End Semester Exam

Roll No:

Course ID: CS204

Total Marks: 50

Name:

From Q1-Q5, each carries 2 marks only. 2X5=10

1. What are the time and space complexities of Floyd-Warshall's algorithm?
   a. $O(n^3)$ and $O(n^3)$ b. $O(n^3)$ and $O(n^2)$ c. $O(n^2)$ and $O(n^2)$ d. None of these

2. For a 2- approximation algorithm **A** for a maximization problem, S(**A**) represents the solution for any instance of the problem and S_o represents the optimum solution.
   a. $S(\mathbf{A})<=2S_o$ b. $S_o<=2S(\mathbf{A})$ c. $S(\mathbf{A})<=2+S_o$ d. $S_o<=2+S(\mathbf{A})$

3. Which one of the following is true?
   a. Graph isomorphism and sub-graph isomorphism both are NP, but not NP-complete.
   b. Graph isomorphism and sub-graph isomorphism both are NP-complete.
   c. Graph isomorphism is NP, not NP-complete but sub-graph isomorphism is NP-complete
   d. Sub-graph isomorphism is NP, not NP-complete, but graph-isomorphism is NP-complete

4. Which one is polynomial time solvable?
   a. 2-SAT b. 3-SAT c. 4-SAT d. 5-SAT

5. In a parallel algorithm, the degree of concurrency _____ as decomposition becomes finer in granularity.
   a. Increases b. decreases c. remains same

From Q6-Q13, each carries 5 marks only. 5X8=40

6. Let set S={1,2,3,4,5,6,7,8,9}. Apply the following sequence of Unions and Finds: Union(1,2), Union(3,4), Union(1,3), Union(5,6), Union(7,8), Union(8,9), Union(5,7), Union(1,9), Find(5), Find(1). Union represents Union by rank, Find represents find by path compression.

   Which one of the following is true?
   a. Node 9 is parent of all other nodes except node 5
   b. Node 8 is parent of all other nodes except node 3
   c. Node 2 is parent of node 1, node 4 is parent of node 2 and node 8 is parent of node 4
   d. Node 3 is parent of node 4 and node 7 is parent of node 3.

7. For two sequences A=xyxxzxyzxy and B=zxzyyzxxyxxz, find out the longest common subsequence.
   a. xyxxz b. zxyzyx c. xyxxyz d. zxzxy

8. Apply dynamic programming approach to multiply a chain of 4 matrices A1, A2, A3 and A4, where dimensions of A1, A2, A3 and A4 are 4X5, 5X3, 3X6, 6X7 respectively. Find out the optimum cost (number of multiplications) and the corresponding optimal parenthesization.

a. 230, A1(A2(A3XA4)) b. 300, ((A1XA2)A3)A4

c. 270, (A1XA2)(A3XA4) d. None of these

9. For a pattern P=abcababcbcdabcd of length m=15, Use KMP algorithm to compute $\pi(i)$, $1<=i<=m$, where $\pi(i)$ is the longest prefix of P which is also proper suffix of P_i.

a. 000120123000123 b. 000121230001230 c. 000120012001230 d. None

10. We have four distinct books B_i, $1<=i<=4$, with the following price (p_i) and thickness (t_i), to be stored optimally in a bucket of capacity 8.

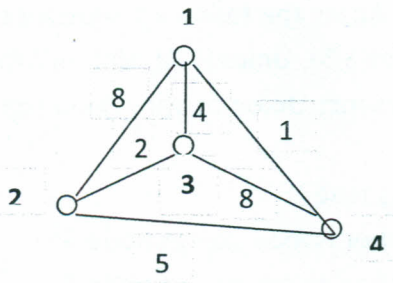
i	1	2	3	4
p_i	15O	70	170	160
t_i	3	1	2	3

Apply DP for this 0/1 knapsack problem. What are the values in entries *P[4,4]* and *keep[4,4]*, where *P[i,t]* is the maximum price of any subset of the books *{1,2, ..., i}* to be stored in a bucket of capacity *t*, and *keep[i,t]* is 1 only if the i^{th} book is decided to be stored in a bucket of capacity *t* to fill it optimally, otherwise 0. Which two entries of the table *P[i,t]*, $0<=i<=4$, $0<=t<=8$, have you directly used to compute *P[4,4]*?

a. 230, 1, P[4,3], P[4,1] b. 320, 1, P[3,4], P[3,1]

c. 240, 0, P[3,4], P[3,1] d. 240, 1, P[4,3]. P[4,1]

11.



For the above undirected graph with 4 vertices **1,2,3,4,** applying Floyd-Warshall algorithm. Which one of the following is the final parent matrix P_4 (after considering all 4 vertices), giving the shortest path information between all pair of vertices.

a.
-1 3 3 4
3 -1 3 4
3 3 -1 4
4 4 4 -1

b.
-1 3 1 1
2 -1 2 2
3 3 -1 1
4 4 4 -4

c.
0 6 4 1
6 0 2 5
4 2 0 5
1 5 5 0

d.
-1 3 1 1
3 -1 2 2
3 3 -1 1
4 4 1 -1

12. In which set, all the three statements are true?

Set I:
1. The maximum amount of flow passing from source s to sink t in a flow network is equal to the minimum capacity over all s-t cuts
2. Cardinality of maximum matching in a bipartite graph equals to the value of maximum flow in its corresponding flow network
3. For any bipartite graph, cardinality of maximum matching is equal to the cardinality of maximum vertex cover.

Set II:
1. The maximum amount of flow passing from source s to sink t in a flow network is equal to the maximum capacity over all s-t cuts
2. Cardinality of minimum matching in a bipartite graph equals to the value of maximum flow in its corresponding flow network
3. For any bipartite graph, cardinality of maximum matching is equal to the cardinality of maximum vertex cover.

Set III:
1. The maximum amount of flow passing from source s to sink t in a flow network is equal to the minimum capacity over all s-t cuts
2. Cardinality of maximum matching in a bipartite graph equals to the value of maximum flow in its corresponding flow network
3. For any bipartite graph, cardinality of maximum matching is equal to the cardinality of minimum vertex cover.

a. Set I b. Set II c. Set III d. none

13. For finding cut-vertex in a graph through DFS numbering (given by Val(v) for vertex v), for each non-root vertex v, low(v) is the vertex with lowest Val reachable from v by a directed path with at most one back edge in the DFS tree. Then, Min(v)=Val(low(v)) depends on which of the followings:

i. Maximum of Min(y) for all tree edges (v,y)
ii. Minimum of Min(z) for all back edges (v,z)
iii. Minimum of Min(y) for all tree edges (v,y)
iv. Minimum of Val(z) for all back edges (v,z)
v. Minimum of Val(y) for all tree edges (v,y)
vi. Val(v)

a. i, iv, vi b. iii, iv, vi c. iv, v, vi d. ii, iii