Coimisiún na Scrúduithe Stáit
State Examinations Commission

# Leaving Certificate Examination 2023

# Computer Science

## Sections A & B

## Ordinary Level

## Wednesday 24 May   Morning      9:30 – 11:00

### 130 marks

**Examination Number**

**Day and Month of Birth**

For example, 3rd February
is entered as 0302

| For Examiner use only | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Section | Question | Mark | Section | Question | Mark | Section | Question | Mark |
| A | 1 | | A | 7 | | B | 13 | |
| | 2 | | | 8 | | | 14 | |
| | 3 | | | 9 | | | 15 | |
| | 4 | | | 10 | | Section B Total: | | |
| | 5 | | | 11 | | C | 16 | |
| | 6 | | | 12 | | Section C Total: | | |
| Section A Total: | | | | | | Total: | | |

# Instructions

There are **three** sections in this examination. Section A and B appear in this booklet. Section C is in a separate booklet that will be provided for the computer-based element.

| Section A | Short Answer Questions | Attempt any nine questions<br>All questions carry equal marks | 54 marks |
| Section B | Long Questions | Attempt any two questions<br>All questions carry equal marks | 76 marks |
| Section C | Programming | Answer all question parts | 80 marks |

Calculators may **not** be used during this section of the examination.

The superintendent will give you a copy of page 78 (Logic gates) of the *Formulae and Tables* booklet on request. You are not allowed to bring your own copy into the examination.

Write your answers for Section A and Section B in the spaces provided in this booklet. There is space for extra work at the end of the booklet. Label any such extra work clearly with the question number and part.

Answer any **nine** questions.

**Question 1**

Given the following variable declarations, state the Boolean result, either `True` or `False`, of each of the Python `print` statements in the table below.

```
a = 21
b = 10
```

| Column A<br>print statement | Column B<br>True or False |
|---|---|
| print(a == b) | |
| print(b != a) | |
| print(a > b) | |
| print(b <= a) | |
| print(a == 10) | |
| print(b != 21) | |

**Question 2**

**(a)** Describe the main difference between a general-purpose computer and an embedded system.
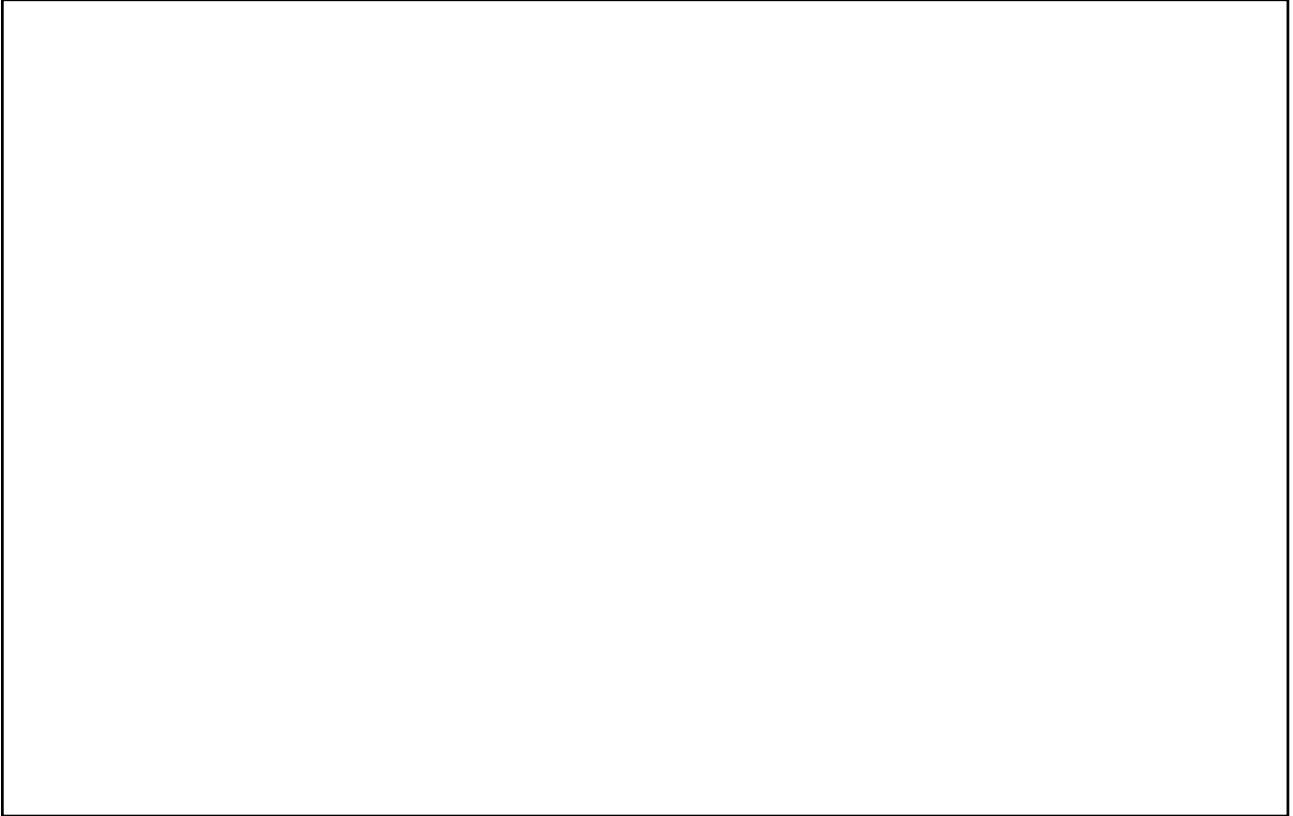
| |
|---|
| |
| |
| |
| |

**(b)** Name **one** example of an embedded system you might find in your home.

| |
|---|
| |

**Question 3**

Using either a flowchart or pseudocode, create an algorithm which must do the following:

- Ask the user to input three separate numbers
- Work out the average of the three numbers
- Print the average of the 3 numbers

**Question 4**

Convert the decimal number 14 to a binary number.

**Question 5**

The computational thinking skill of pattern recognition is used by machine learning algorithms to identify objects in images, such as that in **Figure 1**.

Explain, with the use of an example, how pattern recognition might be used by such algorithms.
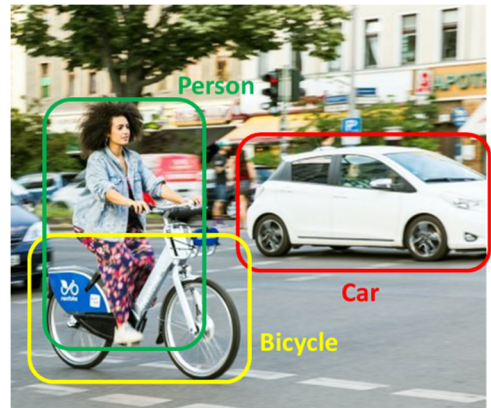


**Figure 1**

|  |
|  |
|  |
|  |
|  |

**Question 6**

Flying Fit is a fitness club that uses a computer system to store information about its members.

Choose the most suitable data type from the list below and place it in Column B to match the corresponding variable description in Column A. Each data type should be used only once.

Float          Integer          Boolean          String          List

| Column A<br>Variable Description | Column B<br>Data Type |
| --- | --- |
| Member Name |  |
| Member Age |  |
| Amount Paid |  |
| Most Popular Days to Visit |  |
| Member Completed Induction – Yes/No |  |

## Question 7

The Central Processing Unit (CPU) is considered the most important component of the computer system. What is the role of the CPU?
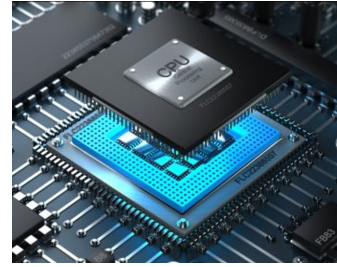
**Figure 2**

| |
|---|
| |
| |
| |
| |
| |

## Question 8

Below is a sorted list of student names.

| Ava | Cara | Chan | Dara | Julie | Kevin | Senan |
|---|---|---|---|---|---|---|

**(a)** If a binary search algorithm is used to search for the name "Chan" what name will first be identified as the Mid (middle) item?

| |
|---|
| |

**(b)** Why is the binary search algorithm sometimes referred to as a "divide and conquer" method?

| |
|---|
| |
| |
| |

**Question 9**

Numeric data can be categorised as either discrete data or continuous data. For each example listed in Column A in the table below, enter whether it is "discrete" or "continuous" in Column B.

| Column A<br>Example of Data | Column B<br>Discrete or Continuous |
|---|---|
| The number of players in a football squad | |
| The number of students in a class | |
| The speed of a school bus | |
| The temperature of a classroom | |
| The number of days it rained in March | |
| The weight of a box | |

**Question 10**

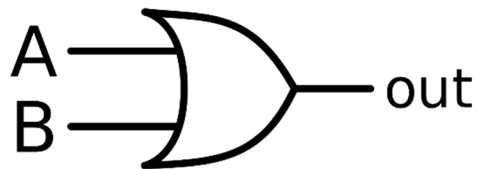Complete the truth table for the OR logic gate, shown below in **Figure 3**.



**Figure 3**

| A | B | out (A OR B) |
|---|---|---|
| 0 | 0 | |
| 0 | 1 | |
| 1 | 0 | |
| 1 | 1 | |

## Question 11

The Python code below is being used to calculate a Junior Cycle grade descriptor from a percentage. Examine the code carefully and answer the questions below.

```python
1  percentage = int(input("How many marks out of 100? "))
2
3  grade = ""
4  if percentage >= 90:
5      grade = "Distinction"
6  elif percentage >= 75:
7      grade = "Higher Merit"
8  elif percentage >= 55:
9      grade = "Merit"
10 elif percentage >= 40:
11     grade = "Achieved"
12 elif percentage >= 20:
13     grade = "Partially Achieved"
14 else:
15     grade = "Not Graded"
16
17 print(grade)
```

**(a)** What is the output of the program if the user enters 19 when asked for the number of marks?

**(b)** What is the output of the program if the user makes a mistake and enters 110 when asked for the number of marks?

**(c)** What is the purpose of the `int` function in line 1 of the code?

**Question 12**

A community centre is installing a computer suite so that they can offer IT training courses to the people who live locally. They want the computers to be accessible to everybody and need some suggestions on adaptive or assistive technology that they could use to support people who may have additional needs.

Suggest **two** types of adaptive or assistive technology that could be used and explain how they might support someone with additional needs.

| Adaptive / Assistive Technology 1: |
| --- |
| Explain: |
| |
| |
| |
| |
| Adaptive / Assistive Technology 2: |
| Explain: |
| |
| |
| |
| |

Answer any **two** questions.

**Question 13**

**(a)**

   **(i)** Select the correct computer science term from the following list and place it in Column B to match the definitition in Column A in the table below.

**Variable**     **Array**     **Function**     **Operator**     **Conditional**     **Boolean**

| Column A<br>Definition | Column B<br>Term |
|---|---|
| A data structure that can store a collection of elements of the same data type | |
| A character that represents a mathematical or logical action | |
| A command for handling a decision | |
| A memory location that can store a value | |

   **(ii)** While loops are used in computer science to iterate over certain blocks of code. Examine the code below and complete the trace table that tracks the progress of the code being executed.

```
1  i = 1
2  j = 10
3  while i < j:
4      print(i)
5      i = i + 1
6      j = j - 1
```

| | i | j | while i < j | print(i) |
|---|---|---|---|---|
| 1 | 1 | 10 | True | 1 |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |

*This question continues on the next page.*

**(b)** A public electric car charging point uses an algorithm to work out the cost for a customer to charge their car battery to 100%. Regular customers with loyalty cards get a discount. Examine the flowchart for the algorithm, shown in **Figure 4** below, and answer the questions that follow.
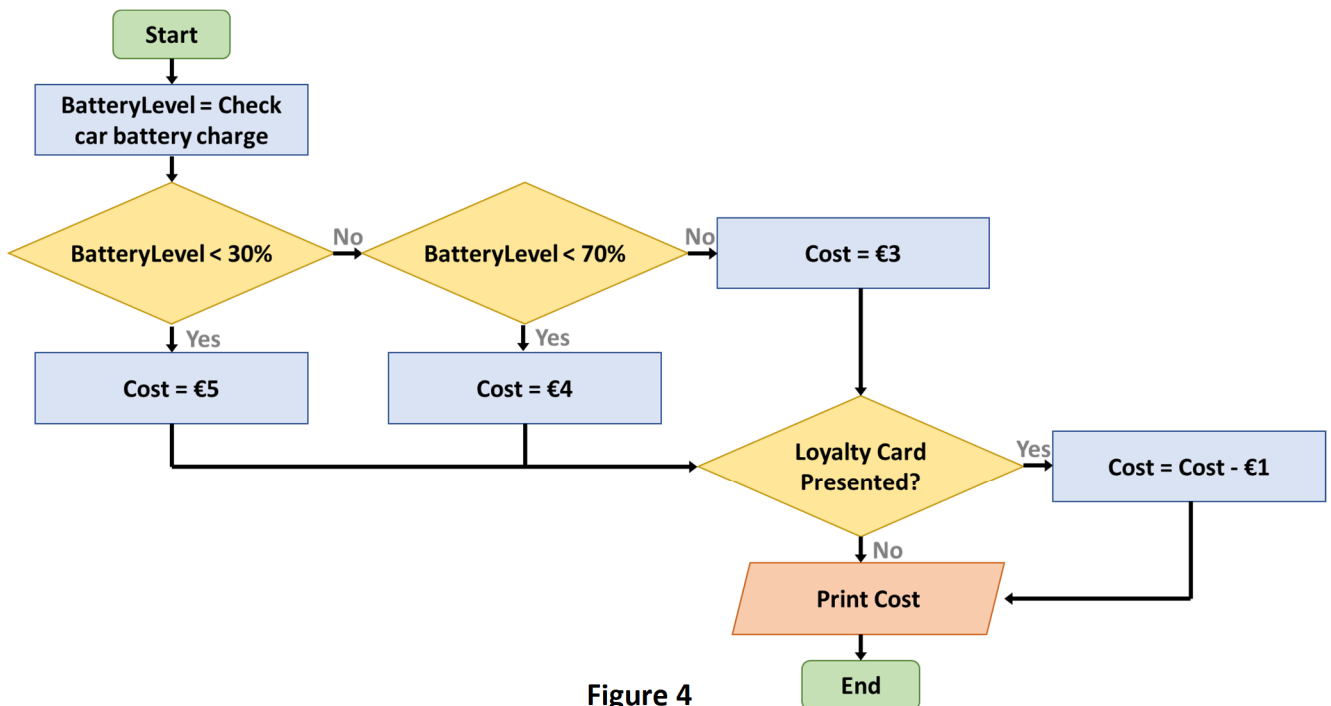


**Figure 4**

**(i)** What cost will be printed when a customer has a car battery with a charge of 25% and no loyalty card?

**(ii)** What cost will be printed when a customer has a car battery with a charge of 50% and a loyalty card?

**(iii)** What cost will be printed when a customer has a car battery with a charge of 80% and no loyalty card?

**(iv)** What is the lowest possible cost that this algorithm can print?

*This question continues on the next page.*

**(c)** Three cars arrive at an electric vehicle charging point location. There are two charge stations so only two cars can be charged at the same time. None of the three electric vehicle's batteries have any charge. It takes one hour to fully charge each electric vehicle but this does not need to be done all in one go.
**Note**: you do not need to account for time taken to change which car is being charged.



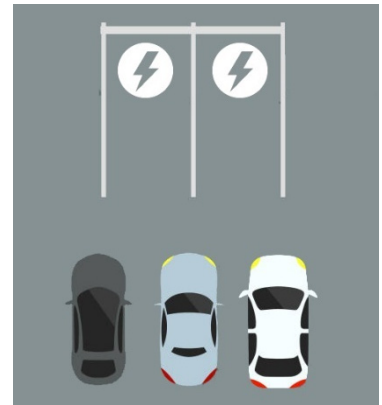**(i)** What is the shortest time needed to fully recharge the three electric vehicles? Show your workings below.

**Figure 5**

**(ii)** Name and explain a computational thinking skill you used to try and solve this problem.

| Name: |
|---|
| Explain: |
|  |
|  |
|  |

**Question 14**

**(a)** RTÉ Player was first launched in 2009 as a web browser-based application to allow people living in Ireland to catch up on TV shows. Over the years, there have been several updates and newer versions released, such as an app for Apple and Android devices.

Over the past year RTÉ have been looking into updating their RTÉ Player app.

When a new piece of software is created for such a large organisation there are many different stages of the software development lifecycle to go through and also many different people involved.

**(i)** Explain who the stakeholders and end users would be in this project.

| Stakeholders: |
|---|
| |
| |
| |
| End Users: |
| |
| |
| |

**(ii)** Name and describe **two** different roles in a software development project such as this.

| Role 1: |
|---|
| Description 1: |
| |
| |
| Role 2: |
| Description 2: |
| |
| |

*This question continues on the next page.*

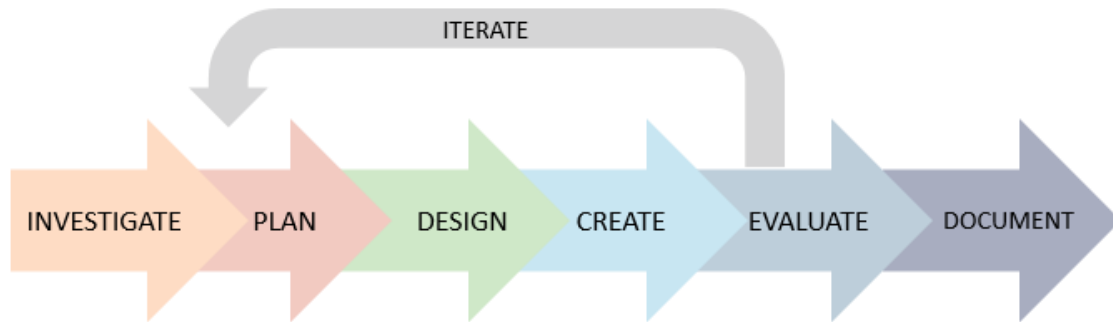**(b)** The diagram, in **Figure 5** below, shows a typical software development lifecycle.



**Figure 5**

**(i)** Describe **one** activity that will take place in the Create stage, and also **one** activity that will take place in the Document stage of the process for a project such as this.

| Create: |
| --- |
|  |
|  |
|  |
| Document: |
|  |
|  |
|  |

**(ii)** It is often suggested that an agile or iterative approach to systems development is better than a traditional waterfall approach. List **two** advantages of using the agile or iterative approach over the waterfall approach.

| 1. |
| --- |
|  |
|  |
| 2. |
|  |
|  |

*This question continues on the next page.*

**(c)**   As part of the development of the new app it is planned to conduct testing.

   **(i)**   The developers will conduct unit testing. Explain the term 'unit testing'.

| Unit testing: |
| --- |
|  |
|  |
|  |
|  |

   **(ii)**   Beta testing gives a large number of real users of a product the opportunity to test it before it goes live. List **one** advantage and **one** disadvantage of conducting beta testing.

| Advantage: |
| --- |
|  |
|  |
| Disadvantage: |
|  |
|  |

**Question 15**

**(a)** A local school stores student details on their computer network. The school's principal is concerned about the security of the student information held on the network.

    **(i)** Recommend **two** different security measures that the school could implement to make their network more secure.

| Security Measure 1: |
| --- |
| |
| |
| **Security Measure 2:** |
| |
| |

    **(ii)** The school intend to implement a client-server model on their network. With the aid of a diagram, explain how the client-server model works.

<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>

*This question continues on the next page.*

**(b)** Estonia has developed a software system for e-Government. The majority of tax returns are completed online instead of using paper-based returns. Citizens can vote online in elections instead of having to go to a polling station to cast a vote. Every citizen's health records are kept in an online system so that they can be accessed by any doctor or hospital.

Identify **two** possible advantages and **two** possible disadvantages of using this system.

| |
|---|
| Advantage 1: |
| |
| |
| |
| Advantage 2: |
| |
| |
| |
| Disadvantage 1: |
| |
| |
| |
| Disadvantage 2: |
| |
| |
| |

*This question continues on the next page.*

**(c)**  In an article written by Doctor Shelly Batra, CEO of Every Infant Matters she states the following:

> Technology is a two-edged sword. It is up to humans to decide what they will do with it. We can use it for the betterment of mankind, or we can use it to wipe out millions. It is up to us. It is our decision, and ours alone.

Choose **one** technology you have studied and explain how it benefits society and choose **one** technology you have studied and explain how it could be a danger to society.

| |
|---|
| Technology 1: |
| Benefit: |
| |
| |
| |
| |
| |
| Technology 2: |
| Danger: |
| |
| |
| |
| |
| |

Space for extra work.

Indicate clearly the number and part of the question(s) you are answering.

Leaving Certificate – Ordinary Level

# Computer Science – Sections A & B

**Wednesday 24 May**
**Morning 9:30 – 11:00**