1. An algorithm stores the position of a character on a straight line as an integer. A user can move the character left or right.

The following algorithm:

- generates one random number between 1 and 512 (inclusive) to store as the position
- prompts the user to input a direction to move (left or right)
- takes a direction as input until a valid direction is input.

```
p = random(1, 512)

print("The position is ", p)

a = ""

while a != "left" and a != "right"

  a = input("Enter direction, left or right")

endwhile
```

Describe **two** ways to improve the maintainability of the algorithm.

1 _____

_____

2 _____

[4]

2(a). Students take part in a sports day. The students are put into teams.

Students gain points depending on their result and the year group they are in. The points are added to the team score.

The team with the most points at the end of the sports day wins.

Data about the teams and students is stored in a sports day program.

i. Identify the most appropriate data type for each variable used by the program.

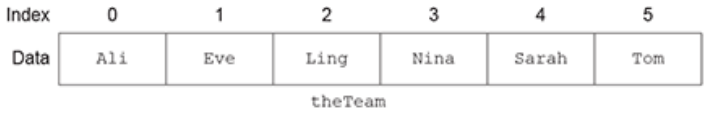
Each data type must be different.

Variable	Example	Data type
teamName	"Super-Team"	
studentYearGroup	11	
javelinThrow	18.2	

[3]

ii. The student names for a team are stored in an array with the identifier `theTeam`

An example of the data in this array is shown:



A linear search function is used to find whether a student is in the team. The function:

- takes a student name as a parameter
- returns `True` if the student name is in the array
- returns `False` if the student name is **not** in the array.

Complete the design of an algorithm for the linear search function.

```
function linearSearch(studentName)

  for count = 0 to ……..……..……

    if theTeam[……..……..……..……] == ……..……..…… then

      return ……..……..……

    endif

  next count

  return False

endfunction
```

[4]

(b). This algorithm calculates the number of points a student gets for the distance they throw in the javelin:

```
01  javelinThrow = input("Enter distance")
02  yearGroup = input("Enter year group")
03  if javelinThrow >= 20.0 then
04    score = 3
05  elseif javelinThrow >= 10.0 then
06    score = 2
07  else
08    score = 1
09  endif
10  if yearGroup != 11 then
11    score = score * 2
12  endif
```

```
13  print("The score is", score)
```

Complete the trace table for the algorithm when a student in year 10 throws a distance of 14.3

You may not need to use all the rows in the table.

Line number	javelinThrow	yearGroup	score	Output

[4]

(c). The height a student jumps in the high jump needs to be input and validated.
The height is entered in centimetres (cm) and must be between 40.0 and 180.0 inclusive.

i. Write an algorithm to:

Each data type must be different.

- take the height jumped as input
- output "VALID" **or** "NOT VALID" depending on the height input.

You must use **either**:

- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied.

[4]

ii. The algorithm is tested using a range of tests.

Complete the table to identify an example of test data for each type of test.

Test data (height jumped in cm)	Type of test	Expected output
	Normal	"VALID"
	Boundary	"VALID"
	Erroneous	"NOT VALID"

[3]

(d). The individual results for each student in each event are stored in a database.

The database table `TblResult` stores the times of students in the 100 m race. Some of the data is shown:

StudentID	YearGroup	TeamName	Time
11GC1	11	Valiants	20.3
10VE1	10	Super-Team	19.7
10SM1	10	Super-Team	19.2
11JP2	11	Champions	19.65

Complete the SQL statement to show the Student ID and team name of all students who are in year group 11

```
SELECT StudentID, .....

FROM .....

.....
```

[4]

(e). Abstraction and decomposition have been used in the design of the sports day program.

i. Identify **one** way that abstraction has been used in the design of this program.

[1]

ii. Identify **one** way that decomposition has been used in the design of this program.

[1]

(f). An algorithm works out which team has won (has the highest score).

Write an algorithm to:

- prompt the user to enter a team name and score, or to enter "stop" to stop entering new teams
- repeatedly take team names and scores as input until the user enters "stop"
- calculate which team has the highest score
- output the team name and score of the winning team in an appropriate message.

You must use **either**:

- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied

[6]

3(a). State what is meant by the term syntax error. Give **one** example of a syntax error in a program.

Definition

Example

[2]

(b). A student writes an algorithm to input two numbers and add them together to create a total.

If the total is between 10 and 20 inclusive, "`success`" is output.

If the total is not between 10 and 20 inclusive, "`warning`" is output.

```
01 num1 = input("Enter a number")
02 num2 = input("Enter a number")
03 total = num1 + num1
04 if total >= 10 then
05   print("success")
06 else
07   print("warning")
08 endif
```

The algorithm does not work correctly.

Identify the line number of the **two** logic errors in the algorithm and refine the code to correct each logic error.

Line number _____

Correction _____

_____

Line number _____

Correction _____

[4]

4. A program allows users to search for and watch videos. Users give a rating to the videos they watch.

Describe **one** method of defensive design that can be used when creating the program.

_____

_____

_____

_____

_____

[2]

5. OCR Drones flies goods around the country using drones.

A pilot's flying experience is validated. An algorithm checks that the experience is between 0 and 20 years.

```
exp = input("Enter number of years")
if exp >= 0 and exp <= 20 then
     print(True)
else
     print(False)
endif
```

Complete this test plan for the algorithm.

Experience in years	Type of test	Expected output
	Normal	True
20	Boundary	
32		

[4]

6(a). State what is meant by a syntax error and a logic error.

Syntax error _____

_____

Logic error _____

_____ **[2]**

(b). This pseudocode algorithm totals all the numbers in the 0-indexed array `scores`

```
01 total = 0
02 for scoreCount = 1 to scores.length - 1
03   scores[scoreCount] = total + total
04 next scoreCount
05 print(total)
```

The function `length` returns the number of elements in the array.

The algorithm contains several errors.

Two types of errors in a program are syntax and logic errors.

Identify **two** logic errors in the pseudocode algorithm.

Write the refined line to correct each error.

Error 1 line number _____

Corrected line _____

_____

_____

Error 2 line number _____

Corrected line _____

_____

[4]

7(a). Charlie is developing an adding game. The rules of the game are:

- the player is asked 3 addition questions
- each question asks the player to add together two random whole numbers between 1 and 10 inclusive
- if the player gets the correct answer, 1 is added to their score
- at the end of the game their score is displayed.

Charlie has been told that the game will need to be tested before giving it to the players.

i. Explain why programs should be tested before use.

_____

_____

_____

[2]

ii. Complete the table by naming and describing **one** type of test that should be used on Charlie's program before releasing it.

Test type	Description

[2]

iii. Complete the table by identifying **and** describing **two** features of an IDE that can be used when testing a program.

Feature	Description

[4]

(b). Validating inputs can reduce errors when a program is being run.

Identify **two** methods of validation **and** explain how they can be used on this game.

Validation method 1 _____

Use _____

_____

_____

_____

Validation method 2 _____

Use _____

_____

_____

[6]

8. OCR Security Services is a company that installs intruder alarm systems in commercial buildings.

The systems use a computer that is connected to the door sensors and window sensors.

The following data is stored in the system:

Data stored	Variable identifier	Example data
The user's name	`UserName`	Admin123
A telephone number to call when the alarm is activated	`EmergencyPhoneNumber`	+449999999999
Whether a door sensor is activated	`DoorSensorActive`	True
Whether a window sensor is activated	`WindowSensorActive`	True
A timer that counts, to the nearest second, how long a door sensor has been activated	`DoorActiveTime`	100
A timer that counts, to the nearest second, how long a window sensor has been activated	`WindowActiveTime`	100
Whether the system is armed	`SystemArmed`	True
Whether the system is in test mode	`TestModeActive`	True

Below is a table showing some variables within the program.

Tick (✓) **one** box in each row to identify the most appropriate data type for each variable.

Variable	Boolean	Char	String	Integer	Real
`UserName`					
`EmergencyPhoneNumber`					
`DoorSensorActive`					
`DoorActiveTime`					

[4]

9. Each member of staff that works in a restaurant is given a Staff ID. This is calculated using the following algorithm.

```
01 surname = input("Enter surname")
02 year = input("Enter starting year")
03 staffID = surname + str(year)
04 while staffID.length < 10
05    staffID = staffID + "x"
06 endwhile
07 print("ID " + staffID)
```

i. Define the term **casting and** give the line number where casting has been used in the algorithm.

Definition _____

_____

Line number _____

[2]

ii. Complete the following trace table for the given algorithm when the surname "Kofi" and the year 2021 are entered.

You may not need to use all rows in the table.

Line number	surname	year	staffID	Output
01	Kofi			
02		2021		

[4]

10. Jack is writing a program to add up some numbers. His first attempt at the program is shown.

```
a = input("Enter a number")
b = input("Enter a number")
c = input("Enter a number")
d = input("Enter a number")
e = input("Enter a number")
f = (a + b + c + d + e)
print(f)
```

Give **two** ways that the maintainability of this program could be improved.

1 _____

_____

2 _____

_____

[2]

11. Customers at a hotel can stay between 1 and 5 (inclusive) nights and can choose between a basic room or a premium room.

When a new booking is recorded, the details are entered into a program to validate the values. The following criteria are checked:

- `firstName` and `surname` are not empty
- `room` is either "basic" or "premium"
- `nights` is between 1 and 5 (inclusive).

If any invalid data is found "NOT ALLOWED" is displayed.
If all data is valid "ALLOWED" is displayed.

i. Complete the following program to validate the inputs.

You must use **either**:

- OCR Exam Reference Language, **or**
- a high-level programming language that you have studied.

```
firstName = input("Enter a first name")
surname = input("Enter a surname")
room = input("Enter basic or premium")
nights = input("Enter between 1 and 5 nights")
stayComplete = False
```

[5]

ii. Complete the following test plan to check whether the number of nights is validated correctly.

Test data (number of nights)	Type of test	Expected output
2		ALLOWED
	Boundary	ALLOWED
	Erroneous / Invalid	NOT ALLOWED

[3]

12(a). A car dealership uses a computer system to record details of the cars that it has for sale. Each car has a make, model, age and number of miles driven.

Each car is given a star rating of 1 to 5, based on the age of the car and the number of miles it has been driven. This rating is recorded in the computer system.

i. Define the term abstraction.

[1]

ii. Give **one** example of how abstraction has been used in the design of this star rating system.

[1]

iii. Explain how authentication could be used as part of the defensive design considerations for this computer system.

[2]

(b). The car dealership only sells cars that have fewer than 10 000 miles and are 5 years old or less.

i. Write an algorithm that will:

- ask the user to enter the number of miles and the age of a car
- validate the input to check that only sensible values that are in the given range are entered
- output `True` if valid data has been entered or `False` if invalid data has been entered.

[5]

ii. The validation routine from **part (i)** must be tested with normal, erroneous and boundary test data.

Identify suitable test data for each type of test.

	Miles	**Age**
Normal		
Erroneous		
Boundary		

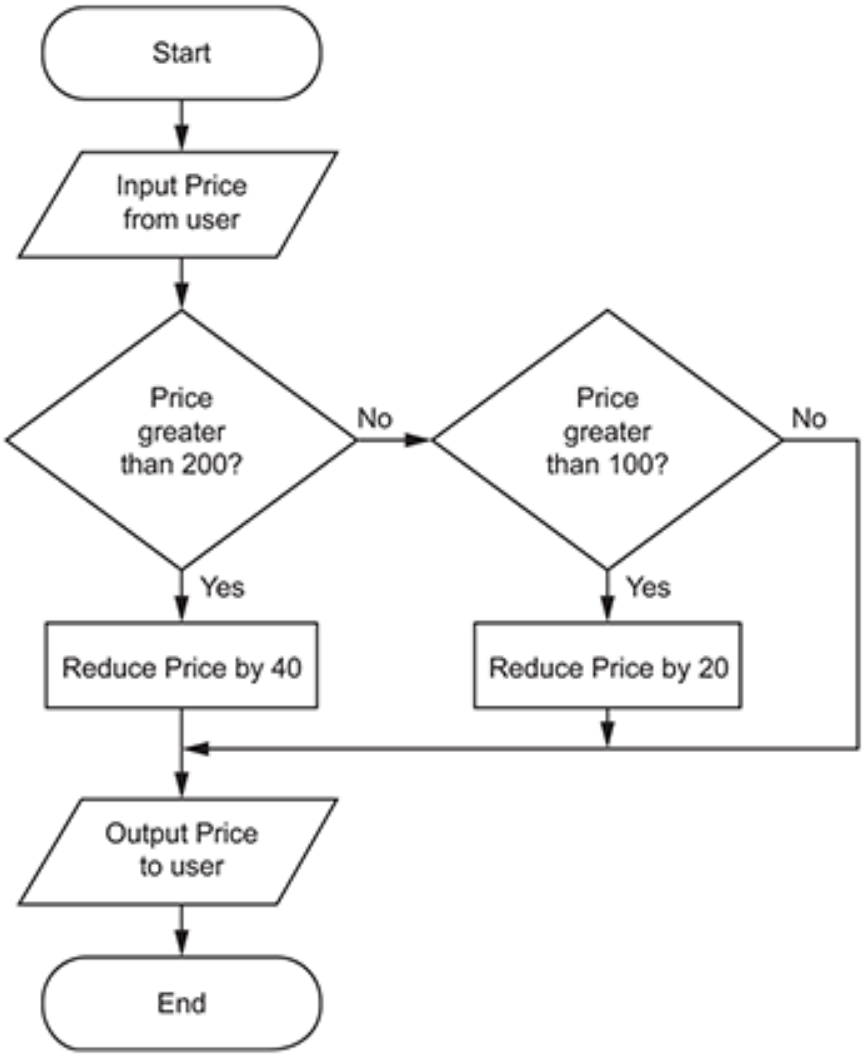
[3]

iii. Identify when iterative testing is performed.

[1]

13(a). OCR Tech is an online shop that sells electronics such as TVs and game consoles.

The following flowchart shows an algorithm to calculate the price of an item during a sale period.



i. Complete the following test plan for the algorithm.

Price input	Test type	Expected price output
50	Normal	
100	Boundary	
150	Normal	
200	Boundary	
250	Normal	

[3]

ii. Rewrite the algorithm above.

You must use **either:**

- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied

[6]

(b). An item is classified as "In demand" if OCR Tech have between 5 and 25 inclusive in stock.

A program is written that allows the user to input the current stock level and output whether the item is in demand or not.

```
stocklevel = input("Enter stock level")
if stocklevel >= 5 or =< 25 then
    print(Not in demand)
else
    print(In demand)
endif
```

The program contains syntax and logic errors.

Refine the program to correct the errors and write the refined version of the program.

You must use **either:**

- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied

[5]

14(a). The program should only allow values from **0** to **300** inclusive as valid inputs. If the data entered breaks this validation rule, an error message is displayed.

i. Complete the following program to output "`Invalid input`" if the data does not meet the validation rule.

You must use **either**:

- OCR Exam Reference Language, **or**
- a high-level programming language that you have studied.

```
mins = input("Enter minutes played: ")

if mins < 0 ..................... mins ..................... then

    ..................... ("Invalid input")

endif
```

[3]

ii. Complete the following test plan for the program in **(i)**.

Test data	Test type	Expected result
25	Normal	Value accepted
	Invalid	`Invalid input` message displayed
	Boundary	

[3]

(b). A teacher researches the length of time students spend playing computer games each day.

The teacher writes a program to add up and print out the total number of minutes student 2 played computer games over 5 days (Monday to Friday).

```
total = 0
total = total + minsPlayed[2,0]
total = total + minsPlayed[2,1]
total = total + minsPlayed[2,2]
total = total + minsPlayed[2,3]
total = total + minsPlayed[2,4]
print(total)
```

Refine the program to be more efficient. Write the refined version of the algorithm.

You must use **either**:

- OCR Exam Reference Language, **or**
- a high-level programming language that you have studied.

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[4]

END OF QUESTION PAPER