# RV University

## School of Computer Science and Engineering

### B.Tech(Hons.) Degree Examination-December 2024

**Semester** : III

**Course Code** : CS2000

**Course Title** : Design and Analysis of Algorithms

**Duration** : 2 Hours **Max. Marks: 30**

**Instructions to students:**

Answer all Questions

| Sl. No. | PART A | Marks | L1-L6 | CO |
|---|---|---|---|---|
| 1. | **a)** Solve the following recurrence relation using substitution method.<br>$T(n)=2T(n/2) + n\log n;\ n>1$<br>$1;\ n<=1$<br>**b)** What is the time complexity of fun()?<br>`int fun (int n)`<br>`{`<br>`  int count = 0;`<br>`  for (int i=n; i>=1; i--)`<br>`  {`<br>`  for (int j=1; j*j<=n; j++)`<br>`  {`<br>`  count = count + 1;`<br>`  }`<br>`  }`<br>`  return count;`<br>`}` | 2.5+2.5 | L2 | CO3 |
| 2. | **a)** A certain permutation of integer stored in an array is provided as an input to the procedure of quicksort. After one pass of algorithm the status of the array is 9, 16, 11, 13, 18, 15, 17, 24. Find the sum of all possible values that could have been used as a pivot.<br>**b)** A priority queue is implemented as a Max-Heap. Initially, it has 9 elements. The level-order traversal of the heap is: 20, 18, 15, 13, 12, 7, 4, 3, 1. Three new elements 16, 24 and 28 are inserted into the heap in that order. Write the level-order traversal of the heap after the insertion of the elements. | 2+3 | L3, L4 | CO2 |

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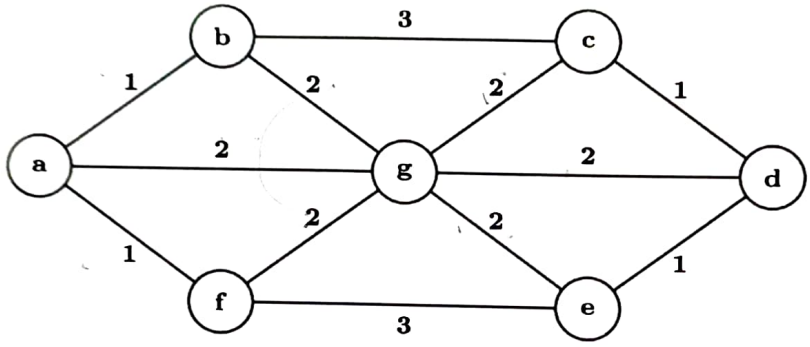
| Sl. No. | PART B – Max Marks(20) | Marks | L1-L6 | CO |
|---|---|---|---|---|
| 3. | **a)** Consider the following message:<br>aabbbbabcccddddeeeebbdd<br>Find the number of bits required for Huffman encoding of the above message. If Huffman tree coded as left child with '0' and right child with '1' from every node then what is the decoded message for 110100?<br><br>**b)** Find the number of distinct minimum cost spanning trees for the following weighted graph. And draw all possible minimum cost spanning trees.<br>  <br> | 5+5 | L3, L4 | CO4 |
| 4. | Consider the weights and values of items listed below. Note that there is only one unit of each item.<br><br>**Item Number** / **Weight (in Kgs)** / **Value (in Rupees)**<br>1 / 3 / 60<br>2 / 5 / 28<br>3 / 4 / 20<br>4 / 2 / 24<br><br>The task is to pick a subset of these items such that their total weight is no more than 5 Kgs and their total value is maximized. Moreover, no item may be split. The total value of items picked by Dynamic programming algorithm is denoted by $V_{opt}$. A greedy algorithm sorts the items by their value-to-weight ratios in descending order and packs them greedily, starting from the first item in the ordered list. The total value of items picked by the greedy algorithm is denoted by $V_{greedy}$. The value of $V_{opt} - V_{greedy}$ is _____ . | 10 | L5 | CO1 |

**Course Outcomes**

1. Design algorithms for addressing sub problems and tasks involving an algorithm component using appropriate design techniques (brute force, greedy, dynamic programming, etc.) as relevant, these tasks could arise in the context of various applications such as engineering, Operations Research, e-commerce and so on
2. Implement a variety of standard algorithms typically covered in an undergraduate course on Design and Analysis of Algorithms such as well known sorting and searching algorithms, graph related algorithms etc., in a high level language