IMPLEMENTATION (DATA TYPES & STRUCTURES)

Describe, exemplify, and implement appropriately the following data types and structures:

- *Character*
- *String*
- *Numeric (integer and real)*
- *Boolean*
- *1D arrays*

SQP Q14b

14. Mark writes a program to calculate a worker's average weekly wage.

The first part of the program asks the user to log in. They are given three attempts to enter the correct password which is 'Bingo'.

```
. . .
Line 6    SET attempts TO 0
Line 7    REPEAT
Line 8      RECEIVE password FROM KEYBOARD
Line 9      SET attempts TO attempts +1
Line 10   UNTIL _____
. . .
```

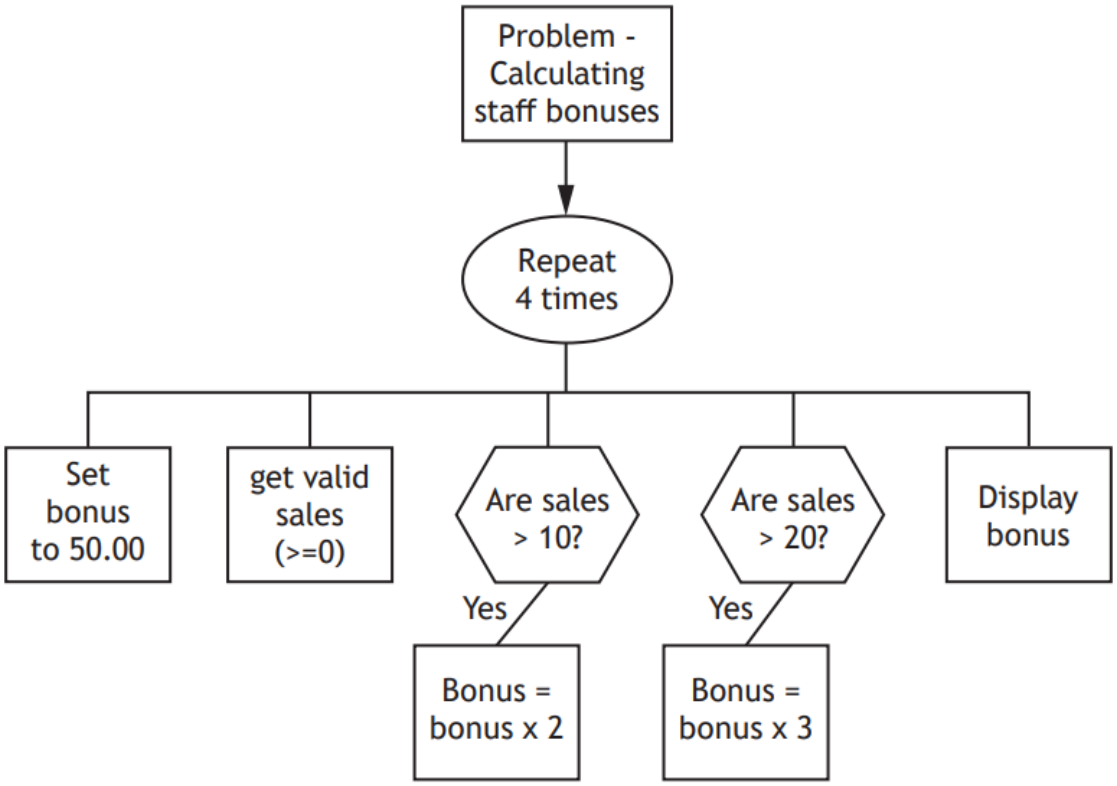
(b) State the data type of the variable `password`. **1**

_____

SQP Q21a

21. Arthur's Antiques sells old furniture. All staff receive a monthly bonus of £50, which is increased if they sell over 10 items of furniture. The bonus is increased further if they sell over 20 items of furniture.

A design for the program used to calculate the bonus payment for each of the four members of staff is shown below.



(a) List the variables and data types that would be required to implement the design.

The first one has been completed for you. **2**

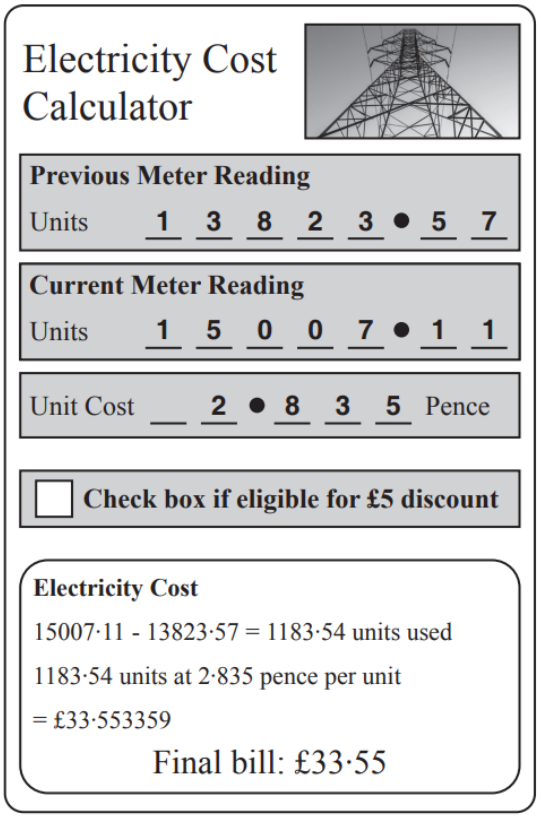
Variable name	Data type
Loop	**integer**

2019 Q13c

13. A smart phone app is needed to calculate the cost of electricity. The following information will be entered by the user.

- Previous meter reading
- Current meter reading
- Unit cost
- Discount eligibility

A possible user interface for the app is shown below.



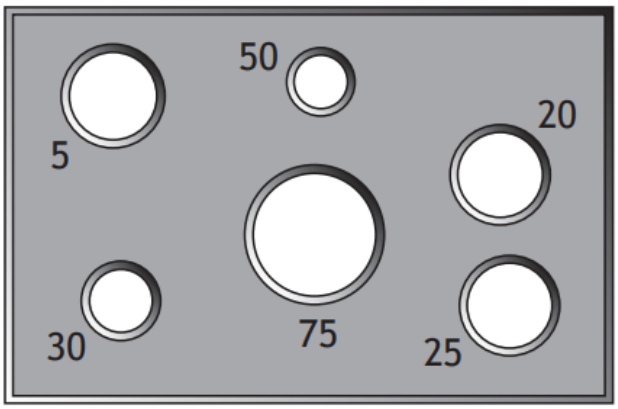
(c) State the data types that will be required to store the values of the following inputs. **2**

The current meter reading	
Check box if eligible for £5 discount	

2019 Q19c(ii)

19. A fairground game involves throwing balls through holes in a large wooden board. Each hole scores different points.

The game is played using the following four rules.



1. A player starts with 3 balls and throws them one at a time.
2. If a ball is successfully thrown through a hole the points are added onto the player's score.
3. The game ends immediately if a player's score is greater than or equal to 50.
4. If the score reaches exactly 50 points the player is told they have won a prize.

A program is written to keep the score for a player.

```
...
Line 3    DECLARE total INITIALLY 0
Line 4    DECLARE balls INITIALLY 3
Line 5    WHILE total < 50 AND balls > 0 DO
Line 6       RECEIVE ballScoreOne FROM KEYBOARD
Line 7       SET total TO total + ballScoreOne
Line 8       SET balls TO balls - 1
Line 9       RECEIVE ballScoreTwo FROM KEYBOARD
Line 10      SET total TO total + ballScoreTwo
Line 11      SET balls TO balls - 1
Line 12      RECEIVE ballScoreThree FROM KEYBOARD
Line 13      SET total TO total + ballScoreThree
Line 14      SET balls TO balls - 1
Line 15   END WHILE
Line 16   SEND "Well done! You have won a prize." TO DISPLAY
```

(c) A single ball can achieve a variety of different possible scores.

Two versions of input validation were coded and tested to check that only valid scores are entered.

Version A

```
...
Line 6    RECEIVE ballScore FROM KEYBOARD
Line 7    WHILE ballScore < 0 OR ballScore > 75 DO
Line 8       RECEIVE ballScore FROM KEYBOARD
Line 9    END WHILE
```

Version B

```
Line 1    DECLARE possScore INITIALLY
          [0,5,20,25,30,50,75]
...
Line 6    DECLARE found AS BOOLEAN INITIALLY false
Line 7    REPEAT
Line 8       RECEIVE ballScore FROM KEYBOARD
Line 9       FOR check FROM 0 TO length(possScore)-1 DO
Line 10         IF possScore[check] = ballScore THEN
Line 11            SET found TO true
Line 12         END IF
Line 13      END FOR
Line 14   UNTIL found
```

(ii) Name the data structure used in line 1 of Version B and state the data type that it is used to store. **2**

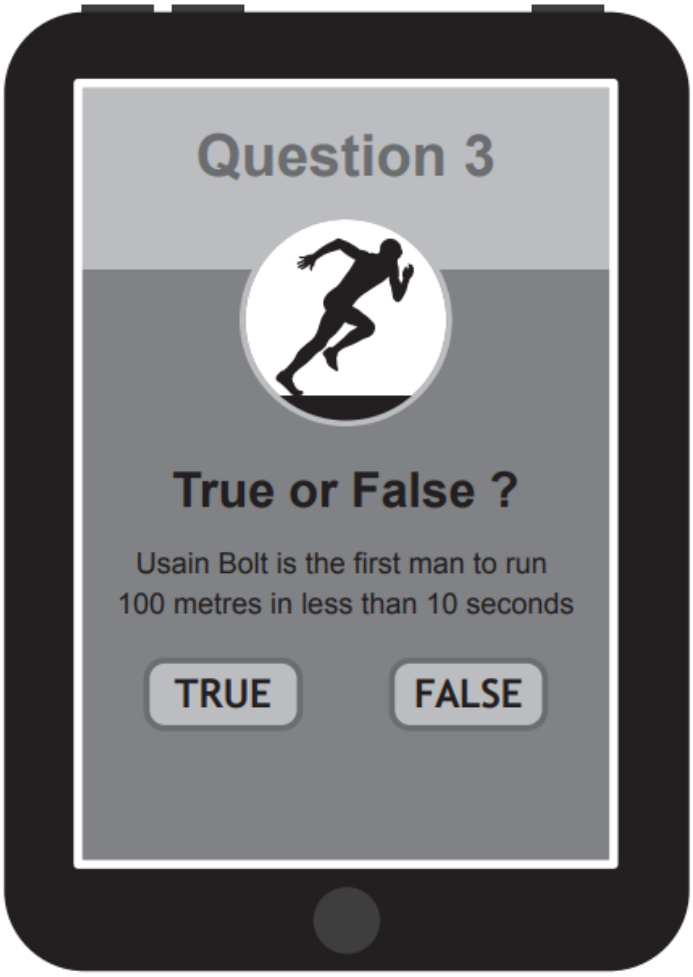
Name of data structure _____

Data type stored _____

2018 Q17a(i)

17. Scott is developing an online quiz with ten true or false questions. At the end of the quiz, the user's final score will be calculated.

(a) The user interface is shown below.



(i) Explain why a 1-D array of Boolean values is a suitable data structure to store the user's responses. **2**

2017 Q3

3. The validity of a password is checked as part of a program.

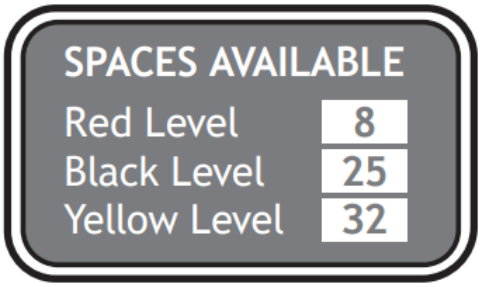
```
. . .
Line 8      SET passValid TO false
Line 9      RECEIVE userPassword FROM (STRING) KEYBOARD
Line10      IF userPassword = storedPassword THEN
Line 11           SET passValid TO true
Line 12     END IF
. . .
```

State the **data type** used to store the variable "passValid". **1**

2017 Q15a

15. A program is being developed to monitor the availability of parking spaces in a multi-level car park. The car park has three levels, each with 50 numbered spaces and a digital display board that shows the number of spaces available on each level.

Level	Numbered Spaces
Red	1–50
Black	51–100
Yellow	101–150



Part of the program is shown below:

```
Line 1      DECLARE redAvailable AS INTEGER INITIALLY 50
Line 2      DECLARE blackAvailable AS INTEGER INITIALLY 50
Line 3      DECLARE yellowAvailable AS INTEGER INITIALLY 50
. . .
. . .
                < vehicle is detected occupying a space>
. . .
. . .

Line 22     IF spaceNumber ≥1 AND spaceNumber ≤50 THEN
Line 23         redAvailable = redAvailable – 1
Line 24     END IF

. . .
. . .
```

(a) Explain why integer data types are used in Lines 1 to 3. **1**

2016 Q16b

16. A Maths game is designed for primary school pupils to test number ordering. In the game the pupil is asked to enter two integer numbers. A third integer number is then randomly generated and shown to the pupil.

The pupil must then state if the random number is:

lower (l) than the two entered numbers
higher (h) than the two entered numbers
in the middle (m) of the two entered numbers.

A design for the code is shown below.

```
Line 1    <enter the first number and assign to numOne>
Line 2    <enter the second number and assign to numTwo>
Line 3    <generate random number and assign to randNum>
Line 4    SEND randNum TO DISPLAY
Line 5    RECEIVE guess FROM (CHARACTER) KEYBOARD
Line 6    IF guess = "l" AND randNum < numOne THEN
Line 7        SEND "Correct it is lower" TO DISPLAY
Line 8        SET score TO score + 1
Line 9    END IF
Line 10   IF guess = "m" AND randNum >= numOne AND randNum <= numTwo
Line 11       SEND "Correct it is in the middle" TO DISPLAY
Line 12       SET score TO score + 1
Line 13   END IF
Line 14   IF guess = "h" AND randNum > numTwo
Line 15       SEND "Correct it is higher" TO DISPLAY
Line 16       SET score TO score + 1
Line 17   END IF
Line 18   <display incorrect message>
```

(b) When the pupil enters the answer it is stored in a variable called "guess".

State the **data type** stored by the variable "guess". **1**

2016 Q19a

19. Gillian designs a program to calculate how much it costs to get her dog Penny groomed. The design is shown below.

```
Line 1    SET total = 0
Line 2    DECLARE all costs INITIALLY [35.00, 36.00, 40.00, 35.00, 42.50]
Line 3    FOR EACH cost FROM all costs DUE
Line 4        SET total=total+cost
Line 5    END FOR EACH
Line 6    SEND "The total cost = £"&total TO DISPLAY
```

(a) Describe the data structure that has been used to store the individual costs. **2**

IMPLEMENTATION

Describe, exemplify, and implement the appropriate constructs in a high-level (textual) language:

- *Expressions to assign values*
- *Expressions to return values using arithmetic operations (addition, subtraction, multiplication, division, and exponentiation)*
- *Expressions to concatenate strings*
- *Selection constructs using simple conditional statements with <, >, ≤, ≥, =, ≠ operators*
- *Selection constructs using complex conditional statements*
- *Logical operators (AND, OR, NOT)*
- *Iteration and repetition using fixed and conditional loops*
- *Pre-defined functions (with parameters)*
    - *Random*
    - *Round*
    - *Length*

Read and explain code that makes use of the above constructs

SQP Q4

4. The code below monitors the speed of a vehicle:

```
. . .
Line 5  RECEIVE speed FROM <sensor>
Line 6  WHILE speed <= 70 DO
Line 7  RECEIVE speed FROM <sensor>
Line 8  END WHILE
Line 9  SEND signal TO <alarm>
```

Describe what happens in lines 6 to 9 above if the sensor detects a value of 83 at line 5. **3**

SQP Q14a

14. Mark writes a program to calculate a worker's average weekly wage.

The first part of the program asks the user to log in. They are given three attempts to enter the correct password which is 'Bingo'.

```
. . .
Line 6    SET attempts TO 0
Line 7    REPEAT
Line 8      RECEIVE password FROM KEYBOARD
Line 9      SET attempts TO attempts +1
Line 10   UNTIL _____________________________________________
. . .
```

(a) Complete line 10 of the code above. **3**

_____

SQP 14c

The following section of code calculates the average weekly wage:

```
Line 11   RECEIVE day1 FROM KEYBOARD
Line 12   RECEIVE day2 FROM KEYBOARD
Line 13   RECEIVE day3 FROM KEYBOARD
Line 14   RECEIVE day4 FROM KEYBOARD
Line 15   RECEIVE day5 FROM KEYBOARD
Line 16   RECEIVE day6 FROM KEYBOARD
Line 17   RECEIVE day7 FROM KEYBOARD
Line 18   SET weeklyAverage TO (day1 + day2 + day3 + day4 +
          day5 + day6 + day7)/7
Line 19   <display the seven days wages and average>
```

14. (continued)

(c) When evaluating this code, it is found to be inefficient.

Using a programming language of your choice, rewrite lines 11 to 18 of the code using more efficient constructs. **5**

SQP 19c

19. Read the following design for a solution to a problem.

Algorithm

1 Ask the user to enter their name

2 Ask the user to enter their flight details

3 Generate the holiday booking reference

4 Display the holiday booking reference

Refinements

1.1 Ask user to enter surname only

2.1 Ask user to enter first three letters of departure airport (for example: Edi for Edinburgh)

2.2 Ask user to enter first three letters of arrival airport

3.1 Store the booking reference as: arrival airport string + surname + departure airport string

(c) Refinement 3.1 stores the holiday booking reference.

State two programming constructs that would be required to implement this refinement. **2**

Construct 1 _____

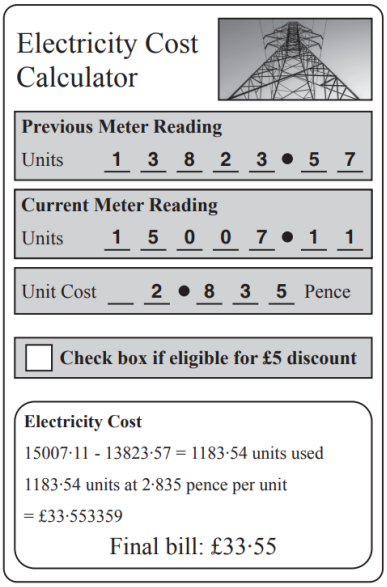
Construct 2 _____

2019 13f

13. A smart phone app is needed to calculate the cost of electricity. The following information will be entered by the user.

- Previous meter reading
- Current meter reading
- Unit cost
- Discount eligibility

A possible user interface for the app is shown below.



13. (continued)

(f) Another part of the program is shown below.

```
...
Line 25   SET meterDifference TO currentReading -
          previousReading
Line 26   SET cost TO (meterDifference*unitCost)/100
...
```

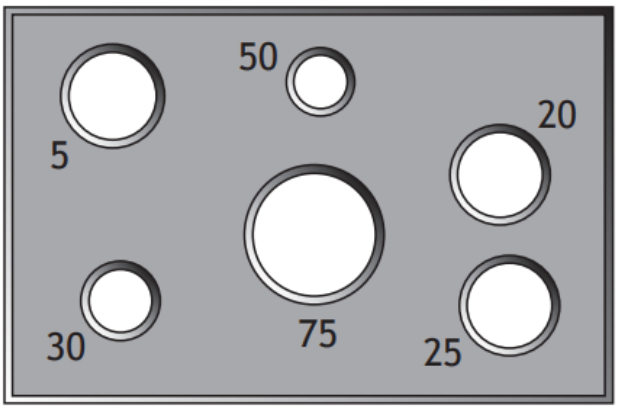
Using a programming language of your choice, write the code to

- subtract £5 from the cost if the discount check box is selected
- display the calculated electricity cost to two decimal places. **4**

2019 19a

19. A fairground game involves throwing balls through holes in a large wooden board. Each hole scores different points.

The game is played using the following four rules.



1. A player starts with 3 balls and throws them one at a time.
2. If a ball is successfully thrown through a hole the points are added onto the player's score.
3. The game ends immediately if a player's score is greater than or equal to 50.
4. If the score reaches exactly 50 points the player is told they have won a prize.

A program is written to keep the score for a player.

```
...
Line 3    DECLARE total INITIALLY 0
Line 4    DECLARE balls INITIALLY 3
Line 5    WHILE total < 50 AND balls > 0 DO
Line 6       RECEIVE ballScoreOne FROM KEYBOARD
Line 7       SET total TO total + ballScoreOne
Line 8       SET balls TO balls - 1
Line 9       RECEIVE ballScoreTwo FROM KEYBOARD
Line 10      SET total TO total + ballScoreTwo
Line 11      SET balls TO balls - 1
Line 12      RECEIVE ballScoreThree FROM KEYBOARD
Line 13      SET total TO total + ballScoreThree
Line 14      SET balls TO balls - 1
Line 15   END WHILE
Line 16   SEND "Well done! You have won a prize." TO DISPLAY
```

(a) Identify one logical operator in the above code. **1**

2019 19c(iii)

(c) A single ball can achieve a variety of different possible scores.

Two versions of input validation were coded and tested to check that only valid scores are entered.

Version A

```
...
Line 6    RECEIVE ballScore FROM KEYBOARD
Line 7    WHILE ballScore < 0 OR ballScore > 75 DO
Line 8       RECEIVE ballScore FROM KEYBOARD
Line 9    END WHILE
```

Version B

```
Line 1    DECLARE possScore INITIALLY
          [0,5,20,25,30,50,75]
...
Line 6    DECLARE found AS BOOLEAN INITIALLY false
Line 7    REPEAT
Line 8       RECEIVE ballScore FROM KEYBOARD
Line 9       FOR check FROM 0 TO length(possScore)-1 DO
Line 10         IF possScore[check] = ballScore THEN
Line 11            SET found TO true
Line 12         END IF
Line 13      END FOR
Line 14   UNTIL found
```

19. (c) (continued)

(iii) Describe how the `found` variable is used in Version B. **2**

2018 Q4a

4. The program below is used to switch a security light on or off depending on a reading taken from a light sensor.

```
Line 1  DECLARE storedLight INITIALLY 765.2
Line 2  RECEIVE reading FROM <light sensor>
Line 3  IF reading < storedLight THEN
Line 4        <switch on light>
Line 5  ELSE
Line 6        <switch off light>
Line 7  END IF
```

(a) State the smallest light sensor value that would result in the security light being off. **1**

_____

2018 Q7

7. The code for part of a program is shown below.

```
. . .
Line 41  SET runnerTime TO firstRaceTime +
         secondRaceTime + thirdRaceTime +
         fourthRaceTime + fifthRaceTime
Line 42  SET runnerAverage TO runnerTime / 5
Line 43  <display average to 2 decimal places>
. . .
```

State the pre-defined function and a parameter that could be used in Line 43. **2**

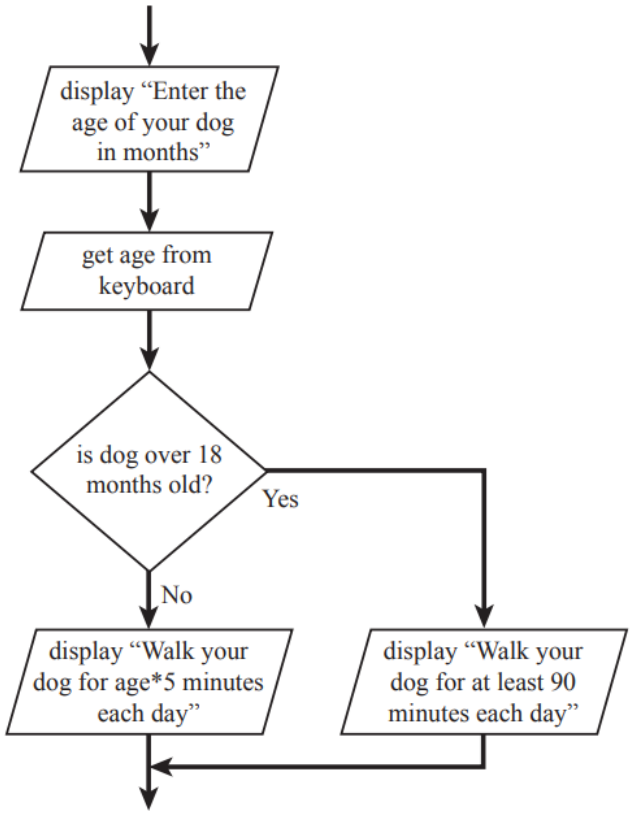
Pre-defined function _____

Parameter _____

2018 Q11

11. The design shown below asks a user to enter the age of their dog. It then displays advice on how many minutes the dog should be walked each day.

Circle the condition in the design below. **1**



2018 Q14c

14. The program code below calculates the delivery cost of orders.

```
...
Line 13   IF orderTotal < 50.00 AND NOT(cardType = "Platinum") THEN
Line 14           SET deliveryCost TO 5.00
Line 15   ELSE
Line 16           SET delivery TO 1.50
Line 17   END IF
Line 18   SEND deliveryCost TO DISPLAY
...
```

(c) State the delivery cost for the following order.

Card Type: Gold
Order Total: 43.00 **1**

2018 Q15

15. Explain why a conditional loop would be used when writing code. **1**

2018 Q19c(i) & Q19c(ii)

19. A program is being designed that will allow pupils to add money to their lunch money account. The user enters their name, an 8 character password and the amount of money they want to add. A button is then clicked and the updated balance of the account is displayed.

(c) The password must contain 8 characters.

(i) State a suitable pre-defined function to check that the password contains 8 characters. **1**

(ii) Explain why a pre-defined function would be used. **1**

2018 Q21b(i)

21. A program will calculate the total cost when customers purchase tickets to a theme park.

Adults pay £25 per ticket; children pay £10. If there are two or more adults with more than two children a discount of £5 is subtracted from the total cost.

Algorithm

1. Store cost of adult and child ticket
2. Get name of person making booking
3. Get quantity of tickets
4. Calculate total cost
5. Display food voucher message

Refinement

2.1 Get first name
2.2 Get second name

3.1 Get quantity of adult tickets
3.2 Get quantity of child tickets

(b) Customers who spend £50 or more on tickets qualify for a number of food vouchers.

Step 5 of the algorithm has been implemented below.

```
...
Line 23   IF totalCost < 50 THEN
Line 24       SEND "Sorry, no food voucher" TO DISPLAY
Line 25   ELSE
Line 26       IF totalCost >100 THEN
Line 27           SEND "You have been awarded 2 food
                  vouchers" TO DISPLAY
Line 28       ELSE
Line 29           SEND "You have been awarded 1 food
                  voucher" TO DISPLAY
Line 30       END IF
Line 31   END IF
...
```

(i) State the output if:

(A) the total cost is 104; **1**

_____

(B) the total cost is 50. **1**

_____

2017 Q7

7. Part of a program is shown below.

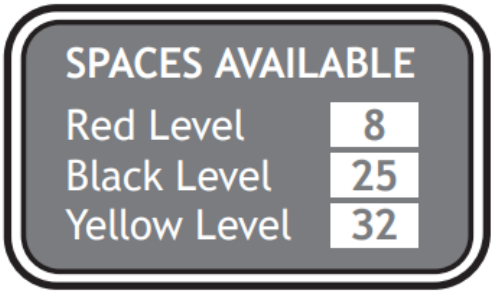
```
Line 1:     DECLARE score AS REAL INITIALLY 0·0
Line 2:     RECEIVE score FROM KEYBOARD
Line 3:     IF score > 2·0 THEN
Line 4:         SEND "Congratulations. You are in the final" TO DISPLAY
Line 5:     ELSE
Line 6:         SEND "You have failed to qualify" TO DISPLAY
Line 7:     END IF
```

Describe what happens in Lines 3 to 6 when the value 1·4 is entered at Line 2. **2**

2017 Q15c(i)

15. A program is being developed to monitor the availability of parking spaces in a multi-level car park. The car park has three levels, each with 50 numbered spaces and a digital display board that shows the number of spaces available on each level.

Level	Numbered Spaces
Red	1–50
Black	51–100
Yellow	101–150



Part of the program is shown below:

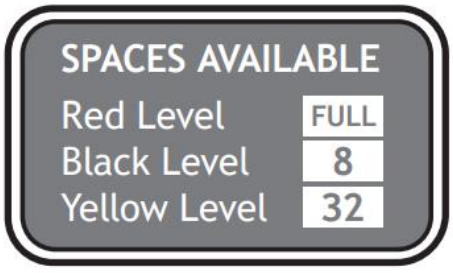
```
Line 1    DECLARE redAvailable AS INTEGER INITIALLY 50
Line 2    DECLARE blackAvailable AS INTEGER INITIALLY 50
Line 3    DECLARE yellowAvailable AS INTEGER INITIALLY 50
. . .
. . .
                < vehicle is detected occupying a space>
. . .
. . .

Line 22   IF spaceNumber ≥1 AND spaceNumber ≤50 THEN
Line 23       redAvailable = redAvailable – 1
Line 24   END IF

. . .
. . .
```

15. (continued)

When a vehicle parks, the digital display board will be updated to show the number of available spaces on each level.



(c) (i) Complete the condition below, that will display the message "FULL" when all the spaces on the Red Level are occupied. **1**

```
IF_____________________________________________THEN
    SEND "FULL" TO DISPLAY
END IF
```

2017 Q19b

19. Louise is conducting a survey at her school to find out how many hours per week her class mates spend playing computer games. Louise will survey 100 pupils.

The program assigns 100 names to a 1-D array as shown below.

```
Line 1      DECLARE name AS ARRAY OF STRING INITIALLY []
Line 2      RECEIVE name[0] FROM KEYBOARD
Line 3      RECEIVE name[1] FROM KEYBOARD
Line 4      RECEIVE name[2] FROM KEYBOARD
. . .
. . .
Line 101    RECEIVE name[99] FROM KEYBOARD
```

(b) Another section of the program is shown below.

```
. . .
Line 119    SET averageHours = totalHours / 7
Line 120    <use a pre-defined function to store averageHours to the
            nearest whole number>
Line 121    SEND "An average of " & averageHours & " hours" TO
            DISPLAY
```

(i) Identify the operator used to concatenate in the program above. **1**

_____

(ii) Explain why averageHours should be stored as a real data type. **1**

(iii) The program is executed. At Line 119 the value 4·26 is assigned to averageHours.

Write the message that will be displayed when Line 121 is executed. **2**

(iv) State the pre-defined function that could be used when Line 120 is coded. **1**

_____

2016 Q9

9. This code design monitors the temperature of food as it is reheated.

```
Line 1    RECEIVE temperature FROM (REAL) <temperature sensor>
Line 2    WHILE temperature <  82 DO
Line 3        SEND "temperature too low: continue to reheat" TO DISPLAY
Line 4        RECEIVE temperature FROM (REAL) <temperature sensor>
Line 5    END WHILE
```

Explain what will happen in lines 2 to 5 if the sensor detects 63°. **2**

2016 Q12

12. A running group has 16 members. They are taking part in a marathon.

Using pseudocode or a programming language of your choice, write the code which will take in each runner's time for the marathon. **2**

2016 Q16d & Q16e

16. A Maths game is designed for primary school pupils to test number ordering. In the game the pupil is asked to enter two integer numbers. A third integer number is then randomly generated and shown to the pupil.

The pupil must then state if the random number is:

lower (l) than the two entered numbers
higher (h) than the two entered numbers
in the middle (m) of the two entered numbers.

A design for the code is shown below.

```
Line 1    <enter the first number and assign to numOne>
Line 2    <enter the second number and assign to numTwo>
Line 3    <generate random number and assign to randNum>
Line 4    SEND randNum TO DISPLAY
Line 5    RECEIVE guess FROM (CHARACTER) KEYBOARD
Line 6    IF guess = "l" AND randNum < numOne THEN
Line 7        SEND "Correct it is lower" TO DISPLAY
Line 8        SET score TO score + 1
Line 9    END IF
Line 10   IF guess = "m" AND randNum >= numOne AND randNum <= numTwo
Line 11       SEND "Correct it is in the middle" TO DISPLAY
Line 12       SET score TO score + 1
Line 13   END IF
Line 14   IF guess = "h" AND randNum > numTwo
Line 15       SEND "Correct it is higher" TO DISPLAY
Line 16       SET score TO score + 1
Line 17   END IF
Line 18   <display incorrect message>
```

(d) The program will have to make use of a pre-defined function.

State the pre-defined function used and describe its purpose. **2**

(e) Using line numbers, describe how the code could be adapted, allowing the pupil to play the game 10 times using the same values for numOne and numTwo but a different random number each time. **2**

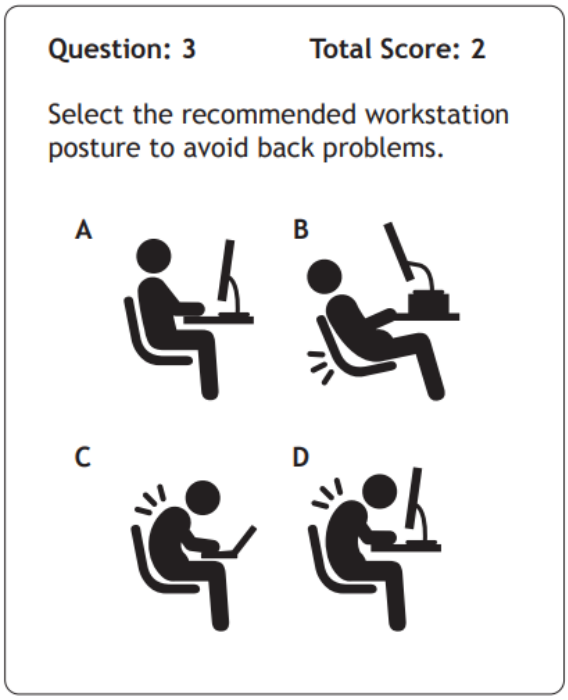
2016 Q18d(ii)

18. A software development company decides to review staff knowledge of computer related legislation.

Mikal is asked to create an app covering a range of legal issues.

18. (d) (continued)

(ii) Mikal uses the graphics to create question 3 for the app.



Using pseudocode or a programming language of your choice, write the code to show how the total score is calculated when the user answers question 3 correctly. **2**

2016 Q19b(i) & Q19b(iii) & Q19c

19. Gillian designs a program to calculate how much it costs to get her dog Penny groomed. The design is shown below.

```
Line 1    SET total = 0
Line 2    DECLARE all costs INITIALLY [35.00, 36.00, 40.00, 35.00, 42.50]
Line 3    FOR EACH cost FROM all costs DUE
Line 4        SET total=total+cost
Line 5    END FOR EACH
Line 6    SEND "The total cost = £"&total TO DISPLAY
```

(b) Gillian writes and tests her program. It works perfectly calculating a correct total of 188.50.

(i) With reference to line numbers, explain how the program calculates the final total. **3**

(b) (continued)

(iii) Gillian edits the program with the following data:
[35.00, 36.00, 40.00, 35.00, 42.50, **45.00**]
The output is still 188.50.

A Explain why the output is still 188.50. **1**

_____

B State how this error could be corrected. **1**

_____

(c) Concatenation has been used in line 6.

State the purpose of concatenation. **1**

IMPLEMENTATION (ALGORITHM SPECIFICATION)

Describe, exemplify, and implement standard algorithms:

- *Input validation*
- *Running total within loop*
- *Traversing a 1D array*

SQP Q19e

19. Read the following design for a solution to a problem.

Algorithm

1 Ask the user to enter their name

2 Ask the user to enter their flight details

3 Generate the holiday booking reference

4 Display the holiday booking reference

Refinements

1.1 Ask user to enter surname only

2.1 Ask user to enter first three letters of departure airport (for example: Edi for Edinburgh)

2.2 Ask user to enter first three letters of arrival airport

3.1 Store the booking reference as: arrival airport string + surname + departure airport string

(e) Using a design technique of your choice, add input validation to refinement 2.1 to ensure that the user only enters a 3 character string. An error message should inform the user when their input is not valid. **4**

2019 Q7b

7. Part of a program requires a user to input the total score achieved when they roll a pair of six-sided dice.

   For example, if the user rolled a 4 and a 1 they would input 5.

(b) The code below shows part of the program.

```
...
FOR loop FROM 1 TO 100 DO
     RECEIVE diceScore FROM KEYBOARD
     SET total TO total + diceScore
END FOR
...
```

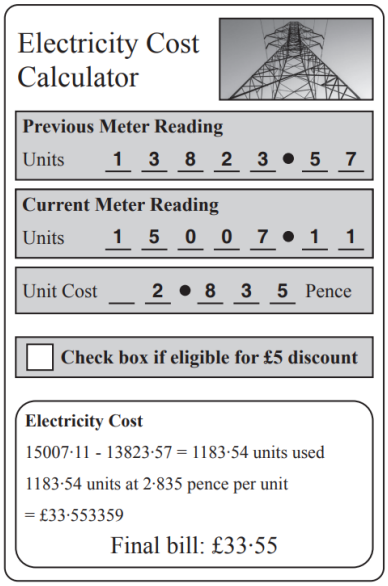
State the standard algorithm shown above. **1**

_____

2019 Q13e

13. A smart phone app is needed to calculate the cost of electricity. The following information will be entered by the user.

- Previous meter reading
- Current meter reading
- Unit cost
- Discount eligibility



(e) The program uses input validation.

```
...
Line 13  REPEAT
Line 14    RECEIVE currentReading FROM <the touch
           screen keyboard>
Line 15    IF currentReading < previousReading THEN
Line 16      SEND "Reading too low. Please re-enter"
             TO DISPLAY
Line 17    END IF
Line 18  _____________________________________________
```

Using a programming language of your choice, complete Line 18.

Ensure that only acceptable values can be entered for the current meter reading. **2**

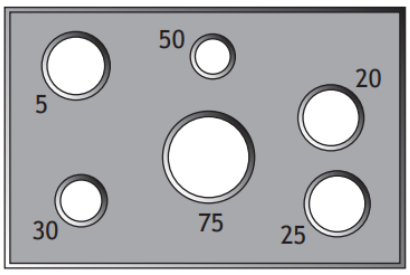
Line 18

_____

2019 19c(i)

19. A fairground game involves throwing balls through holes in a large wooden board. Each hole scores different points.

The game is played using the following four rules.



1. A player starts with 3 balls and throws them one at a time.
2. If a ball is successfully thrown through a hole the points are added onto the player's score.
3. The game ends immediately if a player's score is greater than or equal to 50.
4. If the score reaches exactly 50 points the player is told they have won a prize.

A program is written to keep the score for a player.

```
...
Line 3    DECLARE total INITIALLY 0
Line 4    DECLARE balls INITIALLY 3
Line 5    WHILE total < 50 AND balls > 0 DO
Line 6       RECEIVE ballScoreOne FROM KEYBOARD
Line 7       SET total TO total + ballScoreOne
Line 8       SET balls TO balls - 1
Line 9       RECEIVE ballScoreTwo FROM KEYBOARD
Line 10      SET total TO total + ballScoreTwo
Line 11      SET balls TO balls - 1
Line 12      RECEIVE ballScoreThree FROM KEYBOARD
Line 13      SET total TO total + ballScoreThree
Line 14      SET balls TO balls - 1
Line 15   END WHILE
Line 16   SEND "Well done! You have won a prize." TO DISPLAY
```

(c) A single ball can achieve a variety of different possible scores.

Two versions of input validation were coded and tested to check that only valid scores are entered.

Version A

```
...
Line 6    RECEIVE ballScore FROM KEYBOARD
Line 7    WHILE ballScore < 0 OR ballScore > 75 DO
Line 8       RECEIVE ballScore FROM KEYBOARD
Line 9    END WHILE
```

Version B

```
Line 1    DECLARE possScore INITIALLY
          [0,5,20,25,30,50,75]
...
Line 6    DECLARE found AS BOOLEAN INITIALLY false
Line 7    REPEAT
Line 8       RECEIVE ballScore FROM KEYBOARD
Line 9       FOR check FROM 0 TO length(possScore)-1 DO
Line 10         IF possScore[check] = ballScore THEN
Line 11            SET found TO true
Line 12         END IF
Line 13      END FOR
Line 14   UNTIL found
```

(i) Explain why it would not be appropriate to use the input validation shown in Version A. **1**

2018 Q17a(ii)

17. Scott is developing an online quiz with ten true or false questions. At the end of the quiz, the user's final score will be calculated.

(a) The user interface is shown below.

17. (a) (continued)

(ii) For each correct response, 5 points are added to the user's score.

Using a programming language of your choice, write efficient code to calculate the user's final score.

Your code should use a running total within a loop. **4**

2018 Q21b(ii)

21. A program will calculate the total cost when customers purchase tickets to a theme park.

Adults pay £25 per ticket; children pay £10. If there are two or more adults with more than two children a discount of £5 is subtracted from the total cost.

Algorithm

1. Store cost of adult and child ticket
2. Get name of person making booking
3. Get quantity of tickets
4. Calculate total cost
5. Display food voucher message

Refinement

2.1 Get first name
2.2 Get second name

3.1 Get quantity of adult tickets
3.2 Get quantity of child tickets

(b) Customers who spend £50 or more on tickets qualify for a number of food vouchers.

Step 5 of the algorithm has been implemented below.

```
. . .
Line 23   IF totalCost < 50 THEN
Line 24       SEND "Sorry, no food voucher" TO DISPLAY
Line 25   ELSE
Line 26       IF totalCost >100 THEN
Line 27           SEND "You have been awarded 2 food
                  vouchers" TO DISPLAY
Line 28       ELSE
Line 29           SEND "You have been awarded 1 food
                  voucher" TO DISPLAY
Line 30       END IF
Line 31   END IF
. . .
```

(ii) When the completed code is tested, a user enters 2.5 for the number of adult tickets.

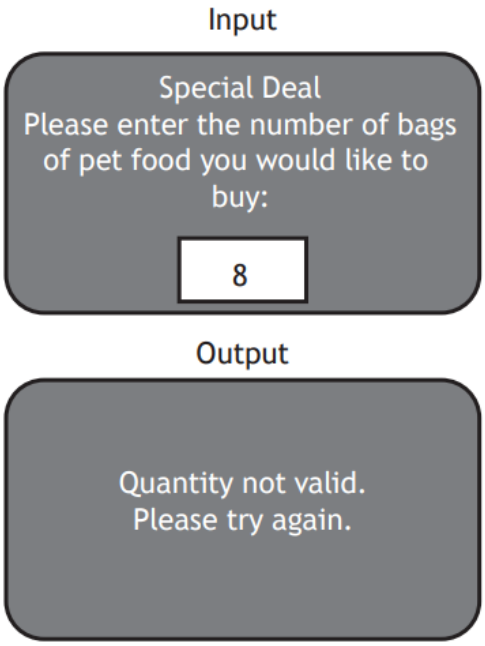
The program continues to run and calculates the total cost.

Explain how the program could be made fit for purpose. **1**

2017 Q17a

17. An online pet supply retailer is offering a special deal to customers buying at least **two**, but not more than **six**, bags of pet food. If customers try to buy any other quantity, a message is displayed.

For example:



(a) Show, using pseudocode or a programming language of your choice, how input validation could be used to ensure an acceptable number of bags is entered. **4**

2017 Q19a

19. Louise is conducting a survey at her school to find out how many hours per week her class mates spend playing computer games. Louise will survey 100 pupils.

The program assigns 100 names to a 1-D array as shown below.

```
Line 1     DECLARE name AS ARRAY OF STRING INITIALLY []
Line 2     RECEIVE name[0] FROM KEYBOARD
Line 3     RECEIVE name[1] FROM KEYBOARD
Line 4     RECEIVE name[2] FROM KEYBOARD
. . .
. . .
Line 101   RECEIVE name[99] FROM KEYBOARD
```

(a) Louise realises that writing the code to read the data into the array like this is time consuming and not good practice.

Write, using pseudocode or a programming language of your choice, the code to show how the data can be entered into the 1-D array using repetition. **3**

2016 Q16a

16. A Maths game is designed for primary school pupils to test number ordering. In the game the pupil is asked to enter two integer numbers. A third integer number is then randomly generated and shown to the pupil.

The pupil must then state if the random number is:

lower (l) than the two entered numbers
higher (h) than the two entered numbers
in the middle (m) of the two entered numbers.

A design for the code is shown below.

```
Line 1    <enter the first number and assign to numOne>
Line 2    <enter the second number and assign to numTwo>
Line 3    <generate random number and assign to randNum>
Line 4    SEND randNum TO DISPLAY
Line 5    RECEIVE guess FROM (CHARACTER) KEYBOARD
Line 6    IF guess = "l" AND randNum < numOne THEN
Line 7        SEND "Correct it is lower" TO DISPLAY
Line 8        SET score TO score + 1
Line 9    END IF
Line 10   IF guess = "m" AND randNum >= numOne AND randNum <= numTwo
Line 11       SEND "Correct it is in the middle" TO DISPLAY
Line 12       SET score TO score + 1
Line 13   END IF
Line 14   IF guess = "h" AND randNum > numTwo
Line 15       SEND "Correct it is higher" TO DISPLAY
Line 16       SET score TO score + 1
Line 17   END IF
Line 18   <display incorrect message>
```

(a) When the two numbers are entered the program should ensure that numTwo is always a higher number than numOne.

Using pseudocode or a programming language of your choice, write several lines to represent this input validation for line 2. **4**