2021L219G1EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2021

Computer Science

Sections A & B

Ordinary Level

Saturday 22 May Morning 9:30 – 11:00

60 marks

Examination number					

Centre stamp

For Examiner use only	
Section	**Mark**
A	
B	
C	
Total	

The 2021 examination papers were adjusted to compensate for disruptions to learning due to COVID-19. This examination paper does not necessarily reflect the same structure and format as the examination papers of past or subsequent years.

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 six questions All questions carry equal marks	30 marks
Section B	Long Questions	Attempt any one question	30 marks
Section C	Programming	One question Answer all question parts	50 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.

Section A — Short Answer Questions — 30 marks

Answer any six questions.

Question 1

Choose the appropriate Python data type from the following list and place it in Column B to match the variable assignments in Column A.

Float **Boolean** **Integer** **String** **List**

Column A Variable Assignment	Column B Data Type
`a = 5`	
`b = "Hello World"`	
`c = True`	
`d = ["apple", "banana", "orange"]`	
`e = 2.718`	

Question 2

Convert the binary number 1101 to a decimal number.

Question 3

Unicode and the American Standard Code for Information Interchange (ASCII) are both character sets used for encoding and decoding messages. Identify **one** advantage of using Unicode rather than ASCII.

Question 4

The image in **Figure 1** shows drones operating inside a modern warehouse full of goods. This is one example of how computing technology can help automate processes.

Give another example of how computing technology can be used to automate a process and explain **one** benefit provided by your example.

Figure 1

Example:

Benefit:

Question 5

The image in **Figure 2** depicts a client-server model over the Internet. Provide **one** practical example of how a client-server model is used in our daily interaction with technology.

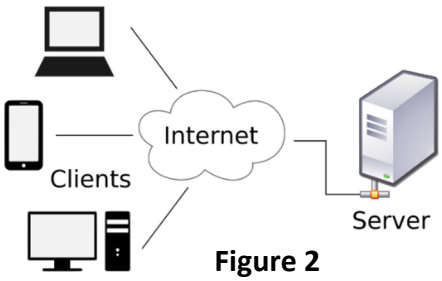


Figure 2

Question 6

(a) Answer the following question by putting a tick (✓) in the relevant box.
Tick one box only.

What is HTTP?

the language used to program web pages	☐
the method for encoding data securely	☐
the web browser	☐
the protocol for transferring hypertext for webpages	☐

(b) Describe **one** difference between the World Wide Web (WWW) and the Internet.

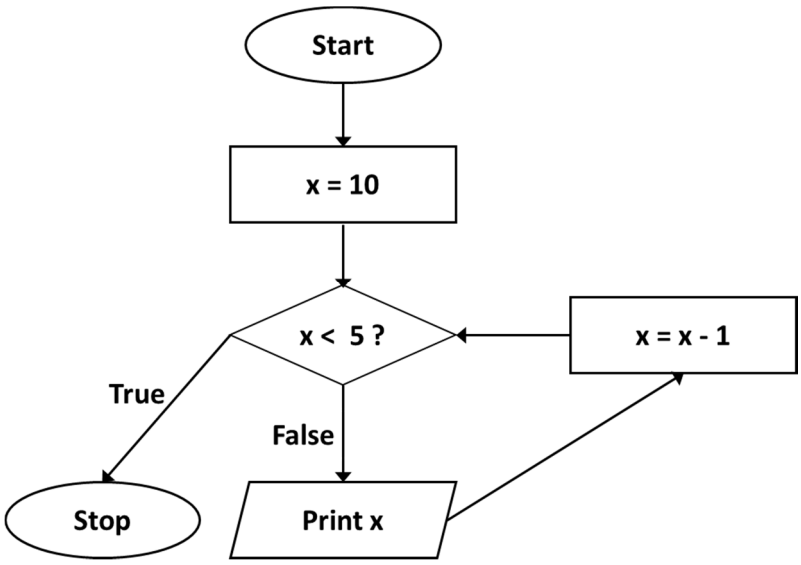
Question 7

Figure 3

Figure 3 shows the wave signals for analogue and digital inputs. Describe **one** difference between the two types of input.

Question 8

What output is produced by the algorithm shown in the flowchart below?



Question 9

Complete the trace table below to determine the output of the following Python program after it has completed running. The first row of the trace table has been completed for you.

```
1  a = 1
2  b = 2
3  while (a < 4):
4     a = a + 1
5     b = b + a
6
7  print(b)
```

Step	a	b	a < 4
1	1	2	True
2			
3			
4			

Output:

Question 10

The linear search algorithm shown below is to be applied to the following data set:

```
L = [10, 25, 21, 15, 85, 69, 74, 22, 19, 6]
```

```
Linear Search (List L, Value x)

Step 1: Set i to 0
Step 2: Set n to number of items in L
Step 3: if i >= n then go to Step 8
Step 4: if L[i] = x then go to Step 7
Step 5: Set i to i + 1
Step 6: Go to Step 3
Step 7: Print position i and go to Step 9
Step 8: Print "item not found"
Step 9: Exit
```

What is the output of this algorithm when you are searching for the following values of `x`?

(a) `x = 21`

(b) `x = 3`

Question 11

Describe **one** example of how adaptive or assistive technology might be helpful for an elderly person living alone.

Question 12

A programmer has written a program to store the name, email address and password of a user of an online chat forum. The programmer has decided to check that the user enters an email address in the correct format.

Describe **two** checks that could be used to validate the email address.

1.
2.

Section B	Long Questions	30 marks

Answer any one question.

Question 13

The following article appeared online on July 7th 2020.

Contact tracing: Ireland launches its app following Apple and Google's model

Ireland is the latest European country to successfully launch a national contact-tracing app designed to support the manual program of tracking down and warning people who have been in contact with someone who has tested positive for COVID-19.

(a)

(i) Assuming that the COVID Tracker app was developed using an iterative design cycle, similar to that in **Figure 4**, describe **two** activities that may have been undertaken in the evaluate stage.

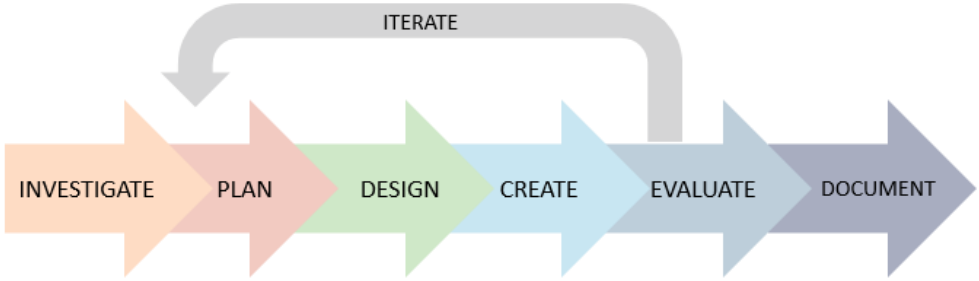


Figure 4

Activity 1:
Activity 2:

This question continues on the next page.

(ii) The Irish COVID Tracker app was developed by an Irish company called NearForm. Name and describe **two** possible roles of people involved in the development of the app.

Role 1:
Description:

Role 2:
Description:

This question continues on the next page.

(b) The Irish COVID Tracker app uses technology from Apple and Google that was designed to protect the privacy of the app users.

Describe **two** reasons why the issue of privacy is so important in the development of such a mobile phone contact tracing app.

1.
2.

This question continues on the next page.

(c) The screenshots in **Figure 5** below, show the interface of the Irish COVID Tracker app.

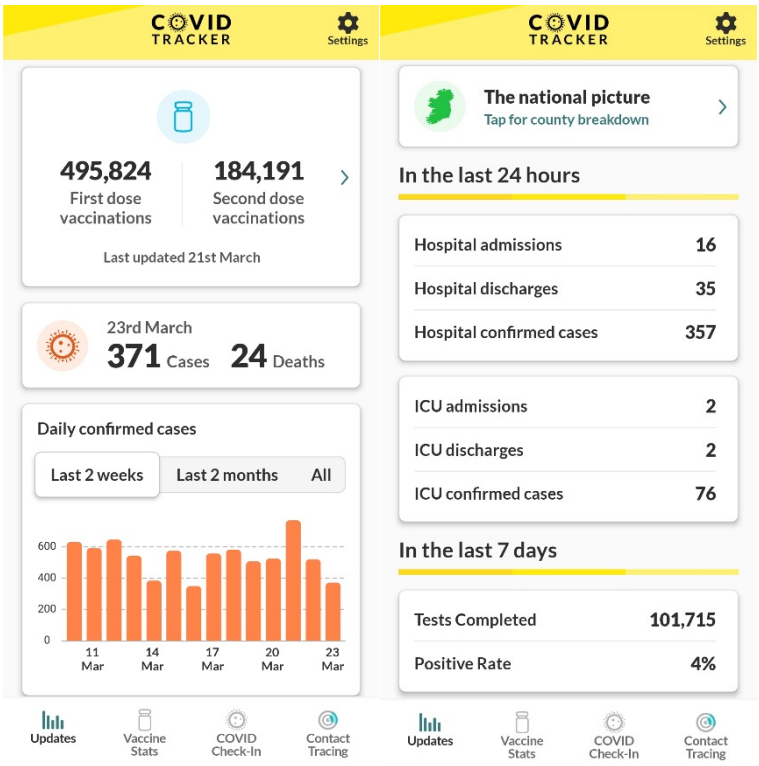


Figure 5

Explain **two** principles of universal design that might have been considered when designing this app.

1.
2.

Question 14

(a) Binary search is an efficient algorithm for finding a particular item from a list of items.

(i) The binary search algorithm is often called a "divide and conquer" algorithm. Explain why.

(ii) Why is the binary search algorithm considered to be more efficient than the linear search algorithm?

(iii) The following list of numbers is to be searched for a specific number using the binary search algorithm.

```
L = [45, 22, 1, 56, 35, 165, 9, 18, 37, 21, 107, 11, 87]
```

Will the binary search algorithm work on this list? Explain your answer.

This question continues on the next page.

(b) The following list of numbers is to be searched using the binary search algorithm.

1	2	3	4	5	6	7	8	9	10	11	12

(i) Illustrate the steps taken to find the number 8.

(ii) A list contains 60 numbers in numerical order. Calculate the maximum number of steps that may be required to find a particular number when using a binary search.

This question continues on the next page.

(c) In America algorithms are being used increasingly to decide whether or not a prisoner should be allowed out of prison while awaiting trial.

Describe **one** potential advantage and **one** potential disadvantage of using an algorithm for a decision such as this.

Advantage:
Disadvantage:

Question 15

(a) Your friend complains to you that their five-year-old computer is slow for playing games.

You check the specifications of the computer and find the following:

- Intel Core i3 CPU
- 2GB RAM Memory
- 1TB 5400RPM SATA Hard Disk Drive (HDD)
- 15.6" 1366x768 Anti-Glare Display
- Intel Integrated Graphics
- Keyboard with numeric keypad
- Bluetooth 4.1
- Webcam with integrated microphone
- Headphone/microphone combo jack
- Multi-format SD media card reader
- 2 x USB 3.1, 1 x USB 2.0,
- HDMI
- 10/100 Ethernet LAN Port
- 4-Cell Li-ion Battery

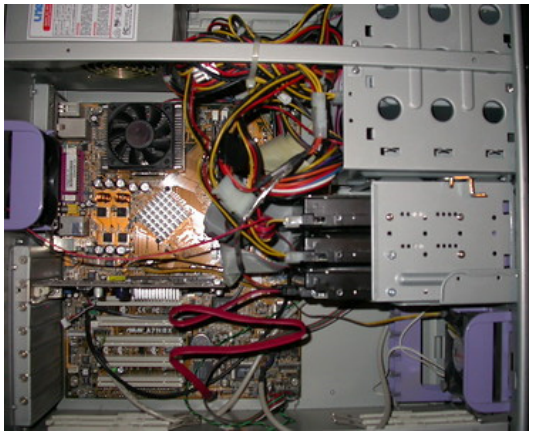


Figure 6

Choose **two** items from this list that are most likely to be having an impact on the speed of the computer and explain their impact.

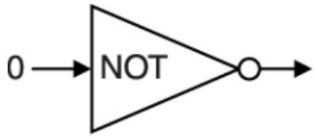
1.
Explanation:

2.
Explanation:

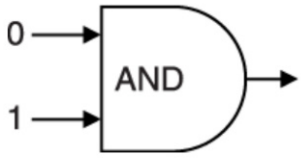
This question continues on the next page.

(b)

(i) State the output of each of the following logic gates for the inputs given.



_____



_____

(ii) Complete the truth table for the OR logic gate, shown in **Figure 7**.

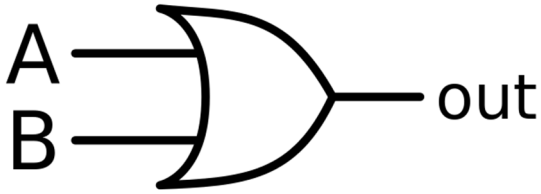


Figure 7

INPUTS		OUTPUTS
A	B	A OR B
0	0	
0	1	
1	0	
1	1	

This question continues on the next page.

(c) The diagram in **Figure 8** below, shows the different layers within a computer system. Explain the purpose of any **two** layers.

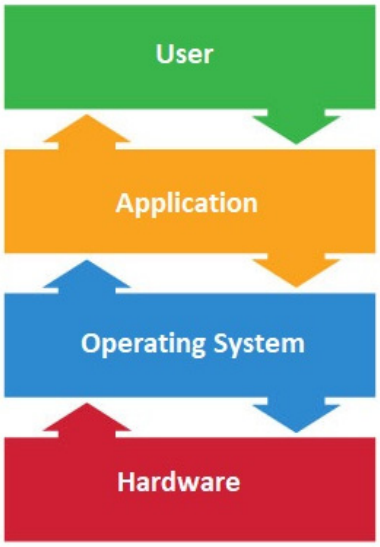


Figure 8

1.
2.

This question continues on the next page.

(d) Developed in 1971, the first commercially produced microprocessor was the Intel 4004 and this led to a rapid and continuous rise in the power of the personal computer.

Describe **one** other important development in computing that has occurred in the last 100 years and discuss its impact on computing today.

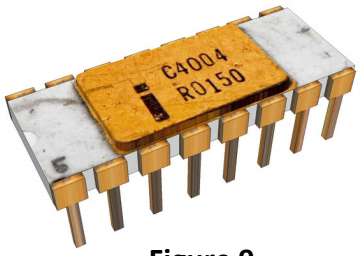


Figure 9

Space for extra work.

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

Space for extra work.

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Space for extra work.

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Acknowledgements

Images
Image on page 4: www.roboticsbusinessreview.com/wp-content/uploads/2019/09/AdobeStock_271589151-600x343.jpeg
Image on page 5: en.wikipedia.org/wiki/Client%E2%80%93server_model
Image on page 17: www.flickr.com/photos/ncreedplayer/4123522747/
Image on page 20: 3dwarehouse.sketchup.com/model/ae548048-7188-4956-a327-d97b7c2cd3e2/INTEL-4004

Texts
Article on page 10 : https://www.zdnet.com/article/contact-tracing-ireland-launches-its-app-following-apple-and-googles-model/

Leaving Certificate – Ordinary Level

Computer Science – Sections A & B

Saturday 22 May
Morning 9:30 – 11:00

2021L219G2EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2021

Computer Science

Section C

Ordinary Level

Saturday 22 May Morning 11:30 – 12:30

50 marks

The 2021 examination papers were adjusted to compensate for disruptions to learning due to COVID-19. This examination paper does not necessarily reflect the same structure and format as the examination papers of past or subsequent years.

Instructions

There is one section in this paper.

Section C	Programming	One question Answer all question parts	50 marks

Answer all parts of the question on your digital device.

Calculators may be used during this section of the examination.

The *Formulae and Tables* booklet cannot be used for this section of the examination.

The superintendent will give you a copy of the *Python Reference Guide*.

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

Save your files using the naming structure described at the beginning of each question part.

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.

Rough work pages are provided at the end of this booklet. Please note that this booklet is not to be handed up and will **not** be reviewed by an examiner.

At the end of the examination it is your responsibility to ensure that you have saved all of your files onto your external media.

You will be provided with a brown envelope for your external media. Write your examination number on this envelope and place your external media into it before sealing. Place this envelope in the pouch at the front of the red envelope that contains your examination booklet from Section A and B.

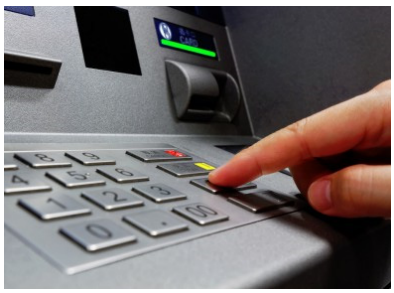
Do not hand this paper up

Section C	Programming	50 marks

Answer all question parts.

Question 16

(a) Open the program called **Question16_A.py** from your device. The source code is shown and described briefly below.



Before making any changes, you should save your working copy of the file using the format **CandidateNumberQuestion16_A.py**. For example, you would save the file as **123456Question16_A.py** if your candidate number was 123456.

Enter your Examination Number in the space provided on **line 2** in your Python file**.**

The program below is for a simple Automatic Teller Machine (ATM). An ATM allows banking customers to withdraw money from their accounts provided they enter the correct Personal Identification Number (PIN). When the user enters the correct PIN, a message appears saying "Welcome".

```
1  # Question 16(a)
2  # Examination Number:
3
4  pin = "1579"
5
6  userTry = input("Enter PIN:")
7
8  if userTry == pin:
9      print("Welcome")
```

Make the following changes to the program:

(i) Insert a comment in the appropriate location to explain what the **`input`** command is doing in this program.

(ii) Amend the program so that the following message is displayed if an incorrect PIN is entered:

```
Incorrect PIN
```

(iii) Create a suitably named Boolean variable (e.g. **`loggedIn`**) that is initially set to **`False`** before the user enters a PIN.

(iv) Amend the program so that the new Boolean variable is set to **`True`** when the user enters the correct PIN.

(v) Using a **`while`** loop or similar, keep asking the user to enter their PIN until they have entered it correctly.

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

```
Enter PIN:1234
Incorrect PIN
Enter PIN:1456
Incorrect PIN
Enter PIN:1579
Welcome
```

(vi) Create a suitably named variable (e.g. **`failedAttempts`**) that is initially set to **0** before the user enters a PIN. This variable will keep track of the number of failed login attempts.

(vii) The user should only be allowed 3 failed login attempts. If the PIN is entered incorrectly 3 times an appropriate message should be displayed.

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

```
Enter PIN:1111
Incorrect PIN
Enter PIN:2222
Incorrect PIN
Enter PIN:3333
Incorrect PIN
You have entered the PIN incorrectly 3 times.
```

Save your file using the format **CandidateNumberQuestion16_A.py**. For example, you would save the file as **123456Question16_A.py** if your candidate number was 123456.

Space for rough work.

This page will not be reviewed by an examiner.

Space for rough work.

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Space for rough work.

This page will not be reviewed by an examiner.

Acknowledgements

Images
Image: page 3: www.thejournal.ie/atm-use-poll-3465721-Jun2017/

Leaving Certificate – Ordinary Level

Computer Science – Section C

Saturday 22 May
Morning 11:30 – 12:30