OCR

Oxford Cambridge and RSA

A Level Computer Science

H446/01 Computer systems

Sample Question Paper

Date – Morning/Afternoon

Time allowed: 2 hours 30 minutes

Do not use:
- a calculator

First name									
Last name									
Centre number						**Candidate number**				

INSTRUCTIONS
- Use black ink.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **140**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

Answer **all** questions.

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.

(a) A duplicate file finder is an example of a utility. Describe what is meant by a utility.

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……**[2]**

(b) 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.

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……**[3]**

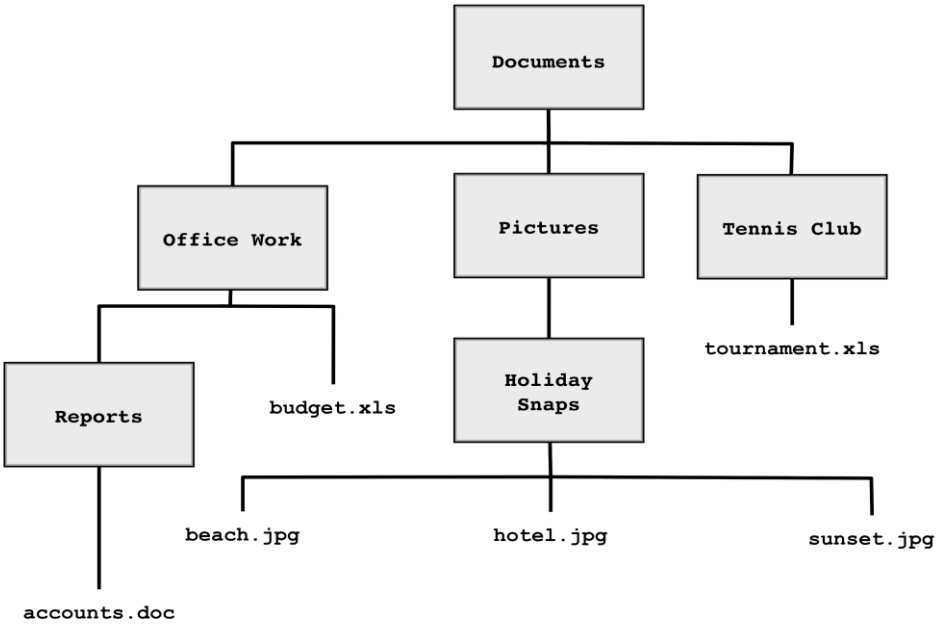

Fig.1

(c) Every time the program encounters a file it takes a hash of the file and checks it against a list. If the hash exists in the list, the file is marked to be deleted. If the hash does not exist it is added to the list.

(i) Explain **two** characteristics you would look for in a hashing algorithm for this purpose.

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(ii) After running the program a user finds that they still have apparent duplicates of some of their images. Explain why these apparent duplicates might still be present.

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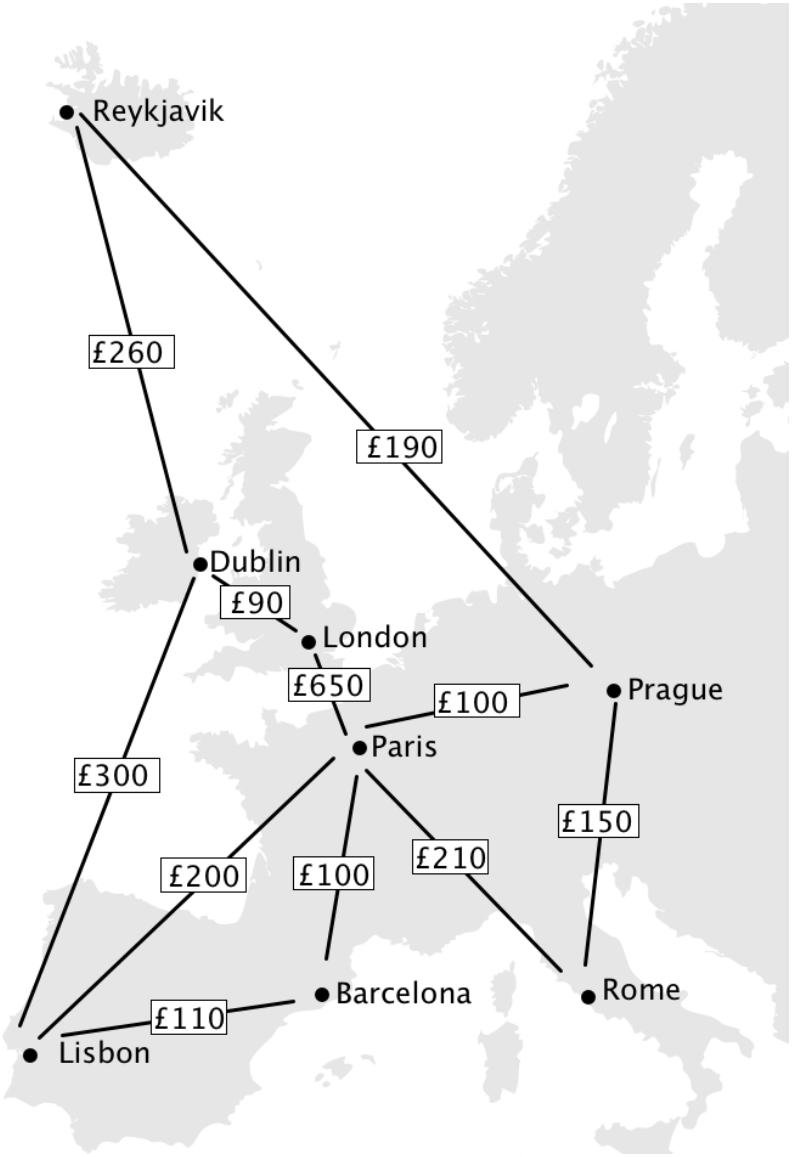
(d)* The software team that produces De-Duplicator decides to make a new version that can detect duplicated images the previous version could not. The software team must decide which methodology they will use for the project. Some members of the team suggest extreme programming whilst others would prefer to use the waterfall lifecycle.

Discuss the **two** methodologies **and** justify which you would recommend.

[12]

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



(a) 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.

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

Describe a difference between an array and a linked list.

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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.

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3 The Big Brains exam board has produced a website that allows students to access revision videos.

All pages in the site contain the following tag in the head section.

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<link href="themes/standard.css" rel="stylesheet" type="text/css" />
```

(a) Describe **one** advantage of storing the CSS in an external file rather than it being embedded within HTML files.

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……**[3]**

(b) The exam board wants to limit access to those students with a school email account (i.e. one ending **.sch.uk**). When students sign up JavaScript is used to check that the email address they have entered is from a school account. The address is checked again when it reaches the server before login details are sent to the address.

Explain why it is important to check the email address with JavaScript and again when it reaches the server.

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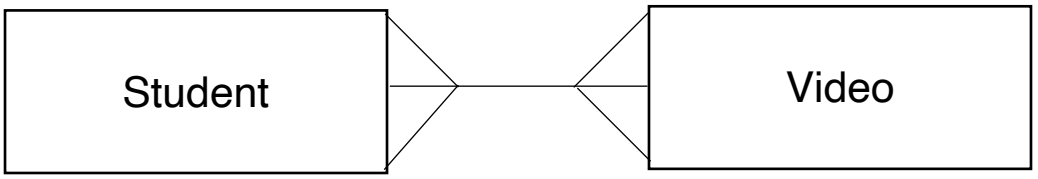
(c) The exam board wants to use a database to keep track of which videos each student has viewed. The structure it plans to use is shown below:



(i) Identify **one** reason why this structure would not be suitable.

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……**[1]**

(ii) Draw a new version of the structure to solve this problem.

[3]

(d) The video table consists of the following fields: VideoID, VideoName, Presenter, Topic.

(i) Describe what is meant by the term *primary key*.

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(ii) Write an SQL query that finds the name and presenter of all videos on the Topic of "The CPU".

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……**[4]**

4 Livid Lizards is a computer game in which players get to fire lizards from a cannon to knock down walls. Players get to pick different types of lizards, each with qualities and special powers.

The game is coded using an object-oriented language. Below is the code for the lizard class:

```
class Lizard

      private speed
      private mass
      private size

      public procedure new(givenSpeed, givenMass, givenSize)
            speed=givenSpeed
            mass=givenMass
            size=givenSize
      endprocedure

      public function breakBlock(brick)
            if speed*mass>=brick.getStrength() then
                  speed=((speed*mass)-brick.getStrength())/mass;
                  return true
            else
                  return false
            endif
      endfunction

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endclass
```

(a) Lizard is a class. Describe what is meant by a class.

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(b) Identify an attribute in the Lizard class.

.....**[1]**

(c)

(i) Describe what is meant by the term *inheritance*.

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(ii) Explain **one** way the game's developers might use inheritance for Livid Lizards.

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(d) The game uses a 2D graphics library. Explain why a linker would need to be used after compilation.

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5 The program, as shown in Fig.2 below, is written in assembly code using the Little Man Computer instruction set. It is *supposed* to take in two numbers and output the higher.

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        INP
        STA   NUMA
        INP
        STA   NUMB
        SUB   NUMA
        BRP   NOTA
        LDA   NUMB
        BRA   QUIT
NOTA    LDA   NUMA
QUIT    OUT
        HLT

NUMA    DAT
NUMB    DAT
```

Fig.2

(a) State what type of translator program would be needed to convert the code above into machine code.

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(b) The program does not work correctly. Describe what the program actually does, using the numbers 4 and 9 being entered as an example.

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……**[2]**

(c) Explain how you would correct the program so it outputs the higher of the two numbers entered.

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(d) Programs can also be written in high level languages. In pseudocode write a procedural program that takes in two numbers and outputs the higher of them.

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A processor executes this program following the Fetch-Decode-Execute cycle. To do this it needs to make use of registers.

One of the registers used is the Program Counter (PC). Ordinarily it would be incremented by one each cycle.

(e)

(i) Identify an instruction in the Little Man Computer program shown in Fig.2 that would cause the PC to change in a different way.

……**[1]**

(ii) State which register the contents of the PC would be copied to in order for the processor to access the next instruction.

……**[1]**

6 People burn calories as they move around. 'FitFeet' trainers come with an attachable device. This device estimates the calories burnt by the user whilst wearing the trainers. Users can then upload this information to their computers.

(a) Describe a sensor that the device might include to help monitor calories burnt.

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……**[2]**

(b) The device stores its data on flash memory. Explain why flash storage would be more appropriate than a magnetic hard drive for this device.

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……**[3]**

(c)* The company wants users to be able to register with its website. Users will provide details such as their weight, height, any allergies and pre-existing medical conditions. The system will use this information along with the data on their calories burnt to recommend meal plans for the user.

Discuss the legal **and** ethical issues the company needs to consider for such a system.

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[9]

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(a) Two equal (unsigned) integers, shown below, are added together. Calculate the result, showing your working.

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00010101
00010101  +
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```

[2]

(b) State which bitwise manipulation on 00010101 would have achieved the same result as the calculation on part (a).

……**[1]**

(c) Convert the denary number -52 into an 8-bit binary number using two's complement.

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……**[2]**

(d) Describe why two's complement may be preferable to sign and magnitude.

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……**[2]**

(e) Using floating point representation with 4 bits for the exponent and 4 bits for the mantissa add together the following floating point binary numbers and write the answer as a normalised floating point number with 4 bits mantissa and 4 bit exponent.

0110 0010 and 0100 0011

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……**[3]**

(f) Demonstrate subtraction in binary using 8-bit two's complement using the equivalent of the denary calculation 47-23. You must show all working.

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……**[4]**

8 A gaming company decides to release a new video games console. The console will use a modified version of an operating system called Linux.

(a) Describe **two** functions an operating system might be expected to carry out on the console.

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……**[4]**

(b) Linux is open-source.

Explain how Linux being open-source would benefit the games company.

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(c) As well as a CPU the console contains a GPU for 3D graphics. Explain why a GPU is more suitable than a CPU for this task.

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(d) Explain **two** reasons why games designed for other companies' consoles may not work on this machine.

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[4]

(e)* *"Video games have a negative effect on those who play them."*

Discuss whether or not you agree with this statement showing you have considered both points of view.

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[9]

9 Zuhair wants to create a Local Area Network (LAN) for himself and his family, in his home.

(a) Describe what is meant by a LAN.

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[2]

(b) TCP/IP uses packet switching.

Explain what is meant by packet switching.

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[4]

10 The truth table below has two inputs, A and B, and two outputs, S and C.

INPUTS		OUTPUTS	
A	B	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

(a)

(i) Write a logic expression for S in terms of A and B.

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……**[1]**

(ii) Write a logic expression for C in terms of A and B.

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(iii) Use the expressions for S and C to draw a single logic circuit for the truth table.

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(b) Using the rules for manipulating Boolean expressions simplify the following:
A∧B ∨ A∧(B∨C) ∨ B∧(B∨C)

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