National College of Ireland

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

Autumn/Repeat Examinations – 2014/15

Tuesday 18th August 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. Explain the concept of Tree Traversal. In your answer describe the three forward (left to right) traversal techniques and indicate the order of the nodes visited under each technique in the following tree.
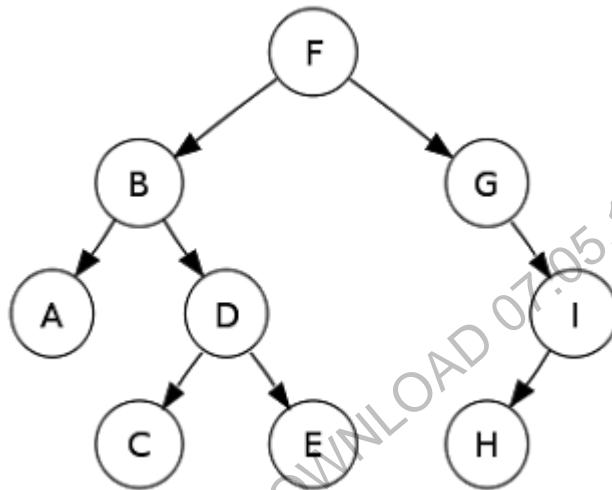
[10 Marks]

2. Explain the main concepts of recursion. Give an example of how recursion could be used to solve a coding problem.

[10 Marks]

3. Differeniate the abstract data types Queue and Priority Queue, in particular considering the actions of adding and removing items from the data structure.

[10 Marks]

4. Compare and contrast Single Link Lists and Double Linked Lists.

[10 Marks]

5. Explain the concept of a Binary Search Tree. In your answer give the Java code for a Node class capable of storing a node of a Binary Search Tree.

[10 Marks]

6. Draw an example of a simple, weighted, directed graph with four nodes.

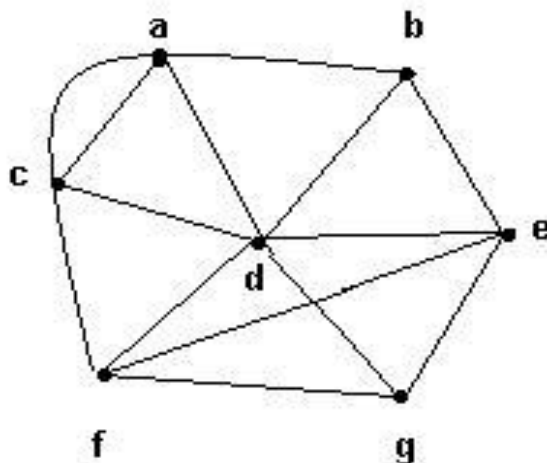[10 Marks]

Answer Question B or C [40 marks]

Question B [40 Marks]

a) Given the following adjancency matrix for a simple graph, name two key features of the graph and how we can identify these features from the matrix.

	a	b	c	d	e	f
a	0	1	0	0	0	4
b	0	0	0	3	0	0
c	0	5	0	0	2	0
d	3	0	7	0	0	0
e	0	0	4	2	0	0
f	0	0	0	3	0	0

[10 Marks]

b) Given the graph below, answer the following.
   a. What terminology is used to describe the individual points?
   b. What terminology is used to describe the connection between two points?
   c. What is the degree of point d?
   d. Is this a simple graph? Why?
   e. Is this a connected graph? Why?

[10 Marks]

c) Describe two solutions to storing a graph in a data structure. In your answer include criteria for why you might choose one structure over another.

[20 Marks]

Question C [40 Marks]

You have been asked to write a video playback app. The app operates a custom playlist of videos to play. The app allows for the insertion and removal of songs at any position within the list. Videos are normally played in a forward sequence automatically but the user can also skip both forwards and backwards using Next and Previous buttons.

The Video class consists of the following attributes:
    String VideoName
    String VideoGenre
    int timeInMinutes

Answer the following questions about the implemention of such a system:
1. Indicate the most suitable Abstrat Data Type to be used for managing the playlist feature, with particular focus on the <u>next</u> and <u>previous</u> commands.

[10 Marks]

2. Provide the java code of the Video class that holds the video details. You code should include getters and setters for each of the Video's attributes.

[10 Marks]

3. Provide the java code for a VideoPlayListManager class that holds information on all the videos in the playlist. For the sake of simplicity you can assume the following features of the Video Playback app that will use this class:
    -   It will always start with the first video in the playlist
    -   It will always add videos to the end of the playlist
    -   Once a video has been added to the playlist it cannot be removed
    -   The object returned by the VideoPlayListManager should allow the Video Playback app find the next and previous videos itself.

    Your code should include :
    -   An interface of the Abstract Data Type
    -   A class implementing your interface

[20 Marks]