Question 1:

Registers are special memory cells that operate at very high speed within a CPU. Results of all arithmetic and logical operations are stored in registers during the Fetch-Decode-Execute cycle.

i) What is the role of the 'program counter' during the fetch-decode-execute cycle.

ii) Identify one other register used during the fetch-decode-execute cycle and briefly explain its function.

Question 2

RAM and ROM are two forms of memory used in computer systems.

i) What would be the effect of installing more RAM in your computer. Explain your answer?

ii) Identify two differences between RAM and ROM.

Question 3

A local coffee shop is developing a self service coffee machine. The coffee machine will allow customers input an order and pay and then the machine will make the coffee. The

shop owner is trying to decide should to use a *general purpose computer system* or an *embedded computer system* for controlling the machine.

i. What is an embedded computer system and how does it differ from a general purpose computer system.

ii. Which system would be a better choice for this scenario in your opinion? Explain your answer.

iii. Identify one possible input device that could be used by this machine and explain is the device you chose an analogue or digital input.

Question 4

All internet connected devices communicate via the TCP/IP protocol. This has four layers - Application, Transport, Network and Physical/Link.

i) Describe the function of each layer.

Layer	Function
Application	
Transport	
Network	
Physical	

Question 5

What is the difference between HTTP and HTTPs?

Question 6

Garveys Bank is the name of a bank that has opened in the local village. The bank uses a computer system to store information about its members.

i.State the must suitable data type that could be used to store data about each of the following three items.

Members data	Data Type
Member ID (e.g 2905)	
Member Name (e.g Martin	
Account Balance (e.g 233.58)	

ii. Suggest the name and purpose of another useful variable for the banks computer system to capture information about its members. It should be a Boolean variable.

Name	Purpose

Question 7

In any relational database, primary and foreign keys are used.

(i) What is a primary key and give an example of any valid primary key.

(ii) What is a relational database.

Question 8

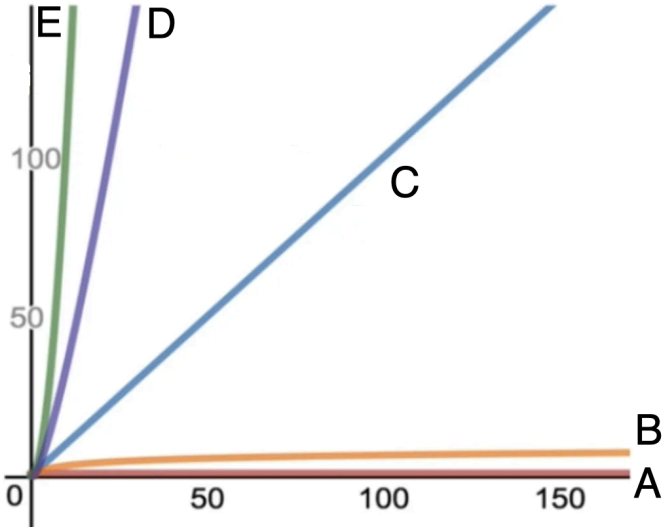
The data set below shows the raw data collected from the result of a 100m school race.

Surname	Gender	Age	Time
Murphy	M	17	13,12
Ogene	M	16	12.14
Ogene	M	16	12.14
Mc Intyre	F.	17	12.87
Lopez	F	-18	14.01
	F	17	1 329
McCarthy	M	77	13.65
Ó Brádaigh	f	16	13.09

List three problems that could arise if a program was trying to analyse this dataset.

Question 9

The diagram below show the graphical representation of the Big 0 notation for a number of algorithms.



iii) What is meant by the term 'Big 0 notation'.

iv) Label each Big 0 notation with its corresponding letter below.

Letter	Big 0 notation
0 $(n)^2$	
0 (n)	
0 (1)	

Question 10

Universal design is the process of designing a product so that everyone can understand, access and use it, regardless of their age, size or ability.

i) Name and explain any two of the seven principles of universal design.

Question 11

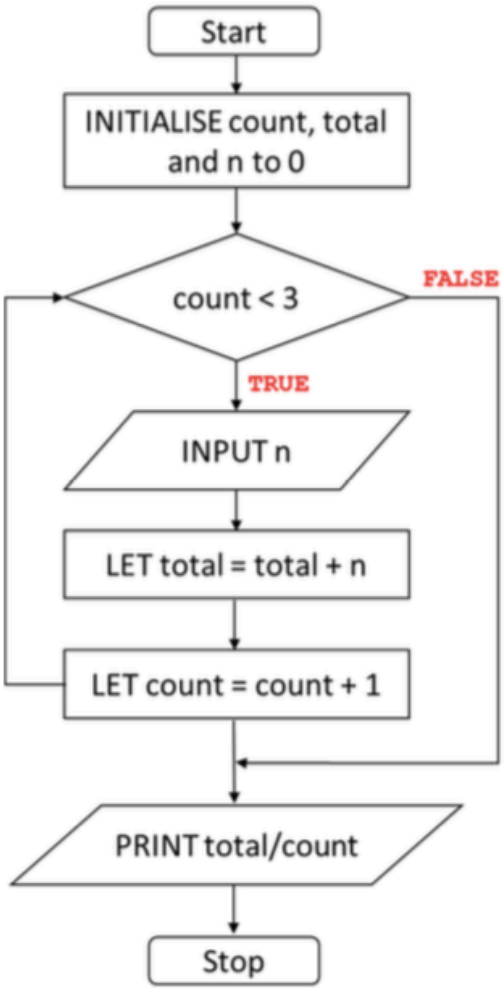
Software can be classified as either **system** or **application software.** What is meant by the term:

i) System software

ii) Application software

Question 12

The flowchart below is a representation of an algorithm.



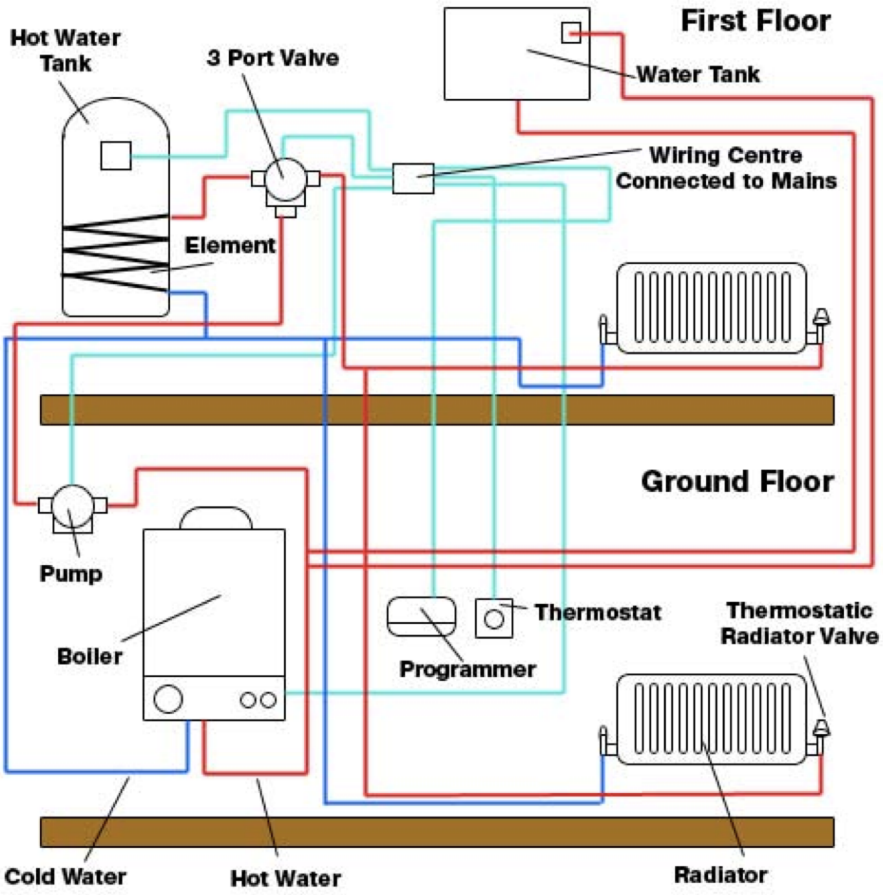
Using inputs of 9, 7 and 5 for the variable n, complete the table showing the execution of the algorithm.

n	Total	Count
0	0	0
9		
7		
5		

Seection B

Question 13

As more and more devices within the home become digitized, the **testing** of logic has become a key part of the software and hardware development process. For example, the heating system in the diagram below is completely automated and is controlled by a thermostat and programmer device. To ensure the process works correctly, the software controlling the system will have to undergo both functional and systematic testing.



A

i) Explain clearly the difference between functional and systematic testing.

ii) During testing the engineer was only given the following test input data to use when testing the system.

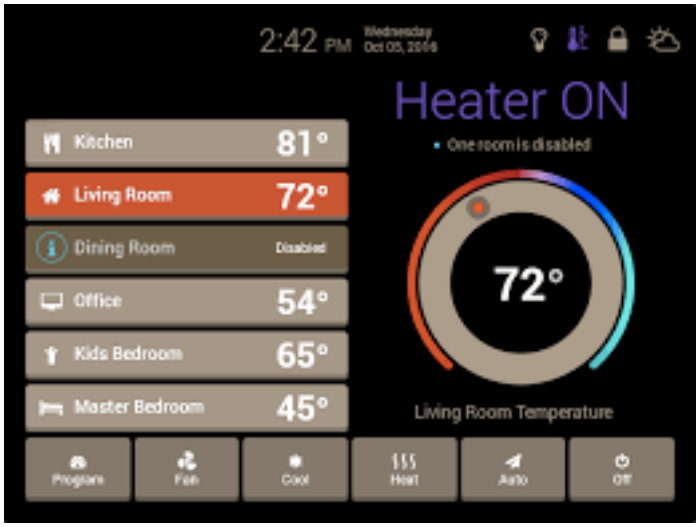
Input Temperature oC	Expected Output
12	Radiator on
15	Radiator on
20	Radiator on
25	Radiator off

Is this set of test data adequate to full test the functionality of this heating system. Explain your answer.

B) IoT enabled home automation gives a user the ability to control domestic appliances with electronically controlled, internet-connected systems. The IoT connects all enabled devices in the home to a central hub that can be remote-controlled by a mobile app so users can monitor their home remotely. You as a software developer have been tasked with *developing the software for one such app*. To do this, you would follow the six stage software development process.

i) State whether you would use a *staged* or *iterative* development process for the project. Justify your answer by giving **two** reasons for your decision.

C) Your project team has identified two user interfaces that they observed in other *IoT app interfaces*. Both of these interfaces are shown below.

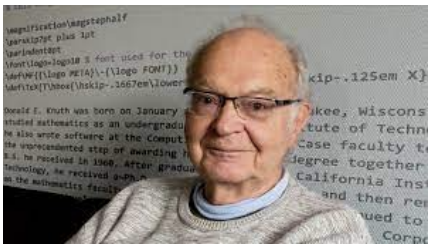


(i) Compare the two interfaces in terms of the *types of hardware t*hey are designed for and *the functionality they offe*r.

(ii) Provide **two** examples of how adaptive technology could be incorporated into the app you are designing to control the heating system in the home.

Question 14

In his book *The Art of Computer Programming*, Donald Knuth states that "searching is the most time−consuming part of many programs, and the substitution of a good search method for a bad one often leads to a substantial increase in speed."



```
def Unknown_Search(arr, l, r, key):
    if r >= l:
        midpoint = l + (r - l) // 2
        if arr[midpoint] == key:
            return midpoint

        elif arr[midpoint] > key:
            return Unknown_Search(arr, l, midpoint-1, key)

        else:
            return Unknown_Search(arr, midpoint + 1, r, key)
    else:

        return -1

arr = [2, 3, 4, 10, 40]
key = 10

result = Unknown_Search(arr, 0, len(arr)-1, key)

if result != -1:
    print("Element is present at index % d" % result)
else:
    print("Element is not present in array")
```

(a) The python code above sows the implementation of a search algorithm,. Examine the code and answer the questions that follow.

(i) State the name of the above search algorithm.

(ii) In the initial call to the function, what value is assigned to the argument ‘r’?

(iii) For a key value of ’10’, what is the output of this algorithm.

(iv) Name one other search algorithm you could have used to search the given array ‘arr’ and explain one difference compared to the algorithm you identified in part (i).

B) Write the pseudocode for a bubble sort algorithm.

C)

The diagram below sets out the operation of the bubble sort algorithm to sort the list of integers [8, 5, 9, 7, 6]. The algorithm works by scanning over the data in four passes. The diagram is complete for pass 1 and started for pass 2.

Complete the diagram for passes 2, 3 and 4. You only need to fill in the numbers.