

# 5th Year Summer Exam

## Computer Science



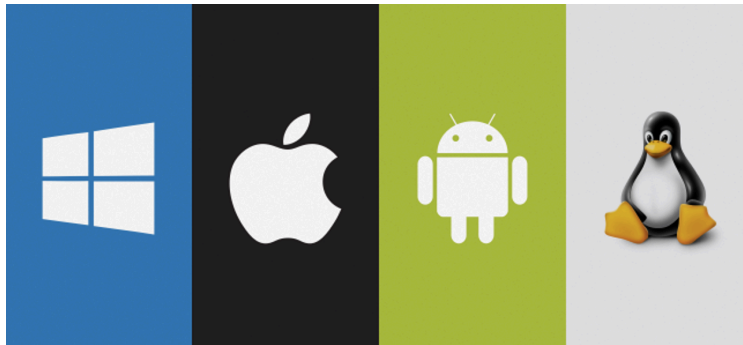
**Name:**

## Section A

## Short Questions

Attempt all questions

Question 1.



(a) Describe **one** difference between **system software** and **application software**.

(b) Describe **two** different **functions** performed by an **operating system**.

(c) Smart phones and tablets all use operating systems.  
Explain why they need to use an **operating system**.

## Question 2.



The processes in a pharmaceutical factory that makes vaccines are monitored by a number of **digital** and **analogue** sensors.

(a) Explain the difference between an **analogue** and a **digital** signal.

(b) A vaccine manufacturing process uses a number of **embedded systems** during the manufacturing process.

(i) Explain what is meant by the term **embedded system**.

(ii) Identify **two** different devices that could be used by the vaccine manufacturing process. (Recall your ALT 4). Is the device you identified an **analogue** or **digital** device?

Sensor 1	
Sensor 1 Analogue or Digital	
Sensor 2	
Sensor 2 Analogue or Digital	

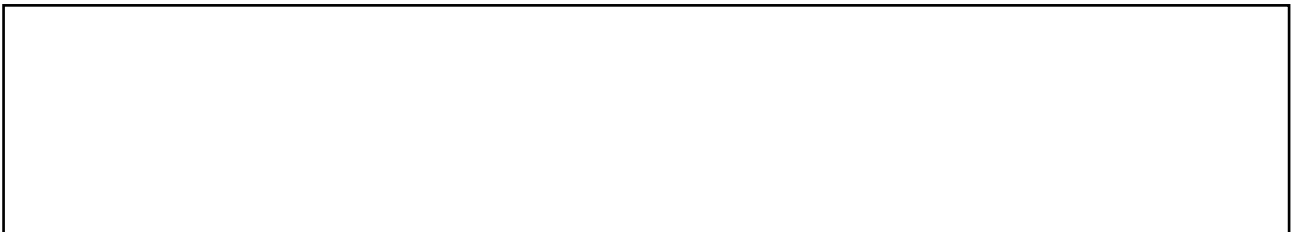
### Question 3.

(a) Explain the difference between **primary** and **secondary storage**.  
Give an example of each.



(b) Computer users will often **store** their data 'in the cloud'.

State **two** reasons why you might want to use **cloud storage** rather than **local storage**.



### Question 4.

Many of today's computers share a common architecture, named after John von Neumann who first described it.

**Draw** a diagram of a basic von Neumann architecture, **labelling** the *CPU*, *Control Unit*, *ALU*, *memory*, *bus*, *input* and *output* devices.



### Question 5.

(a) One of the key features of von Neumann architecture is the use of **buses**.

Match the **bus type** with the **appropriate description**.

Bus Type		Description
Address bus		This bus carries signals to coordinate the computers activities.
Control bus		This bi-directional bus is used to exchange data between process, memos and input/output devices.
Data bus		This uni-directional bus carries signals relating to memory address between processor and memory.

(b) To process an instruction, a CPU goes through a cycle that has **three** main stages.

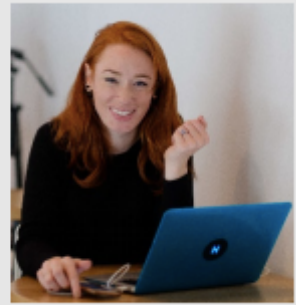
**Identify and explain briefly** the three steps in this cycle.

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## Question 6.

Algorithms have given the world everything from social media feeds to search engines, satellite navigation to music recommendation systems, and are as much a part of our modern infrastructure as bridges, buildings and factories ever were.

Adapted from: *Hello World: Being Human in the Age of Algorithms* by Hannah Fry



(a) The design of algorithms is an important aspect of computer science.

Explain what is meant by the term '**algorithm**'.

(b) The design of an algorithm comes from the abstraction and decomposition of a problem.

**Explain** what is meant by the underlined terms.

### Question 7.

(a) *Explain* what is meant by the terms '**best-case**' and '**worst-case scenario**' in an algorithm, with respect to the amount of *work done*?

(b) Why do computer scientists tend to base estimates of work done by an algorithm on the worst case scenario.

(c) **Identify** and give an **example** of an **algorithm** you have studied for each of the following Big O classes:

- $O(n)$
- $O(1)$
- $O(n^2)$

### Question 8

The World Wide Web (WWW) and the network infrastructure that supports it allow for seamless transmission of data such as web pages, voice applications and streaming services. This is all possible due to the *protocols* that it uses.

- (a) When referring to ***World Wide Web infrastructure***, what is meant by the term **protocol**?

- (b) State the **name** and **purpose** of **one** such **protocol**.

### Question 9.

*Fit don't quit* is the name of a fitness club that uses a computer system to store information about its members.

- (a) State the most suitable ***data type*** for each of the following three items:

Member ID (eg 1754) :

Member Name (eg Martin Garvey) :

Amount Paid (eg 45.50) :



(b) Suggest the **name** and **purpose** of another useful variable for the *Fit don't quit* system to capture information about its members.

It should be a ***boolean variable***.

Name of variable:

Purpose:

### Question 10.

(a) Write a **single** line of code using the **open( )** function that opens a file called 'IMDB\_Movies.csv' as 'data\_in'.

(b) Explain **one error** that may arise in a program when trying to process **numeric** data from a csv file in Python.

(c) Describe how you would fix the issue you identified in part (c).

## Question 11

(a) Explain **two differences** between a **LAN** and a **WAN**.

Difference 1:

Difference 2:

(b) **HTTP** and **HTTPS** are two application layer protocols. **Explain** why **HTTPS** is often **used** rather than **HTTP**.

(c) What do the abbreviations **HTTP** and **HTTPS** stand for?

HTTP:

HTTPS:

(d) The **Application layer** and the **network (Internet) layer** are two of the layers within the **TCP/IP stack**.

Identify **two** other TCP/IP stack layers and explain their **function**?

1
2

### Question 12.

A programmer has a list of numbers in an list called *scores*, as shown below, they want to use a **bubble sort** to sort the list of scores.:

17	9	4	-12	3	39
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(a) One section of the bubble sort algorithm used by the programmer to swap elements is shown in below:

```
if scores[x] > scores [x+1]      # Check if scores in wrong order
scores[x] = scores[x+1]          # Swap scores
scores[x+1] = scores[x]
```

However, when the code is run the programmer ends up with duplicate values at position [x] and [x+1] as shown in the output below.

```
Sorted array :
[-12, -12, -12, -12, 3, 39]
```

Output with duplicate values

- (a) **Rewrite** the 'element swap' part of the **code shown above** so that the numbers are **correctly swapped** and **no duplicates** are given in the output. (Hint: You may need to add another line of code).

- (b) Explain **briefly** how an **insertion sort** algorithm would arrange the numbers in the **scores** array? In your answer **identify how elements are compared** to each other and **how they swap** position.

- (c) What is the difference between about how a **bubble sort algorithm** sorts the data compared to an **insertion sort algorithm**? Which sort algorithm would make the **most swaps** if sorting the list 'scores'?

(d) *Name* one **other** sorting algorithm besides insertion or bubble sort?

(e) What is one advantage and one disadvantage of using a bubble sort?

### Question 13.

A program creates usernames for a school. The first design of the program is shown in the flowchart in fig 1

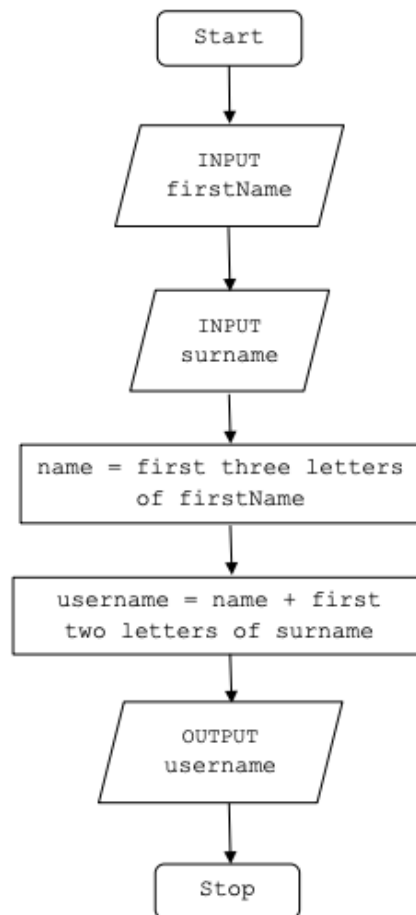


Fig 1

For example, using the process in Fig. 1, Tom Ward's username would be TomWa.

(a) State, using the process in Fig. 1, the username for Martin Garvey.

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(b) The program design in fig 1 is updated to create usernames as follows:

- If the person is a **teacher**, their username is the **last 3** letters of their **surname** and then the first **2** letters of their **first name**.
- If the person is a **student**, their username is the **first 3** letters of their **first name** and then the first **2** letters of their **surname**.

Write the *pseudocode* **OR** create a *flowchart* for the updated program design show in fig 1

