AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
COMPUTER SCIENCE

Unit 2 Computing Fundamentals

Wednesday 7 June 2017 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.
- Question 5 should be answered in continuous prose.
  In this question 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.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
TOTAL	

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

1 (a) State the **hexadecimal** representation of the denary number `183`. You must show your working.

[2 marks]

1 (b) State the **denary** representation of the binary number `10010011`.

[1 mark]

1 (c) What is the largest **hexadecimal** number that can be represented using two hexadecimal digits?

[1 mark]

1 (d) Tick **one** box to indicate the statement that is true about hexadecimal and binary numbers:

Statement	**Tick one box**
Hexadecimal generally uses more digits to represent a decimal number than binary does.	
Binary numbers take up more space in a computer's memory than hexadecimal numbers.	
Any binary number can also be represented in hexadecimal.	

[1 mark]

1 (e) Every ASCII character is stored in a computer system as a bit pattern.

1 (e) (i) State the **minimum** number of bits required to represent any of the 128 different characters used in ASCII.

[1 mark]

_____

_____

1 (e) (ii) State how many **extra** bits will be required to represent a character in ASCII if the number of possible characters was extended from 128 characters to 256 characters.

[1 mark]

_____

_____

7

Turn over for the next question

2 Computer programs can be developed using an Integrated Development Environment (IDE). **Figure 1** shows a window from an IDE with a small program (understanding the program is not required for the following questions).

Figure 1

1		`A ← 3`
2		`B ← 5`
3	`break point`	`C ← A + B`
4		`WHILE (C + A > 2)`
5		`    C ← C - 2`
6		`    A ← A + 1`
7		`ENDWHILE`
8		`f ← OPEN('output.txt')`
9		`WRITE(f, C)`

2 (a) The programmer has created a break point at line 3 in **Figure 1**.

2 (a) (i) State the effect of a break point when a program is run within an IDE.

[1 mark]

2 (a) (ii) Give **one** way break points may help a programmer debug their program.

[1 mark]

2 (b) The programmer knows that she could inspect the value of `C` while the program is running by outputting `C` (using `OUTPUT` or similar). However, she could also use a tool within the IDE to see the value of `C`.

State the name of this tool.

[1 mark]

2 (c) State **three** features of an IDE (other than line numbers, break points and your answer for **Question 2b**) that could help a programmer develop a program.

[3 marks]

2 (d) (i) The code on line 8 in **Figure 1** opens a file called `output.txt`. In the programming language being used, if a file is opened that does not exist then the program will crash. Tick **one** box to indicate the type of error that will occur if the file called `output.txt` does not exist.

Type of error	Tick one box
Logical	
Run-time	
Syntax	

[1 mark]

2 (d) (ii) The code on line 9 in **Figure 1** should have been written `WRITELINE(f, C)` as the command `WRITE` does not exist in the programming language being used. Tick **one** box to indicate what type of error has occurred.

Type of error	Tick one box
Logical	
Run-time	
Syntax	

[1 mark]

8

Turn over for the next question

3 A virtual reality headset can provide the user with an immersive gaming experience. An example headset is shown in **Figure 2**.

Figure 2

The headset has three main features:

Feature 1 The headset displays slightly different images of a landscape on to each of the gamer's eyes giving the illusion of being in a 3-dimensional world.

Feature 2 The headset senses in which direction the gamer is looking by tracking the movement of the gamer's eyes.

Feature 3 The headset can suddenly vibrate to indicate to the gamer that they have hit something in the virtual world.

3 (a) Tick **one** box in each row to indicate if the device that is described is an input device, output device or both.

Description	Input Device	Output Device	Both
The device that allows **Feature 1** to happen			
The device that allows **Feature 2** to happen			
The device that allows **Feature 3** to happen			

[3 marks]

3 (b) State another input or output device that could be incorporated into the headset that could make the gamer feel even more immersed in their virtual world.

[1 mark]

_____

_____

4

4 A student is asked to compare solid state drives, magnetic hard drives and optical media such as CDs. This is the student's answer:

> "Both a solid state drive and a hard drive contain moving parts although the way they store data is different. A solid state drive does not use a laser to read data but hard drives and optical media both do. Both solid state drives and hard drives can have large storage capacities but a hard drive's capacity is commonly greater. Both can be greater than standard CDs. Data is read more quickly from a hard drive than from a normal CD. Data is also read more quickly from a hard drive than from a solid state drive."

4 (a) The student has made factual errors in their answer. One error is stated and explained below (the explanation contains the **reason** why it is an error):

Error 1 A solid state drive contains moving parts.

Explanation 1 A solid state drive is made of electrical circuits.

State and explain **two** further errors the student has made in their answer.

[4 marks]

Error 2 _____

_____

Explanation 2 _____

_____

_____

Error 3 _____

_____

Explanation 3 _____

_____

_____

Question 4 continues on the next page

4 (b) Both a solid state drive and a hard drive are examples of secondary storage. Explain why secondary storage is often needed as well as RAM in computer systems.

[2 marks]

6

5 A programmer wants to develop an application that will allow students to write and save notes for their different subjects at school. The programmer is considering developing this as a web application using the client-server model.

The web application will require students to enter their username and password on a webpage and, if these login details are correct, will then display the student's notes. The student can then create, edit or delete notes for their different subjects. The login details and notes are stored in a database.

Describe **three** advantages/disadvantages of using a web-based client-server model for this application. Your answer should include a combination of advantages and disadvantages, ie two advantages and one disadvantage or one advantage and two disadvantages.

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

6 Develop an algorithm using pseudocode or a flowchart that calculates an estimate of the braking distance in metres for a new model of go-kart that is travelling between 10 and 50 kilometres per hour (kph).

Your algorithm should be based on the following method:

- the user should keep being asked to enter a speed for the go-kart until they enter a speed that is between 10 and 50 (both 10 and 50 are valid speeds)
- the braking distance in metres is calculated by dividing the speed by 5
- the user should be asked if the ground is wet (expect the user to enter 'yes' if it is)
- the braking distance should be multiplied by 1.5 when the ground is wet
- finally, your algorithm should output the calculated braking distance.

[9 marks]

9

7 A developer is deciding which of two different programming languages to use to implement an algorithm.

- Programming language **A** has a `WHILE` loop but not a `REPEAT-UNTIL` loop.
- Programming language **B** has a `REPEAT-UNTIL` loop but not a `WHILE` loop.

A `WHILE` loop has the following structure (the statements will be executed zero or more times):

```
WHILE Boolean Expression is True
   Statements
ENDWHILE
```

A `REPEAT-UNTIL` loop has the following structure (the statements will be executed one or more times):

```
REPEAT
   Statements
UNTIL Boolean Expression is True
```

7 (a) Using programming language **A**, the developer wants the following code to output `'aqa'` three times.

```
x ← 1
WHILE x ≤ 3
   OUTPUT 'aqa'
ENDWHILE
```

Explain the mistake that has been made in the code.

[1 mark]

7 (b) Rewrite the following code so that it uses a `REPEAT-UNTIL` loop instead of a `WHILE` loop.

You may need to use additional programming techniques to deal with the user entering `'end'` as their first input.

```
response ← USERINPUT
WHILE response ≠ 'end'
   OUTPUT response
   response ← USERINPUT
ENDWHILE
```

[4 marks]

5

Turn over for the next question

8 The following tables form a relational database about robotics kits and manufacturers.

RoboticsKit

KitID	Name	MinimumAge	Cost	ManID
rob423	XPlorer	8	30.99	9812
rob999	Doodler	5	15.00	1544
rob154	Butler	10	31.59	9812
rob652	Drone15	15	499.00	4341
rob101	CarBumper	10	30.00	4341
rob273	AirQuadCam	15	585.00	1544

Manufacturer

ManID	Name	City
4341	RobotCity	London
1544	MechShop	Manchester
9812	DarrensIT	London

8 (a) Tick **one** box to indicate the only **true** statement.

Statement	Tick one box
The **RoboticsKit** table has five records.	
The **Manufacturer** table contains a foreign key.	
MinimumAge is a suitable choice for a primary key in the **RoboticsKit** table.	
Every manufacturer manufactures two types of robotics kit.	

[1 mark]

8 (b) Explain the purpose of a primary key.

[1 mark]

8 (c) State **two** reasons why the **Cost** field in **RoboticsKit** is stored as a real number instead of a string starting with a £ symbol. For example, `30.99` is stored instead of `'£30.99'`.

[2 marks]

8 (d) List the results of executing the following SQL query on this relational database.

```
SELECT RoboticsKit.Name, Manufacturer.Name,
RoboticsKit.Cost
FROM RoboticsKit, Manufacturer
WHERE (RoboticsKit.MinimumAge > 10 OR
   Manufacturer.City = 'Manchester') AND
   RoboticsKit.ManID = Manufacturer.ManID
ORDER BY RoboticsKit.Name ASC
```

[4 marks]

8

Turn over for the next question

9 The following function is used by a printing company to calculate the cost of printing photos. The quality is an integer between 1 and 5, where 1 is the lowest quality and 5 is the highest.

```
FUNCTION calculate_cost(delivery, size, quality)
    cost ← 0.0
    IF delivery = True THEN
        cost ← cost + 2.0
    ENDIF
    IF size = 'B3' OR size = 'B4' THEN
        cost ← cost + 1.0
    ELSE
        IF size = 'A3' OR size = 'A4' THEN
            cost ← cost + 3.5
        ELSE
            cost ← cost + 5.0
        ENDIF
    ENDIF
    cost ← cost * quality
    RETURN cost
ENDFUNCTION
```

9 (a) How many parameters does this function have?

[1 mark]

9 (b) What is the data type of `delivery`?

[1 mark]

9 (c) What is the data type of `cost`?

[1 mark]

9 (d) What keyword, apart from `FUNCTION` and `ENDFUNCTION`, makes it obvious that this is a function and not a procedure?

[1 mark]

_____

_____

9 (e) Complete the trace table below when this function is called as follows (you may not need to use all rows in the trace table):

```
calculate_cost(True, 'A2', 4)
```

cost

[4 marks]

8

Turn over for the next question

10 (a) Tick **two** boxes to indicate the correct statements.

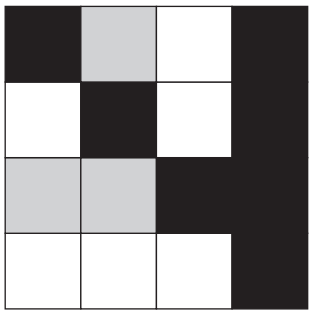
Statement	Tick two boxes
Sound files need to be compressed to be stored on a computer.	
Sound files store digital data.	
Sound files are always stored on a computer using binary.	
An increase in the number of levels used in a sound file will decrease the file size.	
Images always take up less space to store than sound.	

[2 marks]

10 (b) Explain why a sound recording with a high sample rate will normally result in a better quality recording than one with a low sample rate.

[2 marks]

10 (c) **Figure 3**



10 (c) (i) Explain how a bit-mapped image made up of black, white and grey pixels (such as the one shown in **Figure 3**) could be represented using 2 bits for each pixel.

[3 marks]

10 (c) (ii) Explain why adding a fourth colour to the image in **Figure 3** would probably not result in a larger file size than that needed to store the three-colour image in **Figure 3**.

[1 mark]

Question 10 continues on the next page

10 (d) State **one** way, other than increasing the number of colours available for each pixel, that the quality of a bit-mapped image could be improved.

[1 mark]

10 (e) Explain why hexadecimal is often used by humans to represent large binary numbers.

[2 marks]

11

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

11 The following algorithm is used to compare a property of two arrays stored in an array called `arr`.

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

Note: For this algorithm, array indexing starts at 1.

```
1     arr ← [ [3, 2], [4, 3] ]
2     i ← 1
3     h ← 0
4     lenArr ← 2
5     WHILE i ≤ lenArr
6         j ← 1
7         a ← 0
8         WHILE j ≤ lenArr
9             a ← a + arr[i][j]
10            j ← j + 1
11        ENDWHILE
12        IF a > h THEN
13            h ← a
14        ENDIF
15        i ← i + 1
16    ENDWHILE
17    OUTPUT h
```

11 (a) State the line number where iteration is first used.

[1 mark]

11 (b) (i) Complete the trace table for this algorithm (the first row has been completed for you).

You may not need to use all the rows in the table.

i	**h**	**j**	**a**
1	0	1	0

[6 marks]

11 (b) (ii) What does the final value of **h** represent?

[2 marks]

11 (c) Why could `lenArr` be considered to be a constant in this algorithm?

[1 mark]

Question 11 continues on the next page

11 (d) Line 1 in the algorithm on page 22 has been changed to:

```
arr ← [ [3, 2, 1], [4, 3, 1], [1, 1, 1] ]
```

What change will need to be made to line 4 to ensure the algorithm still works as intended?

[1 mark]

11 (e) Explain what is meant by the scope of a variable in a program.

[1 mark]

12

END OF QUESTIONS