

# CS/B.TECH(IT)/SEM-8/IT-803C/2010 2010 <br> DESIGN AND ANALYSIS OF ALGORITHMS 

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

## GROUP - A

( Multiple Choice Type Questions )

1. Choose the correct alternatives for the following :

$$
10 \times 1=10
$$

i) To move 5 disk from BEG to END using AUX peg, The Total no. of Movement required :
a) 32
b) 64
c) 31
d) 63 .
ii) O-notation ( Big Oh ) is Asymptotically bound.
a) tight
b) upper
c) lower
d) loose.

CS /B.TECH(IT)/SEM-8/IT-803C/2010
iii) Average case time complexity of binary search is
a) $O(n)$
b) $O(n \log n)$
c) $\mathrm{O}(\log n)$
iv)

Dia.

Total cost of the spanning tree for the above graph using Kruskal's algorithm is
a) 57
b) 55
c) 64
d) 52 .
v) Lower bound of time complexity for any comparison based sorting algorithm is
a) $\mathrm{O}(\log n)$
b) $\mathrm{O}(\mathrm{n})$
c) $O(n \log n)$
d) $\mathrm{O}\left(n^{2}\right)$.
vi) Space complexity of Merge Sort is
a) $\quad \mathrm{O}(\log n)$
b) $\mathrm{O}(\mathrm{n})$
c) $\quad \mathrm{O}(n \log n)$
d) $O\left(n^{2}\right)$.
vii)

Dia

The chromatic number of the above graph is
a) 1
b) 2
c) 3
d) 4 .

## CS/B.TECH(IT)/SEM-8/IT-803C/2010

 UResviii) $\qquad$ is used in BFS.

## a) Stack

b)
c) Link list
d) None of these.
ix) Time complexity of the following recurrence $T(n)=$ $9 T(n / 3)+n$ is
a) $\quad \mathrm{O}(n \log n)$
b) $\theta\left(n^{2}\right)$
c) $\quad \theta(\log n)$
d) $O\left(n^{3}\right)$.
x) Which edge removal makes the graph disconnected ?
a) Pendant vertex
b) Bridge
c) Articulation point
d) Coloured vertex.

## GROUP - B

## ( Short Answer Type Questions)

Answer any three of the following. $3 \times 5=15$
2. a) Derive the complexity of merge sort.
b) What is the difference between a 0-1 Knapsack problem and a fractional Knapsack problem ? $4+1$
3. Write an algorithm for eight queens problem.
4. State Master's theorem and find the time complexity for the following recurrence

$$
\begin{equation*}
T(n)=3 T(n / 4)+n \log (n) \tag{5}
\end{equation*}
$$

5. a) What are the basic characteristics of dynamic programming?
b) Write down Bellman and Ford algorithm for single source shortest path.
6. Write an algorithm to find a minimal spanning tree of undirected graph. Estimate the time complexity of your algorithm.

7. a) Define the classes $P$ and $N P$ and $N P$ complete.
b) Discuss what you mean by polynomial reductions.
c) Discuss diagrammatically the relations among $P$ class, $N P$ class, $N P$ hard and $N P$ complete.
d) Describe circuit satisfiability prove that circuit satisfiability is in NP. $\quad 3+2+3+7$
8. a) What do you mean by dynamic programming? What is the difference between dynamic programming and gready method?
b) Write an algorithm for Quick sort and find the average case time complexity of this algorithm.
c) Find an optimal parenthesization of a matrix-chain product whose sequence of dimension is $(5,10,3,12,4,50)$. $\quad(1+2)+5+7$
9. a) Discuss the procedure for Strassen's matrix multiplication to evaluate the product of $n$ matrices. Find the resulting recurrence relation for the same and analze its time complexity. Justify that this method is an improvement over the conventional matrix multiplication method.
b) What is UNION-FIND algorithm ? $(7+1+2+2)+3$
10. a) How can you find a solution of simultaneous linear equation using LUP Decomposition ?
b) Given weight vector ( $15,25,35,45,55$ ) and the profit vector ( $10,20,30,40,50$ ) and a Knapsack of capacity 100 , find at least three feasible solutions including optimal one for the Knapsack problem of 5 items.
c) Discuss activity selection problem for job sequencing with an example.
11. Write short notes any three of the following : $3 \times 5$
a) RAM model
b) Turing Machine
c) Eight queens problem
d) Approximations algorithm
e) Asymptotic notation.
