OCR
Oxford Cambridge and RSA

AS Level Computer Science

H046/01 Computing Principles

Monday 6 June 2016 – Morning

Time allowed: 1 hour 15 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.
- If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **70**.
- 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 **16** pages.

Answer **all** the questions

1 See And Believe is a company that specialises in computer-generated imagery (CGI) for films.

Producing CGI requires lots of processing power and so the company has a large number of high-performance computers.

(a) Explain why See And Believe would use a distributed operating system.

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(b) The processors in the company's powerful computers have fast clock speeds and large amounts of cache memory. Describe how each of these improves the processor's performance:

(i) fast clock speed

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(ii) large cache memory

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(c)* The company is working on scenes from the latest *Stellar Scuffles* film. There is strict security around the film, and there are worries about unauthorised people gaining access to the company's network and putting clips from the film on the Internet.

Discuss to what extent each of the following laws is intended to address the issue of someone accessing and distributing clips of the film online:

- the Computer Misuse Act
- the Copyright Design and Patents Act
- the Data Protection Act.

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..... **[9]**

2 Elegant Bags is a company that makes designer handbags. It has decided it wants to sell its products online.

Elegant Bags puts its website on its servers which are given a public IP address. It also purchases the domain name `elegantbagsonline.co.uk`.

(a) Explain the automated process that takes place that allows customers to access the site when they enter the domain name into their browser.

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The company's handbags come in a variety of materials. It would like visitors to its website to be able to select different materials in their browser and for the image shown to then instantly change to one of a handbag made of the selected material.

(b) Explain how the website developer would implement this. You are not expected to write any code.

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(c) Elegant Bags prides itself on its ethical reputation.

(i) State **one** ethical issue the company may have considered when designing its website.

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(ii) State **one** action the company could take to address the ethical issue identified in part **(i)**.

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

3 A burglar alarm runs on a processor with the Little Man Computer (LMC) instruction set.

One of the instructions in the set is Branch if Positive (`BRP`).

(a) Describe what the instruction `BRP` does.

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..... **[2]**

A numeric PIN code entered into the burglar alarm is compared with the code stored at the memory location `passcode`.

If the codes match, the program jumps to the part of the program labelled `deactivate`.

If the codes do not match, the program jumps to the part of the program labelled `alarm`.

(b) Write the LMC code to meet the requirements above. (You don't have to write the code for labels `deactivate` and `alarm`, as you can assume this has already been written elsewhere.)

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4 A programmer spends her spare time contributing to an open source application that converts video files from a range of formats to one which uses lossy compression.

(a) Describe what is meant by the term 'open source software'.

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(b) Describe what is meant by the term 'lossy compression'.

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When a video is selected, the program gives an estimate of the file size of the converted video. The estimate in kilobytes is calculated by multiplying:

- the number of pixels in the video's resolution by…
- the number of frames per second by…
- the length of the video in minutes by…
- the value 0.0013.

(c) Write a function in pseudocode that estimates the size of a converted video.
It should:

- take in 3 parameters: `pixels, framesPerSec, lengthMins`
- calculate the estimated file size
- return a string with the file size, including units
- use megabytes for sizes under 1000 megabytes, otherwise the estimate should be given in gigabytes.

Examples:

- 480000 pixels at 24 frames per second for 60 minutes will return a size of 898.56 MB
- 480000 pixels at 24 frames per second for 120 minutes will return a size of 1.797 GB.

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The coding team are looking at writing a new closed source version of the application that converts audio and image files in addition to video. They intend to sell copies of the program when it is complete. They investigate three programming languages they could use, including:

- **C++**, which is compiled to machine code
- **Java**, which compiles to an intermediate code that then runs off a virtual machine
- **JavaScript**, which runs from an interpreter in a web browser.

(d)* Discuss the benefits and drawbacks of the three options above and justify which option you would recommend.

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5 **(a)** Give the number 55 in binary as an 8-bit unsigned integer.

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(b) Represent the number 55 in normalised floating point binary notation, using 8 bits for the mantissa followed by 8 bits for the exponent, both in two's complement binary.

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(c) Represent the number 55 in normalised floating point binary notation, with the mantissa and exponent both in two's complement binary, using as few bits as possible.

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(d) State why a programmer might choose to declare a variable as a floating point number.

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Turn over for the next question

6 An insurance company's offices have a large number of black and white printers.

The company's technicians keep accurate records of the printers in the building, and the quantity of toner cartridges in stock, in a flat file database. An extract of the database is shown in Fig. 1.

Printer Model	Location	Notes	Cartridge Code	Quantity in stock	Re-order URL
LasPrint LP753	office 3		LP-7XB	12	www.megacheapprint.com/toner/LP-7XB
LasPrint LP710	office 6	drum replaced	LP-7XB	12	www.megacheapprint.com/toner/LP-7XB
Zodiac ZN217	reception		Zod17	4	www.zodiaclaserprinting.com/shop/Z17
Zodiac ZN217	conference Room 2	had to add RAM	Zod17	4	www.megacheapprint.com/toner/LP-7XB
LasPrint LP753	office 8		LP-7XB	12	www.megacheapprint.com/toner/LP-7XB

Fig. 1

(a) Describe **two** issues, referring to Fig. 1, that might arise from using a flat file database structure.

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A relational database is created with three tables:

- PrinterModel: this stores all the data about each model of printer
- PrinterInstance: this stores the data about each individual printer in the building
- Cartridge: this stores information about the toner cartridges.

(b) Draw an entity-relationship diagram to show the relationships between the three tables.

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Most of the printers have their own on-board RAM.

(c) State what the printers' RAM is used for.

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

7 A DIY store has an offer: 'Spend £20 or more on decorating products and get 10% off all gardening products.'

When items are scanned in at the checkout they are stored in a 2-dimensional array called `purchases`, which stores the item name, category and price.

A receipt with the appropriate discounts deducted is then produced.

Examples of the array and corresponding receipt are shown in Fig. 2 and Fig. 3.

Matt Pink Paint	Decorating	6.99
Floral Wallpaper	Decorating	7.99
Magnolia Gloss Paint	Decorating	5.49
Weed Killer	Gardening	2.99
Picture Frame	Decorating	8.99
Plug Socket	Electrics	6.99
Doorbell	Electrics	15.99
Matt White Paint	Decorating	4.99
Tiles	Decorating	19.99
Grass Seed	Gardening	1.99
Lawn Mower	Gardening	129.99

Fig. 2

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Matt Pink Paint £6.99
Floral Wallpaper £7.99
Magnolia Gloss Paint £5.49
Weed Killer £2.99
-£0.30 discount
Picture Frame £8.99
Plug Socket £6.99
Doorbell £15.99
Matt White Paint £4.99
Tiles £19.99
Grass Seed £1.99
-£0.20 discount
Lawn Mower £129.99
-£13.00 discount
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TOTAL: £198.89
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Fig. 3

Write an algorithm in pseudocode, using the array `purchases`, to:

- determine which items are given a discount
- calculate the total price to pay
- present this information on a receipt in the format shown in Fig. 3. **[6]**

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END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page. The question number(s) must be clearly shown in the margin(s).