Total pages: 2

Roll No: 2K13/MC/064

SIXTH SEMESTER B.Tech. Mathematics & Computing

Supplementary End Semester Exam, *Oct. 2016*

Code & Title: MC 312 Stochastic Processes

Time: 3:00 Hours *Max. Marks : 70*

Note : Answer any five questions. All questions carry equal marks. Assume suitable missing data, if any.

1(a) Define random walk and give specific examples. Explain random walk with one reflecting barrier; write the equations governing this walk.

(b) Show that in case of unrestricted simple random walk if the probability of a jump upward is greater than the probability of a jump downward then the particle will drift to ∞ with probability one.

2(a) What is the Bernoulli process. Give example and state important properties of this process. When is the process said to be non homogeneous ? Give example.

(b) What is birth and death process. Find the steady state solution for this process.

3(a) Babies are born in a city at the rate of one birth every 2 minutes. In case the inter arrival time follows exponential distribution then find the expected number of births per week and the probability of ten birth in a specific hour.

(b) Consider a renewal process with renewal function equal to (i) 2, (ii) t. Find the probability distribution of the number of renewals by time k in each case.

4(a) Define a Markov chain. Give example. What is a non-homogeneous chain? How do we find the n-step transition probability matrix of a Markov chain.

(b) A gambler has a fortune of Rs. 3. He bets Re 1 at a time and wins Re 1 with probability 3/4. He stops playing if he loses all his fortune or doubles it. Write the transition probability matrix. What is the probability that the game is over exactly in five play?

5(a) Describe M/M/c queuing system. Derive expression for expected number of customers in the queue.

(b) Consider a computer system with Poisson job-arrival stream at an average rate of one per minute. Determine the probability that the time interval between successive job arrivals is, (i) longer than one minute, (ii) shorter than one minutes, (iii) Between two and six minutes.

6(a) Define reliability. Find the reliability of an n-components system when the components are in (i) series, (ii) parallel, (iii) k out of n.

(b) A barber shop serves one customer at a time and provides five seats for waiting customers. If the place is full, customers go elsewhere. Arrivals occur according to a Poisson distribution with a mean of 4 per hour. The time to get a haircut is exponential with mean 20 minutes. Determine (i) the steady-state probabilities, (ii) the probability of one seat vacant in the shop.

7 Write note on any two of the following:

(1) Classification of stochastic processes.
(2) Renewal process.
(3) Classification of states of a Markov chain.

8 - 20

Total No of Pages 02

SEMESTER- SIXTH

"SUPPLEMENTARY EXAMINATION"

MC-314 THEORY OF COMPUTATION

Roll. No. 2K13/MC/004

B.TECH (MC)

OCT-2016

Time: 03: 00 Hours

Max.Marks: 70

Note:	*Answer any five questions.*
	All questions carry equal marks.

Q1(a). Prove that if L is the set accepted by NDFA, then there exists a DFA which also accepts L.

(b) Construct a DFA equivalent to $M = (\{q_0, q_1\}, \{0,1\}, \delta, q_0, \{q_0\})$, where δ is defined by the state table:

State/Σ	0	1
q_0	q_0	q_1
q_1	q_1	q_0/q_1

Q2(a). Define Finite Automaton. Prove by mathematical induction that for any transition function δ and for any two input strings x and y,

$$\delta(q, xy) = \delta(\delta(q, x), y)$$

(b) State and prove Pumping Lemma for regular sets. Show that $\{w \in \{a, b\}^* : w \text{ contains an equal number of } a's \text{ and } b's\}$ is notregular.

Q3(a). Let $M = (Q, \Sigma, \delta, q_0, F)$ be a finite automata. Let R be a relation in Q defined by $q_1 R q_2$ iff $\delta(q_1, a) = \delta(q_2, a)\ \forall\, a \in \Sigma$. Is R an equivalence relation? Justify the answer. Also prove that if $\delta(q, x) = \delta(q, y)$ then $\delta(q, xz) = \delta(q, yz)$ $\forall\, z \in \Sigma$.

(b) Show that the class $\mathcal{L}_{rl}$ is closed under union where $\mathcal{L}_{rl}$ denotes the family of regular languages.

Q4(a). State and prove Arden's theorem. Describe the algebraic methods using Arden's theorem to find the regular expression recognized by a transition system.

(b) State and prove Pumping lemma for context free language.

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Q5(a) Prove that if PDA A= (Q,Σ, ,δ, q_0, Z_0,F) accepts L by final state then, we can find a PDA 'B' accepting L by empty store i.e. L=T(A)=N(B).

(b) Construct a reduced grammar equivalent to the grammar

$S \to aAa,\ A \to Sb/bCC/DaA,\ C \to abb/DD,\ E \to aC,\ D \to aDA.$

Q6(a) Prove that $A_{DFA}=\{(B,w): B\ \text{accepts the input string}\ w\}$ and $A_{CFG}=\{(G,w): \text{the CFG 'G' accepts the input string}\ w\}$ are decidable.

(b) In how many ways a Turing machine can be described? Explain with suitable examples.