Exercise 2 (3% of total marks)

Due date: Saturday, 10 August 2019

Scope:

The tasks in this exercise consist of activities in the areas of **Data Structures and Algorithms.** The exercise covers the topics discussed for linear data structures – list, stack and queue as well as non-linear data structures – tree, graph and associative table (Hash table).

Marks:

Total mark: 100
Weightage: 3% of total subject mark

Assessment criteria:

Marks will be awarded for:

- Correct,
- Comprehensive, and
- Appropriate

application of the materials covered in this subject.

Deliverables:

Type your solution to each question using MS Word and when done, save your solutions as pdf file-type. The use of MS Word is not compulsory; hand-written solutions are acceptable, but please write them neatly. Similarly, for hand-written solutions, you need to scan the solution and save as pdf file-type.

Please submit your solutions by following the steps described in Submissions section described at the end of this specification.

List, Stack and Queue

Question 1 (20.0 marks)

a. The INORDER traversal output of a binary tree is B, E, D, H, A, F, C, G and the PREORDER traversal output of the same tree is B, A, D, E, H, C, F, G. Construct the tree and determine the output of the POSTORDER traversal output.

(10 marks)

b. Evaluate the following postfix notation of expression. Show status of stack after execution of each operation. Note, you can take '/' as integer division.

16, 2, +, 3, /, 25, 5, +, *

(10 marks)

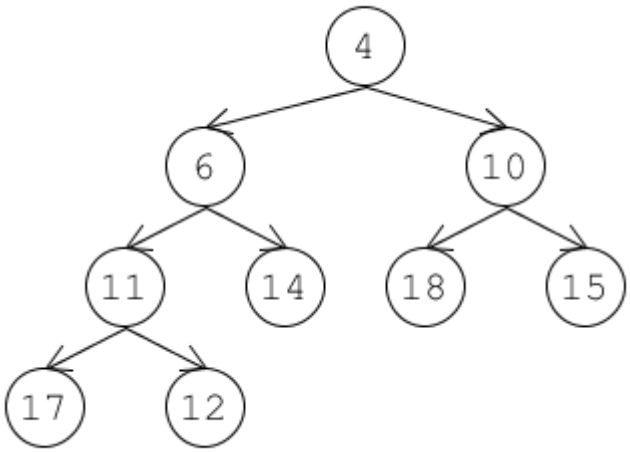
Heap

Question 2 (30.0 marks)

a. What are the minimum and maximum numbers of elements in a heap of height h?
(5 marks)

b. The operation $heapDelete(h, i)$ deletes the item i from the array h. Design an algorithm of $heapDelete$ that runs in $O(\lg n)$ time for an n-element maximum heap. Show that your algorithm runs in $O(\lg n)$. **(15 marks)**

c. Show all the steps of your algorithm (Part b) for removing key 4 from the heap shown below. **(10 marks)**



Sorting – Insertion sort and Selection sort

Question 3 (20.0 marks)

Given the array of integers 14, 1, 10, 5, 6, 4, and 8,

a. Sort the array into ascending order using a selection sort. Write the content of the array each time that the sort changes it. Count the number of comparison operations and swap operations in the sorting. **(10 marks)**

b. Sort the array into ascending order using an insertion sort. Write the contents of the array each time that the sort changes it. Count the number of comparison operations and swap operations in the sorting. **(10 marks)**

In counting the number of comparison and swap, you can assume exchanging of items from one position to another is equivalent to one swap.

Sorting – Mergesort, Quicksort, and Heapsort

Question 4 (30.0 marks)

Given the array of integers 50, 19, 25, 15, 18, 37, 9, 36, and 48,

a. Show the steps that a mergesort takes when sorting the array in ascending order. **(10 marks)**

b. Show the steps that a quicksort with middle-of-three (mean) pivot selection takes when sorting the array in ascending order. **(10 marks)**

c. Show the steps that a heapsort takes when sorting the array in ascending order. **(10 marks)**

Submissions

This assignment is due by **23:59 hour (Singapore time)** on **Saturday, 10 August 2019**.

Save all your solutions in a pdf formatted file, and named them as SolutionQ1.pdf, Solution2.pdf, Solution3.pdf and Solution4.pdf. Next, zip together all your solutions – SolutionQ1.pdf, SolutionQ2.pdf, SolutionQ3.pdf and SolutionQ4.pdf and named it as YourNameE1.zip. Alternatively, you may also work and save all your solution to this exercise in one document and save it as YournameE2.pdf.

Submit the files **YourNameE2.zip** through Moodle in the following way:

1) Access Moodle at http://moodle.uowplatform.edu.au/
2) To login use a Login link located in the right upper corner the Web page or in the middle of the bottom of the Web page
3) When successfully logged in, select a site CSCI203 (SP319) Algorithms and Data Structures

4) Scroll down to a section Submissions of Exercises
5) Click at Submit your Exercise 1 here link.
6) Click at a button Add Submission
7) Move a file, for example, **YourNameE2.zip** into an area. You can drag and drop files here to add them. You can also use a link *Add…*
8) Click at a button Save changes,
9) Click at a button Submit assignment,
10) Click at the checkbox with a text attached: By checking this box, I confirm that this submission is my own work, … in order to confirm authorship of your submission,
11) Click at a button Continue.

A policy regarding late submissions is included in the subject outline.

Only one submission per student is accepted.

A submission marked by Moodle as "late" is always treated as a late submission no matter how many seconds it is late.

A submission that contains an incorrect file attached is treated as a correct submission with all consequences coming from the evaluation of the file attached.

Exercise 2 is an individual assessment and it is expected that all its tasks will be solved individually without any cooperation with the other students. Plagiarism is treated seriously. Students involved will likely receive zero. If you have any doubts, questions, etc. please consult your lecturer or tutor during lab classes or over e-mail.

End of specification