

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

Pearson Edexcel International Advanced Level

Sample assessment material

Time 1 hour 30 minutes

Paper
reference

WCP03/01

Computer Science

International Advanced Level

Unit 3: Advanced Principles of Computer Science

You must have:

Resource Booklet (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You are not allowed to use a calculator.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

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Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

SECTION A

Computer systems and data representation

1 Which type of processor architecture is used by a graphics processing unit (GPU)?

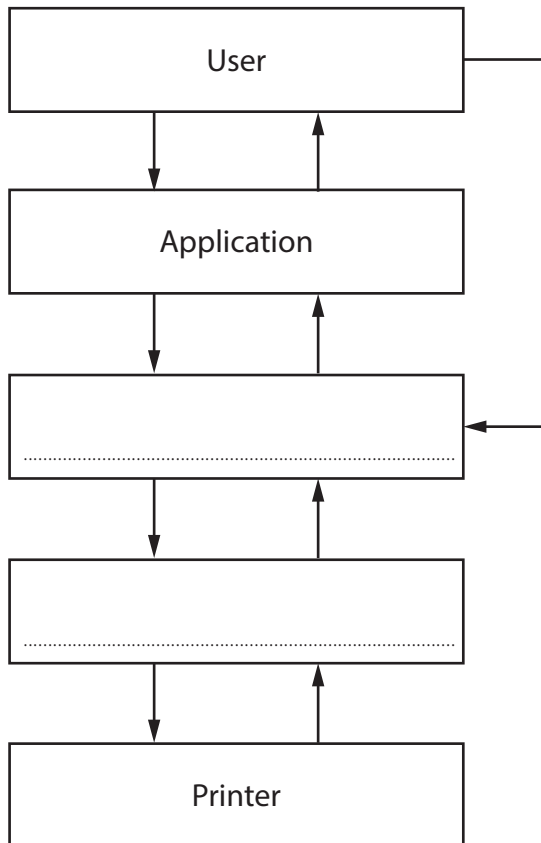
- A multiple instruction multiple data (MIMD)
- B multiple instruction single data (MISD)
- C single instruction multiple data (SIMD)
- D single instruction single data (SISD)

(Total for Question 1 = 1 mark)

2 The partially completed diagram shows how a user interacts with the components of a computer system.

Complete the diagram by adding the **two** missing components.

Diagram



(Total for Question 2 = 2 marks)

3 A software development company uses a virtual machine to write and test software.

(a) Define the term 'virtual machine'.

(2)

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(b) Explain **one** way a virtual machine is suitable for this purpose.

(2)

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(Total for Question 3 = 4 marks)

4 Explain **one** advantage of using Harvard architecture rather than von Neumann architecture.

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(Total for Question 4 = 2 marks)

5 Most mobile phones use RISC architecture.

(a) State what RISC stands for.

(1)

(b) Explain **one** characteristic of RISC architecture that results in devices having longer battery life than devices using CISC architecture.

(2)

(Total for Question 5 = 3 marks)

6 A weather station records air temperature.

Describe how an analogue to digital converter (ADC) is used in this process.

(Total for Question 6 = 3 marks)

7 A processor uses a five-stage pipeline:

- instruction fetch (IF)
- instruction decode (ID)
- execute (EX)
- memory access (MEM)
- register write back (WB).

A program contains the five instructions A, B, C, D and E.

Complete the table to show how the program would execute using pipelining.

Table

	Clock cycle									
Pipeline stage	1	2	3	4	5	6	7	8	9	10
IF										
ID										
EX										
MEM										
WB										

(Total for Question 7 = 3 marks)

8 Explain **one** impact a branch instruction has on a pipeline.

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(Total for Question 8 = 2 marks)

TOTAL FOR SECTION A = 20 MARKS

SECTION B

Emerging technologies and professional practice

9 Deep learning is a subset of machine learning.

Which statement best defines deep learning?

- A It analyses unlabelled data to find patterns and insights without human guidance.
- B It teaches systems to make actions in an environment to maximise rewards.
- C It uses labelled data sets to train algorithms to recognise patterns and predict outcomes.
- D It uses multilayered neural networks to simulate the complex decision-making power of the human brain.

(Total for Question 9 = 1 mark)

10 Complete the table by adding the quantum computing term for the **two** definitions.

Table

Quantum computing term	Definition
	The state in which a quantum particle or system can represent not just one possibility, but a combination of multiple possibilities.
	The basic unit of quantum information, which is the quantum version of the classic binary bit.

(Total for Question 10 = 2 marks)

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11 Describe the process used to create a digital signature.

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(Total for Question 11 = 3 marks)

12 A block chain contains two blocks: block 1 and block 2.

An attacker has modified the contents of block 1.

Explain **one** way unauthorised modification of block 1 can be detected in block 2.

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(Total for Question 12 = 2 marks)

TOTAL FOR SECTION B = 8 MARKS

SECTION C

Programming languages

13 Define the term 'polymorphism' in object-oriented programming (OOP).

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(Total for Question 13 = 2 marks)

14 The program is written using object-oriented programming (OOP).

Program

```
1 class Character():
2
3     def __init__(self, pName):
4         self._name = pName
5         self._strength = 10
6
7     def getStrength(self):
8         return self._strength
9
10    def setStrength(self, pStrength):
11        self._strength = pStrength
12
13    def display(self):
14        print("Name:", self._name)
15
16 class Warrior(Character):
17
18    def __init__(self, pName):
19        super().__init__(pName)
20        self._strength = 18
21        self.__status = "Warrior"
22
23    def display(self):
24        super().display()
25        print("Status:", self.__status)
```

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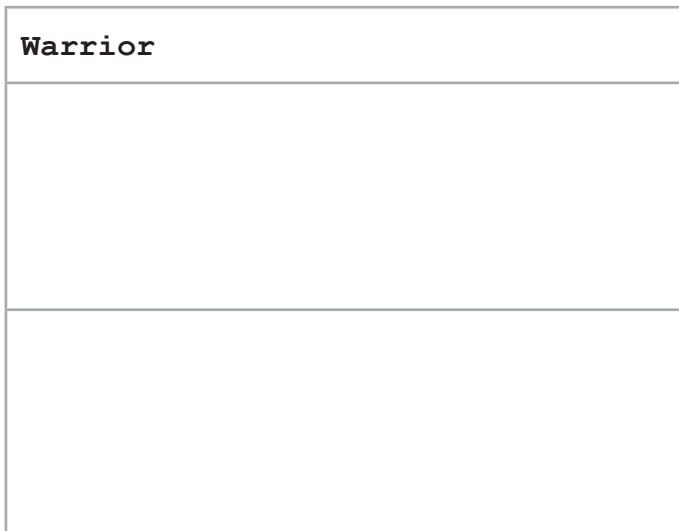
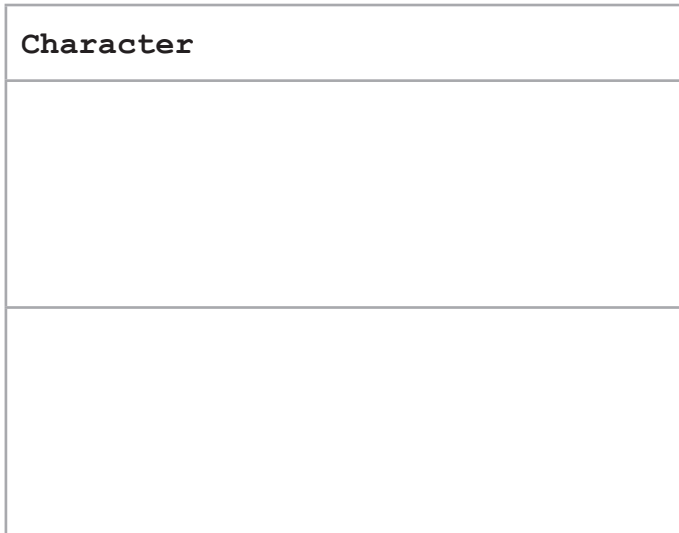
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Complete the class diagram for the program by adding:

- attributes
- methods
- access modifiers: private (-), protected (#), public (+).

Class diagram



(Total for Question 14 = 4 marks)

15 The program is written in assembly language.

Program

```
MOV R0, #6
MOV R1, #5
MOV R2, #0
MOV R3, #0
start: CMP R1, #0
      BEQ end
      MOV R4, R1
      AND R4, R4, #1
      CMP R4, #1
      BNE skip
      LSL R5, R0, R2
      ADD R3, R3, R5
skip:  ADD R2, R2, #1
      LSR R1, R1, #1
      B start
end:   HALT
```

Complete the trace table using the program to:

- trace the execution of the program
- determine the function of the program.

You may not need to use all rows and cells.

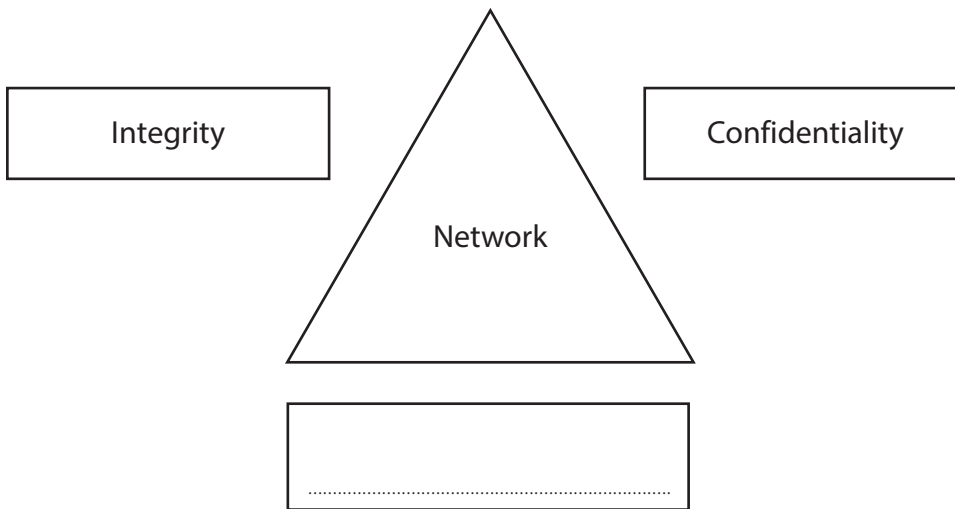
SECTION D

Network and cybersecurity

16 The partially completed diagram shows the CIA network security model.

Complete the diagram by adding the missing label.

Diagram



(Total for Question 16 = 1 mark)

17 State the name of the protocol used to translate www.pearson.com to an IP address.

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(Total for Question 17 = 1 mark)

18 Four bytes are transmitted using the same type of parity.

Which byte contains a single bit that is corrupted during transmission?

- A** 0000 1010
- B** 0100 0100
- C** 1001 1111
- D** 1010 0100

(Total for Question 18 = 1 mark)

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19 Describe how an actuator functions in an Internet of things (IoT) device.

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(Total for Question 19 = 2 marks)

20 Explain **one** way the source IP address in an IP packet header is used.

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(Total for Question 20 = 2 marks)

21 Explain **one** way using large prime numbers makes RSA encryption secure.

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(Total for Question 21 = 2 marks)

TOTAL FOR SECTION D = 9 MARKS

SECTION E

Structuring data

22 Give **two** advantages of using an adjacency matrix rather than an adjacency list to represent a graph.

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(Total for Question 22 = 2 marks)

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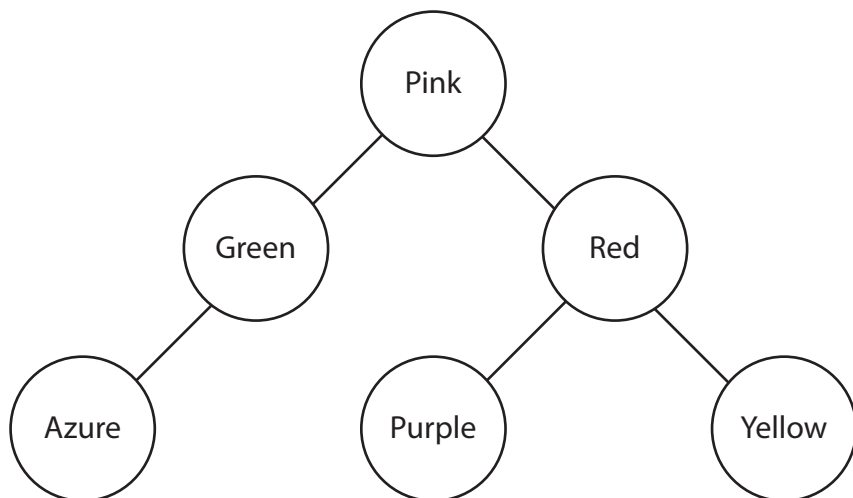
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23 The diagram shows a binary search tree.

Binary search tree



(a) Describe the process of searching for the value Purple in the binary search tree. (4)

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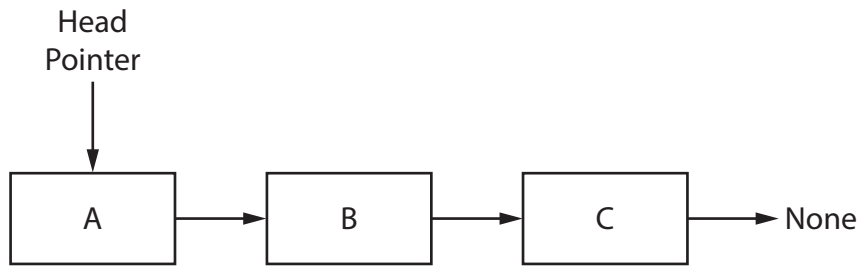
(b) Give the name of the traversal algorithm that would output the values in the nodes in the order Pink, Green, Azure, Red, Purple and Yellow. (1)

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(Total for Question 23 = 5 marks)

24 The linked list contains three values.

Linked list



The function `count()` takes a pointer as a parameter.

Outline how the function can use recursion to count the number of items shown in the linked list.

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(Total for Question 24 = 4 marks)

TOTAL FOR SECTION E = 11 MARKS

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SECTION F**Problem solving**

25 Which statement describes an algorithm with linear complexity?

- A** It halves the number of items to process at each step.
- B** It takes the same amount of time to execute regardless of the number of items to process.
- C** Its run time doubles with each additional data item to process.
- D** Its run time grows in direct proportion to the number of items to process.

(Total for Question 25 = 1 mark)

26 Complete the table to give the average case time complexity for the **two** operations.

Table

Operation	Average case
Binary search	
Merge sort	

(Total for Question 26 = 2 marks)

27 Outline how a pivot is used by a quick sort algorithm when performing partitioning.

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(Total for Question 27 = 2 marks)

28 Explain **one** problem-solving technique that can be used to solve an intractable problem.

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(Total for Question 28 = 2 marks)

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29 The Karnaugh map represents a Boolean function.

Karnaugh map

		AB			
		00	01	11	10
CD	00	0	1	1	0
	01	1	0	1	0
	11	1	0	1	0
	10	0	1	1	0

Construct a Boolean expression for the function in the Karnaugh map as a simplified sum of products.

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(Total for Question 29 = 4 marks)

30 Simplify this expression using Boolean algebra.

$$\overline{\overline{X} + \overline{Y}} + Y \cdot \overline{X}$$

Show your workings.

Answer

(Total for Question 30 = 3 marks)

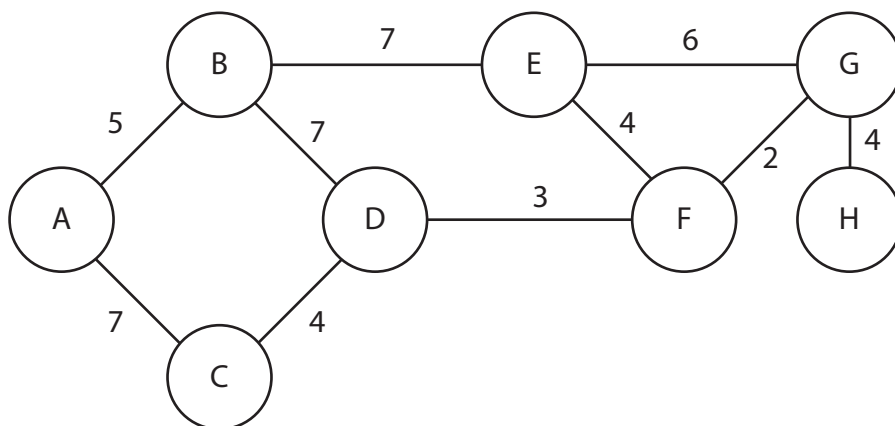
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31 The diagram shows the distance it takes to move between different locations in a computer game.

Locations in a computer game



Complete the table using Dijkstra's shortest path algorithm to:

- find the shortest path from location A to location H
- show the overall distance and the shortest path to reach location H.

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Table

Node	Distance to node	Path to node
A		
B		
C		
D		
E		
F		
G		
H		
Distance		
Shortest path		

(Total for Question 31 = 6 marks)

TOTAL FOR SECTION F = 20 MARKS
TOTAL FOR PAPER = 80 MARKS