Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(An Autonomous Institute Affiliated to University of Mumbai)

End Semester Examination

May 2019

Max. Marks: 60 | **Duration: 3 Hours**
Class: SYMCA | **Semester: IV**
Course Code: MCA43 | **Branch: MCA**
Name of the Course: Design and Analysis of Algorithms

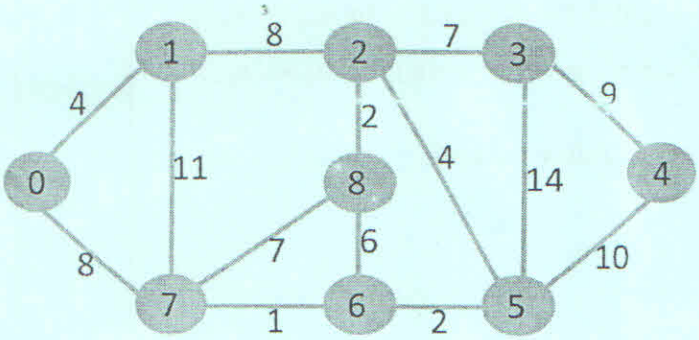
Instructions:

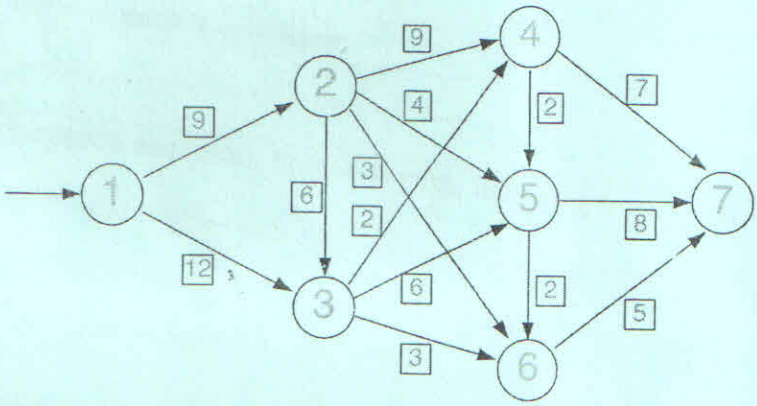
(1) All questions are compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

QN			Marks	CO's

Q.1	a.	Define **asymptotic notations. Map following functions to respective notation**
		1. $(f(n)) \geq \{ g(n)$: there exists $c > 0$ and n_0 such that $g(n) \leq c.f(n)$ for all $n > n_0$. $\}$
		2. $(f(n)) = \{ g(n)$: there exists $c > 0$ and n_0 such that $f(n) \leq c.g(n)$ for all $n > n_0$. $\}$
		$(f(n)) = \{ g(n)$ if and only if $g(n) = O(f(n))$ and $g(n) = \Omega(f(n))$ for all $n > n_0$. $\}$
		[OR]
		Find the bounding function and complexity of following code.
		1.
		`void function(int n)`
		`{`
		`  int count = 0;`
		`  for (int i=n/2; i<=n; i++)`
		`  for (int j=1; j<=n; j = 2 * j)`
		`  for (int k=1; k<=n; k = k * 2)`
		`  count++;`
		`}`
		2.
		`void function(int n)`
		`{`
		`  int count = 0;`
		`  for (int i=0; i<n; i++)`
		`  for (int j=i; j< i*i; j++)`
		`  if (j%i == 0)`
		`  {`
		`  for (int k=0; k<j; k++)`
		`  printf("*");`
		`  }`
		`}`
			[6]	CO-1

	b.	Compare P and NP problems give examples in detail	[6]	CO-6

Q.2	a.	Apply quick sort mechanism to sort following array A = (38 81 22 48 13 69 93 14 45 58 79 72)	[6]	CO-2
	b.	Explain in detail merge sort. Illustrate the algorithm with a numeric example. Provide complete analysis of the same.	[6]	CO-2
Q.3	a.	Determine the cost and structure of an optimal binary search tree for a set of n = 7 keys with the following probabilities: I 1 2 3 4 KEYS 10 20 30 40 FRQ 4 2 6 3	[5]	CO-3
	b.	State the Greedy Knapsack? Find an optimal solution to the Knapsack instance n=3, m=20, (P1, P2, P3) = (25, 24, 15) and (W1, W2, W3) = (18, 15, 10). **[OR]** Apply Prim's algorithm to find Minimum spanning tree on following graph 	[5]	CO-3
	c.	Given a chain of four matrices, A1, A2, A3, A4 (5,4,8,6,7). Find the cost of matrix multiplication.	[5]	CO-3
Q.4	a.	Write an algorithm to determine the Hamiltonian cycle in a given graph using backtracking.	[5]	CO-4
	b.	Generate FIFO branch and bound solution for the given knapsack problem. m = 15, n = 3. (P1 P2 P3) = (10, 6, 8) (w1 w2 w3) = (10, 12, 3) **[OR]** Write a backtracking algorithm to solve sum of subsets problem with m=35, w= {20, 18, 15, 12, 10, 7, 5} to the variable tuple size formulation.	[5]	CO-4

	c.	Consider start and goal state for a 15 puzzle problem as shown in figure 1 and figure 2. Show all intermediate states with justification 	1	2	3	4
---	---	---	---
5	6		8
9	10	7	11
13	14	15	12 | Figure 1 Start State | 1	2	3	4
---	---	---	---
5	6	7	8
7	10	11	12
13	14	15		 Figure 2 Goal State	[5]	CO-4
Q.5	a.	Maximize the flow from s=1 to t=7 in the flow network below using Ford-Fulkerson algorithm  **[OR]** Generate the finite automata (5-tupple) for pattern matching for following string and pattern. **String : abcdsspisspitabcd** **Pattern : sspit**	[6]	CO-5