1 A software company decides to release a duplicate file finder which it has named “De-Duplicator”. Duplicate files are files that are exactly the same (bit for bit identical). Space is often wasted on computers by having multiple versions of the same file. Duplicate file finders are programs that find and identify duplicate files on a hard drive so that they can be removed.

De-Duplicator creates a tree to represent directories and files on the system. It then traverses each directory and file represented in the tree. It does this using a depth-first traversal. State what order it will visit each of the **files** as shown in Fig.1 below.

--- [3]

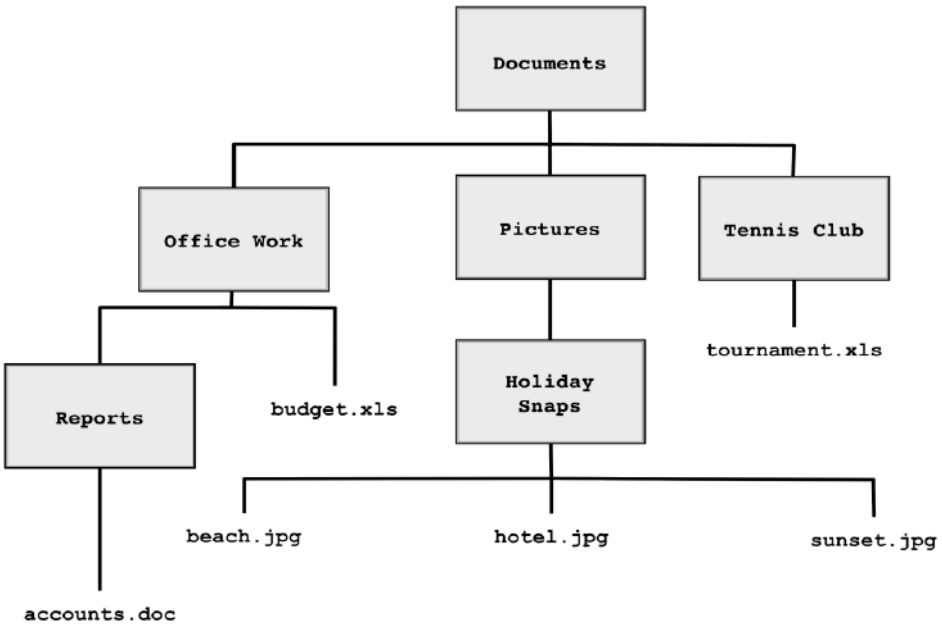
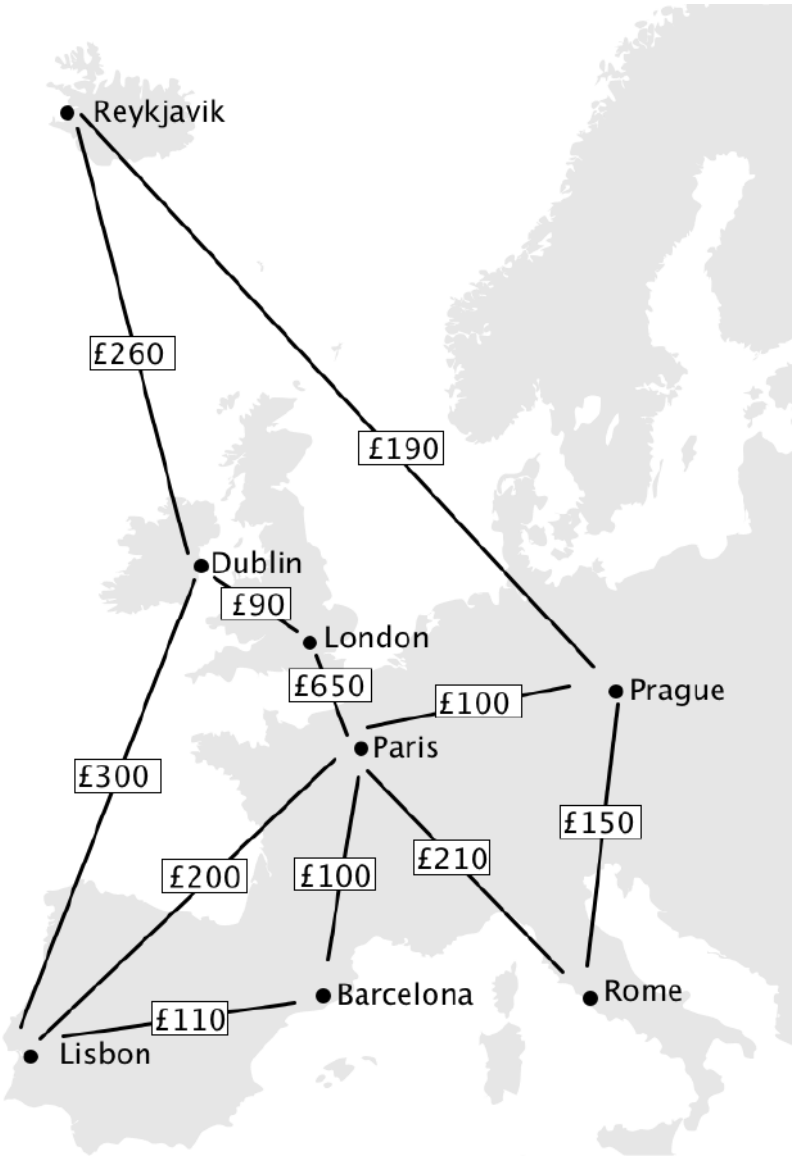


Fig.1

2(a) Atlas Airlines runs flights across cities in Europe. It stores the prices of different flights in its computer system.



State a data structure that would be suited to represent the data above.

---

[1]

(b) A function `tripCost` has been written that takes in two cities and returns the price of a direct flight between them.

e.g. `tripCost("Dublin", "London")` returns 90

A journey is represented by an array called cities. An example of a trip from Dublin to Rome is shown below:

Dublin
London
Paris
Rome

(i) Write a program in the language or pseudocode of your choice that uses the cities array to calculate and output the cost of a given journey as a monetary value. In the case above this would be £950.

[5]

(ii) Rather than storing cities in an array you could use a linked list.

Describe a difference between an array and a linked list.

[2]

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(c) Each airport has a three letter code. The airline's system stores the airports and corresponding airport codes:

Code	Name
BCN	Barcelona International
DUB	Dublin
LIS	Lisbon
LHR	London Heathrow
CDG	Paris, Charles De Gaulle
PRG	Prague
RKV	Reykjavik
FCO	Rome, Fiumicino

In a programming language or pseudocode of your choice write a program that takes in an airport code and finds and displays the airport name. You can assume a 2D array called airports has already been declared and populated with the data above. There is no need to validate the input and you can assume that the user will only enter a code that exists in the array.

---

[6]

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3 Data structures may be described as static or dynamic.

(i) State the meaning of the term static.

(ii) State **one** type of data structure that is always considered to be static.

(iii) State the meaning of the term dynamic.

(iv) Give **one disadvantage** of using a dynamic data structure.

---

[4]

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4 Laser Tag is a game where teams of players move round an arena shooting each other with infrared guns. Players wear sensors that keep track of how many times they have been hit by the laser. This is known as being 'tagged'.

At the end of each match players upload their score to a computer. The computer stores the scores in the order they are received in a 2D array called `player`. The array stores the team as an integer (1 for green, 2 for red) and their score. An extract of the array called `player` is shown below. The first entry shows a green team member scored 45 points and the next shows a red team member scored 30 points.

1	45
2	30
2	46
1	31
1	10
1	32
2	2

Once all the players have uploaded their scores the computer adds up the scores for each team.

Using pseudocode write a program for a procedural language that works out and outputs the total score for each team. You may assume that there are always 20 players.

[6]

5(a) A binary search tree is used to store the names of dog breeds.

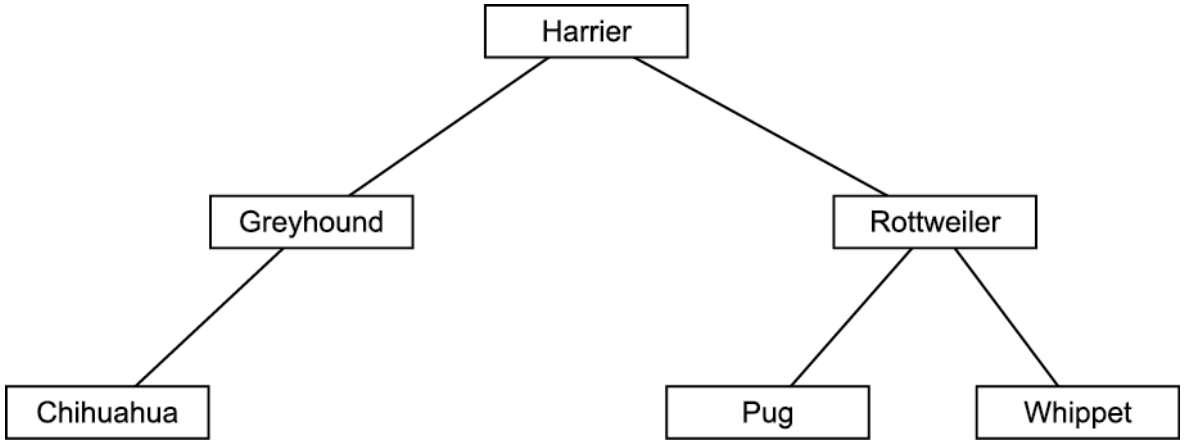

Fig. 7.1

The breeds Doberman and Dalmatian are added to the tree in that order. Add them to Fig. 7.1.

[2]

(b) Explain how you would determine if the breed Pug is in the binary search tree.

---

[3]

(c) Explain how you would determine if the breed Spaniel is in the binary search tree.

---

[3]

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(d) The tree is coded using object oriented programming.

Each dog breed is represented by an object of class Node.

The Node class has the methods:
getLeftNode () – returns the left hand child node or null if there is no left hand child.
getRightNode () – returns the right hand child node or null if there is no right hand child.
getBreed () – returns the name of the breed stored in that node.

The program allows for a breed name to be entered, and depending on whether the breed is in the tree or not, displays either:

```
<breed name> is not in the tree.
```

or

```
<breed name> is in the tree.
```

Complete the program below. Credit will be given for readability of code.

```
name=input("Enter the name of a breed")
breedNode=tree.root() //breedNode is an object of type Node
                      //representing the root of the tree
```

[6]

6 A coach company offers tours of the UK.

A linked list stores the names of cities on a coach tour in the order they are visited.

(i) Describe what is meant by the term ‘linked list’.

[3]

(ii) The tour is amended. The new itinerary is: London, Oxford, Manchester then York. Explain how Birmingham is removed from the linked list and how York is added. You may use the diagram below to illustrate your answer.

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[4]

7(a) Stacks and queues are both data structures.

State which of a stack or queue would be considered as a ‘First In First Out’ data structure.

[1]

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(b) A queue is shown in Fig. 4.3.

Draw what the queue shown in Fig 4.3 would look like after the following operations:

```
enqueue("A"), enqueue("B"), dequeue(), enqueue("C"), dequeue(),
enqueue("D")
```

Fig. 4.3

[2]

END OF QUESTION PAPER

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