UNIVERSITY OF BRADFORD

Assignment Brief

Data Structures and Algorithms

COS5021-B

Coursework-2 (50%)

The University of Bradford
Faculty of Engineering & Digital Technologies
School of Computer Science, AI, and Electronics

Coursework-2 (50%)

Module Title: Data Structures and Algorithms

Module Code: COS5021-B
Module Credit: 20
Level: L5
Academic Year: 2024/25

Date due: 03 Dec 2024, 15:00
Length limit: There is no limit whereas each question should be explained for each steps performed.

Learning Outcomes:
This assessment will evaluate follow learning outcomes of the module:

LO3: Identify algorithms and demonstrate their operation and effect in solving problems.

LO4: Assess efficiency of various implementations and justify choice of implementation for any application.

LO5: Construct and test simple algorithms using suitable data structures, analyse the complexity and running times for algorithms.

Assessment Methods:
Coursework - This consists of **four (04)** questions including their sub-parts. You need to answer all the questions according to the question asked. **Note:** Understanding the questions is part of the assessment and no AI tools would be used for this assessment.

Please take note of the following regulations/advice where appropriate:

- Check the assignment marking criteria when doing your assessment.
- Go through your lecture/lab materials on the canvas for more understanding.

Guidelines: Prepare a report for each solution based on the guidelines explained below. Include a cover sheet with your name and UoB number. The coursework must be submitted using Canvas by the deadline. Please name your file with your name and UoB number. If you have problems with Canvas, please contact the Module Coordinator as soon as possible.

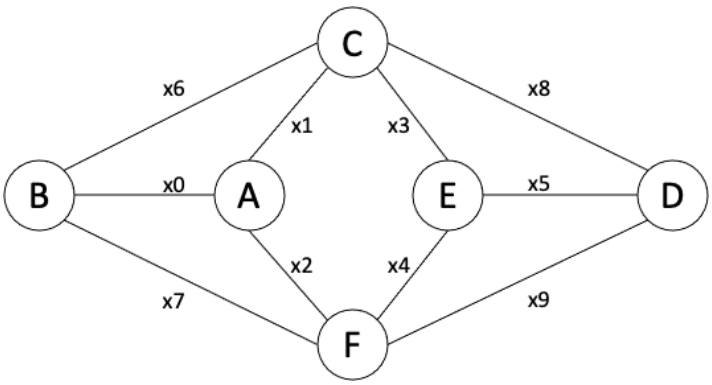
Important Note:

You are expected to submit a report with the solutions of all the following questions. Please note that you should explain your solutions with details. **For this CW, please match the variable with the given keys: [xx, xx, xx, …, xx] = [x0, x1, x2, …, x9]** provided on the Canvas**.**

Q1: Please operate your keys sequentially by Stack and Queue and show each step by tables.
1). push(x0), push(x1), push(x2), isEmpty(), peek(), pop(), pop(), push(x3), push(x4), size(), pop(), isEmpty(); **(10%)**
2). enqueue(x5), enqueue(x6), enqueue (x7), isEmpty(), front(), dequeue(), dequeue (), enqueue (x8), enqueue (x9), size(), dequeue(), isEmpty(); **(10%)**

Q2: Please operate your keys sequentially by Binary Search Tree and 2-4 Tree and show each step by diagrams.
1). Create an empty BST, and insert your keys (x0, x1, x2…) sequentially. Once all the keys have been inserted, please start to delete the keys (x0, x1, x2…) sequentially; **(20%)**
2). Create an empty 2-4 Tree, and insert your keys (x0, x1, x2…) sequentially. Once all the keys have been inserted, please start to delete the keys (x0, x1, x2…) sequentially; **(20%)**

Q3: Based on the key-based weighted graph below, please apply Dijkstra's algorithm to search the shortest path starting from node A.
1). Show each step by table and, at each step, the calculation and the two sets of nodes and distances; one set for which shortest distances have been determined and the other set of the remaining nodes and distances. **(20%)**
2). Analyse the complexity of Dijkstra's algorithm. **(5%)**



Q4: Please sort the given keys using Quicksort and show each step by diagrams. **(10%)** and analyze the complexity of Quicksort. **(5%)**

Coursework 2: Marking Criteria

Since every student gets a different data set, it is not possible to give a sample solution to the coursework. There is a single marking criterion: correctness of the solution. However partial credit will be awarded to solutions based on what mistakes are made. It is very important that for each step of the questions in the entire coursework should be backup with its explanation. For instance, if you insert/delete a key in the tree, you should clearly explain why you have inserted/deleted the key in the respected location. May be due to a current key is less than or greater than the previous key etc. Keep in your mind a mistake at the early stage could end with wrong tree or answers and you will be deducted the marks. Double-check your current step while proceeding with the further steps.

The components of the coursework are weighted as follows:

Q1-1, Stack, **10%**
Q1-2, Queue, **10%**
Q2-1, Binary Search Tree, **20%**
Q2-2, 2-3-4 Tree, **20%**
Q3-1, Dijkstra's algorithm, **20%**
Q3-2, Complexity Analysis, **5%**
Q4-1, Quick Sort, **10%**
Q4-2, Complexity Analysis, **5%**

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