Enrollment No.....................................

Faculty of Engineering
End Sem (Even) Examination May-2018
CA5EL05 Design and Analysis of Algorithms
Programme: MCA   Branch/Specialisation: Computer Application

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. Which notation expresses asymptotic tight bound for a function   **1**
         (a) Big oh   (b) Omega   (c) Theta   (d) All of these

     ii. Consider an undirected graph G with n vertices and e edges   **1**
         represented by adjacency list. Time taken by breadth first search
         algorithm is:
         (a) $O(n^2)$ (b) $O(n + e)$ (c) $O(n + 2e)$ (d) $O(n^3)$

     iii. Algorithm for single source shortest path problem using greedy   **1**
         method is:
         (a) Dijkstra algorithm   (b) Kruskal algorithm
         (c) Hoare algorithm   (d) None of these

     iv. The recurrence relation of binary search is: **1**
         (a) T(n/2) + k   (b) 2T(n/2) + k
         (c) T(n/2) + log n   (d) T(n/2) + n

     v. Matrix chain multiplication problem can be expressed as   **1**
         (a) Independent sub-problems(b) Overlapping sub-problems
         (c) Both (a) and (b)   (d) None of these

     vi. Which of the following term is not related to dynamic programming   **1**
         (a) Memorization   (b) Principle of optimality
         (c) Pre-decided split point   (d) Optimal substructure

     vii. Explicit constraints are rules that   **1**
         (a) Are dependent on problem instance
         (b) Are independent of problem instance
         (c) Satisfy criteria function
         (d) None of these

P.T.O.

viii. Depth first generation of nodes with bounding function is called **1**
(a) FIFO Branch and bound   (b) LIFO Branch and bound
(c) LC Branch and bound   (d) Backtracking

ix. Both P and NP are closed under the operation of **1**
(a) Union   (b) Intersection (c) Kleene   (d) Concatenation

x. If P1 is a NP-complete and there is a polynomial time reduction of P1 **1**
to P2 then P2 is
(a) NP-complete   (b) Not necessarily NP-complete
(c) Cannot be NP-complete   (d) None of these

Q.2 i.   Explain the purpose of asymptotic notations? **2**
ii.   What is an algorithm? Discuss the criteria an algorithm should satisfy. **3**
iii. Explain depth first traversal algorithm with the help of an example. **5**
OR   iv. Explain two ways to represent directed graphs. **5**

Q.3 i.   Write the recurrence relation of strassen's matrix multiplication. **2**
Specify it's time complexity.
ii.   Discuss worst case behaviour of Quick sort and techniques to avoid it. **8**
OR   iii. What is minimum cost spanning tree? Write Prim's algorithm to **8**
generate minimum cost spanning tree.

Q.4 i.   Differentiate between dynamic programming and greedy method. **3**
ii.   Calculate and construct minimum cost tour for the following graph **7**
using dynamic programming approach.
$$\begin{bmatrix} 0 & 2 & 9 & 10 \\ 1 & 0 & 6 & 4 \\ 15 & 7 & 0 & 8 \\ 6 & 3 & 12 & 0 \end{bmatrix}$$
OR   iii. Find longest common subsequence for the sequences AGGTAB and **7**
GXTXAYB using dynamic programming approach.

Q.5 i.   Discuss explicit constraints and implicit constraints for 4-queen **4**
problem.
ii.   Discuss LC search **6**
OR   iii. Explain FIFO branch and bound **6**

Q.6   Attempt any two:
i.   Discuss relationship between class P, NP, NP-Hard and NP-complete **5**
problems.
ii.   State and prove Cook's theorem. **5**
iii. Explain Knuth-Morris Pratt algorithm. **5**

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Marking Scheme
CA5EL05 Design and Analysis of Algorithms

Q.1   i.   Which notation expresses asymptotic tight bound for a function   **1**
(c) Theta

ii.   Consider an undirected graph G with *n* vertices and *e* edges represented by adjacency list. Time taken by Breadth First Search algorithm is: **1**
(b) O(n + e)

iii.   Algorithm for single source shortest path problem using greedy method is: **1**
(a) Dijkstra algorithm

iv.   The recurrence relation of binary search is: **1**
(a) T(n/2) + k

v.   Matrix chain multiplication problem can be expressed as   **1**
(b) Overlapping sub-problems

vi.   Which of the following term is not related to dynamic programming   **1**
(c) Pre-decided split point

vii.   Explicit constraints are rules that   **1**
(a) Are dependent on problem instance

viii.   Depth first generation of nodes with bounding function is called   **1**
(d) Backtracking

ix.   Both P and NP are closed under the operation of   **1**
(c) Kleene

x.   If P1 is a NP-complete and there is a polynomial time reduction of P1 to P2 then P2 is   **1**
(a) NP-complete

Q.2   i.   Purpose of asymptotic notations   **2**

ii.   Algorithm   - 1 Mark   **3**
Criteria an algorithm   - 2 Marks

iii.   Depth first traversal algorithm   - 3 Marks   **5**
Example.   - 2 Marks

OR   iv.   Two ways to represent directed graphs.   - 2.5 marks each   **5**
(2.5 marks * 2)

Q.3   i.   Recurrence relation of strassen's matrix   - 1 Mark   **2**
It's time complexity   - 1 Mark

ii.   Worst case behaviour of Quick sort   - 6 Marks   **8**
Techniques to avoid it.   - 2 Marks

OR   iii.   Minimum cost spanning tree   - 2 Marks   **8**
Prim's algorithm   - 6 Marks

Q.4   i.   Differentiate between dynamic programming and greedy method.   **3**

ii.   Calculate and construct minimum cost tour for the following graph using dynamic programming approach.   **7**

$$\begin{bmatrix} 0 & 2 & 9 & 10 \\ 1 & 0 & 6 & 4 \\ 15 & 7 & 0 & 8 \\ 6 & 3 & 12 & 0 \end{bmatrix}$$

(6 Marks + 1 Mark)

OR   iii.   Find longest common subsequence and its length for the sequences GXTXAYB and AGGTAB using dynamic programming approach.   **(6 Marks + 1 Mark)**   **7**

Q.5   i.   Explicit constraints   - 2 Marks   **4**
Implicit constraints for 4-queen problem.   - 2 Marks

ii.   Discuss LC search   **6**

OR   iii.   Explain FIFO branch and bound   **6**

Q.6   Attempt any two:

i.   Discuss relationship between class P, NP, NP-Hard and NP-complete problems. (1 Mark + 1 Mark + 2 Marks + 1 Mark)   **5**

ii.   State and prove Cook's theorem.   **5**

iii.   Explain Knuth-Morris Pratt algorithm.   **5**

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