Hall Ticket Number:

Code No.: 22114 AS

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (C.S.E.) II Year II-Semester Advanced Supplementary Examinations, June/July-2017

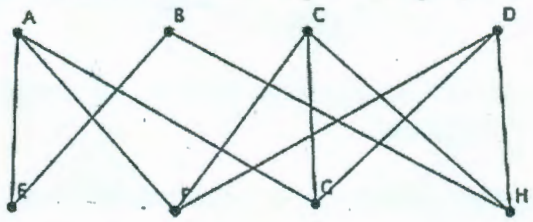
Design and Analysis of Algorithms

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. What is an algorithm? And how to analyze the performance of an algorithm?
2. Show that $3^{n+1} = \Omega(3^n)$.
3. Give recurrence for running time of merge sort. Solve it by using master's method?
4. Solve fractional knapsack problem for the instance n = 3, m = 20, (p1, p2, p3) = (25, 24, 15), and (w1, w2, w3) = (18, 15, 10).
5. Determine the number of ways in which the product of chain of given 3 matrices can be obtained. A_1, A_2, A_3 are matrices of order 10x20, 20x30, and 30x40 respectively.
6. What is the dynamic programming and when it appeals for the principle of optimality.
7. Determine the minimum number of colors required to properly color the following graph.



8. What is the difference between brute force and backtracking methods?
9. State Cook's theorem.
10. Give an example of a problem which is NP-hard but not NP.

Part-B (5 × 10 = 50 Marks)

11. a) Define the 5 asymptotic notations with set representation and same with growth of functions. Give an example for each of the notations. [5]

    b) How to estimate time complexity for iterative and recursive algorithms? And analyze the time and space complexity for the following code segments: [5]

(i)
```
Sum_array(int a[n])
{
   sum=0;
   for(i=1; i<=n; i++)
      {
        sum=sum+a[i];
      }
   return sum;
}
```

(ii)
```
fact(int n)
 {
  if(n==1)
        return 1:
  else
        return n*fact(n-1);
}
```

Contd 2

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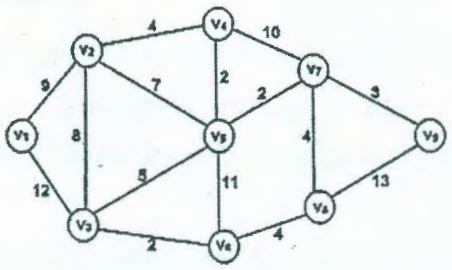
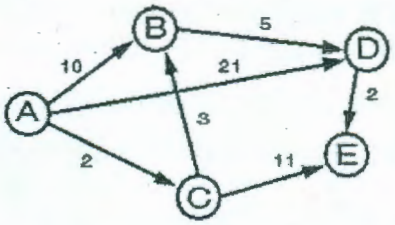
12. a) Solve the job sequencing with deadlines for the instance n = 5, profits (p1, p2, p3, p4, p5) = (20, 15, 10, 5, 1) and deadlines (d1, d2, d3, d4, d5) = (2, 2, 1, 3, 3). [5]

    b) Define a Minimum Spanning Tree (MST). Determine a MST of the following graph by applying Prim's algorithm. [5]



13. a) Define *all pairs shortest paths* (APSP) problem. Write pseudo code and explain working of Floydd-Warshall algorithm. Apply Floydd-Warshall algorithm to the following graph. [5]



    b) Design a dynamic programming algorithm for Longest Common subsequence problem. And analyze its time complexity. [5]

14. a) Design a backtracking algorithm to solve 4-Queens problem. [4]

    b) Solve knapsack problem with branch-and-bound technique for instance with n = 4, (p1, p2, p3, p4) = (10, 10, 12, 18), (w1, w2, w3, w4) = (2, 4, 6, 9), and m = 15. [6]

15. a) Prove Satisfiability (SAT) is NP-complete. [5]

    b) Consider the following Decision Problem: [5]

    CLIQUE

    Input: A simple, undirected graph G = (V, E) and a positive integer k.

    Question: Does G have a clique of size $\leq$ k?

    Show that CLIQUE decision problem is NP-complete by reducing it from 3-SAT problem.

16. a) Explain with a suitable example for different methods of amortized analysis of algorithms. [5]

    b) Sort the keys H, L, P, T, W, G, E, C, A in ascending order by applying quick sort. [5]

17. Write short notes on any ***two*** of the following:

    a) 0/1 Knapsack problem [5]

    b) Backtracking technique [5]

    c) P, NP, NP-hard and NP-complete problems. [5]