National College of Ireland

Higher Diploma in Science in Computing – Part-time – Year 1 – HDCSDEV

Semester Two Examinations – 2014/15

Tuesday 12th May 2015
6.30pm – 8.30pm

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Data Structures and Algorithms

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Answer Question A and answer either Question B or C

Duration of exam: 2 hours
Attachments: None

Question A [60 Marks]
Answer all parts of this question. Each part carries 10 marks.

1. Write the java class interface for the queue abstract data type that supports the following operations in the stack:
    *   Enqueue
    *   Dequeue
    *   Size
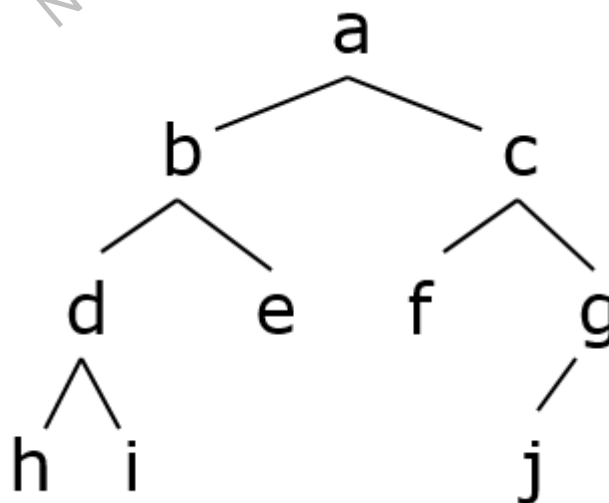   *   IsEmpty

    [10 Marks]

2. What are the two main elements of a recursive coding solution? Outline an example problem and how recursion can be used to solve it.

    [10 Marks]

3. From the tree diagram below, identify:
    *   The root of the tree
    *   The size of the tree
    *   Is it is a binary tree?
    *   The height of node e
   *   The depth of node i

    [10 Marks]

4. Compare the process of inserting into a Single Linked List with that of inserting into a Double Linked Link.

    [10 Marks]

5. Identify and explain the Java feature that the ArrayList class uses to improve its type safety. In your answer give an example of instatiating an ArrayList of *Person* objects that uses this feature.

    [10 Marks]

6. Describe the key features of the graph below.
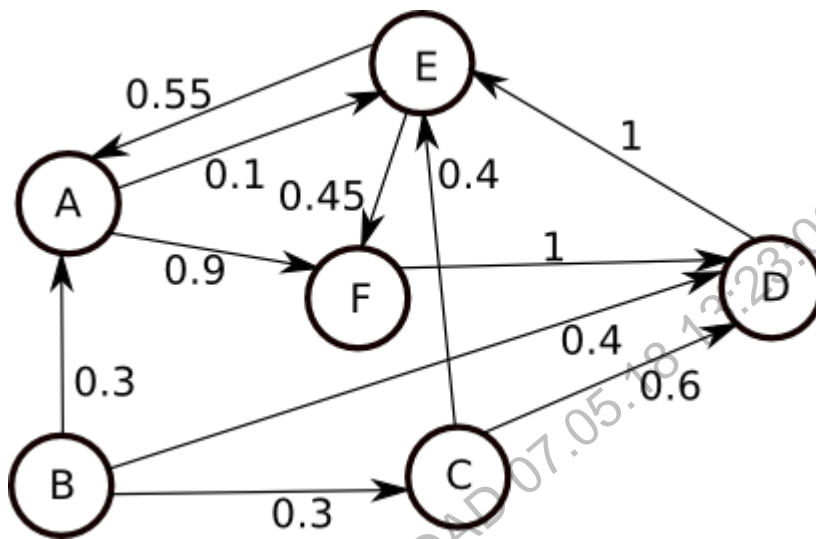
[10 Marks]

Answer Question B or C [40 marks]

Question B [40 Marks]

a) A postman's route has been designed using a data structure whereby each entry has details for that house (house number and owner name) and a link to the next house on the route. What is this type of data structure called?

[5 Marks]

b) Provide the java code that models an entry (node) in this data structure.

[10 Marks]

c) Provide the java code to list out the route from start to finish.

[10 Marks]

d) Outline the changes required to the data structure if it should allow for backwards as well as forwards traversal. Include the java code that models a node in this changed structure.

[15 Marks]

Question C [40 Marks]

A holiday company has commissioned a phone call handling system that allows callers to input their first name and the approximate cost of the holiday they wish to purchase. Callers wishing to purchase a higher value holiday are dealt with before callers wishing to purchase a lower value holiday.

Answer the following questions about the implemention of such a system:

1. What type of abstract data structure would you use to manage the waiting calls? Explain your answer.

[10 Marks]

1. Provide the java code of an appropriate Element class that is capable of storing the caller's approximate holiday cost (as an integer) and their first name. Your code should include getters and setters for each of the caller's attributes.

[10 Marks]

2. Provide the java code for a CallsWaiting class that implements the data structure mentioned in your answer to Part 1 of this question. The class should hold information on all the callers waiting to be answered and should use the Element class mentioned in your answer to Part 2 of this question. Your code should include the methods to add a caller and to get the next caller.

[20 Marks]