

**END Semester Examination****Programme: B.Tech [TY]****Semester: VI****Course Code: IT-1707****Course Name: Design and Analysis of Algorithms****Branch: Information Technology****Academic Year: 2018-2019****Duration: 3 Hr****Max Marks: 60****Student MIS No.**

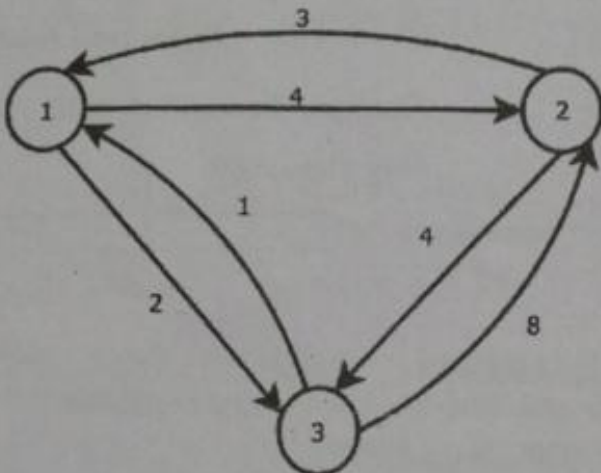
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Instructions:

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of stationery, calculator etc. not allowed.
5. Write your MIS Number on Question Paper.

Q1] Answer and Justify the Following				CO	PO
A) Find the time complexity for the following code				1	a
1) i = n; while(i >1) { j = i; while (j<n) { k =0; while (k < n){ k = k +2; } j=j*2; } i = i/2; }	2) int a =0; while (a<10) { a++; }	[2M]			
B) The given array is arr = {2,6,1}. What are the pivots that are returned as a result of subsequent partitioning? Why?				[2M]	2,4 a,d,g,i,k
C) Determine LCS of <1,0,0,1,0,1,0,1> and <0,1,0,1,1,0,1,1,0>				[2M]	2,3,4 a,d,g,i,k
D) State the properties so that a polynomial-time mapping reduction is a function $f: \Sigma_1^* \rightarrow \Sigma_2^*$				[2M]	4 g,i,k



E) Calculate Row and column reduction of the following TSP using branch and bound technique.		[2M]	2,3,4	a,d,g,i,k						
<div></div>										
F) Consider a linked list of n element which is pointed by an external pointer. What is the time taken to delete the element which is successor of the element pointed to by s given pointer?		[2M]	1.4	a, g,i,k						
Q2]	1) Use a recursion tree to give asymptotically tight solution to the recurrences	[2M]	1	a						
A)	$T(n) = T(n-a) + T(a) + cn$ where $a \geq 1$ and $c > 0$ are constant.									
	2) Solving with help of master method	[2M]								
	$T(1) = 1$									
	$T(n) = 3T\left(\frac{n}{2}\right) + 2n^{1.5}$									
Q2]	1) Can we use binary search to replace the linear search the insertion sort algorithm. Write Modified code to calculate the worst case complexity of modified insertion sort.	[4M]	1,2,3	a, d						
B)										
Q2]	2) Construct an optimal prefix code for following frequency:	[4M]	2,4	a,d,g,i,k						
C)	<table border="1"><tr><td>F → 5</td><td>E → 9</td><td>C → 12</td><td>B → 13</td><td>D → 16</td><td>A → 45</td></tr></table>	F → 5	E → 9	C → 12	B → 13	D → 16	A → 45			
F → 5	E → 9	C → 12	B → 13	D → 16	A → 45					
Q3]	Multiplication of two n digit numbers takes n^2 multiplication operations. A variation of this multiplication using a divide-and-conquer strategy uses the following approach:	[4M]	1,2,3	a, d						
A)	$A * B = A_1 * B_1 * 10^n + (A_1 * B_2 + A_2 * B_1) * 10^{n/2} + A_2 * B_2$ The idea is to decrease the number of multiplications from 4 to 3:									

$$(A1 + A2) * (B1 + B2) = A1 * B1 + (A1 * B2 + A2 * B1) + A2 * B2,$$

$$\text{i.e., } (A1 * B2 + A2 * B1) = (A1 + A2) * (B1 + B2) - A1 * B1 - A2 * B2,$$

Which requires only three multiplications at the expense of extra add/sub.

Use recurrence relations to find the number of multiplication operations required using this approach.

Q3] 1) What happens when the value of k is 0 in the Floyd's Algorithm?

[1M]

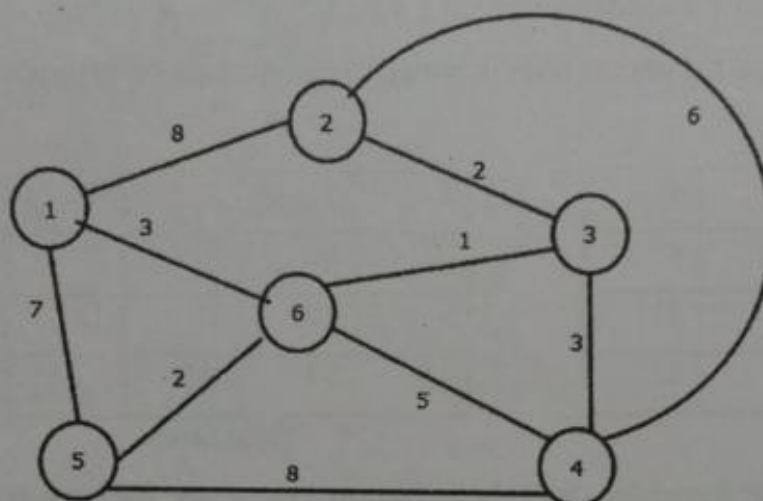
B) 2) State Space and time complexity of algorithm?

[1M]

2,4

3) Determine the shortest paths between all pairs of nodes.

[6M]



Q4] Let there be N task and N workers. The NXN cost matrix is as follow:

2,4

a,d,
g,i,k

Task	1	2	3	4
A	7	42	47	10
B	12	28	4	20
C	34	14	15	10
D	12	26	14	8

Assign unique job to every worker such that the total cost is minimized.

[6M]

Q4] Knapsack problem using backtracking method for M=8 Kg

[6M]

2,4

a,d,
g,i,k

I	1	2	3	4
W (kg)	2	3	4	5
P	3	5	6	10



Q5 OR Q6

Q5] A)	<p>Consider the suitcase password problem, where a three digit passwords of suitcase is forgotten. Assume that the digits of the password are restricted to binary numbers and the unknown passwords is said to be having at least two 1's.</p> <p>1) Which will be the suitable design paradigm for solving the above problem? Why? [2M]</p> <p>2) Draw state space tree as a solution for suitcase problem [4M]</p> <p>3) Using above state space tree define live node and dead node [2M]</p>		2,3,4	a,d, g,i,k																																
Q5] B)	<p>1) What is the connection between P and NP? Explain through venne diagram. [2M]</p> <p>2) Proof. If any NP-complete language is in P, then $P = NP$. [2M]</p>		1, 4	a, g,i,k																																
Q6] A)	<p>15 Puzzle Problem:</p> <p>The 15 puzzle consist of 15 number tiles on a square frame with capacity if 16 tiles. The only legal moves are ones in which tile adjacent to empty spot [ES] is moved to ES</p> <table border="1" data-bbox="255 880 675 1097"> <tr><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr><td>5</td><td>6</td><td></td><td>8</td></tr> <tr><td>9</td><td>10</td><td>7</td><td>11</td></tr> <tr><td>13</td><td>14</td><td>15</td><td>12</td></tr> </table> <p align="center">Initial State</p> <table border="1" data-bbox="777 880 1201 1097"> <tr><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>9</td><td>10</td><td>11</td><td>12</td></tr> <tr><td>13</td><td>14</td><td>15</td><td></td></tr> </table> <p align="center">Goal State</p> <p>1) Which designing paradigm will best suit to transform the initial arrangement of tiles to goal arrangement? Why? [2M]</p> <p>2) Draw state space tree for initial arrangement to reach to goal state, where edges are labelled according to the direction in which empty space moves [4M]</p>	1	2	3	4	5	6		8	9	10	7	11	13	14	15	12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			2,3,4	a,d, g,i,k
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Q6] B)	<p>Answer all about amortized analysis</p> <p>1) Suppose we perform a sequence of n operations on a data structure in which the i^{th} operation costs i, if i is an exact power of 2 and 1 otherwise. Use aggregate analysis and accounting method to determine the amortized cost per operation. [4M]</p> <p>2) Say we want to use an array to implement a stack.</p> <p>Cost model: Say that inserting into the array costs 1, taking an element out of the array costs 1, and the cost of resizing the array is the number of elements moved. (Say that all other operations, like incrementing or decrementing "top", are free.). What if when we resize we just increase the size by 1. Is that a good idea? Why? [2M]</p>		1,4	a, g,i,k																																