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09.30 - 11.30am

CMPU 1014 Introduction to
Algorithms

Basement 2, Kevin Street

Programme Code: DT211C

Module Code: CMPU 1014
CRN: 22499

TECHNOLOGICAL UNIVERSITY DUBLIN

KEVIN STREET CAMPUS

BSc. (Honours) Degree in Computer Science (Infrastructure)

Year 1

SEMESTER 2 EXAMINATIONS 2018/19

Introduction to Algorithms

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Dr. Deirdre Lillis

Answer 3 out of 4 Questions

All questions carry equal marks
Each student will be awarded a bonus of 1 mark

Question 1

- a) What is meant by the term "algorithm"? List 4 key properties of algorithms. Why are algorithms important in computer science?
(10 marks)
- b) Explain, using pseudocode, how to find the minimum, maximum and sum of a set of numbers ($a_1, a_2 \dots a_n$) in an array (A) of size n .
(11 marks)
- c) Draw a flowchart for the above procedure.
(12 marks)

Question 2

- a) Explain with the aid of pseudocode how the bubble sort works. Your answer should demonstrate how the algorithm would sort a set of 6 values, showing the results after each pass.
(10 marks)
- b) The insertion sort models the manual shuffling technique used to sort a deck of cards. Demonstrate with the aid of pseudocode how this works – show how the sort works on the same set of data.
(10 marks)
- c) Using Big-O notation, illustrate the complexity of each sorting algorithm.
(3 marks)
- d) Describe, using pseudocode, either the Quick Sort or Merge sort algorithms. Use Big-O notation to illustrate the complexity of your algorithm.
(10 marks)

Question 3

- a) What is the difference between Queue and Stack data structures. Use a diagram to explain the difference. (6 marks)
- b) Write pseudocode for adding and removing elements from a queue data structure using a linear array A with a maximum of $QMAX$ elements. (12 marks)
- c) Evaluate the following postfix expressions using a stack - show the contents of the stack at each stage :-
i. $4\ 4\ 8\ * + 9\ /$
ii. $5\ 8 + 8\ 7 + -$
iii. $2\ 2\ ^ 2 + 3\ /$ (6 marks)
- d) Write pseudocode to populate a stack with user input characters and then print the reverse. Assume standard stack operators are available such as $pop()$, $push()$ and $isEmpty()$. The stack is implemented as a linear array A with a maximum number of elements $SMAX$. (9 marks)

Question 4

- a) What is a binary search tree? What is meant by the following terms in relation to binary trees –Perfect, Balanced and Complete? (8 marks)
- b) Write pseudocode for the insertion of a new node into a binary search tree. (12 marks)
- c) Draw a binary tree for the following values – 13, 9, 7, 8, 6, 20, 30, 25, 21 (7 marks)
- d) What is the result of traversing the above tree in 3 modes – inorder, preorder and postorder? (6 marks)