An investigation of the choices of the customers revealed that with probability 0.15 a customer of store A one week would go over to store B next week and with probability 0.10 a customer of store B would go over to store A.

(i) Write down the *tpm* for this problem.

(ii) Draw a diagraph for the *tpm*.

(iii) What percentage of customers will remain loyal to each store after the second week?

(iv) If initially each store had 50% of the customers, what will be the percentage of customers with each store after two weeks? [8]

b. Define a M/M/1 (∞, FIFO) queue and state its operating characteristics. [7]

OR

5. a. What do you understand by a periodic Markov chain? Give on example each of a periodic Markov chain and an aperiodic Markov chain. [7]

b. A computer system has three states (0 = busy, 1 = idle and 2 = under repair). The *tpm* between these states was observed to be as follows.



(i) Draw the transition state diagram.

(ii) Show that the Markov chain is irreducible.

(iii) Compute P2 and P3.

(iv) Show that the system has a period 2. [8]

6. Write short notes on any TWO of the following. [2 x 5]

a. Chapman-Kolmogorov equation for a Markov chain

b. Recurrent and transient states

c. Pure birth process

d. Structure of a basic queue