

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical and Computer Engineering



Study Programme : Bachelor of Science Honours in Engineering
Name of the Examination : Final Examination
Course Code and Title : **EEX4435 Data Structures and Algorithms**
Academic Year : 2023/24
Date : 06th February 2025
Time : 09:30 – 12:30 hrs.
Duration : **3 hours**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **five (5)** questions in **three (3)** pages.
3. Answer all **FIVE (5)** questions. All questions carry equal marks.
4. Answer to each question should commence from a new page.
5. Answers should be in clear handwriting and do not use Red colour pen.
6. Clearly state your assumptions, if any.
7. This is a **Closed Book Test (CBT)**.

Q1

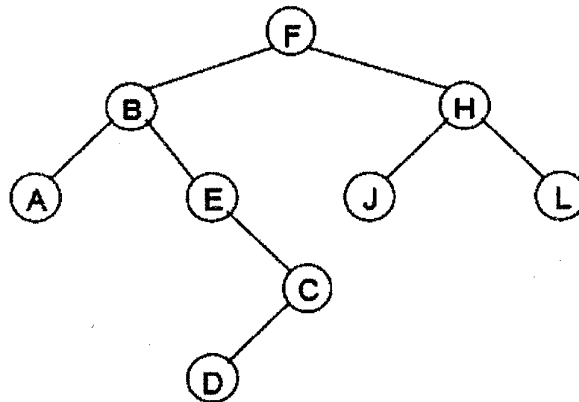
(a) Briefly explain the asymptotic notations for the *time-complexity* analysis. [06]

(b) Each expression below indicates the processing time an algorithm takes to solve a problem of size n . By explaining your work, determine the worst-case time complexity for each. [14]

- i) $\log_2(\log_2(\log_2 n)) + 3 \log_8 n$
- ii) $n(\log_2 n)^2 + n^2 \log_2 n$
- iii) $n(\log_2 n)^2 + n \log_2 n$
- iv) When inserting n elements into an initially empty binary search tree.
- v) Sorting 32-bit unsigned n integers by using Insertion Sort.

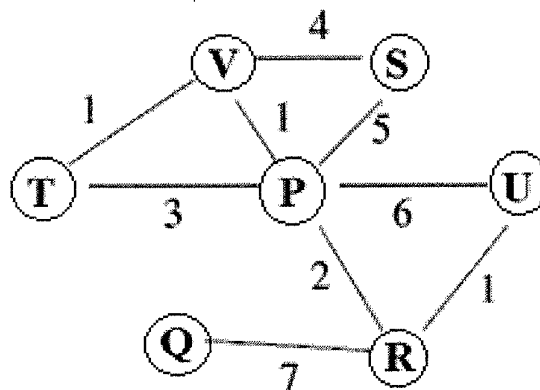
Q2

(a) Consider the binary tree shown below. For each of the traversals listed, give the order in which the nodes are visited. [06]



- i) Pre-order
- ii) In-order
- iii) Post-order

(b) Consider the graph shown below. Starting at vertex U, obtain the list of the vertices that are visited in order by Depth First Search. Show all steps and write any assumption(s) you made. [14]

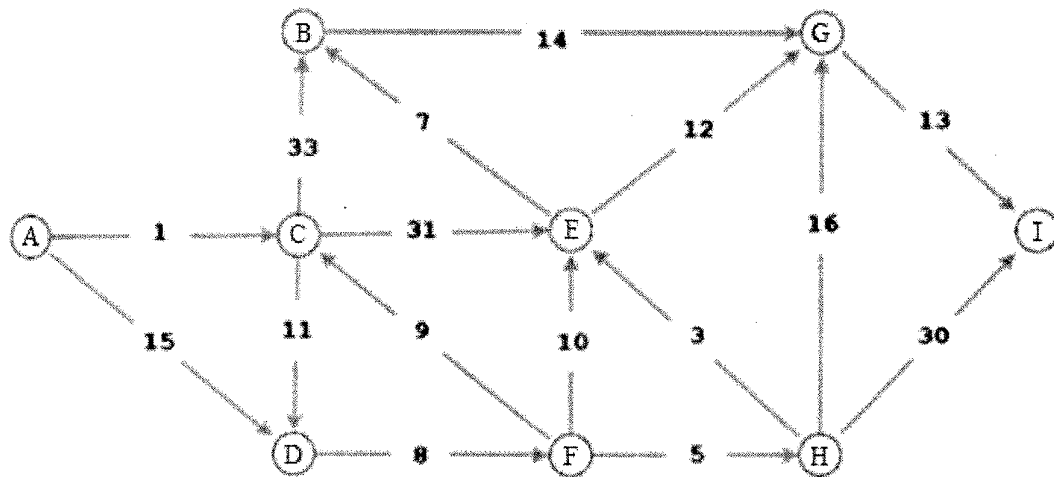


Q3

- (a) Except the Quick Sort, state four other sorting algorithms. [04]
- (b) Briefly describe two functions involved in Quick Sort algorithm. [04]
- (c) Write the complete pseudocode for the functions written in part (b). [12]

Q4

Consider the following directed, weighted graph to answer the questions below.



- (a) Step through Dijkstra's algorithm, calculate the shortest paths from A to every other vertex. Show your steps in the table form. Cross out old values and write in new ones, from left to right, as the algorithm proceeds. [16]
- (b) Show an adjacency list for the above graph. [04]

Q5

- (a) What is a *hash collision*? [04]
- (b) Briefly describe two hash collision resolution techniques. [04]
- (c) Use one of the techniques you mentioned in part (b) to construct a non-collision hash table of length 13 for the given keys in the same order,
 {4684, 4879, 5651, 1829, 1082, 7107, 1628, 2438, 3951, 4758, 6967, 4989}
 by using the hash function,

$$h(k) = (\text{sum of all digits of a key}) \text{ MOD } 13. \quad [12]$$

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