Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: **Computer Engineering**

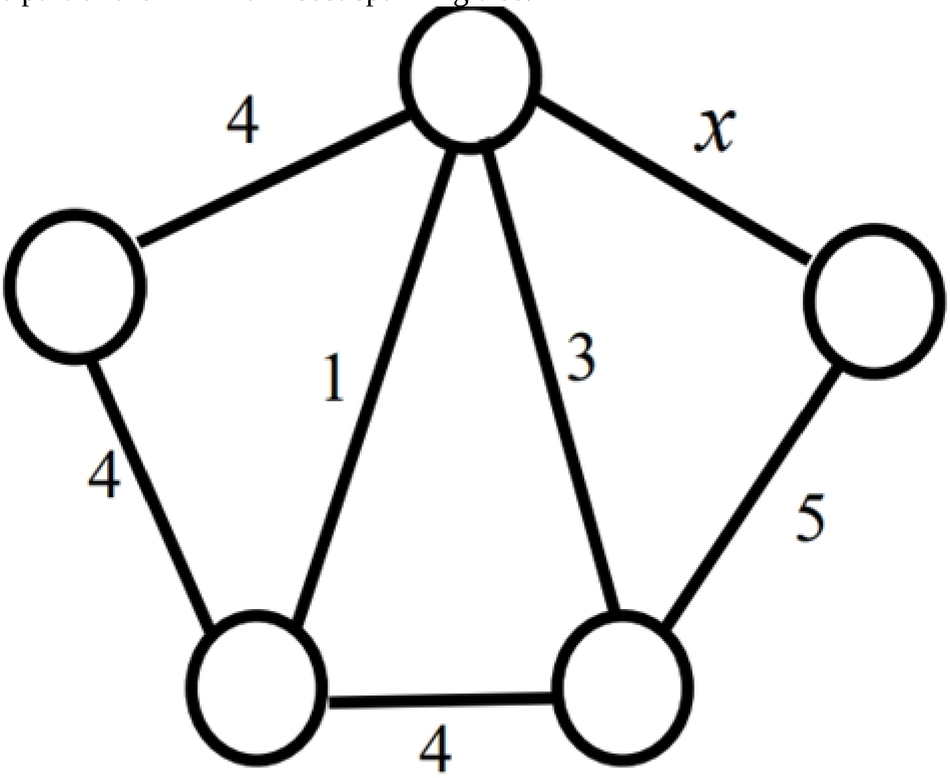
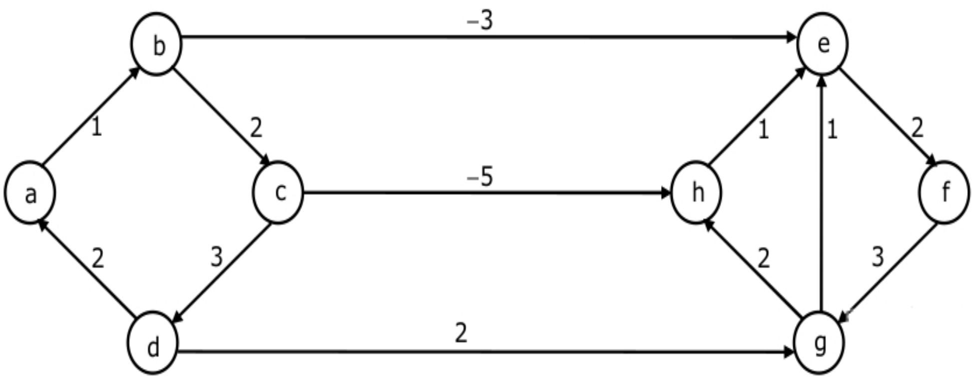
Curriculum Scheme: 2016

Examination: SE Semester: IV

Course Code: CSC402 and Course Name: Analysis of Algorithms

Time: 2 hour Max. Marks: 80

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Which of the following is the tightest upper bound that represents the number of swaps required to sort n numbers using selection sort?
Option A:	$O(n)$
Option B:	$O(n^2)$
Option C:	$O(\log_2 n)$
Option D:	$O(\text{n} \log_2 n)$
2.	The minimum number of comparisons required to determine if an integer appears more than n/3 times in a sorted array of n integers is
Option A:	$O(n)$
Option B:	$O(n^2)$
Option C:	$O(\log_2 n)$
Option D:	$O(\text{n} \log_2 n)$
3.	Let "*S*" be a sorted array of n integers. Let T(n) denote the time taken for the most efficient algorithm to determine if there are two elements with sum less than 200 in "*S*". which of the following statements is true?
Option A:	$O(n) < T(n) < O(\text{n} \log_2 n)$
Option B:	$O(n^2) > T(n) > O(\text{n} \log_2 n)$
Option C:	T(n) = O (1)
Option D:	Difficult to decide without the list.
4.	If one uses merge sort algorithm to sort the following elements in ascending order 30, 57, 25, 18, 19, 14, 50, 40 then the order of these elements after the second pass of the algorithm is:
Option A:	18, 19, 25, 30, 57, 14, 40, 50
Option B:	30, 57,18, 25, 14, 19, 40, 50
Option C:	25, 30, 57, 14, 18, 19,40, 50
Option D:	14, 18, 19, 25, 30, 57, 40, 50
5.	Consider the Quicksort algorithm. Suppose there is a procedure for finding a pivot element which splits the list into two sub-lists each of which contains at least one-seventh of the elements. Let T(n) be the number of comparisons required to sort n elements. Then
Option A:	$T(n) \leq 2T\left(\frac{n}{7}\right) + n$
Option B:	$T(n) \leq 2T\left(\frac{6n}{7}\right) + n$
Option C:	$T(n) \leq 7T\left(\frac{n}{2}\right) + n$

Option D:	$T(n) \leq T\left(\frac{n}{7}\right) + T\left(\frac{6n}{7}\right) + n$
6.	Consider the below graph. Find the maximum value of the "**x**" such it is always be part of the minimum cost spanning tree. 
Option A:	3
Option B:	4
Option C:	5
Option D:	6
7.	 Dijkstra's single source shortest path algorithm when run from vertex a in the above graph, computes the correct shortest path distance to
Option A:	Only vertex a
Option B:	Only vertex a, b, c, d
Option C:	All vertices except c, d
Option D:	All the vertices
8.	The Floyd-Warshall algorithm for all-pair shortest paths computation is based on
Option A:	Greedy Method

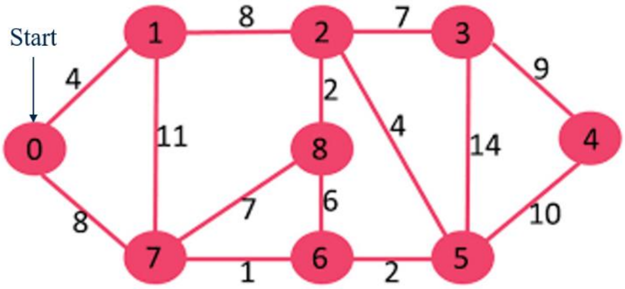
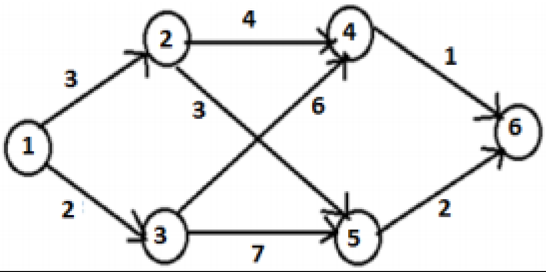
Option B:	Divide & Conquer Method (DAC)
Option C:	Dynamic Programming
Option D:	Combination of Greedy & DAC
9.	Consider two strings A = “0123254345” and B = “054012354”. Let x be the length of the longest common subsequence (not necessarily contiguous) between A and B and let y be the largest number in longest common subsequences between A and B. Then x + 10y = ___.
Option A:	56
Option B:	65
Option C:	55
Option D:	54
10.	Consider the weights and values of items listed below. Note that there is only one unit of each item. Sr. No. / Weight / Profit: 1 / 20 / 120; 2 / 14 / 56; 3 / 8 / 40; 4 / 4 / 48 The task is to pick a subset of these items such that their total weight is no more than 22 Kgs and their total value is maximized. Moreover, no item may be split. The total value of items picked by an optimal algorithm is denoted by Vopt. A greedy algorithm sorts the items by their value-to-weight ratios in descending order and packs them greedily, starting from the first item in the ordered list. The total value of items picked by the greedy algorithm is denoted by Vgreedy. The value of Vopt − Vgreedy is _______ .
Option A:	16
Option B:	-36
Option C:	-60
Option D:	32
11.	What is a chromatic number?
Option A:	The maximum number of colors required for proper edge coloring of graph
Option B:	The maximum number of colors required for proper vertex coloring of graph
Option C:	The minimum number of colors required for proper vertex coloring of graph
Option D:	The minimum number of colors required for proper edge coloring of graph
12.	The problem of finding a subset of positive integers whose sum is equal to the given positive integer is called as
Option A:	Knapsack problem
Option B:	Sum of subsets problem
Option C:	N-Queen's problem
Option D:	Travelling salesperson problem
13.	The 8-Queen’s problem can be solved using
Option A:	Divide and Conquer
Option B:	Greedy Method
Option C:	Backtracking
Option D:	Dynamic Programming

Table for question 10:

Sr. No.	Weight	Profit
1	20	120
2	14	56
3	8	40
4	4	48

14.	Which of the following is a sub string of "UNIVERSITY"?
Option A:	UNISITY
Option B:	VERY
Option C:	SIT
Option D:	NIIT
15.	Which of the following algorithm uses 'Rolling Hash' method for finding pattern in a given string?
Option A:	Naive string matching algorithm
Option B:	Rabin Karp algorithm
Option C:	Knuth-Morris-Pratt algorithm
Option D:	String matching with Finite Automata
16.	The time complexity of the Naive string matching algorithm is ________ (n = length of text, m = length of pattern).
Option A:	O((n-m+1)m)
Option B:	O(n+m)
Option C:	O(n)
Option D:	O(m)
17.	______ are rules that restrict eaxh xi to take on values only from a given set.
Option A:	Explicit constraints
Option B:	Implicit constraints
Option C:	External constraints
Option D:	Internal constraints
18.	Which of the following branch and bound strategy leads to depth first search?
Option A:	LIFO branch and bound
Option B:	FIFO branch and bound
Option C:	Lowest cost branch and bound
Option D:	Highest cost branch and bound
19.	Which of the following class consists of problems that are solvable in polynomial time?
Option A:	NP
Option B:	NP Complete
Option C:	NP Hard
Option D:	P
20.	__________ is the class of decision problems that can be solved by non-deterministic polynomial algorithms?
Option A:	NP
Option B:	P
Option C:	NP Hard
Option D:	NP Complete

Q2 **(20 Marks)**	**Solve any Four out of Six 5 marks each**

A	Explain with example how divide and conquer policy is used in Merge Sort?
B	Write a short note on Master Method Theorem and find the complexity of following expression using Master Method. $$T(n) = T\left(\frac{n}{2}\right) + 1$$
C	Explain Job Sequencing with deadline. Let n =3, $(P_1, P_2, P_3) = (20, 5, 10)$ and $(d_1, d_2, d_3) = (2, 1, 2)$. Find the optimal solution.
D	Find the Minimum Cost Spanning Tree of the below graph using Prim's Algorithm. 
E	Consider the knapsack instance n=3, (p1, p2, p3) = (25, 24, 15) and (w1, w2, w3) = (18, 15, 20) and m=20. Find Optimal Solution using Dynamic Programming for 0/1Knapsack.
F	Find the path with minimum cost from vertex 1 to vertex 6. 

Q3 **(20 Marks)**	**Solve any Two out of Three 10 marks each**
A	Explain Rabin Karp string matching algorithm with suitable example.
B	Write a short note on 15 puzzle problem.
C	Prove that vertex cover problem is NP Complete.