Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE

Centre Number	Candidate Number

Computer Science

Paper 1: Principles of Computer Science

Sample Assessment Material
Time: 2 hours

Paper Reference
1CP0/01

You do not need any other materials.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- Use of a calculator is prohibited.
- **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.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

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.

Turn over ▶

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S 4 5 2 0 4 A 0 1 2 4

PEARSON

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 ☒.

1 A photographer uses a program on his computer to access an image file stored on a magnetic hard disk drive.

(a) (i) Give **two** features of a magnetic hard disk drive that make it suitable for this purpose.

(2)

1 .....

2 .....

The operating system assigns memory to the image file.

(ii) Describe the function of memory.

(2)

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(b) The photographer downloads images from a website. The images are compressed.

(i) Give **one** reason why images are compressed.

(1)

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A lossless, run length encoding (RLE) algorithm is used to compress the images.

This table shows some of the data for an image.

r	r	r	r	b	b	r	y	y	y

(ii) Apply RLE to the data and give the result.

(2)

A lossy compression algorithm could be applied to the image data.

One feature of lossy compression is that it reduces the file size.

(c) Give **two** other features of lossy compression.

(2)

1 .....

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2 .....

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The photographer sends a message which is encrypted using a Caesar cipher algorithm.

(d) (i) Outline how a Caesar cipher algorithm works.

(2)

(ii) Part of the encrypted text is PEA.

Complete the table to show the original text.

(2)

Encrypted text	P	E	A
Original text	L		

(e) The photographer uses a scanner and computer to convert printed photographs into bitmap images.

Describe how binary digits are used to represent bitmap images.

(2)

(f) The photographer takes up to 2000 photographs per week. Each photograph requires 5 MB of storage on the camera's memory card.

(i) Select the camera memory card with the smallest capacity that can store 2000 photographs.

Indicate your answer by putting a cross in the box.

(1)

	Capacity (GB)	
A	4	☒
B	8	☒
C	16	☒
D	32	☒

(ii) At the end of each week, the photographer transfers the photographs from the camera's memory card to his computer's hard drive.

Explain how to calculate the time it will take to transfer 2000 photographs.

(2)

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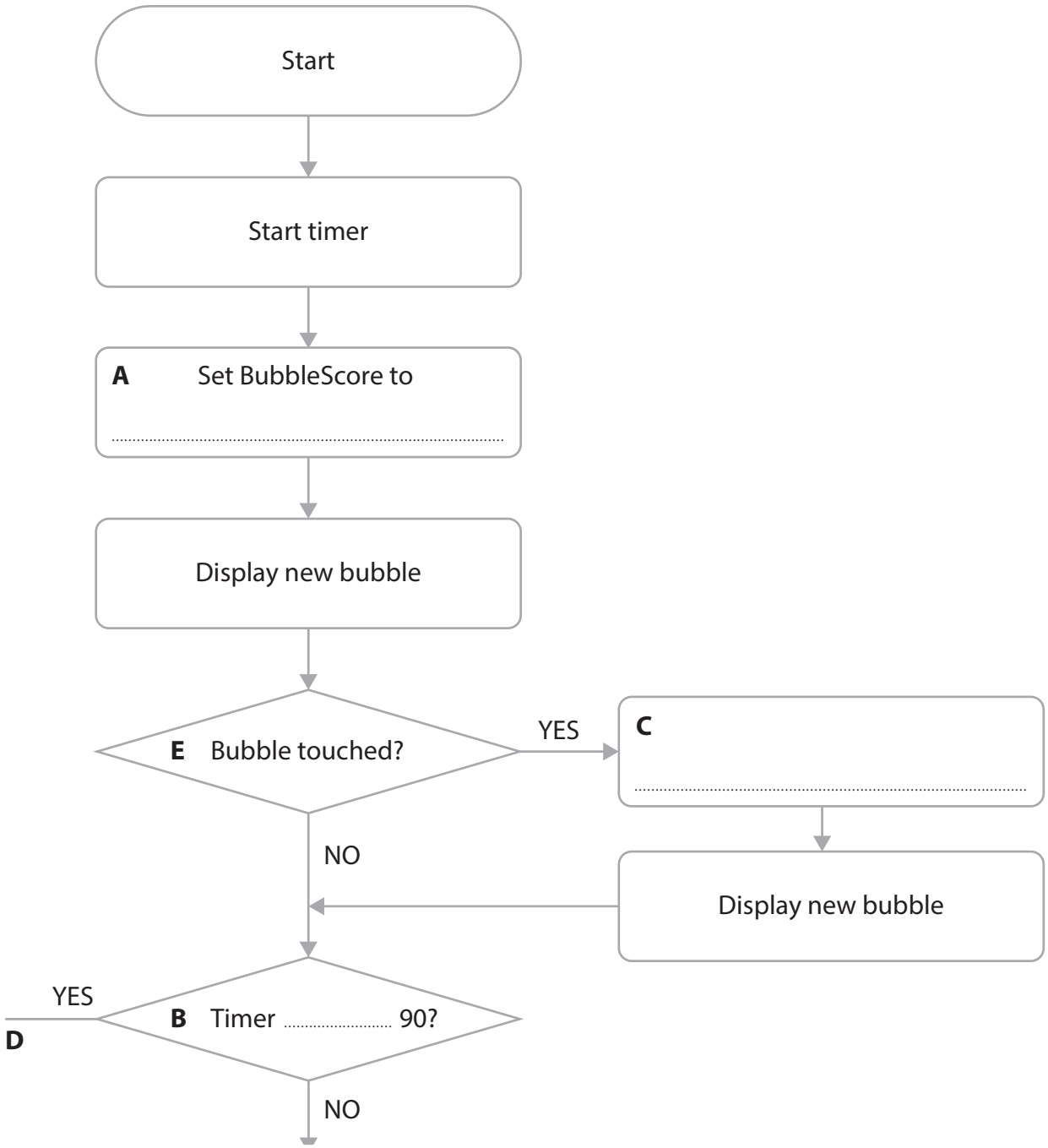
(Total for Question 1 = 18 marks)

2 A game on a touch screen phone displays a bubble. When the player touches the bubble it pops and another bubble appears. The aim of the game is to pop as many bubbles as possible within 90 seconds.

(a) The flow chart for this is given below. It is incomplete.



(i) Complete the process statement in **A**.

(1)

(ii) Complete the statement in **B**.

(1)

(iii) Complete the process statement in **C**.

(2)

(iv) Complete connector **D**.

(1)

(v) At the end of the game the player's score is displayed.
Draw this on the flow chart.

(3)

(vi) Name the programming construct that would be used to implement **E**.

(1)

(b) BubbleScore is a variable.

(i) Describe what is meant by the term **variable**.

(2)

The variable BubbleScore stores the number of bubbles popped.

(ii) Explain which data type is most appropriate for the variable BubbleScore.

(2)

This algorithm is designed to display the highest score.

```
IF HighestScore > BubbleScore THEN
    SET HighestScore to BubbleScore
ENDIF
DISPLAY HighestScore
```

(c) Explain why this algorithm would not work as intended.

(2)

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(d) The array LeaderBoard is used to store the names of the five players with the highest scores.

(i) Explain why an array is a suitable data structure for this purpose.

(2)

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Here are some of the contents of the array LeaderBoard.

Ann	Josie	Cahit	Alex	Layla

(ii) Give the name of the player stored in LeaderBoard [3].

(1)

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(Total for Question 2 = 18 marks)

3 An alarm system sensor embedded in a baby's clothing is used to measure its heart rate.

(a) A digital display shows the baby's heart rate in beats per minute (bpm).

Each digit in the display is represented as a 4-bit binary code.

For example:

0	0	0	1		0	0	0	0
1					0			

(i) Complete the table to show how a heart rate of 95 bpm is represented.

(1)

9					5			

(ii) Complete the table to show what heart rate is being displayed.

(1)

0	1	1	1		0	0	1	0

(b) Assembly code is used to program a microcontroller.

Here is part of an assembly code instruction set showing the commands and a description of each command.

Command	**Description**
ADD Rd, Rn, Rm	Adds the contents of Register m to the contents of Register n and stores the result in Register d
CMP Rn, Rm	Compares the value in Register m with the value in Register n and updates the result status flags according to the result
LDR Rd, [Rm]	Loads the contents of the memory address stored in Register m into Register d
MOV Rd, #<value>	Moves <value> into Register d
MOVGT Rd, #<value>	Moves <value> into Register d if result status flags indicate that the 'greater than' condition is true

(i) The assembly code makes use of registers.

Describe the role of registers in a processor.

(2)

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The microcontroller monitors the input from the sensor using a subprogram.

Here is a subprogram, in assembly code, for the microcontroller:

Register 0 holds the maximum safe heart rate.

Register 1 holds the address of the current heart rate reading.

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LDR R3, [R1]
MOV R2, #0
CMP R3, R0
MOVGT R2, #1
```

(ii) Describe how the subprogram processes the heart rate data.

(4)

The table shows the binary values stored in two registers, R4 and R5.

Register	**Binary value**
R4	0100 1001
R5	0010 1010

(iii) The microcontroller's processor executes the command ADD R6, R4, R5.

State the binary value that would be stored in register R6 when this command is executed.

(1)

(c) The processor has a 32-bit address bus.

(i) State the function of the address bus.

(1)

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(ii) Describe how the size of the address bus affects the maximum amount of memory available to the microcontroller's processor.

(2)

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(iii) The binary number 0110 1110 is stored in a memory location.

State the hexadecimal representation of this binary number.

(1)

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(d) The baby alarm system monitors heart rate, temperature and movement. These are Boolean variables that are set to 0 when the values are within safe limits and 1 when they are outside safe limits.

The microcontroller monitors the readings and sounds an alarm if any two of the readings are outside safe limits.

(i) Give the logic statement the microcontroller uses to determine if the alarm should be sounded.

(2)

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(ii) Complete the truth table for this logic statement.

(2)

INPUTS			OUTPUT
Heart Rate	**Temperature**	**Movement**	**Alarm**

(Total for Question 3 = 17 marks)

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4 A running club uses a computer to record training data for its members. After each run the total time and the number of laps are stored for each runner.

(a) A subprogram is used to calculate each runner's average time per lap.

Write an algorithm to calculate the average time.

(2)

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(b) The subprogram will be written in a high-level language.

(i) Explain **one** benefit of using high-level programming language for this subprogram.

(2)

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(ii) Give **one** reason why programmers use subprograms.

(1)

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(c) A runner completes four laps of the track.

A bubble sort algorithm is used to sort the lap times into ascending order.

Complete the table to show Pass 1 and Pass 2 of the bubble sort.

(2)

Lap time (seconds)	Pass 1	Pass 2	Pass 3
48			40
40			42
47			47
42			48

(d) The running club stores details about members in a structured database consisting of the following format:

Member (MemberID, Surname, Forename, DateOfBirth, RenewalMonth, EmailAddress)

Run (MemberID, DateOfRun, Time)

The club wants to send a reminder email to those members whose membership is due for renewal in September.

(i) Write an SQL query to retrieve the Forename and EmailAddress for the members who should be sent emails.

(3)

Nancy is a member of the running club. Her MemberID is 1234. At her training session on 12 May 2013 she completed a run in 18.4 minutes.

(ii) Write the SQL command to add this information to the database.

(2)

Nick is a member of the running club. His MemberID is 0012. He wants to know the date and time of all his runs.

(iii) Write an SQL query to display his running record in time order.

(3)

Members may log on to the club's website to view details of their training.

(e) Explain the server-side processing that takes place when a member views their training online.

(3)

(Total for Question 4 = 18 marks)

5 Rail passengers carry a contactless smartcard to pay for train journeys. The account balance is stored on the card. A processor in the exit barrier calculates the rail fare.

The card is swiped at the start and end of each journey. If there is enough money on the card at the end of the journey, the balance is updated and displayed on the barrier screen, and the exit barrier opens. If not, the message 'Need to top-up' is displayed and the barrier does not open.

(a) Draw a flow chart for this process in the space provided on page 19.

(5)

Use the answer space on the next page.

Start

A railway company has 30 railway stations. Each station has a LAN that connects the ticket machines, barriers and information points.

Each station is connected to the railway company head office where the main servers are located.

*(b) Evaluate the use of a private WAN and a VPN for this purpose and recommend which would be most suitable for the railway company.

(6)

Rail fares are based on the distance travelled:

- fewer than 5 miles: £2.50
- 5–12 miles: £3.25
- more than 12 miles: £4.15

A processor in the exit barrier calculates the fare.

A discount of 10% is given for off-peak travel, i.e. after 10 am and before 5 pm on Monday to Friday or any time on Saturday and Sunday.

The ID of the railway station at which a passenger starts their journey is recorded on their card when they swipe in.

The processor in the exit barrier uses a data structure called ListOfStations to look up the distance travelled.

(c) Write an algorithm to calculate the cost of a passenger's journey.

It must read in the start of the journey from the card, calculate the fare and apply any discount. The information must then be displayed in a customer-friendly way.

(8)

Answer space continues on the next page.

(Total for Question 5 = 19 marks)

TOTAL FOR PAPER = 90 MARKS

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