B. E. Sixth Semester (Computer Technology) / SoE – 2014-15 Examination

Course Code : CT 1314 / CT 314 / CT 609 **Course Name : Design and Analysis of Algorithm**

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) Due credit will be given to neatness and adequate dimensions.

(2) Illustrate your answers wherever necessary with the help of neat sketches.

1. Solve any **One** :

(A) Write down the algorithm for heapsort and derive the expression to find its time complexity.

OR

(B) Write down the algorithm for selection sort and derive the expression to find its time complexity. 8

2. (A) Solve the following recurrence :

$$t_n = \begin{cases} n & , \text{ if } n = 0,\ 1,\ 2 \\ 5t_{n-1} - 8t_{n-2} + 4t_{n-3}, & \text{otherwise} \end{cases}$$ 7

OR

(B) Explain the master method and use it to give tight asymptotic bounds for the following recurrences.

(i) $T(n) = 4T(n/2) + n$

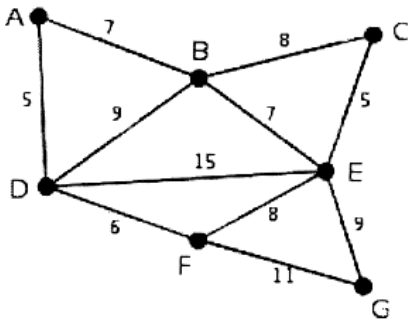
(ii) $T(n) = 4T(n/2) + n^2$

(iii) $T(n) = 4T(n/2) + n^3$ 7

3. (A) Write an algorithm for fractional knapsack and find the optimal solution to the knapsack instance. n = 6, m = 15, $(P_1, P_2, P_3, P_4, P_5, P_6)$ = (10, 7, 12, 13, 6, 20) and $(w_1, w_2, w_3, w_4, w_5, w_6)$ = (3, 2, 4, 3, 13, 8). 7

OR

(B) State and explain Prim's algorithm for finding minimum spanning tree. Run Prim's algorithm on the following graph. (Show all the steps involved).



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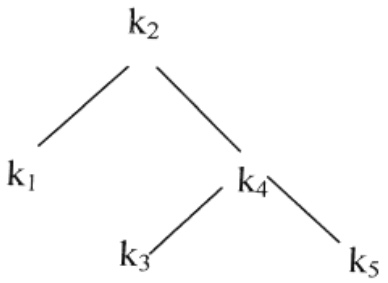
4. (a) Find the optimal binary search tree for the following tree using dynamic programming.

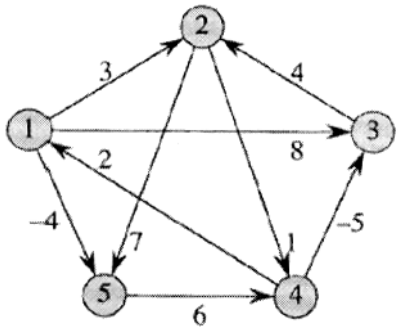
i	1	2	3	4	5
pi	0.25	0.2	0.05	0.2	0.3



8

OR

(b) Write Floyd-Warshall algorithm. Find all pairs shortest paths for the following graph using Floyd-Warshall algorithm.



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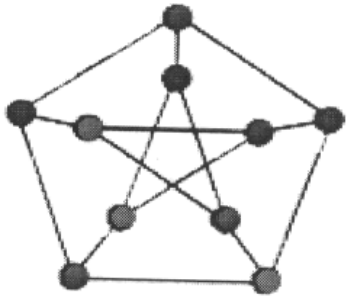
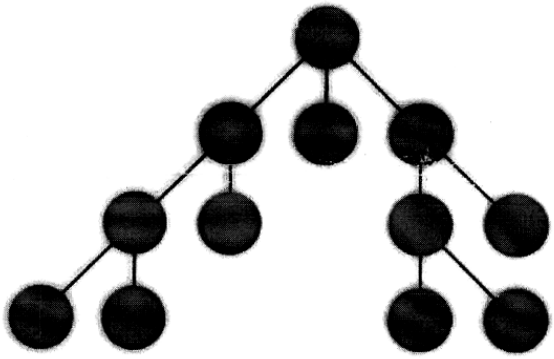
5. Solve any **Three** :

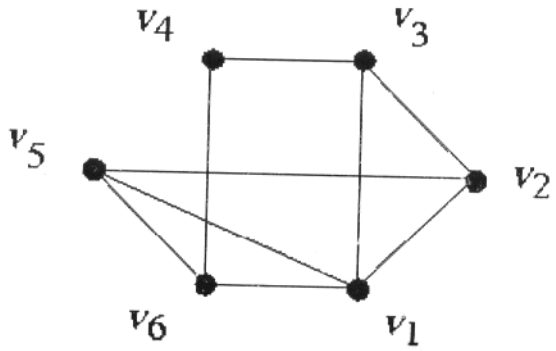
(a) Write graph coloring algorithm using backtracking and find the minimum number of colors required for graph coloring the following graph.



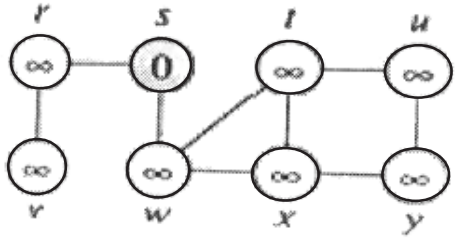
(b) State and run Depth first search on the following graph. (Note : Start at the topmost vertex and number the vertices as you visit them during search from left to right.



(c) Find Hamiltonian cycles for the following graphs.



(d) State and run Breadth first search on the following graph. (Note : Source vertex is s)



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6. Solve any **Three** :

(a) Explain clearly polynomial reduction. How can it be used to show that a problem is NP-complete ?

(b) Prove the following theorem : "SAT is NP-complete."

(c) Prove the following theorem: "SAT-3-CNF is NP-complete".

(d) Explain NP-hard class of problem with example." 15