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BCS-042

BACHELOR OF COMPUTER APPLICATIONS (BCA)

Term-End Examination

December, 2020

BCS-042 : INTRODUCTION TO ALGORITHM DESIGN

Time : 2 Hours *Maximum Marks : 50*

Note : *(i) Question* ***No. 1*** *is compulsory which carries 20 marks.*

(ii) Answer any ***three*** *questions from the rest.*

1. (a) Arrange the following growth rates in the increasing order of running time : 2

$$O(3^n), O(n^3), O(n), n!, \log^n$$

(b) Define recurrence relation and initial condition for the merge sort algorithm and explain. 4

(c) Where is Ω (omega) notation used ? For the function defined by : 4

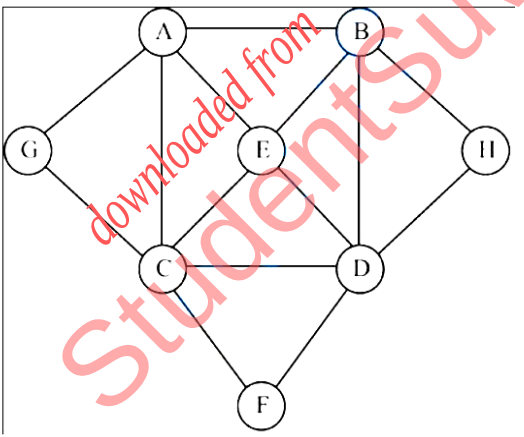
$$f(n) = 5n^3 + 5n^2 + 1$$

and $g(n) = 5n^2 + 5$

show that :

$$f(n) = \Omega\, g(n)$$

(d) Traverse the following graph using DFS taking A as a starting vertex and write the sequence of vertices in the order of their discovery. 3



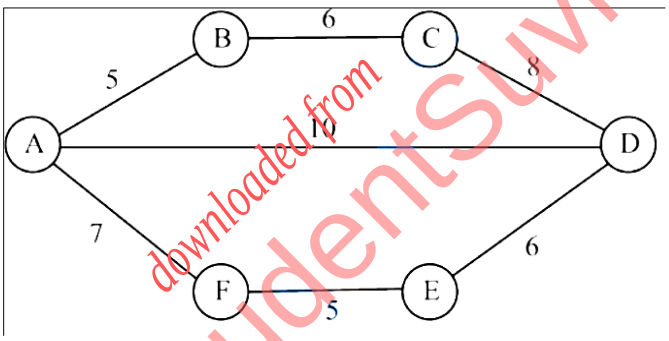
(e) (i) Apply the linear search algorithm to search for the number (4) in the following list of integer numbers. Show the starting three steps : 3

5 15 8 4 25 30 17 20

(ii) Analyze the worst case complexity of the above algorithm. 4

2. (a) Find node degree of all nodes of a graph in Q. 1 (d). 3

(b) Write the Bellman Ford algorithm and apply the same to find the shortest path from a source vertex A to all the remaining vertices of the following directed graph. Show all the intermediate steps. 7



3. (a) For the two values of $n = 1, 4$, calculate the corresponding values of $n \log_2 n$. 2

(b) Define a fractional knapsack problem. Find the optimal solution to the following instance of a knapsack problem. Show the stepwise running of the algorithm for the following example : 8

No. of objects $n = 5$, M = 13

Capacity of a knapsack :

$(P_1, P_2, P_3, P_4, P_5) = (12, 32, 40, 30, 50)$

where P_i is a profit and :

$$(W_1, W_2, W_3, W_4, W_5) = (4, 8, 2, 6, 1)$$

where W_i is a weight.

Each object has a profit P_i and weight W_i.

4. (a) Apply binary search algorithm to search for a key value = 23 in the following list : 5

6 9 13 15 23 27 35 45

(b) Perform the worst case analysis of the above algorithm and also specify an example in which worst case will occur. 5

5. (a) Apply Karatsuba's method in multiplying 2376201 and 219237 using divide and conquer technique. 5

(b) Define mathematical induction. Prove the following preposition using induction : 5

$$1^2 + 2^2 + 3^3 + ... + n^2 = \frac{n(n+1)(2n+1)}{6}$$