Program: PG Computer Engineering
Curriculum Scheme: Rev2016
Examination: M.E. Computer Engineering, Semester I
Course Name: **Algorithm and Complexity (CSC101)**

Time: 2 hour Max. Marks: 80

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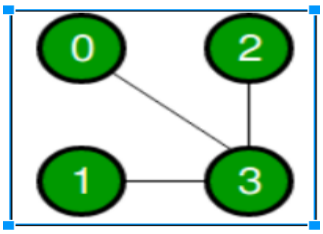
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	In dynamic table, the amortized cost of the single operation is at the most -------
Option A:	2
Option B:	1
Option C:	3
Option D:	4
2.	Maximum flow on augmented path 'P' is _____.
Option A:	$C_f(P)=\min\{ C_f(u,v) : (u,v) \text{ is on } P \}$
Option B:	$C_f(P)=\max\{ C_f(u,v) : (u,v) \text{ is on } P \}$
Option C:	$C_f(P)=$ any random $\{ C_f(u,v) : (u,v) \text{ is on } P \}$
Option D:	$C_f(P)=\{\Sigma C_f(u,v) : (u,v) \text{ is on } P \}$
3.	Objective of Matrix Chain Multiplication algorithm by Dynamic approach is_____.
Option A:	To maximizes the number of scalar multiplications
Option B:	To minimizes the number of scalar multiplications
Option C:	To performs multiplication of given matrices
Option D:	To increases number of operations
4.	Let the capacity of the edge from vertex u to vertex v is 30 and flow from vertex u to vertex v is -10 (minus 10). The residual capacity C_f is ---------
Option A:	20
Option B:	30
Option C:	40
Option D:	50
5.	In bipartite graph G = (V E), vertex set can be partitioned into V = P U Q where ---------- and all edges in E go between P and Q.
Option A:	P is subset of Q
Option B:	Q is subset of P
Option C:	$P \cap Q = \Phi$

Option D:	$P \cap Q \neq \Phi$
6.	The sweeping algorithm which takes n line segments as input and considers endpoints in sorted order have runtime complexity of ---------- to determine any pair of line segments intersects.
Option A:	O(n)
Option B:	O(n lg n)
Option C:	$O(n^2)$
Option D:	O(lg n)
7.	Consider an experiment of throwing a fair dice. Let a random variable X represents "face of one fair dice". The expected value of X , E[X] is---
Option A:	7
Option B:	3.5
Option C:	21
Option D:	6
8.	In Aggregate analysis for sequence of n operations worst case time is T(n). In the worst case the amortized cost per operation is given by ----------
Option A:	n /T(n)
Option B:	T(n)/n
Option C:	T(n) * T(n)
Option D:	n * n
9.	Which one of the following is the recurrence equation for the worst case time complexity of the Quicksort algorithm for sorting $n(\geq 2)$ numbers? In the recurrence equations given in the options below, c is a constant.
Option A:	T(n) = 2T (n/2) + cn
Option B:	T(n) = T(n – 1) + T(0) + cn
Option C:	T(n) = 2T (n – 2) + cn
Option D:	T(n) = T(n/2) + cn
10.	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(n)
Option B:	O(n) < T(n) < O(n^2)

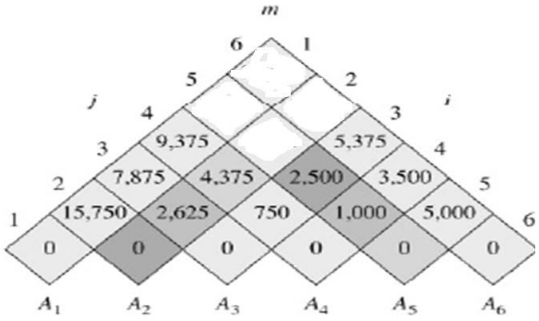
Option C:	T(n) = Constant
Option D:	Can not say
11.	Those problems that can be solved in polynomial time known as ---------- problems.
Option A:	Decision
Option B:	Intractable
Option C:	Tractable
Option D:	Complete
12.	To calculate shortest distance for the vertex v from source, which is the correct expression for edge relaxation algorithm for shortest path finding of graph?
Option A:	d(v) > d(u)+w(u,v)
Option B:	d(v) >= d(u)+w(u,v)
Option C:	d(v) < d(u)+w(u,v)
Option D:	d(v) <=d(u)+w(u,v)
13.	The time complexity of the recurrence T(n) = 3T (n/3)+ n/2 by using master theorem is -----
Option A:	ɵ (n^2)
Option B:	ɵ(n log n)
Option C:	ɵ(log n)
Option D:	ɵ(n)
14.	Dijkstra's shortest path finding algorithm for of graphs solved by greedy approach gives_____
Option A:	Suboptimal Solution
Option B:	Best Optimal solution
Option C:	Can't say
Option D:	Intermediate results
15.	Use Huffman coding technique to code following symbols for the given frequency of occurrences; d:16, e:9, f:5, b:13, c:12. Follow the code conventions as 0 to left side and 1 at right side of every node of the tree. What is code for e?
Option A:	101
Option B:	111
Option C:	001

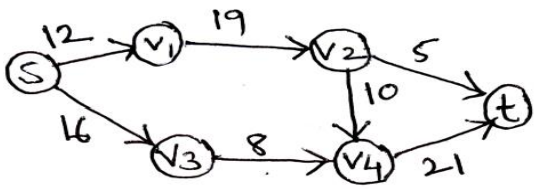
Option D:	110
16.	The cost function c satisfies the triangle inequality if for all vertices u, v, w ∈ V,
Option A:	$c(u, w) \leq c(u, v) * c(v, w)$.
Option B:	$c(u, w) > c(u, v) + c(v, w)$.
Option C:	$c(u, w) \geq c(u, v) + c(v, w)$.
Option D:	$c(u, w) \leq c(u, v) + c(v, w)$.
17.	Let M and N are the two vectors. If the cross product M X N = 0 then --------
Option A:	M and N are said to be collinear
Option B:	M is clockwise from N with respect to the origin (0,0)
Option C:	M is counterclockwise from N with respect to the origin (0,0)
Option D:	M and N are not related to each other.
18.	Suppose two problems A and B not known to be in NP. Let problem C be an NP-Complete problem. Problem A is polynomial-time reducible to C and problem C is polynomial-time reducible to problem B. Which one of the following statements is true?
Option A:	Problem A is NP-hard
Option B:	Problem A is NP-Complete
Option C:	Problem B is NP-hard
Option D:	Problem B is NP-Complete
19.	Bellman ford algorithm gives shortest path for the graph with____
Option A:	Negative weight cycle only
Option B:	Positive & Negative edge weights
Option C:	Negative edge weights with negative weight cycle
Option D:	Negative edge weights with positive weight cycle
20.	Find the minimum vertex cover for the following undirected graph 
Option A:	{1, 2}
Option B:	{2}
Option C:	{3}
Option D:	{0, 1}

Q2 **(20 Marks)**	**Solve any Four out of Six (5 marks each)**
A	Find all pairs shortest path for the given weight matrix using Floyd-Warshall's algorithm. $W =$

	A	B	C	D	E
A	0	5	8	∞	−3
B	∞	0	∞	2	6
C	2	∞	0	∞	∞
D	2	∞	−4	0	∞
E	∞	∞	∞	3	0

B	Explain how accounting method of amortized analysis is used to analyze the increment operation on a binary counter that starts at zero.
C	Use master method to find run time complexity of the following recurrence. $T(n) = 6T(n/3) + n^2 \log n$
D	Prove that vertex-cover problem is NP-complete
E	Determine LCS of (011010110) and (110010100).
F	Write detail note on RSA asymmetric cryptosystem and give analysis of the algorithm.

Q3. **(20 Marks)**	**Solve any Two Questions out of Three (10 marks each)**
A	 For given chain of matrices A_1=30X35, A_2=35X15, A_3=15X5, A_4 =5×10 A_5 =10×20, A_6 =20×25, Complete the table as per Dynamic algorithm for Matrix Chain Multiplication.
B	Use recursion tree method to find time complexity of the following recurrence. $T(n) = T(n/4) + T(n/2) + cn^2$
C	What is maximum flow in the given network from source s to sink t by Ford Fulkerson algorithm? Show all the flow networks, residual networks and augmented paths.

	 12 19 5 10 16 8 21 s v1 v2 v3 v4 t