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B.E DEGREE EXAMINATIONS: OCTOBER / NOVEMBER - 2008

Third Semester

COMPUTER SCIENCE AND ENGINEERING

U07CS301-Design and Analysis of Algorithms

Time: Three Hours **Maximum Marks: 100**

PART A (20 X 1 =20 Marks)

1. Ω notation is used to bound the ---------- of an algorithm
   A. average case running time B. worst case running time
   C. expected case running time D. best case running time.

2. If $f(n)=3n^2+4n+2$ .What is O(f(n))?
   A. n^2 B. n C. n^3 D. 1

3. The Data structure used in BFS and DFS are ---------- .
   A. stack,queue B. queue,stack C. list,stack D. list,queue

4. ---------- is a class of problem that asks for the largest or smallest value meeting some specified criteria.
   A. Decision problem
   B. Optimization problem
   C. NP problem
   D. Polynomial problem

5. Big - O notation for $T(n)=20n^2$ ----------
   A. n^4 B. n C. n^2 D. n^3

6. The worst case running time of selection sort is
   A. O(log n) B. O(n) C. $O(n^2)$ D. $O(n^2 \log n)$.

7. Which of the following describes the Quicksort method?
   1.does not always decompose the array into 2 equal subranges
   2.slicing the array into 2 equal halves and sort the halves separately
   3.running time is O(n log n)
   A. 1,2&3 B. 3 C. 2&3 D. 1&3

8. In Kruskal's algorithm with set of edges t
   1. t forms a tree at all stages
   2. t forms a heap
   3. t forms a forest
   A. 1,2&3 B. 3 C. 2&3 D. 1&3

9. The time complexity of all pairs shortest path is
   A. $O(n^2)$ B. $O(n^3)$ C. O(n) D. O(1)

10. Which of the following problems cannot be solved by divide and conquer method?
    A. Binary search B. Merge sort C. Multiplication of large numbers
    D. queens problem

11. Single source shortest path problem can be solved using ---------- algorithm
A. Prim's B. Kruskal's C. Dijkstra's D. Sollin's

12. The relationship between the Internal path length I and External path length E for a binary tree with n internal nodes is given as

A. E=I+2n B. I=E+2n C. E=I * 2n D. E=I+n.

13. Which of the following technique has a complexity of O(log n).
A. Heap sort B. Selection sort C. Quick sort D.Binary search

14. Depth first node generation with bounding functions is called
A. Greedy method B. Divide and conquer C. Backtracking D. Spanning trees

15. " Once a candidate is included in the solution, it is there for good, once a candidate is excluded from the solution, it is never reconsidered" The above statement best describes

A. Dynamic programming B. Branch and bound method

B. C. Backtracking D. Greedy method

16. Which of the following is true?
A. Dijkstra's algorithm follows Principle of optimality

B. All pair shortest paths in a graph is obtained using dynamic programming approach

C. Spanning tree got from Dijkstra's method is a minimum cost spanning tree

D. Dijkstra's algorithm works correctly even if the edge weights are negative

17. Branch and Bound uses ----------search Technique.
A. Breadth First B. Depth First C. D-Search D. BFS or D-search

18. Which of the following is/are true in the Branch and Bound method of algorithm design?
i) All children of the E-node are generated before a new node becomes the E-node.
ii) E-node remains the E-node until it is dead

A. i & ii are false B. i is true & ii is false
C. i is false & ii is true D. i & ii are true

19. Tree Organizations that are independent of the problem instance are called

A. Dynamic trees B. Static trees C. State space tree D. Decision trees

20. ---------- is a solution vector for 4 queens problem
A. 2,4,3,1 B. 4,2,3,1 C. 3,1,4,2 D. 2,4,1,3

PART B (5 X 16 =80 Marks)

21. a) i) How will you decide the quality of an algorithm? (4)

ii) Write an algorithm that outputs the smallest and second smallest values in the array s[1],.....s[n]. Assume n>1 and the values in the array are distinct. (12)

(OR)

21 b) i) Obtain a lower bound in the sum 1+2+3+...+n (12)

ii) Find the step count for the following loop (4)

```
for ( i = 1; i <=n; i * 2)
{
  a=a+1;
  d=d+2;
}
```

22. a) i) Given f(n)=n! . Find O(g(n), Ω (g(n) and θ(g(n)) and the valid range of n. (8)

ii) Write a non-recursive algorithm to print the Fibonacci series. Find its time complexity. (8)

(OR)

22 b) i) Find a theta notation for the expression. (8)

$3n^2 + 2n \log n$

ii) Solve the recurrence relation. (8)

$a_n = a_{n-1} + 3$, $n>1$; $a_1 = 2$

23. a) i) Write the algorithm for Quick sort and illustrate it with the following 8 elements 43, 21, 7, 6, 4, 0, 34, 8. (8)

ii) Prove that quick sort takes O(N log N) time to sort N elements on the average. (8)

(OR)

23 b) i) Write the algorithm for Preorder and Inorder traversal of a Binary tree (8)

ii) For the Graph in fig -1, list the order in which the vertices are visited by Breadth First Search. Also write the algorithm (8)

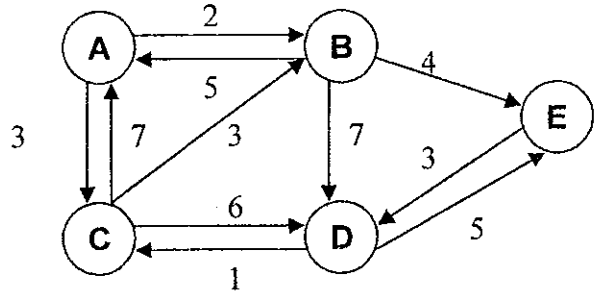

Fig-1

24. a) i) Show the steps in the construction of a heap of records with the following keys 12, 30, 40, 22, 8, 1, 25, 14, 0, 6. (8)

ii) Apply heap sort algorithm to sort the above keys in descending order (8)

(OR)

24 b) Start with an AVL search tree that is a 8 node full binary tree; the keys are 1-8. Remove the keys in the order 1,2,3....8. Draw the tree immediately after each deletion and immediately after each rotation that is performed. Label the nodes with their balance factors and identify the rotation type that is done. (16)

25. a) The sum of subsets problem is to find all combinations of the n given distinct numbers whose sum is M. Draw the state space tree for the problem with the numbers 7,5,12,18,20,8 and M=25. Describe how backtracking gives the solution. (16)

(OR)

25 b) Solve the following assignment problem using branch and bound technique. Make an assignment of these tasks to the workers, one task per worker so that all tasks are accomplished with minimum cost. (16)

Tasks →

workers ↓	1	2	3	4
A	45	6	25	26
B	35	5	24	40
C	4	42	8	35
D	6	18	40	10

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