



GCSE



C500U10-1

MONDAY, 16 MAY 2022 – AFTERNOON

COMPUTER SCIENCE – Component 1

Understanding Computer Science

1 hour 45 minutes plus your additional time allowance

Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	7	
2.	14	
3.	6	
4.	5	
5.	12	
6.	6	
7.	10	
8.	10	
9.	10	
10.	5	
11.	7	
12.	8	
Total	100	

INSTRUCTIONS TO CANDIDATES

Use black ink, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces provided on the front cover.

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 use of calculators is not permitted in this examination.

The total number of marks is 100.

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

Answer ALL questions.

1. Cybersecurity reduces the risk to individuals and organisations of a cyberattack.

(a) Tick (✓) the threat to computer systems that matches each characteristic. [3 marks]

CHARACTERISTIC	WORM	PHISHING	DENIAL OF SERVICE
Making a website unavailable to legitimate users by swamping them with fake requests.			
Self-replicating programs that enable remote control of the infected computer.			
Fake emails asking you to confirm personal details.			

(Turn over)

1 (b) Describe the following types of attack.

(i) Brute force attack. [2 marks]

1 (b) (ii)

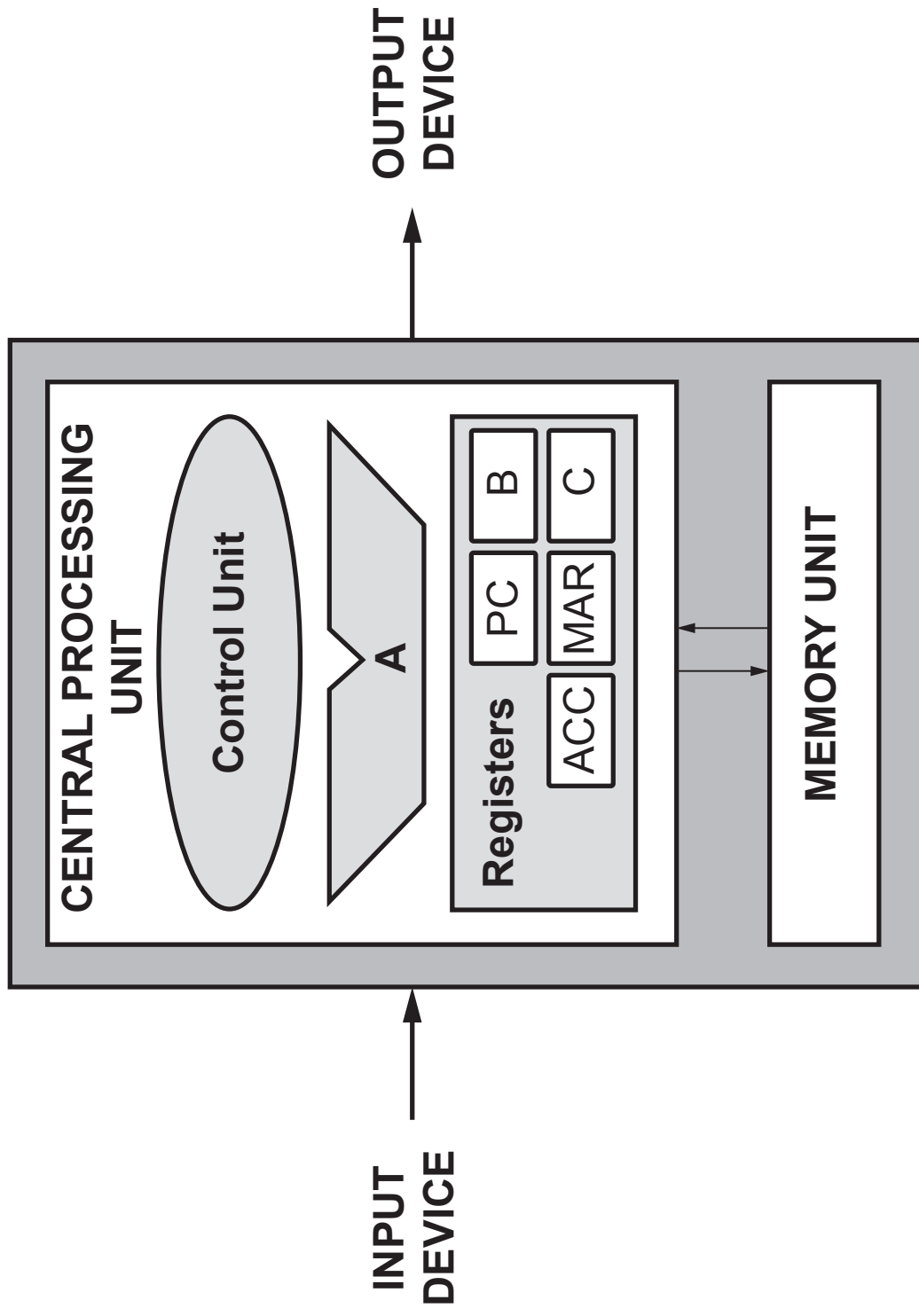
SQL injection. [2 marks]

2. The partially complete diagram opposite represents a typical Von Neumann CPU architecture.

(a) State the name and purpose of each of the following components. [6 marks]

COMPONENT	NAME	PURPOSE
A		
B		
C		

(Turn over)



2 (b) State FOUR events that take place during the fetch-decode-execute cycle. [4 marks]

EVENT 1: _____

EVENT 2: _____

EVENT 3: _____

EVENT 4: _____

(Turn over)

2 (c) Give TWO benefits of increasing cache memory.

[2 marks]

BENEFIT 1: _____

BENEFIT 2: _____

2 (d) Describe the function of virtual memory in a computer system. [2 marks]

3. A computer network is a group of computers that use a set of common communication protocols.

(a) Describe the purpose of a protocol. [2 marks]

3 (b) State the purpose of the following protocols.

[2 marks]

HTTPS: _____

FTP: _____

3 (c) Circle TWO items contained in a data packet.

[2 marks]

CLOCK SPEED	SOURCE ADDRESS
GATEWAY	DEFRAGMENTER
ROUTER	CHECKSUM
SWITCH	COMPILER ADDRESS
SUBROUTINE	LIBRARY

(Turn over)

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

A	B	$\bar{A}$	$\bar{A} \oplus B$	$A \cdot (\bar{A} \oplus B)$

(b) State the simplest Boolean expression represented in the last column from the truth table in 4 (a). [1 mark]

5 (a) Complete the following sentences.

(i) _____
occurs when the execution of a set of instructions returns a value larger than its range. [1 mark]

(ii) _____
is the condition in a computer program where the result of a calculation is smaller than the computer can actually represent in memory.
[1 mark]

(b) Complete the table by converting between binary, denary and hexadecimal number counting systems. [3 marks]

BINARY	DENARY	HEXADECIMAL
01010101_2		55_{16}
	117_{10}	75_{16}
10111101_2	189_{10}	

(Turn over)

- 5 (c) Show how 9_{10} would be subtracted from 21_{10} using two's complementation, binary addition and a 5-bit register. [4 marks]

**5 (d) (i) Shift the following binary number right 2 places.
[1 mark]**

01000100_2

5 (d) (ii)

State the effect of the following arithmetic shifts.

[2]

SHIFT LEFT 3 PLACES: _____

SHIFT RIGHT 4 PLACES: _____

(Turn over)

- 6. Clearly showing each step, simplify the Boolean expressions using Boolean algebra and identities.**

DO NOT USE TRUTH TABLES IN THE SIMPLIFICATIONS.

(a) $A \cdot A + B \cdot (\bar{B} + C)$ [3 marks]

[illegible]

(Turn over)

6 (b) $\bar{X} + \bar{X} \cdot Y + Y \cdot \bar{Y} + \bar{Y}$ [3 marks]

[illegible]

7. A prize is awarded to the student(s) who gain the highest mark in a class test. If more than one student gains the highest mark, each of the students gaining this mark is awarded a prize. All marks are positive integers.

Write an algorithm, using pseudo-code, which inputs:

- the number of students in the group
- the mark for each student.

Its outputs should be:

- the maximum mark
- the number of prizes
- the mean mark for all students who took the test.

For instance if the inputs are:

- 8
- 17 16 11 17 16 17 14 11

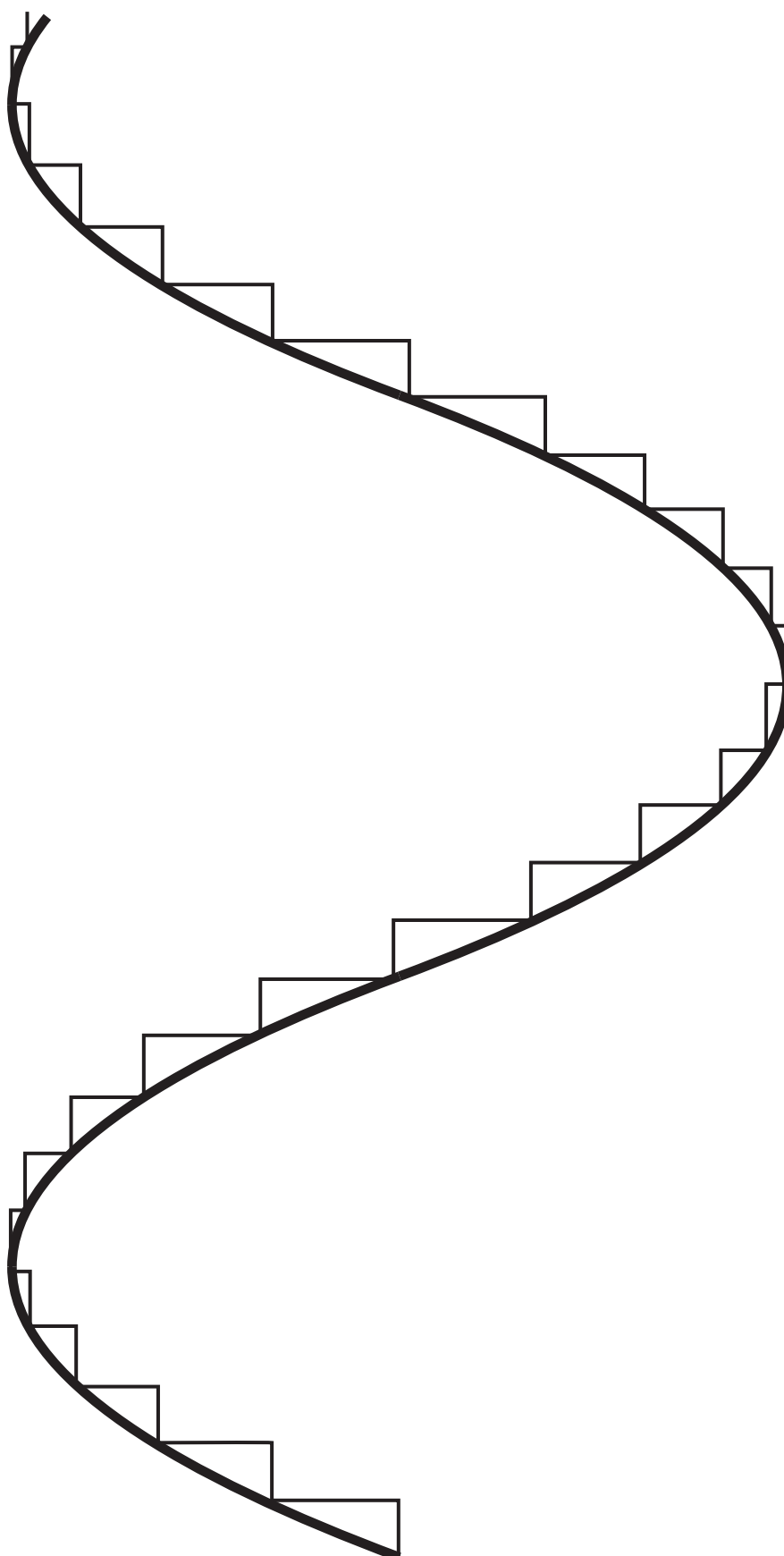
the outputs should be:

- Maximum Mark = 17
- Number of Prizes = 3
- Mean Mark = 14.875 [10 marks]

8. Sound sampling (see image opposite) is used for the digital storage of sound.

(a) Describe the process of sound sampling.

[2 marks]



8 (b) Describe how sound samples are stored.

[2 marks]

- 8 (c) The storage requirements for a sound file can be determined using the following formula:

$$\text{sound file size(bits)} = \text{duration(s)} \times \text{no. of channels} \times \text{sample rate(Hz)} \times \text{bit depth(bits)}$$

- (i) A sound file is created using a 5 minute dual-channel sound file (at a bit depth of 16 bits) with a sample rate of 44.1 kHz.
Calculate the file size in bits. [2 marks]

(Turn over)

[2 marks]

[illegible]

8 (d) Metadata describes and gives information about other data.

Give TWO examples of metadata stored in sound files.

[2 marks]

9. Operating systems are a low-level software that support a computer's basic functions.

(a) Describe how the operating system manages:

(i) Multitasking. [2 marks]

9 (a) (ii)

Backing store. [2 marks]

9 (b) Describe the purpose of THREE different types of utility software. [6 marks]

(Turn over)

10. Describe the characteristics of a merge sort algorithm. [5 marks]

[illegible]

11. (a)

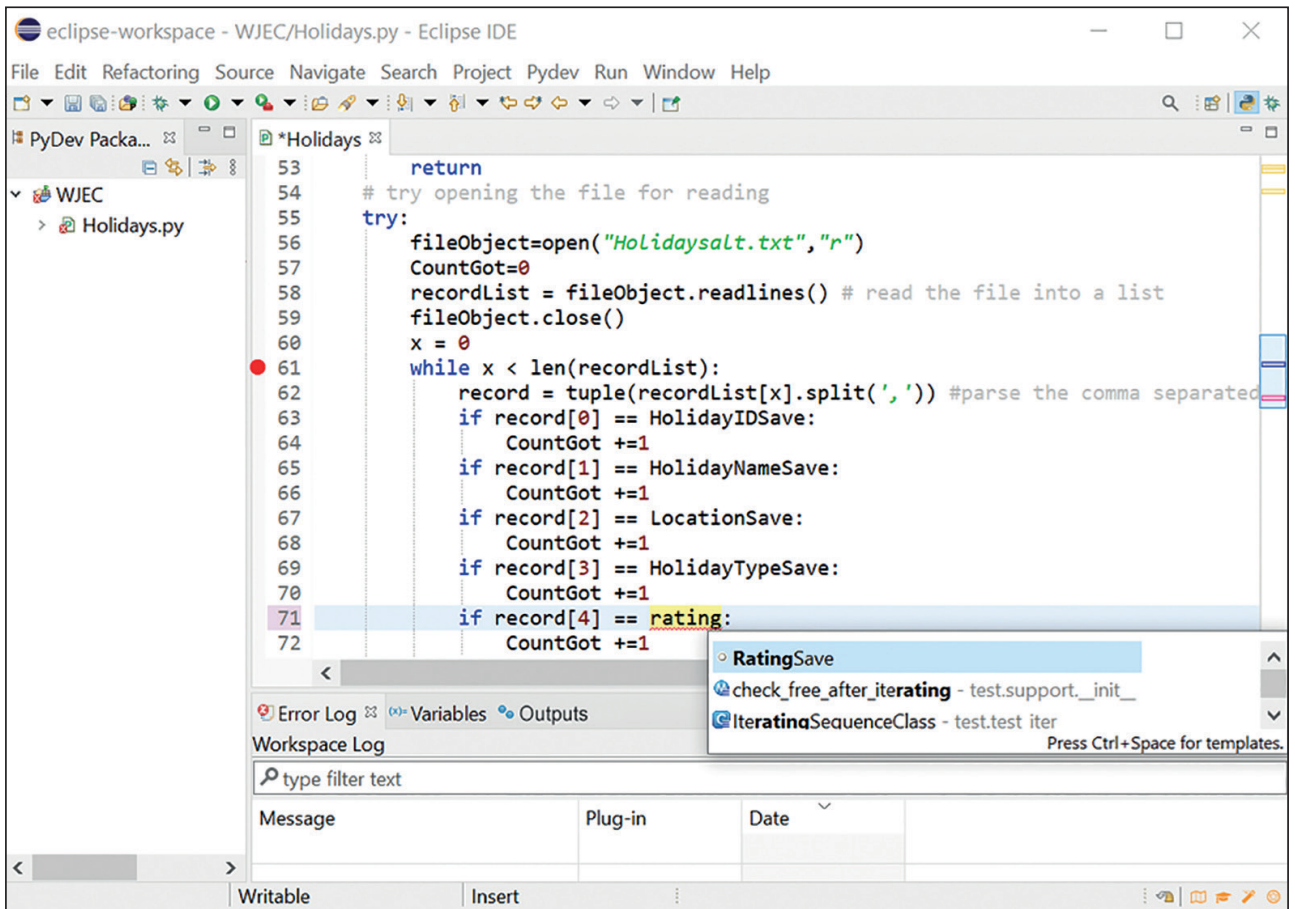
Label five Integrated Development Environment (IDE) tools in the image opposite. [5 marks]

(b) Give the purpose of TWO of the tools that you have identified opposite. [2 marks]

TOOL 1: _____

TOOL 2: _____

(Turn over)



12. (a)

Complete the following sentences about the different stages of compilation.

Use only the terms given below.

LEXICAL ANALYSIS

CODE GENERATION

CODE OPTIMISATION

SYNTAX ANALYSIS

LOSSLESS COMPRESSION

SEMANTIC ANALYSIS

(i) Variables are checked during the

stage to ensure that they are of the correct data type. [1 mark]

(ii) During the

stage, keywords, constants and identifiers are replaced by 'tokens'. [1 mark]

(iii) Tokens are checked to see if they match the spelling and grammar expected, using standard language definitions during the

stage. [1 mark]

(Turn over)

12 (a) (iv)

may be employed to make programs less resource intense. [1 mark]

(b) Describe the function of the following translators.

(i) Interpreters. [2 marks]

[illegible]

(Turn over)

12 (b) (ii)

Assemblers. [2 marks]

END OF PAPER

(Turn over)

Question number	Additional page, if required. Write the question numbers in the left-hand margin.

(Turn over)

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