Question Paper

Exam Date & Time: 24-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. DEGREE EXAMINATIONS - MAY/JUNE 2023
SUBJECT: CSE_2252/CSE 2252 - DESIGN AND ANALYSIS OF ALGORITHMS
(SPL: COMPUTER SCIENCE AND ENGINEERING - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING / COMPUTER SCIENCE / COMPUTER SCIENCE AND ENGINEERING - CYBER SECURITY)

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A) For the graph shown in **Fig. 1A**, starting at vertex 'A' and resolving ties by the vertex alphabetical order, traverse the graph by breadth-first search and construct the corresponding breadth-first search tree, showing all types of edges. Classify the order in which the vertices were reached for the first time. Discover the edge types that are used in algorithm along with one application. (5)

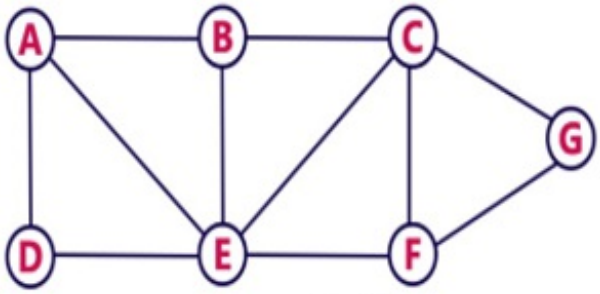


Fig.1A

1B) Develop an iterative algorithm to convert a decimal number to a binary equivalent and analyse the time complexity. (3)

1C) Consider the following algorithm and answer the questions below. (2)

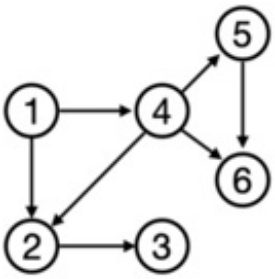
ALGORITHM *Secret*$(A[0..n-1])$

//Input: An array $A[0..n-1]$ of n real numbers
$minval \leftarrow A[0]$; $maxval \leftarrow A[0]$
for $i \leftarrow 1$ **to** $n-1$ **do**
  if $A[i] < minval$
    $minval \leftarrow A[i]$
  if $A[i] > maxval$
    $maxval \leftarrow A[i]$
return $maxval - minval$

i) What does this algorithm compute?
ii) What is its basic operation?
iii) How many times is the basic operation executed?
iv) What is the efficiency class of this algorithm?

2A) Apply quicksort to sort the given list **T, E, C, H, N, O, P, A, R, K, S**in alphabetical order by taking first element as pivot element, showing all intermediate steps. Include the recursive tree calls. (5)

2B) Illustrate the source removal technique and perform topological sort on given graph in numerical order with steps. Comprehend the algorithmic design technique used to solve this problem. (3)



2C) Apply divide and conquer technique to compute the product of **957** and **4014** and show all intermediate steps. (2)

3A) Write the properties of AVL trees. Clearly show all the steps involved in constructing AVL tree for the given list of elements **21, 12, 6, 33, 41, 3, 5, 28, 24, 29, 51**. Give the best-case and worst-case efficiency for the same. (5)

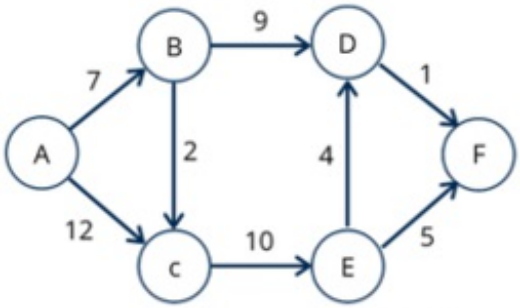
3B) Consider the string COMPUTER SCIENCE ENGINEERING and search for the pattern ENGINEER in this string using Horspool algorithm. (3)

3C) Compute the efficiency of Boyer-Moore Algorithm and compare it with Horspool algorithm. (2)

4A) Apply the bottom-up dynamic programming algorithm to the instance of the knapsack problem given in below table, with capacity W = 5. Explain how memory functions is more efficient than bottom-up dynamic programming for the same data given in below table. (5)

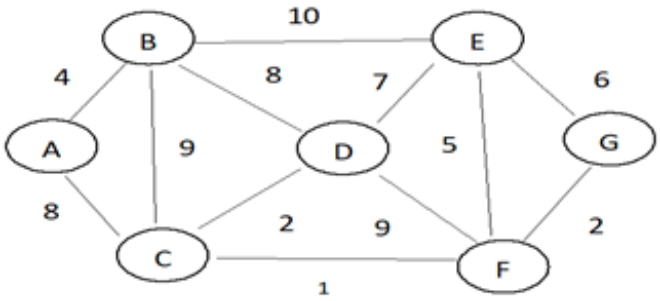
Item	weight	Value
1	2	$14
2	1	$12
3	3	$22
4	2	$17

4B) Find the all-pair shortest path using Floyd's algorithm for the graph shown in below figure. Show the distance matrices, $D^{(i)}$, in each iteration of the algorithm. (3)



4C) Construct 2-3 tree for the list **19, 33, 13, 24, 31, 11, 16, 21, 22, 25, 32, 41, 46, 48, 51, 53** using successive insertion method. (2)

5A) Construct a minimum spanning tree of the following graph using Prim's algorithm. [**Starting Vertex a**] (5)



Compute the time complexity of the algorithm.

5B) Demonstrate P, NP and NP complete complexity classes. (3)

5C) Using the backward substitution method, Identify the efficiency classes of the following recurrence relations. (2)

i) $X(n) = X(n-1) + 5$ for $n > 1$, $X(1) = 0$

ii) $M(n) = 2M(n-1) + 1$ for $n > 1$, $M(1) = 1$.

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