GCSE
COMPUTER SCIENCE

Unit 2   Computing Fundamentals

Wednesday 8 June 2016   Morning   Time allowed: 1 hour 30 minutes

Materials
You will need no other materials.
You must **not** use a calculator.

Instructions
- Use black ink or black ball-point pen. Use pencil only for drawing.
- Answer **all** questions.
- Questions 7 and 8 should be answered in continuous prose.
  In these questions you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 84.
- You are reminded of the need for good English and clear presentation in your answers.

Answer **all** questions in the spaces provided.

1 (a) State the **binary** representation of the denary number 87.

[1 mark]

_____

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1 (b) State the **binary** representation of the hexadecimal number CE. You must show your working.

[2 marks]

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1 (c) Place these **three** numbers into order of size (**1–3** where **1** is the largest and **3** is the smallest).

Number	Order (1–3)
The denary number 12	
The binary number 1110	
The hexadecimal number D	

[2 marks]

1 (d) What is the minimum number of bits needed to be able to represent any character from a character set that contains only the 26 lower-case letters of the alphabet?

[1 mark]

_____

_____

1 (e) Describe how a **date** (e.g. 15/06/16) could be represented using a data structure.

[2 marks]

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1 (f) Two typical secondary storage devices, with the same cost, are advertised as follows.

Device A	Device B
Solid state drive, capacity 128GB	Magnetic hard drive, capacity 1TB

1 (f) (i) State **one** reason why **Device B** could be considered a better choice than **Device A**.

[1 mark]

_____

_____

1 (f) (ii) State **two** reasons why **Device A** could be considered a better choice than **Device B**.

[2 marks]

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11

Turn over for the next question

Turn over ▶

2 (a) State the difference between data and information.

[1 mark]

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2 (b) Programming languages typically use data types. Explain how one bit could be used to store a Boolean value.

[1 mark]

_____

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2 (c) What is the minimum number of bits needed to store any integer between 0 and 255?

[1 mark]

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2 (d) How many bits does ASCII use to represent a single character?

[1 mark]

_____

_____

2 (e) The following are data types (labelled **A – E**).

> **A.** Integer
> **B.** Boolean
> **C.** Real
> **D**. Character
> **E.** String

For each of the values in the table, write the label of the **most** suitable data type.
Use a label only once.

Value	Label (A – E)
43.13	
"Curry-Howard"	
978	

[3 marks]

7

Turn over for the next question

Turn over ▶

3 The pseudocode in **Figure 1** is written to make sure that the user enters a value within a given range.

Figure 1

```
inp ← USERINPUT
WHILE inp ≤ 0 OR inp ≥ 10
  OUTPUT "not in range"
  inp ← USERINPUT
ENDWHILE
```

3 (a) (i) Tick the set of test data that is the **most** appropriate to check that the code works as expected.

Test data	Tick **one** box
-1, 0, 9, 10	
0, 1, 10, 11	
-1, 0, 10, 11	
0, 1, 9, 10	

[1 mark]

3 (a) (ii) Why is the set of test data that you have chosen in **Question 3(a)(i)** likely to be enough to show that the code in **Figure 1** works as expected?

[1 mark]

_____

_____

3 (b) Develop an algorithm using pseudocode or a flowchart that asks the user to create a new password.

The algorithm should:

- get the user to enter a password
- get the user to re-enter the password
- repeat the two bullet points above until both entered passwords are identical
- output `"password created"` when they are identical.

[5 marks]

Turn over ▶

3 (c) State **two** possible weaknesses of the passwords that this algorithm would accept.

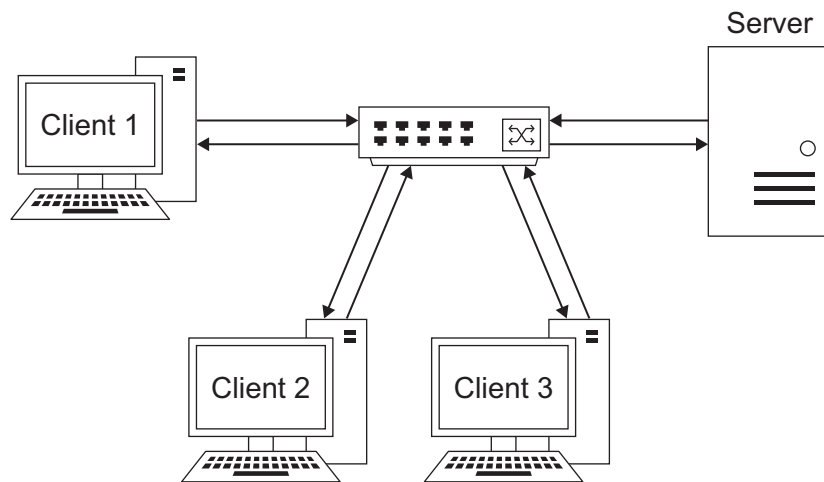[2 marks]

1 _____

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2 _____

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9

4 **Figure 2** shows a client–server network. The clients are connected to a switch.

Figure 2

4 (a) (i) What network topology is shown in **Figure 2**?

[1 mark]

_____

_____

4 (a) (ii) State **two** advantages of this particular topology.

[2 marks]

1 _____

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2 _____

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4 (b) A dynamically-created web page is being viewed on one of the client machines.

The following four actions would have had to take place to allow this to happen.
Put the actions in the correct order (**1–4**, where **1** is the first action to happen and **4** is the last action to happen).

Action	Order (1–4)
The client receives the web page.	
The client requests the web page.	
The server delivers the web page.	
The server connects to a database to complete the web page.	

[3 marks]

6

Turn over for the next question

Turn over ▶

5 Therac-25 was a medical system that gave patients radiation therapy. Due to errors in the software, it seriously injured at least six patients over a two-year period.

5 (a) Even though Therac-25 was tested before use, there were errors in the system. State **three** reasons why any code could still contain logical errors after testing.

[3 marks]

1 _____

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2 _____

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3 _____

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5 (b) Therac-25 is an example of a safety-critical system. Safety-critical software is code that may cause serious injury or damage if it does not work properly. State **one** situation, other than medical systems, where safety-critical code is used.

[1 mark]

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6 The pseudocode in **Figure 3** represents a procedure called Mult.

Figure 3

```
PROCEDURE Mult(n, m)
  x ← 1
  WHILE x ≤ m
    OUTPUT n * x
    x ← x + 1
  ENDWHILE
ENDPROCEDURE
```

The pseudocode in **Figure 4** represents a procedure called Display.

Figure 4

```
PROCEDURE Display(a, b)
  IF b > 3 THEN
    Mult(a, 3)
  ELSE
    Mult(a, b)
  ENDIF
ENDPROCEDURE
```

6 (a) Select the **most** suitable data type for the parameter n in the procedure Mult (tick **one** box only).

Most suitable data type of n	Tick **one** box
String	
Boolean	
Integer	

[1 mark]

6 (b) Explain **one** difference between a procedure and a function.

[1 mark]

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6 (c) Tick the **two** correct statements.

Statement	Tick **two** boxes
`Display(2, 6)` and `Display(2, 3)` will both have the same output.	
`Display(2, 6)` and `Display(6, 2)` will both have the same output.	
`Display(2, -1)` will not output anything.	
`Display(-2, 1)` will output two different values.	

[2 marks]

6 (d) Complete the trace table below showing the changes in the variable `x` and the output for the procedure call `Mult(2,3)`.

x	Output

[4 marks]

6 (e) What is the output from the procedure call `Display(3, (3-1))`?

[2 marks]

Question 6 continues on the next page

Turn over ▶

6 (f) State **two** reasons why writing your own functions/procedures in a program can make your code more reliable.

[2 marks]

1 _____

_____

2 _____

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12

7 Syntax and run-time are two different types of errors that can occur within code. The different types of errors are normally found at different points during the development of code.

Explain the differences between syntax and run-time errors. Your answer should describe what syntax and run-time errors are.

In this question you will be marked on your ability to use good English, to organise information clearly and to use specialist vocabulary where appropriate.

[6 marks]

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Turn over ▶

6

8 There are several CPU characteristics that can affect its performance. One of these is clock speed.

Explain how clock speed and **one** other CPU characteristic can affect CPU performance.

In this question you will be marked on your ability to use good English, to organise information clearly and to use specialist vocabulary where appropriate.

[6 marks]

6

9 The two tables **Student** and **FormTutor** form a relational database.

Student

StudentID	Firstname	Lastname	FormTutorID	Age
701	Chloe	Smith	678	16
154	Tareq	Dhir	130	14
667	Max	Taylor	678	15
203	Ella	Williams	252	16
559	Holly	Faluyi	252	16
446	John	Jones	130	16

FormTutor

FormTutorID	Title	Lastname	Subject
252	Mr	Evans	English
130	Dr	Myslinski	Art
678	Mrs	Lewis	English

9 (a) (i) How many records are there in the table **Student**?

[1 mark]

9 (a) (ii) Explain why the field **Age** cannot be the primary key of the table **Student**.

[1 mark]

9 (a) (iii) What is the role of the **FormTutorID** field in the **Student** table?

[1 mark]

9 (b) List the results of executing the following SQL query on this relational database.

```
SELECT Student.FirstName, Student.Lastname
FROM Student, FormTutor
WHERE FormTutor.Subject = 'English' AND
      Student.Age > 15 AND
      Student.FormTutorID = FormTutor.FormTutorID
ORDER BY Student.Lastname ASC
```

[4 marks]

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9 (c) The **Age** field in the **Student** table is included to show a student's current age.
Explain why this is not the best way to store this information.

[1 mark]

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Turn over for the next question

8

Turn over ▶

10 The algorithm in **Figure 5** simulates the game of rock–paper–scissors.

Player 1 enters the number 1 for paper, the number 2 for rock or the number 3 for scissors. Player 2 then does the same.

You should assume that the numbers entered by the players are stored as integers.

Note: line numbers have been included but are **not** part of the algorithm.

Figure 5

```
1    options ← ['paper', 'rock', 'scissors']
2    player1 ← USERINPUT
3    player2 ← USERINPUT
4    player1HasWon ← false
5    draw ← false
6    IF player1 = 1 THEN
7       IF player2 = 2 THEN
8          player1HasWon ← true
9       ENDIF
10   ENDIF
11   IF player1 = 2 THEN
12      IF player2 = 3 THEN
13         player1HasWon ← true
14      ENDIF
15   ENDIF
16   IF player1 = 3 THEN
17      IF player2 = 1 THEN
18         player1HasWon ← true
19      ENDIF
20   ENDIF
```

10 (a) Tick the line of code that is equivalent to lines 6 **and** 7 together.

[1 mark]

Line of code	Tick **one** box
`IF player1 = 1 OR player2 = 2 THEN`	
`IF player1 ≠ player2 THEN`	
`IF player1 = 1 AND player2 = 2 THEN`	

10 (b)   What data structure has been used for `options`?

[1 mark]

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_____

10 (c)   Tick the programming technique that has **not** been used in this algorithm.

Programming technique	Tick **one** box
Iteration	
Selection	
Variable assignment	

[1 mark]

10 (d)   Using either pseudocode or a flowchart, extend the algorithm in **Figure 5** so that the variable `draw` is set to the value `true` when both player 1 and player 2 choose the same option. This code should follow on from the end of the algorithm in **Figure 5**.

[3 marks]

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Turn over ▶

10 (e) Using either pseudocode or a flowchart, extend the algorithm in **Figure 5** and your answer to question **10(d)** by outputting:

- either that the game was a draw
- or, if it was not a draw, which option beat which option.

Example 1: If player 1 entered a 2 and player 2 entered a 3 then the algorithm should output:
```
rock
beats
scissors
```

Example 2: If player 1 entered a 1 and player 2 entered a 2 then the algorithm should output:
```
rock
beats
paper
```

Example 3: If both players entered 1 then the algorithm should output:
```
draw
```

Your answer should extend the algorithm in **Figure 5** and leave the original algorithm unchanged.

Note: assume that array indexing starts at 1 so OUTPUT options[1] will output the value paper.

[9 marks]

END OF QUESTIONS

15

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