



COMPUTER SCIENCE

HIGHER & ORDINARY LEVEL

MARKING SCHEME

Pre-Leaving Certificate Examination 2021

Higher Level: page 2

Ordinary Level: page 14

Please note: While the overall marks for the paper remain the same, the marks per section for Sections A and B were changed by the SEC after the exam papers had been printed. At both higher and ordinary level, the marks are now: Section A 54 marks, Section B 76 marks and Section C 80 marks. The number of questions and answering options within each section remain unchanged.

HIGHER LEVEL

Section A, answer any 9 of 12 questions @ 6 marks each

54 marks

Q1. Rank the following data units from smallest to largest.

Size	Ranking
2 Gigabytes	3
3000 Kilobytes	1
1000 Megabytes	2
.5 Terabytes	4

1 mark for each correct answer, **6 marks** for all answers correct

**Q2. The Python programming language has a variety of inbuilt data types.
Give one example of the following data types:**

Variable	Data Type
Boolean	True / false
Integer	Any integer value
List	Any list, must have more than one value and contain [] (square brackets)

2m for each correct answer, **6 marks** for all correct answers

Q3. A user wants to display the elements of a list using a print statement. However, when they run the Python code the program just outputs the text 'fruit_basket'.

Modify the code so the user gets the desired output.

Remove the quotation marks from the print statement. (6 marks)

Q4. What is the output of the following piece of Python code:

```
x = 3
while(x<20):
    print("Number",x)
    x = x + 3
```

Output is:

Number 3
Number 6
Number 9
Number 12
Number 15
Number 18

6 marks only if all six values with the Number prefix are given.

4 marks if one value is left out.

3 marks if the six values 3,6,9,12,15,18 are given without the Number prefix.

2 marks if two values are left out.

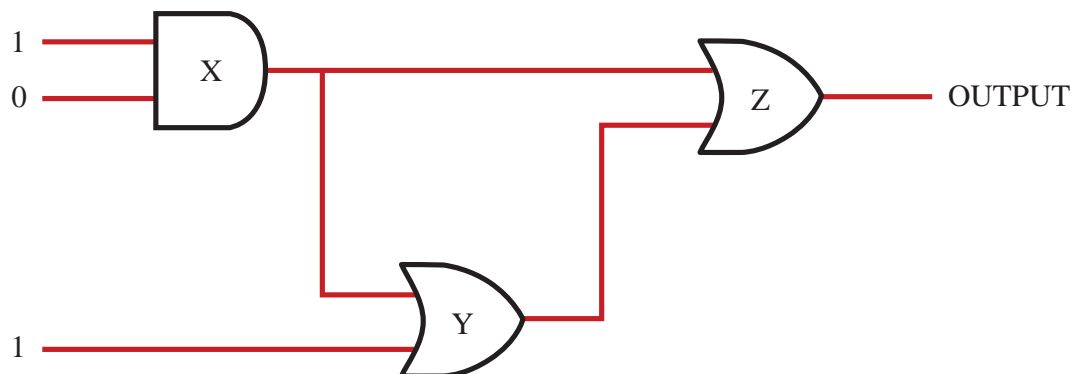
Q5. (a) Convert the decimal number 182 into an 8 bit binary number

10110110 (3 marks)

(b) Convert the binary bit pattern shown below into hexadecimal.

10011000 (3 marks)

Q6.



(a) What type of logic gate is labelled X – AND Gate (1 mark)

(b) What type of logic gate is labelled Y – OR Gate (1 mark)

(c) What effect does a not gate have on its input? – Inverts the input (2 marks)

(d) What is the output of the logic gate Z with the current inputs? Output = 1 (2 marks)

Q7. (a) Define what is meant by the term relational database.

A relational database is a type of database that stores and provides access to data points that are related to one another.

Any relevant description that indicates that the database provides access to data that are related to one another. (3 marks)

(b) What name is given to the unique identifier of each row of data in a relational database?

Key (3 marks)

Q8. The diagram above identifies some of the stages of a software development design process. Outline briefly the main purpose of the:

(a) Design stage

The development team work out the details of the program by breaking it down into smaller chunks. The team will use pseudocode and diagrams to work out how the program should work. Other topics possibly covered in the design stage may include:

- Choice of programming language to be used.
- How the program will be used and maintained.
- Development of a design specification
- Data structure and database design

Any explanation that identifies a relevant topic covered at the design stage (3 marks)

(b) Evaluate stage

In the evaluation stage the development process requires the developer and the client to review the software and progress. The software is evaluated against criteria such as

- Is the software fit for purpose?
- Does it meet the user requirements?
- Is the software reliable?
- How will the software be maintained?

Any explanation that identifies a relevant topic covered at the evaluate stage (3 marks)

Q9. (a) Identify two ways in which you believe the computer systems on board the Crew Dragon spacecraft make spaceflight safer or reliable or cost effective.

Any 2 valid reasons (3 marks)

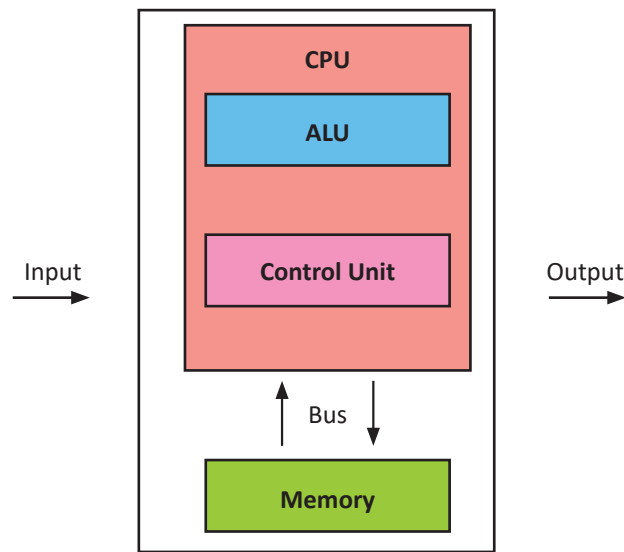
Any 1 valid reason = 2 marks

(b) Outline one ethical concern which you believe relates to allowing computer systems autonomously control dangerous tasks such as piloting a spacecraft. How might this concern be overcome?

Any valid concern and solution (3 marks)

Valid concern but no solution = 2 marks

Q10. Draw a diagram of the basic von Neumann computer system architecture, labelling the CPU, ALU, Control Unit, bus, memory and input and output devices.



- (a) *Correct drawing of architecture (3 marks)*
Any component missing or mislabeled = - 1 mark per component

- (b) **What is the purpose of the bus system in von Neumann architecture?**
A bus is responsible for the data transfer (3 marks)

Q11. (a) Define what is meant by the term abstraction, in the context of computational thinking.

Abstraction is the process of ignoring or removing patterns or properties from a problem in order to focus or identify the patterns or properties we do need to solve a problem.
Correct definition of abstraction that refers to the blocking out or ignoring parts of a problem that are not relevant to a solution. (3 marks)

- (b) **Explain how decomposition could be used in designing a solution to this problem.**

Decomposition will allow us to break down the problem into separate parts that can be solved individually, in this problem the user could split the problem down into separate parts such as how they would count the number of students, what are the possible grades, how will they compare students results to grade conditions, how will they keep count of how many students get each grade, how will the results be displayed.

Identify that: decomposition is the breaking down of a problem into smaller parts (2 marks)
and the student identifies 1 possible operate part the problem can be broken into (1 mark)

Q12. (a) Name and briefly explain the function of two of the layers in the TCP/IP protocol.

Any two of the following identified as layers: Application layer, transport layer, network/internet layer, data/interface layer (2 marks for each correctly identified layer)
Correct function of any two (2 marks)

- (b) **What is an advantage of layering?** *Any relevant advantage (2 marks)*
 e.g. Allows cross-platform communication, scalable, open

Section B - Long Questions

76 Marks

Any two of three questions, each question carries 38 marks

Q13.

(a) **Total = 15 marks**(i) **What does the term PCB stand for?**

Printed Circuit Board (5 marks)

(ii) **What is the difference between continuous and discrete data?**

Continuous data is data that can take any value. (3 marks)

Must indicate continuous data can be ANY value to get full 3 marks

Discrete data is data that can only take certain values. (3 marks)

Must indicate that discrete data can only be CERTAIN values to get full 3 marks.(iii) **Identify the following data as either being continuous data or discrete data.**

Data	Data Type
Height	Continuous
Sound volume	Continuous
Number of students in a class	Discrete
Wind speed	Continuous

(4 marks = 1 mark for each correct answer)

(b) **Total = 13 marks**(i) **Using the letters A, B, C and D, match each image with the corresponding component in the table below.**

Component	Image
Resistor	C
Capacitor	A
Transistor	D
LED	B

(8 marks = 2 marks for each correct answer)

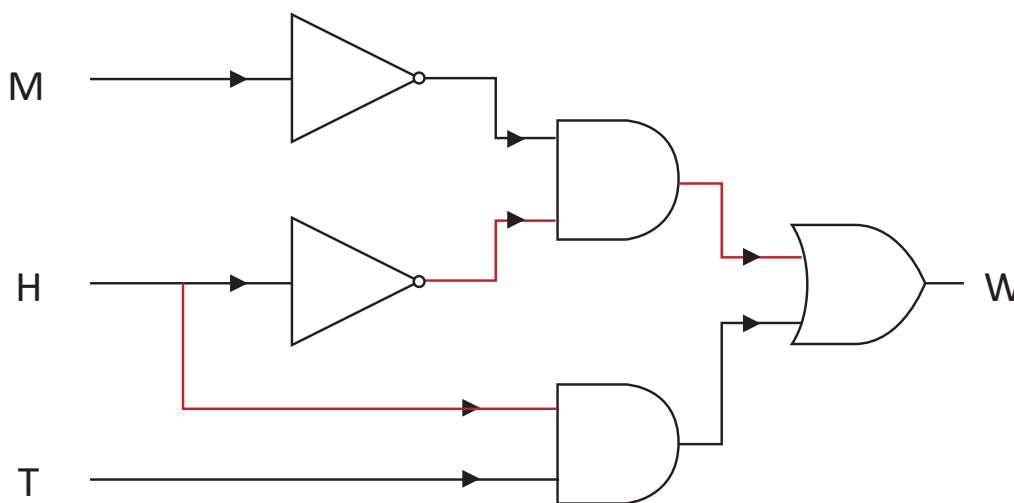
(ii) **What is an analog signal? Give two examples of analog signals you have examined during the course.**

An analog signal is a signal that varies and can be any value. (3 marks)

*Description of analog signal must indicate the signal can be any value to get full 3 marks.**Any two analogue signals (2 @ 1 mark each)*

(c) **Total = 10 marks**

Complete the following logic circuit so that under condition 1 and 2 the window controller (w) will receive an output of 1 to open the window.

**Solution**

All 3 logic lines correctly drawn **(10 marks)**

Two logic lines correctly drawn = **6 marks**

One logic line correctly drawn = **3 marks**

Q14.

(a) **Total = 10 marks**

- (i) Mary wants to use the computer for work which involves the editing of large movie files and high-quality images. The salesperson in the store explains that Computer 2 is able to do this faster than Computer 1. Use the information provided by the table to identify one reason for this.

Computer 2 has 32 cores, more than twice that of computer 1. More cores means the computer has more processing power available to run multiple programs at the same time. **(5 marks)**

Answer must identify more cores results in more processing power to get full 5 marks.

If student only states there is more cores and not the effect of having more cores only award 3 marks

- (ii) Identify two other components not mentioned in the table that Mary should consider when comparing the performance of the two computers.

Examples include:

- Random access memory (RAM)
- Graphics system
- Internal hard drive speed
- Internal hard drive capacity
- Front Side Bus

Any two relevant components that Mary should consider **(5 marks)**

Any one relevant component that Mary should consider = **3 marks**

(b) Total = 13 marks**(i) Explain two key differences between primary and secondary storage.**

- Primary storage is storage/memory that is directly accessible by the CPU. It holds the data and commands the processor is currently working on. The processor does not directly interact with the secondary storage/memory.
- Primary storage/memory is temporary, while secondary storage/memory is permanent.
- Primary storage uses semiconductors, while secondary tends to use magnetic and optical memories.
- Primary storage is also known as main or internal memory, while secondary storage is also known as external or auxiliary storage.
- Examples of primary storage include RAM, ROM, Cache memory, Registers etc.
- Examples of secondary storage include mass storage devices such as hard drives, solid state drives, optical drives, USB, Cloud.

Any two listed differences or valid differences (7 marks)

Only one difference identified = 4 marks.

(ii) State two benefits of Solid State Drives (SSD) compared to magnetic drives.

- Faster
- More durable
- No moving parts
- Based around flash memory

Any two valid benefits identified (6 marks)

Any one valid benefit identified = 3 marks

(c) Total = 15 marks**Explain the cycle of operations that are carried out during the the fetch and execute cycle. The explanation should refer to the role of registers.**

- Program counter register contains the address of the memory location that has the next instruction to be fetched.
- The instruction at the address is copied to the memory address register and then copied to the memory data register.
- The instruction is then sent to the current instruction register.
- The program counter increments by 1 so it now points to the next instruction that must be fetched.
- The instruction is decoded and then executed by sending signals via the control bus to the various components of the computer.
- Cycle is repeated

Full fetch and execute cycle correctly described with reference to program counter, memory address register, memory data register, current instruction register and program counter incrementing by 1 (15 marks)

+3 marks for each step correctly explained

– 2 marks for each register not identified or referenced

– 2 marks for not stating the program counter increments by 1 during the cycle

Q15.

(a) Total = 5 marks**Define the term algorithm.**

An algorithm is a sequence of well-defined, computer-implementable instructions, used to solve a class of problems or to perform a computation. **(5 marks)**

Any relevant definition must clearly identify an algorithm as a set of instructions used to solve a problem/perform computation to get the full 5 marks.

If only one of these is left out of the answer then only award 3 marks.

(b) Total = 14 marks

(i) Fill in the blank arrays to show the final form of the array [5,1,4,3,9] if an ascending bubble sort algorithm is applied to it.

Final iteration is 1, 3, 4, 5, 9

Has all final iteration correct (5 marks)

1 mark for each correct value

(ii) How many passes through the data in part (i) will be made?

Correctly writes down formula, $(n-1)$, for calculating number of passes but doesn't use it correctly
= 2 marks

$n-1 = 5-1 = 4$

Answer: 4 passes **(5 marks)**

(iii) What would be the maximum number of passes through an array of 100 values?

Correctly writes down formula, $(n-1)$, for calculating number of passes but doesn't use it correctly
= 2 marks

$n-1 = 100-1 = 99$

Answer: 99 passes **(4 marks)**

(c) Total = 15 marks

(i) Explain how a linear search algorithm works and how it would find the integer value 2850 in the Subscriber Viewing Numbers array above.

Linear search sequentially moves through the data structure looking for a matching value. It looks through a list, one item at a time. In this array, each value within the array will be compared with 2850 one at a time until a match has been found. **(6 marks)**

Student must identify:

That the search moves sequentially/one = 3 marks

The search moves through each value one at a time through all values. = 3 marks

(ii) What property of the Subscriber Viewing Numbers array means the programmer could use a binary search algorithm to find the position of the integer value 6700?

The array is in sequential order **(3 marks)**

- (iii) **For some data, the programmer must search large arrays containing hundreds of values. Which search algorithm should the programmer use if he wants to use the most efficient algorithm? Explain your answer (6 marks)**

A binary algorithm is more efficient as it checks to see if the middle value in the array is bigger or smaller than the desired element. The algorithm keeps repeating this until the element is found. In a linear array every value will be checked until the desired value is found, so the larger the list the more values that must be searched.

Identifies the binary algorithm as the most efficient (3 marks)

Identifies that a binary algorithm keeps halving the list or carrying out ordering comparisons (3 marks)

- OR** *Identifies that in a linear search the more values means more values have to be individually checked, which takes longer (3 marks)*

- OR** *Any valid reason (3 marks)*

- (d) **Total = 4 marks**

Outline briefly one example of how algorithms have played a role in the following areas of society:

Healthcare: Any valid reasons (2 marks)

Automotive industry: Any valid reason (2 marks)

Section C - Programming

80 Marks

Q16. (a) Total = 40 marks

```

1  # Question 16_A ( 40 MARKS TOTAL)
2  # Examination Number:
3
4
5  def username():                                     # Part (iv)
6      user_name=str(input("Please enter your username: ")) # Part (iv)
7      return(user_name)                             # Part (iv)
8
9  print("Welcome",username()),",to the student result calculator.\n") # Part (iv)
10
11
12  student_name=input("Please enter the students name: ") # given
13
14  student_score=float(input("Please enter the students mark: ")) # Part (i)
15
16  exam_total=int(input("Please enter the total amount of marks going for the exam: ")) # Part (ii)
17
18  percentage=round((student_score/exam_total)*100,1) # Part (ii) and Part (iii)
19
20  if (percentage >=80) and (percentage <=100):         # Part (v)
21      print(student_name,"scored",percentage,"%.", "They got an A.") # Part (v)
22  elif (percentage >=60) and (percentage <=79):        # Part (v)
23      print(student_name,"scored",percentage,"%.", "They got a B.") # Part (v)
24  else:                                                 # Part (v)
25      print(student_name,"scored",percentage,"%.", "They got a C.") # Part (v)
26
27  # Part (i) 5 marks
28  # 5 marks for changing int to float, 0 marks for not changing the data type.
29
30  # Part (ii) 9 marks
31  # Variable correctly identified, declared as int and working according to question = 9 marks
32  # Breakdown of marks
33  # Correctly declares variable called 'exam_total' = 1 Marks
34  # Allows user to enter a value for exam_total using input function = 3 Marks
35  # Converts exam_total input value to an integer = 3 Marks
36  # Correct calling of exam_total value to carry out percentage calculation = 2 Marks
37
38  # Part (iii) 6 marks
39  # Correct syntax for round function and percentage value correctly rounding to one decimal place = 6 Marks.
40  # Breakdown of marks
41  # Round function called = 3 marks
42  # Round function called, but significant value not declared - 3 marks i.e round(student_score/exam_total)*100 = 3 Marks
43
44  # Part (iv) 11 marks
45  # Username function correctly declared and returning relevant value to where the function is called = 11 marks
46  # Breakdown of marks
47  # Function called username correctly declared = 3 Marks.
48  # Allows user to enter a value for username = 3 Marks
49  # Returns user_name to function call = 3 marks
50  # Displays welcome message containing user_name data = 2 Marks
51
52  # Part (v) 9 marks
53  # Correct use of if/elif/else statements, conditionals and correct output = 9 Marks
54  # Breakdown of marks
55  # Student can use any combination of if/elif/else statements.
56  # Only two conditons accounted for, but correct output is given for both those conditions = 6 Marks
57  # All correct conditions accounted for but no output messages indicating students grade = 6 marks
58  # Only one condition correctly accounted for with correct ouput = 3 Marks
59  # Incorrect grading ranges used = -2 Marks for each incorrect range.
60
61  # (i) - 5 Marks
62  # (ii) - 9 Marks
63  # (iii) - 6 marks
64  # (iv) - 11 marks
65  # (v) - 9 marks
66

```

Q16. (b) Total = 40 marks

```

1  # Question16_B.py
2  # Examination Number:
3  # 40 marks
4
5  Student_Names=[] # Part i
6  Student_Results=[] # Part i
7
8  def names(): # Part i
9      student_name=str(input("Please enter the students name and type 'end' when complete: ")) # Part i
10     Student_Names.append(student_name)
11     while True: # Part i
12         student_name=str(input("Please enter the students name and type '-1' when complete: ")) # Part i
13         if student_name == ('end') or student_name == ('End'):
14             break
15         else:
16             Student_Names.append(student_name) # Part i
17
18 def scores(): # Part i
19     student_result=float(input("\nPlease enter the students result and type  when complete: ")) # Part i
20     Student_Results.append(student_result) # Part i
21     while True: # Part i
22         student_result=float(input("Please enter the students result and type  when complete: ")) # Part i
23         if student_result==--1:
24             break
25         else:
26             Student_Results.append(student_result) # Part i
27
28 names() # Part i
29 scores() # Part i
30
31 print("\nStudent names are: ",Student_Names) # Part i
32 print("Student results are: ",Student_Results) # Part i
33
34
35 while len(Student_Names)!=len(Student_Results): # Part
36     if len(Student_Names)<len(Student_Results): # Part
37         print("\nERROR: You have entered more student results than student names") # Part
38         print("Compare the entered names and results and add the missing name to the correct index location") # Part
39         print("\nStudent results are: ",Student_Results)
40         print("\nStudent names are: ",Student_Names)
41
42         student_name=str(input("\nPlease enter the students name that was left out: ")) # Part
43         index=int(input("What is the index position of the name: ")) # Part
44         Student_Names.insert(index,student_name) # Part
45
46     elif len(Student_Names)>len(Student_Results): # Part
47         print("\nERROR: You have entered more student names than student results") # Part
48         print("Compare the entered names and results and add the missing result to the correct index location") # Part
49         print("\nStudent results are: ",Student_Results)
50         print("\nStudent names are: ",Student_Names)
51
52         student_result=float(input("\nPlease enter the students result that was left out: ")) # Part
53         index=int(input("What is the index position of the result: ")) # Part
54         Student_Results.insert(index,student_result) # Part
55
56
57 maxvalue=((max(Student_Results)/200)*100) # Part (iii)
58 minvalue=((min(Student_Results)/200)*100) # Part (iii)
59 maxvalueindex=Student_Results.index(max(Student_Results)) # Part (iii)
60 minvalueindex=Student_Results.index(min(Student_Results)) # Part (iii)
61 averagevalue=round(((sum(Student_Results)/len(Student_Results))/200)*100,1) # Part (iii)
62 print("\nHighest value scored is: ",maxvalue,"%") # Part (iii)
63 print("Lowest value scored is: ",minvalue,"%") # Part (iii)
64 print("\nThe student who scored the highest value is: ",Student_Names[maxvalueindex]) # Part (iii)
65 print("The student who scored the lowest value is: ",Student_Names[minvalueindex]) # Part (iii)
66 print("The average value in the calss is: ",averagevalue) # Part (iii)
67
68
69
70 # Part (i) (15 marks)
71 # A blank list to contain the student names is declared = 1 marks
72 # A blank list to contain the student results is declared = 1 marks
73 # A function for entering student names is correctly declared = 1 mark
74 # User is prompted to enter students name = 1 mark
75 # User input is added to appropriate list = 1 mark
76 # Use of appropriate method so program continues to ask user to input names until 'end' or 'End' is entered = 3 marks
77 # While loop runs, but does not run the desired number of times = -1 mark
78 # A function for entering student results is correctly declared = 1 mark
79 # User is prompted to enter students results = 1 mark
80 # User input is added to appropriate list = 1 mark
81 # Use of appropriate method so program continues to ask user to input results until '-1' is entered = 3 marks
82 # While loop runs, but does not run the desired number of times = -1 mark
83 # Display contents of both lists = 1 marks
84
85
86 # Errors
87 # Both lists hardcoded with names and results and then a print statement used to display hard coded contents = max 5 m
88 # One list is hardcoded with names or results and then a print statement used to display hard coded contents, other li
89 # end/End/-1 not used to break loop = -2 marks for each one that is forgotten UNLESS user turns input to all lower cas
90 # and only has one conditional exit, this is acceptable.

```

```
91 # Not displaying contents of lists = -2 mark for each list not displayed
92 # User input of 'end'/'End'/-1 being added to respective lists and not removed = -3 marks for each value that appears
93
94
95 # Part (ii) (10 marks)
96 # Program works as described with no errors or warnings = 10 marks
97 # No attempt to this part of the question = 0 marks
98
99 # Program correctly compares the length of the two lists or otherwise, to check for discrepancies = 2 marks
100 # Program recognises discrepancy between the two lists = 1 mark
101 # Program correctly asks the user to adjust the students name or students results = 2 marks
102 # Program allows user to re-enter the missing value = 2 marks
103 # Program correctly uses the .insert method or otherwise to put missing value at correct index location
104 # as compared to the question = 3 marks
105
106
107 # Part (iii) - 15 marks
108 # Student uses the max function or otherwise to correctly identify the largest value in the list and turn into a perce
109 # Student uses the min function or otherwise to correctly identify the smallest value in the list and turn into a perc
110 # Student uses the .index method or otherwise to correctly locate the index of the largest result value = 2 marks
111 # Student uses the .index method or otherwise to correctly locate the index of the smallest result value = 2 marks
112 # Program correctly calculates the average of the input results = 2 marks
113 # Program correctly displays the highest value as a percentage = 1 mark
114 # Program correctly displays the lowest value as a percentage = 1 mark
115 # Program correctly displays the student who got the highest value = 1 mark
116 # Program correctly displays the student who got the lowest value = 1 mark
117 # Program correctly displays the average of all the results as a percentage = 1 mark
118
```

Ordinary Level

Section A - Short Answer Questions

54 Marks

Answer any 9 of 12 questions. All questions carry 6 marks.

Q1. (a) What is meant by the term 'secondary storage'?

Secondary storage is non-volatile, long-term storage used to hold data and programs when the computer is not in use. **(3 marks)**

Student must identify one of the following:

- Non volatile
- Long term storage
- Holds data when computer system is powered off.

To get full 3 marks.

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

Cloud computing is internet based computing. Data and other computer services are provided remotely from an integrated network of hardware, software and internet infrastructure. **(3 marks)**

Student must identify one of the following:

- Internet based computing
- Services provided remotely

To get full 3 marks.

Q2. (a) Place an x next to the statement(s) that are true about RAM.

- The more RAM a computer has, the more operations it can handle at the same time.

(2 marks)

- There are two types of RAM. **(2 marks)**

(b) What does the acronym RAM stand for?

Random Access Memory **(2 marks)**

Q3. Identify three other in-built technologies that allow data to be input to a typical tablet computer.

Voice/microphone

- Camera
- GPS device
- Motion/Accelerometer
- Light sensor
- External mouse
- Any valid option

2 marks for each correct technology identified

- Q4. (a) Convert the binary bit pattern into a decimal. 84 (3 marks)
 (b) Convert the binary bit pattern into a hexadecimal. 54 (3 marks)

- Q5. Arrange the following units from smallest to largest (where 1 is the smallest and 5 is the largest)

Size	Ranking
GigaByte	5
Bit	1
Megabyte	4
KiloByte	3
Byte	2

1 mark for each correct placement, 1 extra mark for all correct.

- Q6. What is the output of the following piece of Python code:

56 (6 marks)

5+6 = 3 marks

11 = 0 marks

- Q7. Give an example of the following data types:

String: Any string value (2 marks)

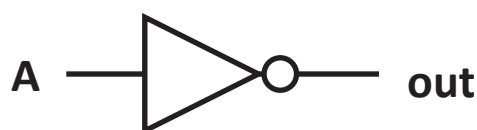
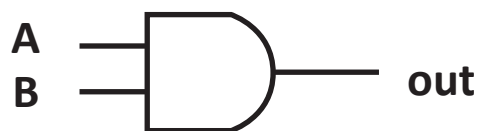
Float: Any float value (2 marks)

Boolean: Either True or False (2 marks)

- Q8. Identify each of the following logic gates by name and complete their respective truth tables.

Logic Gate Name: AND		
A	B	OUT
0	0	0
0	1	0
1	0	0
1	1	1

Logic Gate Name: NOT	
A	OUT
0	1
1	0



Both gates correctly identified (3 marks)

Only one gate correctly identified = 2 marks

Both tables correctly completed (3 marks)

Only one table correctly completed = 2 marks

- Q9. What is an analogue input? Give two examples of analogue inputs you have studied during your course.

An analogue input is one that can change and represent any value. (2 marks)

Student must identify that analogue inputs can represent any value for the 2 marks.

Any **two** analogue signals @ 2 marks each

- Q10. (a) Should the teacher use a linear search or a binary search algorithm to search the array in its current form?**

Linear **(3 marks)**

- (b) Explain your answer.**

Not possible to use a binary array unless the values within the array are first put in sequential order. **(3 marks)**

Student must identify that binary search requires the values to be in sequential order for the 3 marks.

- Q11. (a) Identify two ways in which the use of the Crew Dragon spaceship can improve scientific research carried out on board the ISS.**

Can increase the numbers of crew on board the ISS

Can increase the time dedicated to research in the space environment

Can return more scientific data to Earth.

*Any two of these reasons or reasons that relate to these answers **(3 marks)***

*Any one of these reasons or reasons that relate to these answers = **2 marks***

- (b) Outline one positive result of allowing computers to autonomously control dangerous tasks such as piloting a spacecraft.**

*Any valid reason. **(3 marks)***

- Q12. (a) Explain how a bubble sort works.**

A bubble sort starts at the beginning of an array and checks the first item against the second item. If the first item is greater than the second item, the algorithm swaps them. If the first item is less than the second item, it then moves on to the second item and checks this against the third item in the array. When the algorithm gets to the end of the array it goes back to the start and repeats the process until it makes no changes.

*States that the array compares the first and second item and swaps them if necessary = **2 marks***

*States the compares first and second items, then second and third and repeats this pattern until reaches the end of the array = **4 marks***

*Correctly identifies how algorithm goes through the array and then identifies the algorithm repeats until no more changes are needed = **4 marks***

- (b) An ascending bubble sort algorithm is applied to the data set shown below. What will the final form of the data be after the bubble sort algorithm is applied**

1,4,6,8,9

*All values correctly placed **(2 marks)***

*Three values correctly placed = **1 mark***

Section B - Long Questions

76 Marks

Any two of the following three questions, each question has 38 marks.

Q13. (a) **Total = 10 marks**

What is an algorithm?

An algorithm is a sequence of steps designed to accomplish a specific task (definition from CS specification)

Algorithm identified as a sequence of steps (5 marks)

Algorithm identified as used to accomplish a task (5 marks)

(b) **Total = 15 marks**

Develop an algorithm using either pseudo-code or a flowchart that allows a bus company to calculate how much a fare should be.

Pseudo code example 1:

Userinput -> distance in km

While distance <=0

Userinput -> distance in km

End while loop

Userinput -> Number of passengers

Calculate fare = (2*number of passengers)+(1.5*distance)

Output fare

Pseudo code example 2:

Userinput -> distance in km

if distance <=0

Userinput -> distance in km

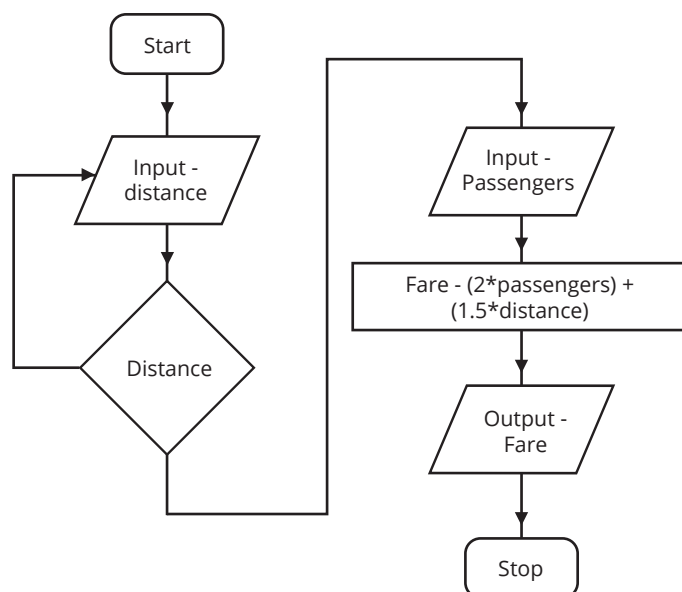
Else:

Userinput -> Number of passengers

Calculate fare = (2*number of passengers)+(1.5*distance)

Output fare

Flow chart example:



3 marks for correctly identifying distance as a user input

3 marks for validating user distance input (If/While/Any valid method)

3 marks for correctly identifying number of passengers as a user input

3 marks for correct fare calculation

3 marks for displaying output

(c) **Total = 13 marks**

(i) **Abstraction** is the process of ignoring or removing patterns or properties from a problem in order to focus or identify the patterns or properties we do need to solve a problem. *Correct definition of abstraction that refers to the blocking out or ignoring parts of a problem that are not relevant to a solution. (6 marks)*

(ii) **Decompositon** will allow us to break down the problem into separate parts that can be solved individually, in this problem the user could split the problem down into separate parts such as how they would count the number of students, What are the possible grades, how will they compare students results to grade conditions, How will they keep count of how many students get each grade, how will the results be displayed. *Identify that decomposition is the breaking down of a problem into smaller parts and the student identifies 1 possible operate part the problem can be broken into (5 marks)*
Student identifies 1 possible way the problem can be broken (2 marks)

Q14. (a) Total = 8 marks

The function `compare` returns an integer value when called. Explain why a Boolean return value could not be used in this function.

A Boolean value only deals with true or false statements and there is three different potential outputs from this function

Identify Boolean as true and false statement (3 marks)

Identify that there is three potential outputs but a Boolean only has two outputs (5 marks)

(b) Total = 10 marks

What integer value is returned when the function is called with the following arguments.

(i) 0

(ii) 1

(iii) -1

Each correct answer – 3 marks

All three correct – add 1 mark

(c) Total = 12 marks

The function shown compares two integer values and returns an integer value of 1,-1 or 0 depending on the arguments supplied to the function. Change the function so it will take three integers and returns the largest. The arguments you should use are x, y and z. You should also have an output if all three arguments are the same.

```
def compare(x,y,z):
1   if(x>y) and (x>z):
2       return(x)
3   elif(y>x) and (y>z):
4       return(y)
5   elif(z>x) and (z>y):
6       return(z)
7   else:
    return("The largest values is the same")
```

Correctly identify x,y,z as the arguments = 3 marks

Correct use of if/else/elif statements = 3 marks

Correct comparisons = 6 marks

Only uses if statements instead of if/else/elif = 2 marks

Only two comparisons correct = 3 marks

(d) Total = 8 marks

Tick the box if the following code will result in an error and explain the reason for the error.

Type in:	Error?	Explanation
print ("hello world")		
print "hello world"	x	Missing the brackets.
Print ("hello world")	x	Capital P

2 marks for each correct error identification.

2 marks for each correct explanation.

Q15. (a) Total = 8 marks

What is meant by a computer system? (8 marks)

A computer system is a machine/system that uses input and outputs to process data.

Student identifies a system uses inputs and outputs = 4 marks

Student identifies a system processes data = 4 marks

(b) Total = 15 marks

(i) Why does the the autopilot computer system require input devices?

So it can process the world around it AND make decisions.

Student identifies that the input devices process the systems surroundings (5 marks)

Student identifies that the system uses the devices to make a decision or give an appropriate output (5 marks)

(ii) Identify one form of adaptive technology that can assist drivers with special needs and describe how it would be used.

Any valid option (5 marks)

e.g. voice instruction, parking assist, lane change assist, GPS etc

(c) Total = 15 marks

(i) State one task performed by a CPU.

CPU processes and executes the instructions **(5 marks)**

(ii) Explain why the autopilot's driving instructions are stored using binary representation. (10 marks)

Transistors and electrical components all act as switches so they can only be in an on or off position. Binary instruction is either 1 or 0 which is then used as an on/off identifier.

Identify components work as switches **(3 marks)**

Identify switches can only be in on/off position **(3 marks)**

Binary instruction is either a 1 or 0 **(4 marks)**

Section C - 80 Marks

Q16. (a) Total = 40 marks

```

1  # Question 16(a)
2  # Student Name
3  # 40 marks
4
5  # This program is a simple ordering system"                # Part (i)
6  print("Welcome to the new online ordering system.\n")        # given
7
8
9  total_cost=0                                                # given
10 item_count=1                                                # given
11
12 user_name=input("Please enter your user name: ")            # Part (ii)
13 total_number_of_items=int(input("How many items are in the customers order: ")) # Part (iv)
14 # if student leaves input as a string then that is ok, however if they dont convert that string to an integer data type
15 # later in the program then the program wont work and they will loose marks then.
16
17 for x in range (total_number_of_items):                    # Part (iv) -1 mark if student hard cod
18     price_of_item=float(input("Enter the price of item {}".format(item_count)+" : € ")) # given
19     total_cost+=price_of_item                               # given
20     item_count+=1                                           # given
21
22 print("\nYou entered",total_number_of_items,"items and the total due is €",total_cost) # Part (iv)
23 customer_account_balance=float(input("\nWhat is the customers current account balance € ")) # Part (v)
24 remaining_balance=round(customer_account_balance-total_cost,2) # Part (v)
25 if customer_account_balance<total_cost:                    # Part (vi)
26     print("The customer does not have enough credit in their account, they still owe:€",(total_cost-customer_account_balance))
27 else:
28     print("\nThe member of staff who processed your order was: ",user_name) # Part (iii)
29     print("Your remaining balance:€ ",round(remaining_balance,2))
30
31
32 # Part (i) 5
33 # Comment correctly added to start of program - 5 Marks
34
35 # Part (ii) 5
36 # New variable created to store user name value - 2 Marks
37 # Input function correctly used to accept user input and assigned to new user name variable - 3 marks
38 # New variable created but input not assigned to new variable - 2 Marks
39 # New variable NOT created but input function used correctly to accept data - 2 Marks
40
41 # Part (iii) 5
42 # Print statement used to display message including the new user name variable from part (ii) - 5 Marks
43 # Print statement used to display message but does not include the new user name variable from part (ii) - 2 Marks
44
45 # Part (iv) 14
46 # New variable created to store total number of items - 2 Marks
47 # Input function correctly used to accept user input and assign the value to the number of items variable - 3 marks
48 # Uses the number of items as the range value for the for loop - 3 Marks
49 # Uses the given variable 'total_cost', to get a total value of the items entered by the user - 3 marks
50 # Print statement used to display total_cost variable value - 3 Marks
51
52 # Part (v) 7
53 # New variable created to store customers current balance - 2 Marks
54 # New variable created to store customers remaining balance - 2 Marks
55 # Calculation result of customer_balance - total_cost assigned to customers remaining balance - 3 Marks
56
57 # Part (vi) 4
58 # Correct use of if/else statement to display output telling customer if they still owe money - 2 Marks
59 # Correct due balance is displayed - 2 Marks
60
61
62
63

```

Q16. (b) Total = 40 marks

(20 marks)

```

1  # Question 16_b
2  # Student Name
3  # 40 Marks
4
5  Standard_Postal_List=["Netherlands","Denmark","Poland","Portugal","Finland","Romania","France","Germany","Greece","Spain"]
6
7  choice=input("Please enter the country that you wish to send the order to: ")# (ii)
8
9  if choice in Standard_Postal_List: # (ii)
10     print("\nThis country uses standard postage and packaging costs.")# (ii)
11 else:# (ii)
12     print("\nThis country is not on the approved delivery list.\n")# (ii)
13     new_country=input("Would you like to add this country to the approved Postal List for future deliveries, y/n:") #(i
14
15 if new_country=="y": #(iii)
16     Standard_Postal_List.append(choice) #(iii)
17     print(choice,"has been added to the Standard Postal List") #(iii)
18     print("\nThe new postal list is",sorted(Standard_Postal_List)) #(iv)
19
20 elif new_country=="n": #(iv)
21     print("This country has not been added to the Standard Postal List") #(iv)
22
23 else:
24     print("Invalid selection the program has terminated")
25
26
27 # (i) 10 marks for putting all 13 values into the list, order doesnt matter, lower or upper case doesnt matter.
28 # - 1 mark for each country not added to the list
29
30 # (ii) 10 marks total for this section
31 # 10 marks for correctly asking the user to input a country and using the if/else statment to see if user input exists
32 # and correct outputs are given dependent on the input.
33 # -5 marks if if/else statement does not compare user input to Standard_Postal_List but does give the appropriate outpu
34 # -3 marks if user has the desired outputs reversed. i.e says country is not on the list when it is and vice versa
35 # +3 marks if the input function correctly allows user to enter a country.
36 # +5 marks if outputs put correctly in the if/else statements.
37 # +5 marks if if/else statements used but doesnt compare user country input to the Standard_Postal_List
38
39 # (iii) 10 marks total for this section
40 # Full marks if program works as requested. number of ways to do this, full marks if program is efficient regardless the
41 # +3 marks if program asks user if they want to add country to the list or not.
42 # +3 marks if program successfully adds new country to the list if that option is chosen
43 # +3 marks if program outputs a message saying country not added to the list if that option chosen
44 #
45 # (iv) 10 marks for displaying the list in alphabetical order.
46 # 5 marks for displaying the list not in alphabetical order.
47

```




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