Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

C500U10-1

S18-C500U10-1

COMPUTER SCIENCE – Component 1
Understanding Computer Science

MONDAY, 14 MAY 2018 – MORNING

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**11**	
2.	**18**	
3.	**7**	
4.	**11**	
5.	**6**	
6.	**10**	
7.	**8**	
8.	**9**	
9.	**8**	
10.	**12**	
Total	**100**	

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INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the continuation pages at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The use of calculators is not permitted in this examination.

The total number of marks is 100.

Questions 1, 2, 3 and 6 will require you to draw on knowledge from multiple areas of your course of study.

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1. Sound and graphics can be stored by computer systems.

(a) **Tick** (✓) the boxes below to show whether the statements about sound sampling are TRUE or FALSE. [3]

STATEMENT	TRUE	FALSE
Natural sound is in digital form. This is sampled and converted into analogue form to be stored by computer systems.	☐	☐
A sound sample rate of 16 KHz means the wave is sampled 160,000 times a second.	☐	☐
The lower the sampling rate, the better the quality of the sound file.	☐	☐

(b) State what is meant by metadata and give an example of metadata stored in graphics files. [2]

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(c) Kevin has compressed a sound file to reduce its size using lossy compression. He then converted the resulting file to a lossless file format to improve its quality.

Explain the disadvantages of this process. [3]

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(d) A simple bitmap graphic has the following characteristics:

- 8-bit colour depth
- 10 × 300 pixels.

Calculate the file size of this graphic in kilobytes. Show your workings. [3]

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2. The computer systems used at a warehouse have a single-core Central Processing Unit (CPU) and a typical Von Neumann architecture.

(a) Describe the role of the following components. [2]

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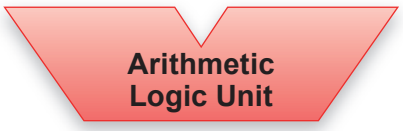
[1]



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(b) Describe RISC type processors. [2]

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(c) Explain how main memory is used during the fetch-decode-execute cycle. [3]

(d) The computer systems used at the warehouse are starting to run slowly when searching for items in stock.

(i) The warehouse is considering replacing the CPUs in their computer systems with either of the following:

CPU 1	CPU 2
3 GHz Quad-core 4MB cache	4 GHz Dual-core 8MB cache

Compare the performance of the two CPUs. [6]

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(ii) The warehouse staff could use different types of utility software to improve the disk access speed.

Give examples of utility software that could be used to improve disk access speed. [4]

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3. Many different embedded systems are used in household devices.

(a) Describe what is meant by the term embedded systems. [2]

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(b) A heater is controlled by an embedded system.

- There is a power button (A) to turn the power going to the heater on or off.
- A temperature sensor (B) will turn the heater on when the temperature is below 20°C, provided the power button has been left on.
- A manual override switch (C) will turn the heater on, regardless of the temperature, provided the power button has been left on.

Construct a logic statement to represent this situation, using the symbols A, B, and C. [3]

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(c) Bit patterns can be used to represent the different states of an embedded system. These bits can be manipulated by several different operations.

Perform an arithmetic shift left by 3 places on the 16 bit binary number 0000101001001111_2 and state the effect that this has on the number. [2]

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4. Protocols provide an agreed set of rules to allow networked devices to communicate.

(a) **Tick** (✓) the box to identify the protocol used to **send** email messages to an email server. [1]

SMTP	☐
FTP	☐
POP3	☐
IMAP	☐

(b) Describe the role of the Ethernet protocol. [2]

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(c) Explain the difference between the HTTP and HTTPS protocols. [2]

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(d) Describe each of the following layers in the TCP/IP 5-layer model for data transmission: [6]

- Physical layer
- Transport layer
- Application layer

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5. Describe and give examples of the following types of programming errors. [6]

Error	Description	Example
Runtime/ execution		
Linking		
Rounding		

6. Different types of programming language are used by programmers.

(a) Describe why high-level programming languages are preferred for many programming tasks. [4]

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(b) The following code, which contains errors, is written in a certain high-level programming language:

```
1    Declare CountProc
2    Count is integer
3    set Count = 0
4
5    for i = 1 t 1000
6         Cout = Count + i
7         output Count
8    next i
9
10   End Subroutine
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(i) Describe the difference in the way in which this code would be interpreted and the way in which this code would be compiled. [2]

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(ii) Discuss the benefits and drawbacks of compilers and interpreters. [4]

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7. The table below shows data for a payroll system.

Field	Example Data	Further information
Surname	Williams	
National Insurance (NI) number	JN126523A	
Job title	Semi-skilled	Apprentice, semi-skilled, skilled, supervisor
Week number	12	
Full time	Y	Y or N
Hours worked (current week)	35	Maximum 40 hours per week Full hours only
Hourly pay rate	7.50	Maximum of 15.00 per hour

(a) State the most suitable data structure to store this data, justifying your choice. [2]

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(b) Some of the data can be validated. Design **three** different types of validation check.

Validation Check 1 [2]

Field: .....

Type of check: .....

Rule:

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Validation Check 2 [2]

Field: .....

Type of check: .....

Rule:

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Validation Check 3 [2]

Field: .....

Type of check: .....

Rule:

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8. *(a)* Complete the table below, converting between denary, binary and hexadecimal numbers. [3]

Denary	Binary	Hexadecimal
41_{10}	00101001_2	29_{16}
58_{10}		$3A_{16}$
	10101111_2	AF_{16}
253_{10}	11111101_2	

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(b) Complete the table to calculate the binary addition of 14_{10} to 67_{10} using an 8-bit register. [3]

67_{10}								
14_{10}								
Answer								

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(c) Using a suitable example, explain the concept of overflow in relation to binary addition. [3]

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9. *(a)* Complete the following truth table. [4]

P	Q	$P + Q$	$P.Q$	$\overline{P.Q}$	$\overline{P.Q} + (P + Q)$
1	1				
1	0				
0	1				
0	0				

(b) Draw a truth table for the expression: [4]

$$X = A.B + \bar{A}.B$$

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10. Internet protocols, operating systems and network equipment all present inherent technical vulnerabilities that must be identified and protected against.

(a) Describe the following forms of attack on cybersecurity:

(i) SQL injection. [2]

(ii) IP address spoofing. [2]

(b) Describe methods of identifying these vulnerabilities. [8]

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END OF PAPER

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