P 5 1

Pre-Leaving Certificate Examination 2024

Computer Science

Sections A & B

Higher Level

Time: 1 hour, 30 minutes

123 marks

Name:
School:
Address:
Class:
Teacher:

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 All questions carry equal marks	45 marks
Section B	Long Questions	Attempt any two questions All questions carry equal marks	78 marks
Section C	Programming	Answer all question parts	87 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 45 marks

Answer any **nine** questions.

Question 1

Please study the code carefully and then answer the following question.

Given the following six lines of code from a program, for each line, fill in the value stored in the variable `answer`.

```
answer = 7
name = “Robin”
answer += 1
name = answer
answer = “Charlie”
answer = name
```

Lines of Python code	Value stored in “`answer`” at each line
`answer = 7`	
`name =”Robin”`	
`answer += 1`	
`name = answer`	
`answer = “Charlie”`	
`answer = name`	

Question 2

Briefly describe **one** problem that can be solved using heuristics and why it needs a heuristic approach to be solved.

Question 3

The following code was intended to replace any negative numbers in a list with the value `0`.

```
myList = [1, 2, 3, 4, -5, 6]

for item in myList:
    if item < 0:
        item = 0

print (myList)
```

However, the above code does not work, printing out the result:

```
[1, 2, 3, 4, -5, 6]
```

Explain why the code did not work as intended.

Question 4

Testing is used in software development. The below code was intended to replace any negative numbers in a list with the value `0`, but instead it outputs `[1, 2, 3, 4, -5, 6]`, not changing the negative values as intended.

```
myList = [1, 2, 3, 4, -5, 6]

for item in myList:
    if item < 0:
        item = 0

print (myList)
```

Explain how you might test the above code to identify the errors in the program.

Question 5

Describe what a unit test is, and how it differs from a system test.

Question 6

The list below contains 100,000 integers. Only the first six items in the list are shown.

```
myList = [1, 2, 3, 4, -5, 6, ...]
```

(a) Why would you **not** present the data in the above form to someone that wants to find the number of items in the list that are negative?

(b) Name **one** graphical form that would be suitable for presenting the data in the list, and **one** graphical form that would be unsuitable and why (for each form).

Question 7

Below is the code of a sorting algorithm:

```
myList = [9, 10, 30, 19, 3]

for index in range(1, len(myList)):
    itemToInsert = myList[index]
    position = index
    while position > 0 and myList[position-1] > itemToInsert:
        myList[position] = myList[position-1]
        myList[position-1] = itemToInsert
        position -= 1
```

(a) Name the sorting algorithm.

(b) What is the time complexity for the worst-case scenario for this algorithm?

Question 8

Agent-based modelling is an effective modelling tool for certain scenarios.

(a) Name a scenario that agent-based modelling can be used for.

(b) Explain the benefits of using agent-based modelling for your example named above.

Question 9

Below are two relational tables in a database.

ID	FName	SName	Year
1	Keith	Quille	1
2	Roisin	Faherty	2
3	Karen	Nolan	3

Year Tutors

ID	Year_Tutor_ID	FName	SName
1	3	Charlie	Quille
2	2	Robin	Quille

Students

Describe the relational relationship between the tables above.

Question 10

Below is an extract from a US National Cancer Institute post titled 'Can Artificial Intelligence Help See Cancer in New, and Better, Ways?' (2022). Read the extract carefully and answer the question that follows.

“Two identical black-and-white pictures of murky shapes sit side-by-side on a computer screen. On the left side, Ismail Baris Turkbey, M.D., a radiologist with 15 years of experience, has outlined an area where the fuzzy shapes represent what he believes is a creeping, growing prostate cancer. On the other side of the screen, an artificial intelligence (AI) computer program has done the same — and the results are nearly identical.”

Name and describe **one** ethical consideration and proposed action that you think should be applied if we are to use AI in the medical domain for predicting cancer.

Question 11

Websites are typically not as adaptive as they should be to allow for inclusive use for users with special/additional needs. Name and describe **two** elements or design features that you would implement in a website to support users with additional needs.

1.

2.

Question 12

The below code uses the mean function from the statistics module to find the mean in a list:

```
myList = [1, 2, 3, 4, 5]
median = statistics.mean(myList)
print(median)
```

Pattern recognition is the ability to recognise common approaches (such as code) or patterns within problems you are trying to solve. When you break down (decompose) a problem into smaller subproblems, you may be able to spot patterns/previous code approaches that will help you to solve the problem (adapted from Isaac Computer Science).

Identify **one** pattern and explain its use if you were to write the code for the **`statistics.mean`** function yourself.

Section B Long Questions 78 marks

Answer any **two** questions.

Question 13

(a) What is a recursive algorithm?

(b) Recursion is slower computationally than solving the same problem using a loop, yet recursion is often the preferred method over a loop for some algorithms such as the quicksort algorithm, why is this the case?

(c) Below is an example of a recursive function for the quicksort algorithm. This algorithm sorts a list in ascending order. Modify the code to sort the list in descending order. The first four rows are completed where no modifications were needed.

Original code	**Modified code – leave blank if modification is not needed.**
`def qS(listIn):`	-
`    if len(listIn) > 1:`	-
`        pivot = listIn[-1]`	-
`        belowPiv =[]`	-
`        for item in listIn[:-1]:`	
`            if item < pivot:`	
`                belowPiv.append(item)`	
`        abovePiv =[]`	
`        for item in listIn[:-1]:`	
`            if item > pivot:`	
`                abovePiv.append(item)`	
`        return qS(belowPiv) + [pivot] + qS(abovePiv)`	
`    else:`	
`        return(listIn)`	

Question 14

(a) The internet allows the world wide web to run on it. This happens in part due to communication protocols. One such set of protocols that is widely used is TCP/IP.

Explain what TCP is in the transport layer in the TCP/IP protocol stack.

TCP:

(b) IP addresses are used in the internet layer of the TCP/IP protocol stack. The following is an example of an IP address:

`192.168.0.1`

(i) What is an IP address?

(ii) As the number of devices connected to the internet grows, identify **one** issue that could arise with an IPv4 address as shown above.

(c) An IP address is often used when cybercrime is investigated. This is part of the TCP/IP stack. How can an IP address be used in cybercrime investigations?

(d) Interactive information systems are often implemented as a client server model. With respect to data security, why is a client server model a good choice?

Question 15

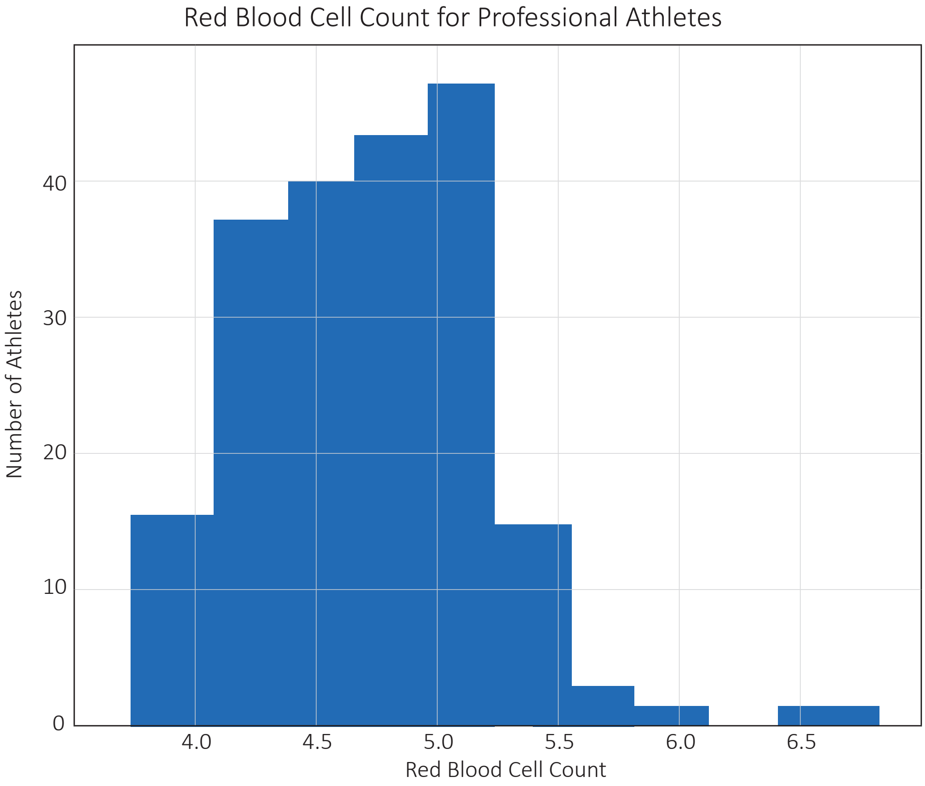
(a) What is the difference between raw data and data transformed for analysis?

Raw data:

Transformed data:

(b) The World Anti-Doping Agency (WADA) state that “Blood doping is the misuse of certain techniques and/or substances to increase one’s red blood cell mass, which allows the body to transport more oxygen to muscles and therefore increase stamina and performance.”

Each year, athletes are tested for increased red blood cells, where the data presented in the following histogram shows the red blood cell count on the X axis and the number of athletes on the Y axis.



Mean= 4.71
Mode= 4.87
Median= 4.75

Figure 1

Do you think that some athletes were blood doping? Analyse the histogram and available data (mean, mode and median) to support your answer.

(c) WADA would like you to develop an algorithm that automatically detects if blood doping has occured based on red blood cell count. By examining the graph in **Figure 1**, write an algorithm in pseudocode that will detect if athletes are blood doping assuming that the red blood cell counts are stored in a list such as the one below.
(note: the data is in a one-dimensional list called `athletes_RBCB` that you can reference).

List example: `athletes_RBCB =  [4,5.6,4.2, 6.6, 6.4, 4,1]`

Hint: Loop through the list and write the pseudocode to identify any possible values that may indicate blood doping.

(d) False predictions are often made by such algorithms. A False Positive (FP) is where an athlete was predicted as blood doping but did not, and a False Negative (FN) is where an athlete was predicted as not blood doping but was.

Briefly describe, basing your answer on ethics, which of the above predictions (a False Positive or a False Negative) is worse for the WADA.

Space for extra work.

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

Space for extra work.

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

Space for extra work.

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

P52

Pre-Leaving Certificate Examination, 2024

Computer Science

Section C

Higher Level

Time: 1 hour

87 marks

Instructions

There is one section in this paper.

Section C	Programming	One question Answer all question parts.	87 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.

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 work will **not** be reviewed by an examiner.

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

Section C Programming 87 marks

Answer all question parts.

Question 16

(a) Surveys are common practice, and analysis of such surveys is often essential to gain an understanding of data collected, transforming it into information. This survey was data collected by asking people the county they were from and their monthly rent. This was to determine national and country average rent rates. This survey only included people from Dublin, Kildare and Laois.

Open the program called **Question16_A.py** from your device.

Enter your name on **line 2**.

```
# Enter name:

county = [“Dublin”, “Laois”, “Dublin”, “Dublin”, “Dublin”, “Dublin”,
“Dublin”, “Kildare”, “Laois”, “Kildare”, “Dublin”, “Laois”, “Dublin”]

rent = [2500, 1200, 2000, 2100, 1900, 1999, 1790, 1500, 1000, 1390, 1980,
1105, 1999]

# Part i

# Part ii

print(“-”*18)
print(“{:<12}”.format(“County”)+”{:<12}”.format(“Rent €”))
print(“-”*18)
for index in range(len(county)):
    print(“{:<12}”.format(county[index])+”{:<12}”.format(rent[index]))

# Part iii

# Part iv
```

The way the data is stored is that each index (0, 1, 2 …) in each of the two lists (**`county`** and **`rent`**) holds corresponding data. That is, the first element of each list is a response from the same person. The list **`county`** records their county and the list **`rent`** records how much their monthly rent is. For any analysis in this question, you must assume that the lists could be larger, so you must calculate all values using code, they must **not** be hard coded.

The program currently loops through the list and prints to the screen each survey response:

```
----------------------------
County      Rent €
----------------------------
Dublin      2500
Laois       1200
Dublin      2000
```

Modify the program to do the following:

(i) Where **`Part i`** is a comment in the code, write code to calculate and print the total number of survey responses that the study has collected. When the program is run, it may look as follows:

```
The total people in the survey is: 13
```

(ii) Where **`Part ii`** is a comment in the code, write code to take in and store another survey response from the user; you must take in their county name and monthly rent and add them to the appropriate lists. You can assume that the user will always enter one of the following counties (in the correct case, that is, first letter uppercase and the rest lowercase): Dublin, Kildare and Laois. When the program is run, it may look as follows:

```
Please enter your county: Laois

Please enter your monthly rent amount: 2000
```

(iii) Where **`Part iii`** is a comment in the code, write code to calculate and print the average rent across all three counties (rounding to two decimal places).

```
  averageRent = sum of the values / number of values.
```

When the program is run, it may look as follows:

```
Average Rent for all counties: € 1747.36
```

(iv) Where **`Part iv`** is a comment in the code, write code to calculate and print the average rent for each of the three counties, Dublin, Kildare and Laois (rounding to two decimal places). When the program is run, it may look as follows:

```
Average Rent for Dublin: € 2033.5
Average Rent for Kildare: € 1445.0
Average Rent for Laois: € 1326.25
```

(b) The infinite monkey theorem states that a monkey hitting keys at random on a typewriter keyboard for an infinite amount of time will almost surely type any given text, including the complete works of William Shakespeare.

Open the program called **Question16_B.py** from your device.

Enter your name on **line 2**.

```
# Enter name:

import random

targetWord = “T”

def monkeys_typing():
    guessNumber = random.randint(65, 90)
    letter1 = chr(guessNumber)
    count = 1
    guess = letter1
    print(guess)

    while guess != targetWord:
        guessNumber = random.randint(65, 90)
        letter1 = chr(guessNumber)
        guess = letter1
        print(guess)
        count +=1
    return count

print(monkeys_typing())
```

This `monkeys_typing` function is designed to return the number of times it takes a monkey to guess characters (mimicking the infinite monkey theorem for a limited amount of text) until it guesses the letter T. Please note the random number guesses the ASCII range for uppercase letters and converts them to characters to compare against the desired output, the letter T.

Modify the program to do the following:

(i) For this part, do not modify the function, modify the main body code to run the function three times and get an average of how many guesses are needed to type the letter T. An example output would be:

```
Average number of guesses for three runs is: 107.33
```

(ii) Modify the function to identify how many guess it may take to generate the word “THE”, note you will also have to modify the variable: **`targetWord = “THE”`**. An example output would be:

```
Average number of guesses for three runs is: 18148.0
```

Space for rough work.

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Space for rough work.

This page will not be reviewed by an examiner.

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