Hall Ticket Number:

Code No. : 22115

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (C.S.E.) II Year II-Semester Main & Backlog Examinations, May-2017

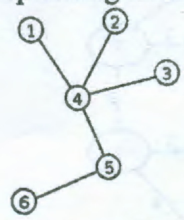
Design and Analysis of Algorithms

Time: 3 hours Max. Marks: 70

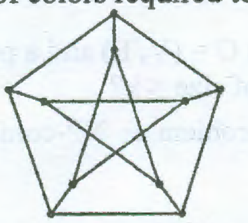
Note: Answer ALL questions in Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

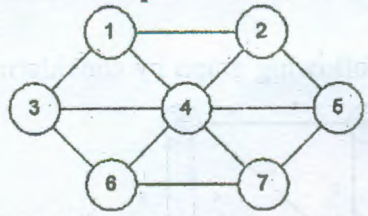
1. List out the criteria an algorithm must satisfy. And what is the amortization?
2. Prove or disprove that $2^{2n} != O(2^n)$.
3. Determine the number of minimum spanning trees of the following graph. Assume that the cost (i.e. weight) of each edge is 1.



4. Give recurrence for worst-case running time of the binary search. And solve it.
5. Determine the number of binary search trees possible with 3 distinct keys. In general for n keys.
6. Let G(V, E) be a simple, undirected, connected and weighted graph. Name the efficient algorithm which is used to find the distances between every pair of vertices in the graph G.
7. What is the Hamiltonian cycle of a graph?
8. Determine the minimum number of colors required to properly color the following graph.



9. Determine the size of the maximum clique in the following graph.



10. Define node cover of a simple, undirected and connected graph.

Part-B (5 × 10 = 50 Marks)

11. a) Let $f(n)= a_m n^m + a_{m-1}n^{m-1}+ a_{m-2} n^{m-2} + \dots + a_1 n + a_0$, be a degree m polynomial in n and $a_m > 0$. Show that $f(n) = O(n^m)$. [5]

    b) Compute the running time and space for the following code segment [5]

```
for(i=1;i<=n; i=i++)
{
    for(j=1;j<=n);j=j++)
    {
        for(k=1;k<=n; k++)
        {
            C[i][j]=A[i][k]*B[k][j];
        }
    }
}
```

Contd... 2

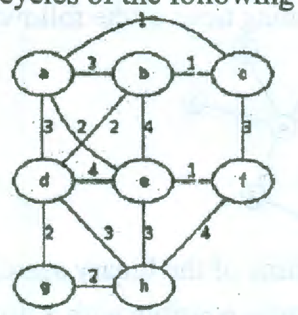
12. a) Design the merge sort algorithm. And Sort the keys 18, 48, 27, 43, 3, 9, 82, 60, 28 in ascending order by applying merge sort. Analyze the running time of merge sort. [6]

b) Design knapsack algorithm by greedy design strategy. Analyze the time complexity. [4]

13. a) Design matrix chain multiplication algorithm by dynamic programming. Also analyze the running time of your algorithm. [5]

b) Solve the knapsack instance for n = 3, weights (w1, w2, w3) = (2, 3, 5), profits (p1, p2, p3) = (1, 2, 5), and capacity (m) = 6 by dynamic programming. [5]

14. a) Determine two Hamiltonian cycles of the following graph if exist. [5]



Write an algorithm for the same.

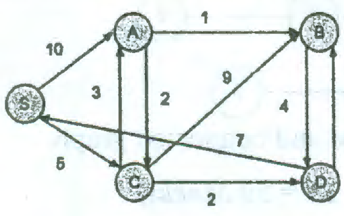
b) Design an algorithm for N-Queens. Give a backtracking solution to 4-queens problem. [5]

15. a) Design a non-deterministic sorting algorithm. Analyze its time complexity. [5]

b) Consider the following Decision Problem: [5]
NODECOVER
Input : A simple, undirected graph G = (V, E) and a positive integer k.
Question : Does G have a nodecover of size ≤ k?
Show that NODECOVER decision problem is NP-complete by reducing it from a known NP-complete problem.

16. a) Formally define the asymptotic notations with set representation and give an example for each. [5]

b) Apply Dijkstra's algorithm to the following graph by considering vertex S as source. [5]



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

a) Bi-connected components and articulation points [5]

b) FIFO branch and bound [5]

c) Steps to prove NP-completeness. [5]