



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination
Sample Paper

Computer Science

Sections A & B

Ordinary Level

Time: 1 hour, 30 minutes

130 marks

| Examination number | | | | | |
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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.

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|-----------|------------------------|----------|--------------|
| Section A | Short Answer Questions | 60 marks | 12 questions |
| Section B | Long Questions | 70 marks | 3 questions |
| Section C | Programming | 80 marks | 1 question |

Answer all questions.

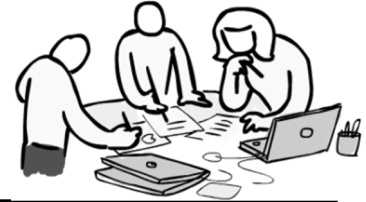
Write your answers for Section A and Section B in the spaces provided in this booklet. There is space for extra work at the end of the booklet. Label any such extra work clearly with the question number and part.

This examination booklet will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

Answer all twelve questions.

Question 1

Working as part of a team is an important aspect of software development. You have worked as a member of a team for your Applied Learning Tasks (ALTs).



(a) Name **two** roles in a typical software development team.

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| 1. |
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| 2. |
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(b) List **one** advantage of working in a software development team.

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Question 2

(a) What is meant by the term 'cloud computing'?



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(b) Give **two** examples of how cloud computing is used in everyday life.

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| 1. |
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| 2. |
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Question 3

Choose each term from the following list and place it in Column B to match a description in Column A.

Unicode CSS HTTP

| Column A Description | Column B Term |
|---|------------------|
| A style sheet language used for describing the presentation of a document written in a markup language like HTML. | |
| A large character set that attempts to include all possible characters. | |
| The underlying protocol used by the World Wide Web. | |

Question 4

- (a) How many megabytes (MB) are in one gigabyte (GB)?

- (b) How many bits are there in one byte?

- (c) A computer stores data and instructions in binary form.
Explain the reason for using the binary number system in computing.

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Question 5

What is the output of the following piece of Python code:

```
1 x = 10
2 y = x + 20
3 print(y)
```

Output:

Question 6

The following line of JavaScript code is intended to run a function called **myJS** when a button is clicked.

Fill in the **two** pieces of missing JavaScript code:

```
<button _____ = " _____ ">Click me</button>
```

Question 7

The Python programming language has a variety of inbuilt data types.

An example of an **Integer** data type is the number 10.

Give an example of the following datatypes:

| | |
|--------------|----------------------|
| (a) Float: | <input type="text"/> |
| (b) Boolean: | <input type="text"/> |
| (c) List: | <input type="text"/> |

Question 8

Turtle graphics was part of the original Logo programming language developed by Seymour Papert in 1966. The following Python programme makes use of turtle graphics.

```
1 import turtle
2
3 pencil = turtle.Turtle()
4
5 for i in range(4):
6     pencil.forward(50)
7     pencil.right(90)
8
9 turtle.done()
```

(a) Name the shape that will be drawn out.

(b) Using Python or pseudocode, write out the instructions to draw a triangle.

Question 9

Complete the following truth table for the **OR** logic gate:

| INPUTS | | OUTPUTS |
|--------|---|---------|
| A | B | A OR B |
| 0 | 0 | |
| 0 | 1 | |
| 1 | 0 | |
| 1 | 1 | |

Question 10

- (a) In JavaScript, which of the following is the correct method for inserting a multi-line comment?

Insert a tick in the correct box.

//This is a multi
line comment//

☐

<!--This is a multi
line comment-->

☐

/*This is a multi
line comment*/

☐

- (b) Describe **one** possible feature you could include on a webpage using JavaScript.

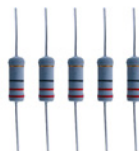
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Question 11

Using the letters A, B, C and D match each image with its corresponding term in the table below:



A



B



C



D

| Term | Image |
|-----------------|-------|
| Resistor | |
| LED | |
| Switch | |
| Embedded system | |

Question 12

- (a) Bubble sort, simple sort and insertion sort are examples of sorting algorithms. What is the purpose of a sorting algorithm?

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(b)

| | | | | |
|---|---|---|---|---|
| 7 | 3 | 9 | 1 | 4 |
|---|---|---|---|---|

An ascending bubble sort algorithm is applied to the data set above.
Which **two** numbers will **first** swap position?

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Answer all three questions.

Question 13

Jenny is building a desktop computer using various pieces of hardware.

- (a) Describe **each** of the following components of a desktop computer – **Central Processing Unit (CPU)**, **Input Devices**, and **Memory**.

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| Central Processing Unit (CPU): |
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| Input Devices: |
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| Memory: |
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- (b) List **three** different factors which affect the processing speed of Jenny's computer?

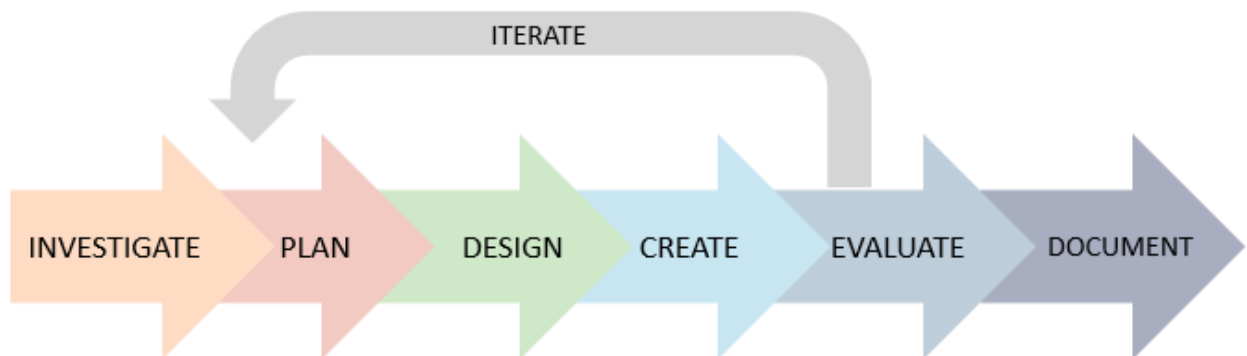
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- (c) When Jenny finishes building her new desktop computer she installs an operating system. Describe **three** functions of an operating system?

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Question 14

It is important to follow a design process when working on computer science projects such as the Applied Learning Tasks (ALTs).



- (a) The diagram above outlines the stages involved in a typical design process. Describe what is involved in the first two stages of the process – (i) **Investigate** and (ii) **Plan**.

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| Investigate: |
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| Plan: |
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- (b)** What are the ethical considerations that need to be addressed with respect to any personal data that is collected?

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- (c)** Iteration is an important part of the design process.

- (i)** What is an iterative design process?

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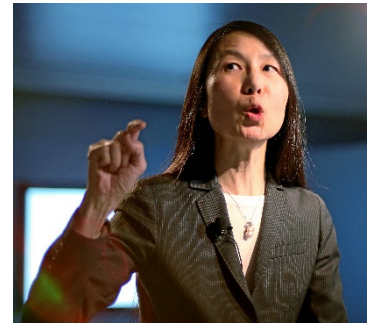
- (ii) Explain the advantages of implementing an iterative design process.

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Question 15

Jeannette Marie Wing is Director of the Data Science Institute at Columbia University, where she is also a professor of computer science.

In a 2010 publication, Wing stated that ‘algorithms are at the heart of computational thinking and computer science’.



(a) What is an algorithm?

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(b) In her 2006 essay, entitled *Computational Thinking*, Jeannette Wing stated that ‘computational thinking is using abstraction and decomposition when attacking a large complex task or designing a large complex system.’

Describe what is meant by the terms (i) **abstraction** and (ii) **decomposition**.

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| Abstraction: |
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| Decomposition: |
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- (c) Read the following excerpt from *Artificial Intelligence in Medicine* and answer the questions that follow.

One of AI's biggest potential benefits is early detection and prevention of deadly diseases. Imagine having an app that can tell you when something's wrong with your body, even before you visit a doctor or feel unwell. That's exactly what researchers at Stanford University are trying to accomplish, and they've already made a huge breakthrough. In early 2017, a group of scientists announced the development of an AI algorithm that detects skin cancer. They first created a system containing 130,000 images of skin abnormalities and diseases. Based on this large data-set, they trained an algorithm to diagnose skin cancer. The results were then compared to diagnoses made by board-certified dermatologists, showing that the algorithm was 91 percent accurate.

(Adapted from *Artificial Intelligence in Medicine: Current Trends and Future Possibilities*, 2018)

- (i) List **two** benefits of artificial intelligence in medicine.

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- (ii) The algorithm used by the Stanford University researchers is an example of how artificial intelligence can benefit society.

Describe another example of the use of artificial intelligence and list some of the potential benefits to society.

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| Example: |
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| Benefits: |
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- (iii) In 2015, Stephen Hawking warned that artificial intelligence will be 'either the best, or the worst thing, ever to happen to humanity'.

Outline **two** ways in which artificial intelligence could impact negatively on human life.



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Space for extra work.

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

[illegible]

Space for extra work.

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

[illegible]

Acknowledgements

Images

Image on page 6: www.microbit.org

Image on page 14: en.wikipedia.org/wiki/Jeannette_Wing

Image on page 17: www.aruma.com.au/about-us/blog/6-surprising-facts-about-stephen-hawking/

Texts

Document on page 14: Computational Thinking, Jeannette Wing www.cs.cmu.edu/~15110-s13/Wing06-ct.pdf

Document on page 15: Adapted from Artificial Intelligence in Medicine: Current Trends and Future Possibilities, Richard van Hooijdonk cliniciantoday.com/artificial-intelligence-in-medicine-current-trends-and-future-possibilities/

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Leaving Certificate – Ordinary Level

Computer Science – Sections A & B

Sample Paper

Time: 1 hour, 30 minutes



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination
Sample Paper

Computer Science

Section C

Ordinary Level

Time: 1 hour

80 marks

| Examination number | | | | | |
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Instructions

There is one section of the examination paper in this booklet.

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|-----------|-------------|----------|------------|
| Section C | Programming | 80 marks | 1 question |
|-----------|-------------|----------|------------|

Answer all parts of the question on your digital device.

Instructions are provided for each question.

Ensure that you save your work regularly and when you complete each question.

Do not change the file names or save your work under different file names.

If you are unable to get some code to work correctly you can comment out the code so that you can proceed. The code that has been commented out will be reviewed by the examiner.

Answer all questions parts.

Question 16

- (a) Open the program called **Question16_A.py** from your device.
Enter your Examination Number in the space provided on **Line 2**.

This is a simple calculator program that can add and subtract two numbers. When this program is run it prompts the user to select addition or subtraction.



The user enters the letter 'a' if they wish to add the numbers or enters the letter 's' if they wish to subtract.

```
1  # Question 16(a)
2  # Examination Number:
3
4  num1 = 9
5  num2 = 5
6
7  print('Do you want me to (a)dd or (s)ubtract?')
8  choice = input()
9
10 if choice == 'a':
11     print (num1 + num2)
12 elif choice == 's':
13     print (num1 - num2)
14
```

Modify the program to do the following:

- (i) Add a comment at the start of the program that states 'This calculator can only add and subtract'.
- (ii) The user should be prompted to enter their name when the program runs. A suitable variable should be used to store the name:

```
Please enter your name: Jane
```

- (iii) The program should output the following to the screen, including the user's name:

```
Hello Jane.
Welcome to the addition and subtraction calculator.
```

- (iv) The program currently adds the two numbers stored in the variables `num1` and `num2`. Modify the program so that the user is asked to enter the numbers that will be added or subtracted:

```
Enter the first number:4
Enter the second number:5
```

- (v) Currently the program only displays the answer. In the above example, when addition is selected, the output is:

```
9
```

Modify the program so that it outputs the equation and the answer. When the program is run the output may look as follows:

```
4 + 5 = 9
```

- (vi) The program only works if the user enters a lowercase 'a' for addition or a lowercase 's' for subtraction. Modify the program so that it will still work if the user enters an uppercase 'A' for addition or an uppercase 'S' for subtraction.
- (vii) If the user enters an invalid option (anything other than 'a', 'A', 's' or 'S') the program terminates without warning. Edit the program so that if the user selects any other option the program will output a message stating:

```
Invalid option
```

- (viii) If the user enters an invalid option when prompted to select addition or subtraction the program terminates. Modify the program so that it will continue to prompt the user to select either addition or subtraction until a valid option is selected.

When the program is run the output may look as follows:

```
Do you want me to (a)dd or (s)ubtract?
w
Invalid option
Do you want me to (a)dd or (s)ubtract?
a
4 + 5 = 9
```

Save and close your file before moving onto the next part.

- (b) Open the program called **Question16_B.py** from your device.
Enter your Examination Number in the space provided on **Line 2**.

This program also runs a calculator but this calculator can only multiply and divide.
When you compile the program, you will be prompted to enter '1' for multiplication or '2' for division. The program generates 2 random numbers between 1 and 12 that are either multiplied or divided.

This program uses functions.

```
1  # Question 16(b)
2  # Examination Number:
3
4  # This function multiplies two numbers
5  def multiply(x, y):
6      return x * y
7
8  # This function divides two numbers
9  def divide(x, y):
10     return x / y
11
12 # Main Program
13 import random # To generate random numbers
14
15 print("Select operation.")
16 print("1.Multiply")
17 print("2.Divide")
18 # Take input from the user
19 choice = input("Enter choice(1/2):")
20
21 num1 = random.randint(1,12)
22 num2 = random.randint(1,12)
23
24 if choice == '1':
25     print(num1,"*",num2,"=", multiply(num1,num2))
26 elif choice == '2':
27     print(num1,"/",num2,"=", divide(num1,num2))
```

Modify the program to do the following:

- (i) When the user selects division the answer that is returned can contain many digits after the decimal point. Round this number so that it has only one decimal place e.g. 4.3.
- (ii) Modify the program so that the calculator works for multiplication, division, addition and subtraction.
The user should also be able to enter the two numbers, rather than using two random numbers.
You will need to:
 - a. Create new functions to perform addition and subtraction.
 - b. Give the user the choice to select addition and subtraction as well as multiplication and division.
 - c. Allow the user to enter the two numbers.

When the program is run the output may look as follows:

```
Select operation.  
1.Multiply  
2.Divide  
3.Add  
4.Subtract  
Enter choice(1/2/3/4):1  
Enter first number: 5  
Enter second number: 6  
5 * 6 = 30
```

- (iii) The program currently calculates the answer to a single question. Modify the program so that the user can specify the number of calculations they wish to ask the calculator. The calculation number should appear with each question.

When the program is run the output may look as follows:

```
How many calculations will I do?:3  
Calculation 1  
Select operation.  
1.Multiply  
2.Divide  
3.Add  
4.Subtract  
Enter choice(1/2/3/4):1  
Enter first number: 5  
Enter second number: 6  
5 * 6 = 30  
  
Calculation 2  
Select operation.  
1.Multiply  
2.Divide  
3.Add  
4.Subtract  
Enter choice(1/2/3/4):3  
Enter first number: 7  
Enter second number: 8  
7 + 8 = 15  
  
Calculation 3  
Select operation.  
1.Multiply  
2.Divide  
3.Add  
4.Subtract  
Enter choice(1/2/3/4):2  
Enter first number: 8  
Enter second number: 3  
8 / 3 = 2.7
```

Save and close your file before moving onto the next part.

(c) Open the program called **Question16_C.py** from your device.

Enter your Examination Number in the space provided on **Line 2**.

This python file contains an empty list called **squared_numbers**.

The first squared number is 1 (1*1), the second squared number is 4 (2*2).

```
1 # Question 16(c)
2 # Examination Number:
3
4 squared_numbers = []
5
```

Write a Python program to do the following:

- (i) Calculate the first 20 squared numbers and place them in the list **squared_numbers**. You are expected to use a loop and the **append()** method.
- (ii) Print the list **squared_numbers** to the screen.
- (iii) Ask the user which of the first 20 squared numbers they would like to see. Print that squared number to the screen by selecting it from the list **squared_numbers**.

When the program is run the output may look as follows:

```
[1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225,
256, 289, 324, 361, 400]

Which squared number will I display (1-20)?:16
256
```

Save your file.

Ensure that you have saved and closed all files before you finish the examination.

Acknowledgements

None

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Leaving Certificate – Ordinary Level

Computer Science – Section C

Sample Paper

Time: 1 hour