RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Information and Communication Technology
Second Year - Semester I Examination – September/October 2019

ICT 2301 – DESIGN AND ANALYSIS OF ALGORITHMS

Time: Three (03) hours

- **Answer ALL the questions.**

1. a) "The algorithm design is an important phase in software development". Do you agree with this statement? Justify your answer. **(04 marks)**

   b) What are the basic constructs of an algorithm? **(03 marks)**

   c) Briefly explain, with examples, how to measure the efficiency of an algorithm. **(05 marks)**

   d) Compare and contrast *polynomial time* and *super-polynomial time* algorithms. **(04 marks)**

   e) Explain how to use the "step count method" to measure the performance of algorithms. **(04 marks)**

2. a) "Some operations can be efficiently performed on a sorted data set". Elaborate this statement. **(04 marks)**

   b) Compare and contrast Heap sort and Merge sort. **(04 marks)**

   c) Explain the "Heapify" process in heap sort with a suitable example and find its time complexity. **(06 marks)**

   d) What are the algorithmic techniques used in Merge sort algorithm? **(03 marks)**

   e) Illustrate sorting of the following data set with the selection sort algorithm.
   [15,13,18,42,25,10, 16,20] **(03 marks)**

3. a) Briefly explain the functions of "Greedy" approach in algorithm designing.   **(05 marks)**

    b) Describe the features of Brute-Force algorithms.
        For what kind of problems, you can apply the "Brute-Force" strategy?   **(05 marks)**

    c) Suppose that you have a bag of size 12. Assume that you want to select a set of items into the bag such that the value of the bag is maximized, if the following list of items are available:

Item (i)	Size (w)	Value (v)
01	7	11
02	5	7
03	3	9
04	4	10
05	2	8

    i.   Find the value of the bag if you use Greedy strategy to collect items into the bag.
    ii.   What is/are the drawback(s) of the above method?
    iii. Describe an algorithm to collect items into the bag if Brute-Force strategy is used.
    iv.   Find the running time of the algorithm you used in iii. above.   **(10 marks)**

4. a) Briefly explain the general features of "Back Tracking" algorithm, and the features of the problems that can be solved using this method.   **(06 marks)**

    b) Consider the following maze. Suppose a robot wants to traverse from **S** to **T**. When traversing through, the robot has to decide between three or fewer choices Go straight, Go left, and Go right.

    i. Illustrate how to find the path from S to T using Backtracking strategy.

    ii. Draw the state space tree rooted at S.

    iii. In Backtracking, there should be a way to go back to the previous states of the solution path. Suggest a suitable structure to keep the states and explain how to use it.

(10 marks)

  c) Compare and contrast Dynamic and Recursive algorithms. **(04 marks)**

5.   The graph given below represents a map of a geographical region. Circled letters and lines represent cities and access roads respectively. The numbers beside the lines are the distances between the respective cities.
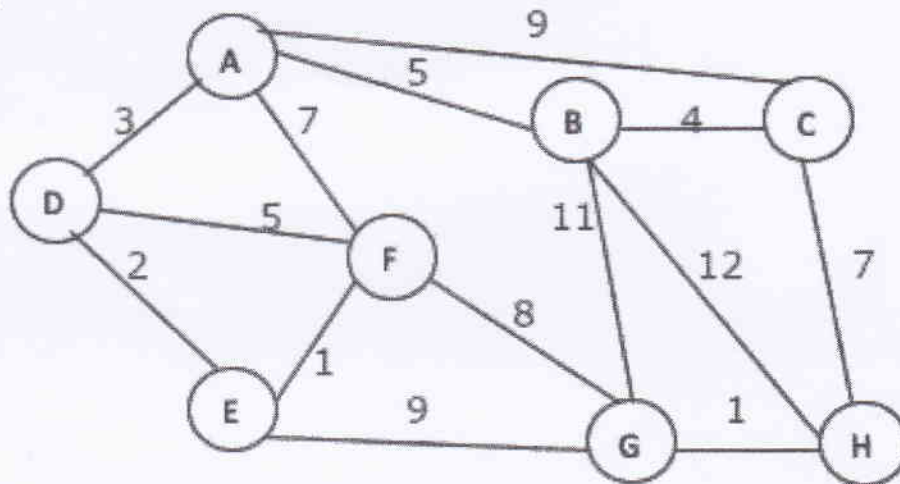
  a) Write a suitable algorithm to find a minimum spanning tree of the graph. **(04 marks)**

  b) Find the time complexity of the algorithm you wrote in a) above. **(04 marks)**

  c) Draw the Breadth-First and Depth-First search trees rooted at city B. **(04 marks)**

  d) Find the shortest path from city A to city G. Illustrate the steps. **(04 marks)**

  e) Depict how to represent the graph using a dynamic structure. **(04 marks)**

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