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Vith SEMESTER
END SEMESTER EXAMINATION

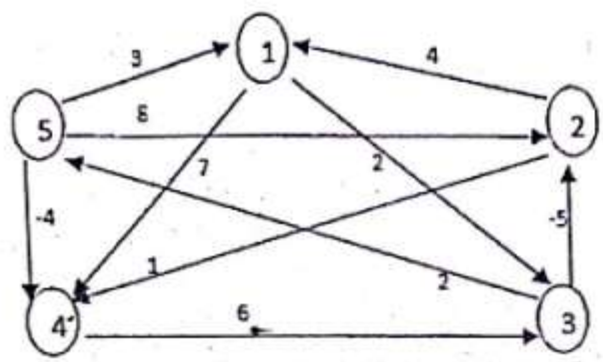
Roll No. MC/009
B.Tech.(MCE)
(May, 2015)

Paper Code: MC-311
Subject: Algorithm Design and Analysis
Time: 3:00 Hours
Max. Marks: 70

Note: Answer any five questions.
Assume suitable missing data, if any.

Q1: [8+6]

a) Explain the Floyd Warshall Algorithm for calculating the shortest distance in a digraph. Use it to compute the all pair shortest distance matrix for the following graph.



b) Explain the 0-1 Knapsack problem. How can it be solved using Dynamic Programming Approach?

Q2: [8+6]

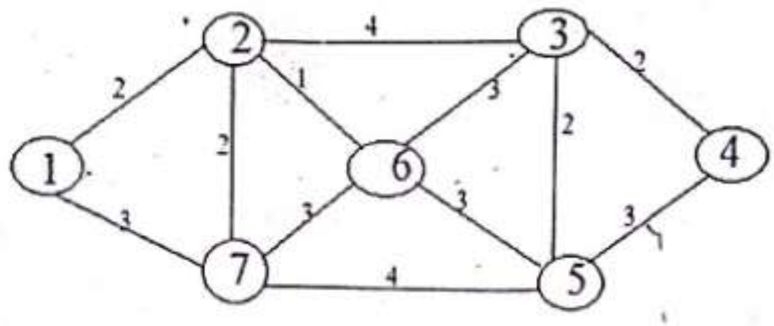
a) Use dynamic programming approach for finding the best way to parenthesize following matrix chain-
A(2x5) * B(5x3) * C (3x4) * D(4x2)

b) Given the characters set C <q,w,e,r,t,y> with the probability of occurrence in a file given by P<.45, .13, .12, .16, .09, .05>. Find the optimal Huffman codes for each character

Q3: [7+7]

a) Explain the travelling salesman problem and the greedy strategy to solve TSP using a suitable example.

b) Explain the Kruskal's Algorithm. Find the minimum cost spanning tree for the following graph.



Q4: [8+6]

a) What is backtracking approach of problem solving? Use it to solve for n-queens problem where n=8.

b) Using the hash function '*h=(key+1) MOD 12*' insert the following keys into a hash table of size 12:
{123, 43, 94, 106, 102, 152, 197, 255, 132, 19, 27, 18}
Use linear probing technique for collision resolution.

Q5: [9+5]

a) Explain the following:
   i. P and NP Class of problems
   ii. NP-Completness
   iii. NP-Hard problems

b) Explain the Heapsort Algorithm and derive its running time complexity.

Q6: [4x3.5]

a) Which graph algorithm would you use to find the shortest path in a graph between two nodes? Does your answer rely on any assumptions about the graph?

b) Give asymptotic upper bound of the recurrence relation $T(n) = T(7n/10) + n$. Assume that $T(n)$ is constant for $n \leq 2$.

c) Write down both iterative and recursive versions of Binary Search algorithm.

Q7: Write short notes on the following: [4+4+6]

a) Memoization
b) Asymptotic notation
c) Backtracking
d) Rabin Karp String Matching Algorithm

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SIXTH SEMESTER **B.Tech. Mathematics & Computing**

END SEMESTER EXAMINATION, *May 2015*

Code & Title: MC 312 Stochastic Processes

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

Note : Answer all question by selecting any two parts from each questions. All questions carry equal marks. Assume suitable missing data, if any.

Q.1[a] What is a Bernoulli process? Give example of homogeneous and non-homogenous Bernoulli processes. If X be the number of succeeding trials before the next success in a sequence of homogenous Bernoulli trials, then find its expected value and variance.

[b] Define a renewal counting process and give its example. What are renewal function and renewal density? Consider a renewal process with renewal function equal to $2t$. Find the probability distribution of the number of renewals by time 5.

[c] Explain the following stochastic processes with suitable examples in each:
(i) Gaussian Process, (ii) Stationary Process.

Q.2[a] What is a simple random walk. Give examples of random walks with,
(i) Two absorbing barriers, (ii) One reflecting barrier.
Write the equations depicting the respective walks.

[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.

[c] Discuss the simple random walk with one absorbing barrier.

Q.3[a] Define a Markov chain. Give examples of homogeneous and non-homogeneous chains. How is the steady-state distribution of a Markov chain obtained?

[b] A man drives a car or catches a train to go office each day. He never goes 2 days in a row by a train but if he drives on a day, then the next day he is just as likely to drive again as he is to travel by train. Now suppose that on the first day of the week the man tossed a fair coin and drive to work if head appeared. Write the transition probability matrix and find the probability that he takes a train on the second day. Also find the probability that he drives to work in the long run.

[c]A gambler has a fortune of Rs. 2. He bets Re 1 at a time and wins Re 1 with probability ½. He stops playing if he loses all his fortune or doubles it. Write the transition probability matrix. What is the probability that he loses his fortune at the end of three plays?

Q.4[a]Consider a computer system with Poisson job-arrival stream at an average rate of 60 per hour. Determine the probability that the time interval between successive job arrivals is, (i) Longer than four minutes, (ii) Shorter than eight minutes, (iii) Between two and six minutes.

[b]A simplified model of accident 'contagion' is obtained by supposing that the probability of an accident in $(t, t+\Delta t)$ is $\lambda_o \Delta t + o(\Delta t)$, if no previous accidents have occurred, and is $\lambda_1 \Delta t + o(\Delta t)$ otherwise, independently of the actual number of accidents. Obtain the probability generating function, mean and variance of the number of accidents in time t.

[c]Describe pure death process. Give two examples. Find its probability generating function.

Q.5[a]Describe M/M/1/N queuing system. Derive expression for expected number in the queue, and in the system.

[b]Define reliability. Find the reliability of an n-components system when the components are in (i) Series, (ii) Parallel, (iii) k out of n.

[c]A barber shop serves one customer at a time and provides three 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 15 minutes. Determine (i) The steady-state probabilities, (ii) The expected number of customers in the shop.

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Roll No. MC/009

SIXTH SEMESTER

B. Tech.[MC]

END SEMESTER EXAMINATION

May, 2015

MC- 313, *Matrix Computation*

Time: 3.0 Hours

Max. Marks: 70

Note: *Attempt Any two parts from each questions. All questions carry equal marks. Assume suitable missing data, if any. Only simple calculators are allowed*

1. (a) Use the Rayleigh quotient to compute the eigenvalue of A corresponding to the given eigenvector x.
$A = \begin{bmatrix} 4 & -5 \\ 2 & -3 \end{bmatrix}$ and $x = [5, 2]^t$.

   (b) Find the necessary and sufficient condition on k , so that the Gauss-Seidel converges for the system $Ax = b$, where $A = \begin{bmatrix} 1 & 0 & k \\ 2 & 1 & 3 \\ k & 0 & 1 \end{bmatrix}$

   (c) Use the Householders method to reduce the matrix into the tridiagonal form $\begin{bmatrix} 1 & 4 & 3 \\ 4 & 1 & 2 \\ 3 & 2 & 1 \end{bmatrix}$

2. (a) Discuss: Generalized eigenvectors, Hessenberg Matrix and Positive definite matrix. [3+2+2]

   (b) Write the following matrix into Jordan canonical form $\begin{bmatrix} -1 & -1 & 0 \\ 0 & -1 & -2 \\ 0 & 0 & -1 \end{bmatrix}$

   (c) State and prove Gerschgorin's and Brauer's theorems.

3. (a) Discuss the effect of perturbation on the right hand side vector of the system $Ax = b$.

   (b) Discuss the complexity of Gauss Elimination method for a (nxn) system.

(c) Prove that, a matrix A is of full rank if and only if $A^T A$ is non-singular.

4. (a) Find the eigenvalue nearest to 3 for the matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ using the inverse power method. Perform five iterations.

(b) The following system of equations is given

$$\begin{aligned} 3x + 2y &= 5 \\ 2x + 3y - z &= 4 \\ -y + 2z &= 1. \end{aligned}$$

Set up the SOR iteration scheme for the solution and find the optimal relaxation factor and the rate of convergence.

(c) Find the singular value decomposition of the matrix $\begin{bmatrix} 1 & -4 \\ -2 & 2 \\ 2 & 4 \end{bmatrix}$.

5. (a) Solve the following system using Moore Penrose inverse

$$\begin{aligned} x + 0y &= 1 \\ x + y &= 2 \\ 0x + y &= -1. \end{aligned}$$

(b) Find QR factorization for the matrix using Householder method.

$$\begin{bmatrix} 1 & 1 & 4 \\ 1 & 4 & 2 \\ 1 & 4 & 2 \end{bmatrix}$$

(c) Transform the following matrix into upper triangular using Givens method

$$\begin{bmatrix} 1 & 1 & 4 \\ 0 & 4 & 2 \\ 1 & 4 & 2 \end{bmatrix}$$

SIXTH SEMESTER

B.TECH (MC)

END SEMESTER EXAMINATION

MAY 2015

MC-314 THEORY OF COMPUTATION

Time: 3 Hours

Maximum Marks: 70

Note: Answer ALL by selecting any TWO parts from each question. All questions carry equal marks.

Q1 (a) Define Moore machine. Construct a Moore machine equivalent to the Mealy machine defined by table given below:

Present state	Next state			
	a=0		a=1	
	state	Output	State	output
$\rightarrow q_1$	q_1	1	q_2	0
q_2	q_4	1	q_4	1
q_3	q_2	1	q_3	1
q_4	q_3	0	q_1	1

(b) Construct a minimum state automaton equivalent to a given automaton M whose transition table is defined below:

State / Σ	a	b
$\rightarrow q_0$	q_0	q_3
q_1	q_2	q_5
q_2	q_3	q_4
q_3	q_0	q_5
q_4	q_0	q_6
q_5	q_1	q_4
q_6	q_1	q_3

(c) Define the language generated by a grammar. Test whether 001100, 001010, 01010 are in the language generated by the grammar given by

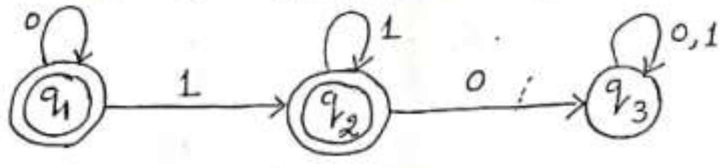
$S \rightarrow 0S1 / 0A / 0 / 1B / 1, \quad A \rightarrow 0A / 0, \quad B \rightarrow 1B / 1.$

2 (a) State and prove Kleene's theorem.

(b) Construct the transition systems equivalent to the regular expressions given below:

(i) $(ab + a)^*(aa + b)$ (ii) $a(a + b)^*ab$

(c) Find the strings recognized by the finite automaton given below:



3 (a) Write the steps involved in the construction of a grammar in CNF. Find a grammar in CNF equivalent to $S \rightarrow aAbB,\ A \rightarrow aA / a,\ B \rightarrow bB / b$.

(b) Construct a reduced grammar equivalent to the grammar

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

(c) Find a grammar in GNF equivalent to the grammar

$E \rightarrow E{+}T / T,\ \ T \rightarrow T{*}F / F,\ \ F \rightarrow (E) / a$

4 (a) let G be a CFG in CNF and T be a derivation tree in G. Prove that if the length of the longest path in T is less than or equal to k, then the yield of T is of length less than or equal to 2^{k-1}.

(b) State and prove Pumping lemma for context- free languages. Show that

$L = \{\, a^p : p \text{ is a prime} \,\}$ is not a context- free language.

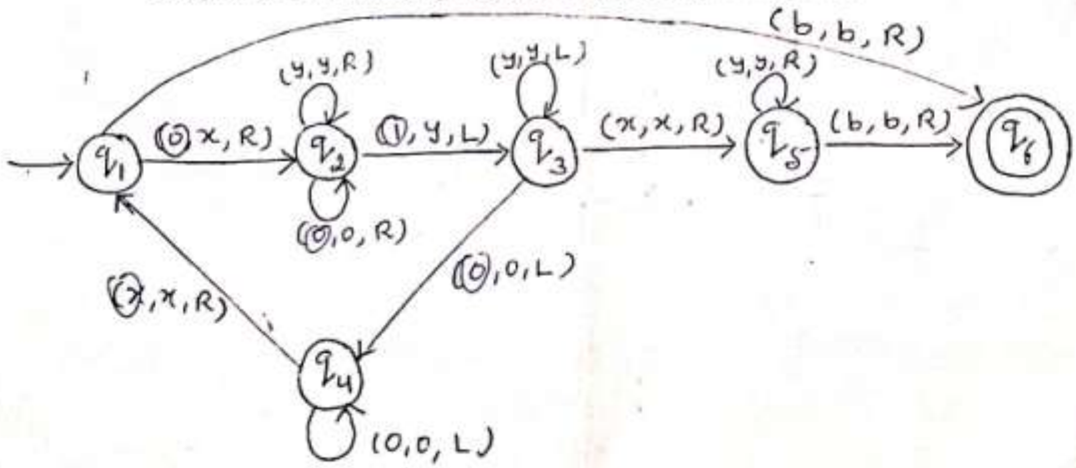
(c) Let $G = (\{S,C\}, \{a,b\}, P, S)$, where P consists of $S \rightarrow aCa,\ C \rightarrow aCa\ /\ b$. Find L(G).

5 (a) Describe the set accepted by pda by final state as well as by null store. Construct a pda A equivalent to the following CFG:

$S \rightarrow 0BB,\ B \rightarrow 0S / 1S / 0$. Show that 010000 is in N(A).

(b) If L is a CFL, then show that there exists a pda A accepting L by empty store.

(c) Define Turing machine. What do you mean by an ID of a Turing machine? M is a Turing machine represented by the transition diagram below. Obtain the computation sequence of M for processing the input string 0011.



MC/009

VI-SEMESTER
END SEMESTER EXAMINATION

B.Tech.(MCE)
May- 2015

MC-315 Operating System

Time: 3:00 Hours

Max. Marks: 70

Note: Answer all questions by selecting any two parts from each question.
All questions carry equal marks

Q.No. 1

A) Explain different states of a process with the help of state diagram. What is an operating system (OS)? List the various services provided by the operating system.

B) Consider the set of processes given in the table with following information

Process	*Arrival Time*	*CPU burst Time*
P1	0	08
P2	1	07
P3	2	11
P4	4	06

iii. Calculate average waiting and turnaround time using FCFS, SJF (Preemptive & no preemptive).

iv. Assume time quantum to be 2 units of time. Calculate average waiting and turnaround time using Round-Robin scheduling.

C) What are real time systems? How they are developed and implemented? Illustrate some applications where they can be used.

Q.No. 2

A) Describe the Banker's algorithm for safe allocation. Consider a system with three processes and three resource type and at time T_0 the following snapshot of the system has been taken:

Process	Allocated			Maximum			Available		
	R1	R2	R3	R1	R2	R3	R1	R2	R3
P1	0	0	1	6	6	5	3	3	2
P2	2	0	0	4	2	2			
P3	3	0	2	2	1	1			
P4	2	1	1	0	0	2			
P5	0	0	2	3	2	1			

(i) What is the content of Need matrix?

(ii) Is the current allocation safe state?

(iii) Would the request be granted in the current state? If Process P2 requests (2, 1, 0).

B) What are necessary conditions to hold a deadlock in a system? Explain the resource allocation graph algorithm to deal with deadlock problem. What are the limitations of this approach?

C) What are the approaches that can be used for prevention of deadlock? State and solve readers/writers problem with help of semaphore.

Q.No. 3

A) Describe Producer-Consumer problem with its solution. How does Semaphores solve Producer -Consumer problem?

B) What is Belady anomaly? Given references to the following pages by a program 0,1,7,2,3,2,7,1,0,3,5,2,3. How many page faults will occur if the program has four page frames available to it
and using: i. LRU replacement ii. Optimal replacement.

C) What is Process Control Block (PCB)? Explain Multilevel feedback queue scheduling with suitable example.

Q.No. 4

A) Explain inverted and hash page table with example.
B) Compare and contrast implementation of Paging and Segmentation with suitable example. How is sharing possible with segmentation?

C) Suppose the head of a moving head disk with 1000 tracks, numbered 0 to 999, is currently serving a request at track 345 and moving towards 0 queue contains the following
122, 875,690,470,105,370, 667. What is the total movement to satisfy these requests for the following disk scheduling algorithms?
i) SSTF ii) FIFO iii) C-SCAN

Q.No. 5

A) In a paged-segmented system, a virtual address consists of 32 bits of which 12 bits are displacement, 11 bits are segment no. And 9 bits are page no. Calculate the following
iii. Page size ii. Max segment of pages
iv. Max. Number of pages iv. Max number of Segments

B) Explain working of Paged -Segmented system with suitable example.

C) Explain following
iii. Critical section Problem and Race condition
iv. Blocking & non-blocking I/O system