Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

S24-3500U10-1

3500U10-1

WEDNESDAY, 15 MAY 2024 – AFTERNOON

COMPUTER SCIENCE

Unit 1: Understanding Computer Science

1 hour 45 minutes

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

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INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

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 additional page(s) 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 need for good English and orderly, clear presentation in your answers.

The total number of marks is 100.

Some questions will require you to draw on your knowledge from multiple areas of your course of study.

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Answer **all** questions.

1. Tick (✓) the correct box to show if each statement about CPUs is TRUE or FALSE. [4]

Statement	True	False
The Control Unit (CU) decodes the program instruction in the Current Instruction Register (CIR).		
The Program Counter (PC) holds the address in main memory that is currently being read.		
RISC CPUs run at lower clock speeds than CISC CPUs.		
The slower the clock speed, the more power is generally required.		

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2. Computer networks are constructed using specialised hardware.

(a) Tick (✓) the boxes to match the hardware with the correct description. [4]

Description	Hardware			
	Hub	**Router**	**Switch**	**Bridge**
Joins together two networks that use the same base protocols.	☐	☐	☐	☐
Copies all packets of data to all devices on the network.	☐	☐	☐	☐
Stores the addresses of computers on the network and transfers data between devices.	☐	☐	☐	☐
Analyses each data packet and sends it to the computer it was intended for.	☐	☐	☐	☐

(b) Identify **four** different types of computer network. [4]

(i) .....

(ii) .....

(iii) .....

(iv) .....

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3. Compilation is a process for converting high level programs into machine code.

(a) Using the terms given complete the following sentences about the stages of compilation.

Symbol	**Lexical**	**Code**	**Translation**
Optimisation	**Assembly**	**Semantic**	**Syntax**

(i) During ..... analysis keywords and identifiers are replaced by tokens. [1]

(ii) During ..... analysis variables are checked to ensure they are the correct data type. [1]

(iii) A ..... table is created to hold the addresses of variables and subroutines. [1]

(iv) Code ..... may be employed to make the program more efficient. [1]

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(b) This pseudo code is part of a payroll system. The system calculates the net pay by subtracting deductions from the gross pay. The pseudo code includes errors. Identify **two** errors in the code. State each error type and correction needed. [4]

```
def CalcPay():

    Gross = input
    Tax = (Gross * 0.20)
    NatIns = (Gross * 0.10)
    Pension = (Gross * 0.10)
    Deducts = tax + NatIns + Pension
    NetPay = Gross + Deducts
```

(i) **Type of error:** .....

.....

Correction: .....

.....

(ii) **Type of error:** .....

.....

Correction: .....

.....

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4. (a) Convert the following:

(i) the binary number $1111\,1100_2$ to hexadecimal. [2]

(ii) the denary number 138_{10} to hexadecimal. [2]

(iii) the hexadecimal number $5D_{16}$ to denary. [2]

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(b) State the effect of:

(i) An arithmetic shift left by one place. [1]

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(ii) An arithmetic shift right by two places. [1]

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5. An IDE is a software application that provides programmers with facilities to develop, debug and translate software.

Describe **three** IDE tools that are provided to help identify and remove errors in program code. [6]

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6. Utility software are operating system programs designed to maintain the functionality of a computer system.

Describe **three** types of utility software that are provided to help maintain the security and integrity of computer data. [6]

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7. Describe **three** examples of current legislation, relevant to the privacy and security of an individual's data when held on computers. [6]

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8. Programmers use Boolean logic to create code that can make decisions about data. It is a form of algebra that follows laws for simplifying expressions.

KEY:	$+ = OR$	$\cdot = AND$	$\oplus = XOR$	$\bar{} = NOT$

(a) Apply the distributive law to complete the expressions. [2]

(i) $(A \,.\, B) + C =$ .....

(ii) $(A + B) \,.\, C =$ .....

(b) Apply the absorption law to complete the expressions. [2]

(i) $A \,.\, (A + B) =$ .....

(ii) $A + A \,.\, B =$ .....

(c) Clearly showing each step, simplify the Boolean expression. [4]

$$A \,.\, (A + B) + B \,.\, (A + B)$$

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(d) Complete the truth table. [4]

P	Q	$P \cdot Q$	$P + (P \cdot Q)$
0	0		
0	1		
1	0		
1	1		

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9. Parkwood Vale Motors wants to store details of the cars it has in stock in a database, as shown. The first two fields have been set as Strings, with validation checks as specified.

(a) Complete the table to include:

(i) **Two** other data types. [2]

(ii) **Two** other methods of validation. [2]

FIELD NAME	DATA TYPE	EXAMPLE DATA	VALIDATION CHECK
Car ID	String	E23TES	Format check
Manufacturer	String	Tesla	Presence check
Range Miles		305	
Model (X, Y, 3 or Z)		X	

(b) The ASCII code for **V** is 01010110_2. Demonstrate how **V** would be encrypted by Parkwood Vale Motors' system and then decrypted using the XOR encryption method.

The key used is 11110000_2. [4]

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(c) Explain why Parkwood Vale Motors have decided to encrypt the data they hold on their customers. [2]

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10. (a) Describe the main characteristics that distinguish high-level programming languages from low-level languages. [6]

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(b) Describe a typical situation that requires the use of:

(i) a high-level language [2]

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(ii) a low-level language. [2]

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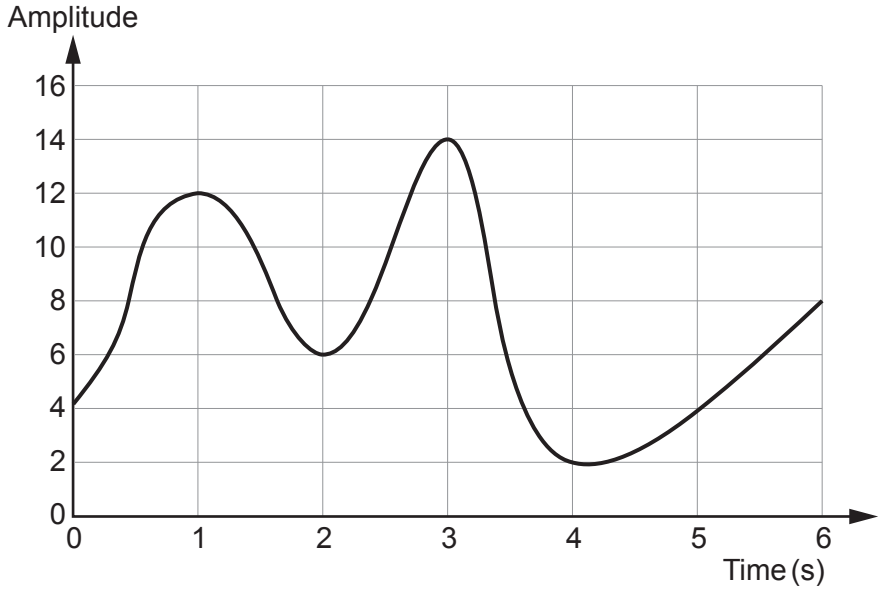
11. The chart is a representation of a simple sound wave. The wave is sampled every second and the amplitude is stored as a 4-bit binary number.



(a) Complete the table to show how the wave would be represented in binary. [5]

Time	1	2	3	4	5	6
Amplitude	12					
Binary	1100					

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(b) (i) State the number of bits required to store the binary data from the completed table. [1]

.....

.....

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.....

(ii) Convert your answer from (b) (i) to bytes. [1]

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(c) (i) Calculate the number of bytes required to store the data for the wave if four samples per second are taken. [1]

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(ii) State the effect that increasing the sampling rate will have on the captured sound wave. [2]

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12. Explain the purpose and functionality of the TCP/IP 5-layer model in computer networks. [12]

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