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VI TH SEMESTER

B.Tech.[IT]

END SEMESTER EXAMINATION

(May-2017)

MC-311

ALGORITHM DESIGN AND ANALYSIS

Time: 3 Hours

Max. Marks : 70

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

Q1.

a) List all the similarities and difference between backtracking and branch and bound with example? (7)

b) Propose divide and conquer solution power(x,y) where x is base and y is exponent, the solution should be having complexity O(n), now optimize the same to have the complexities O(log n), also the recurrence equation for both the cases and solve them with the help of master method. (7)

Q2.

a) Consider the following instance for simple knapsack problem. Find the solution using greedy method.
N=8
P={11,21,31,33,43,53,55,6}
W= {1,11,21,23,33,43,45,55}
M=110 (7)

b) Given a graph G=(V,E) with source s and weight function W:E->R, then write an algorithm to solve a single source shortest path problem whose complexity O(VE). Apply on the following graph (7)

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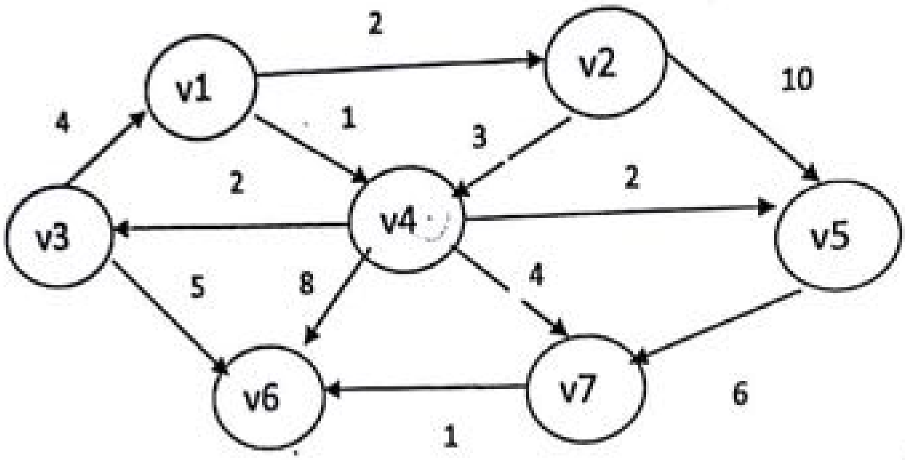


Q3.

a) Describe approximation algorithm in detail. What is the approximation ratio? Show the vertex cover problem is approximation algorithm? (7)

b) What is string matching algorithm? Write Rabin karp algorithm with complexity? (7)

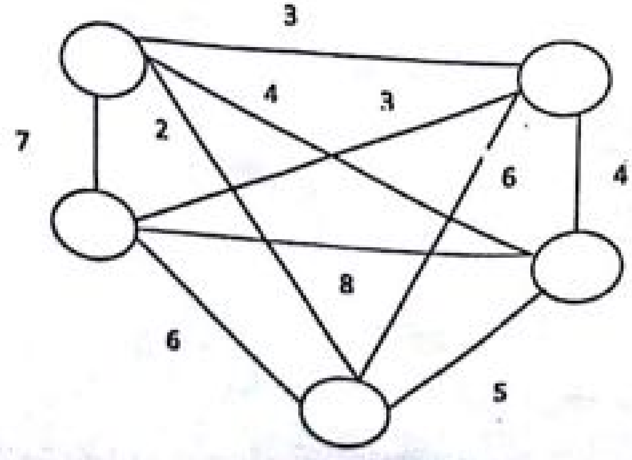
Q4.

a) For the recurrence equation $T(n)=T(n/3)+T(2n/3)+n$

i)Apply recurrence tree method to find complexity, show each and every step involved in calculation.

ii)For the complexity calculated in the previous part, use the same to prove with the help of substitution method. Use $\log_2 3$ and $\log_2 (3/2)$ as 3/2 and ½ respectively. Also write the minimum value of constant c for which the proof holds. (7)

b) Define TSP problem in detail and suggest algorithm to solve it. Find the solution for the following instance of TSP problem using dynamic programming. (7)



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Q5.

a) Write pseudocode for n -queen problem with an example . Also compute its complexity. (7)

b) Prove that if we order the characters in an alphabet so that their frequencies are monotonically decreasing, then there exists an optimal code whose codeword lengths are monotonically increasing. (7)

Q6.

a) Use the master method to give tight asymptotic bounds for the following recurrences:-

i) $T(n)=2T(n/4)+1$

ii) $T(n)=2T(n/4)+n^2$

iii) $T(n)=2T(n/4)+n$ (2*3=6)

b) Give a recursive algorithm MATRIX-CHAIN-MULTIPLY(A,s,i,j) that actually performs the optimal matrix chain multiplication, given the sequence of matrices $(A_1, \ldots, A_n)$, the s table computed by MATRIX-CHAIN-ORDER, and the indices i and j. (8)

Q7 Write short notes on the following(any two):- (7X2=14)

(a) P, NP, NP-hard and NP-complete

(b) FIFO branch and bound with example

(c) Minimum cost spanning trees

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

END SEMESTER EXAMINATION **May 2017**

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.

1[a]What is a random process? Based on state and parameter, classify random processes and elaborate by giving one example of each class.

[b]Define a Poisson process. Give example. Find the distribution of the inter-arrival times of successive events.

[c] Describe M/M/c/c model. Find the probability that an incoming call is lost by assuming suitable parameters for arrival, departure patterns and number of servers.

2[a]Describe random walk with two absorbing barriers. A particle performs a random walk with absorbing barriers at 0 and 4, that is, whenever it is at position r, $0 < r < 4$, it moves to r+1 with probability p or to r-1 with probability q, such that $p+q = 1$. But as it reaches to 0 or 4 it remains there. Write the transition probabilities of the process and classify the various states.

[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]Describe random walk with two reflecting barriers by considering an example of your choice.

3[a]Explain Markov chain. By considering an example of your choice demonstrate how a steady state distribution is obtained in case of a Markov chain.

[b] Suppose that in a specific city whether it rains today depends on previous weather conditions only from the last two days. Assume suitable probabilities as per your choice for all the four possibilities. Consider the

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system to be homogeneous and write it as Markov chain. Let it rained on both Monday and Tuesday; find the probability of rain on Thursday.

[c] Explain birth and death process. Find its steady state solution.

4[a] What is a renewal process ? Give example. Suppose in a renewal process the renewal function is $M(t) = 2t^2$. Find the pdf for the inter-renewal time. Can you identify the renewal distribution ?

[b] Derive renewal equation and find its solution. Demonstrate its application.

[c]Describe, (1) Gaussian Process, (2) Brownian motion.

5[a] Describe M/M/1 model. Find the mean queue length and the waiting time in the system.

[b]Define hazard rate function. If the pdf of the life time T of a system is

$$f(t) = abt^{b-1}e^{-at^b} \quad (a > 0, b > 0)$$

then find, (1) hazard rate, (2) survival function of the system.

[c]Explain the brand share model. Demonstrate its application by considering a suitable example of your choice.

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SIXTH SEMESTER

END SEMESTER EXAMINATION

Roll No: 59

B. Tech.[MC]

May, 2017

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. Simple calculators are allowed*

1. (a) Discuss Rank deficiency and Numerical rank of a matrix.

   (b) Show if A is a strictly diagonally dominant matrix, then the Gauss-Seidel iteration scheme converges for any initial starting vector.

   (c) Obtain the least square solution of $Ax = b$, where $A = \begin{bmatrix} 0 & 1 \\ 3 & 0 \\ 0 & 2 \\ 4 & 10/3 \end{bmatrix}$ and $b = (1, 1, 1, 1)^T$

2. (a) Determine the QR decomposition of $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 1 & 1 \end{bmatrix}$ using Householder transformation.

   (b) Determine the induced matrix norm of A using following vector norm

$$(a)\|A\|_1 \quad (b)\|A\|_\infty$$

   when $A = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$.

   (c) Discuss Moore Penrose inverse with example.

3. (a) Let $A(\alpha) = \begin{bmatrix} 0.1\alpha & 0.1\alpha \\ 10 & 15 \end{bmatrix}$. Determine α such that condition number of $A(\alpha)$ is minimized. Use the maximum norm.

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(b) Determine the smallest eigenvalue and the corresponding eigenvector of the matrix $\begin{bmatrix} 4 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 4 \end{bmatrix}$ correct upto 3 decimal places using the power method.

(c) Define and drive the formula for spectral radius of a matrix A.

4. (a) Prove that for a system $Ax = b$, A is a $m \times n$ matrix, $(A^T A)$ is non-singular if A has full rank.

(b) Transform the matrix $\begin{bmatrix} 2 & 1 & -2 \\ -3 & 1 & 0 \\ 4 & 3 & 1 \end{bmatrix}$ to the Hessenberg form.

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

5. (a) Define generalized eigen vectors and find the generalized eigen vector for the matrix $\begin{bmatrix} 2 & 2 & 3 \\ 1 & 3 & 3 \\ -1 & -2 & -2 \end{bmatrix}$

(b) Find QR factorization for the matrix (using Gram-Schmidt process) $\begin{bmatrix} 1 & 1 & 4 \\ 1 & 4 & 2 \\ 1 & 4 & 2 \end{bmatrix}$

(c) Prove that each eigen value of a square matrix A lies in at least one Gerschgorin's disk generated by A.

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SIXTH SEMESTER

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B.TECH (MC)

END SEMESTER EXAMINATION

MAY 2017

MC- 314 THEORY OF COMPUTATION

Time: 3 Hours

Max.Marks: 70

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

Q1(a) Construct an NDFA accepting $\{ab, ba\}$ and use it to find a DFA accepting the same set.

(b) Define Mealy machine. Construct a Mealy machine which is equivalent to the Moore machine defined below:

Present State	Next State		Output
	a=0	a=1	
$\rightarrow q_0$	q_1	q_2	1
q_1	q_3	q_2	0
q_2	q_2	q_1	1
q_3	q_0	q_3	1

(c) Prove by mathematical induction that for any transition function δ and for any two input strings x and y,

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

Q2(a) State whether the following statements are true or false. Justify your answer with a proof or a counter example.

(i) If G_1 and G_2 are equivalent, then they are of the same type.
(ii) If L is a finite subset of Σ^*, then L is a context free language.
(iii) If L is a finite subset of Σ^*, then L is a regular language.

(b) Construct (i) a context-sensitive but not context-free grammar, (ii) a context-free but not regular grammar, (iii) a regular grammar to generate $\{a^n : n \geq 1\}$.

(c) Show that the set of context-free languages is closed under concatenation and transpose operation.

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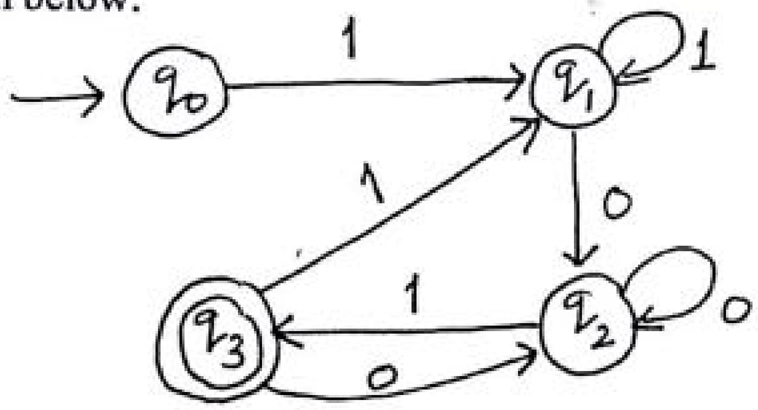
Q3. (a) Construct a DFA accepting all strings over {0,1} ending in 010 or 0010.

(b) Find the regular expression corresponding to the automaton given below:



(c) State Pumping lemma for regular set and hence show that the set $\{a^n b^{2n} : n > 0\}$ is not regular.

Q4(a) Define ambiguity in grammar. Show that the grammar $S \rightarrow a / abSb / aAb$, $A \rightarrow bS$ / $aAAb$ is ambiguous.

(b) Reduce the following grammar into CNF:

$S \rightarrow 1A/0B$, $A \rightarrow 1AA/0S/0$, $B \rightarrow oBB$ / $1S$ / 1.

(c) State and prove Pumping lemma for context-free languages.

Q5(a) Prove that if L is a context-free language, then we can construct a pda 'A' accepting L by null store.

(b)Let a pda is given by $A = (\{q_0, q_1, q_f\}, \{a, b, c\}, \{a, b, Z_0\}, \delta, q_0, Z_0, \{q_f\})$, where δ is defined as $\delta(q_0, a, Z_0) = \{(q_0, aZ_0)\}$, $\delta(q_0, b, Z_0) = \{(q_0, bZ_0)\}$,
$\delta(q_0, a, a) = \{(q_0, aa)\}$, $\delta(q_0, b, a) = \{(q_0, ba)\}$,
$\delta(q_0, a, b) = \{(q_0, ab)\}, \delta(q_0, b, b) = \{(q_0, bb)\}$
$\delta(q_0, c, a) = \{(q_1, a)\}, \delta(q_0, c, b) = \{(q_1, b)\}$, $\delta(q_0, c, Z_0) = \{(q_1, Z_0)\}, \delta(q_1, a, a) = \delta(q_1, b, b) = \{(q_1, \wedge)\}, \delta(q_1, \wedge, Z_0) = \{(q_f, Z_0)\}$
If an initial ID of 'A' is $(q_0, aacaa, Z_0)$, what is the ID after the processing of aacaa? If the input string is (i) abcba, (ii) abcb,(iii) acba, will 'A' process the entire string? If so, what will be the final ID?

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(c) Consider the Turing machine description given below

Present State	Tape Symbols		
	b	0	1
$\rightarrow q_1$	$1Lq_2$	$0Rq_1$	-
q_2	bRq_3	$0Lq_2$	$1Lq_2$
q_3	-	bRq_4	bRq_5
q_4	$0Rq_5$	$0Rq_4$	$1Rq_4$
q_5	$0Lq_2$	-	-

Draw the transition diagram of the TM. Draw the computation for the string 00.

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VI-SEMESTER ***B.Tech.(MCE)***
END SEMESTER EXAMINATION **May– 2017**

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) What do you understand by batch processing? Explain with examples and also 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*	*Priority*
P1	0	4	2
P2	2	10	3
P3	3	18	1
P4	4	22	4

Assuming 1 to be the highest priority, calculate following

i. Average waiting and turnaround time using FCFS, SJF (Preemptive) and priority (preemptive) scheduling mechanism.

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

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

Q.No. 2

A) Describe the Banker's algorithm for safe allocation. Consider a system with five 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	3	3	4	4	7	9	7	7	10
P2	3	1	4	5	4	4			
P3	2	3	5	4	5	5			

(i) What is the content of Need matrix?

(ii) Is the current allocation safe state?

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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) What is virtual memory? Describe its advantages with respect to user point of view and with respect to system point of view. And also compare contiguous and non contiguous memory allocation.

B) What is page fault? given references to the following pages by a program 7,0,1,2,0,3,4,2,3,0,3 and there are three frames available in the memory, by using the following page replacement algorithm calculate the number of page fault in each case

i. FIFO ii. LRU iii. Optimal.

C) Suppose average page fault service time is 20 milliseconds and memory access time is 200 nanoseconds. suppose we wish to have less than 10 % degradation in memory access when a page fault occurs ,what must be the page fault rate less than?

Q.No. 4

A) Explain file access mechanism and file attributes. And also differentiate linked and indexed files.

B) Compare and contrast implementation of Paging and Segmentation with suitable example. How is sharing possible with segmentation?

C) What are the various disk scheduling mechanism discuss with suitable examples.

Q.No. 5

A) Explain I/O management system and differentiate between blocking & non-blocking I/O.

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

C) Explain following
   i. Critical section Problem and Mutual exclusion.
   ii. I/O buffering and Multilevel feedback queue scheduling.

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