

Please write clearly in block capitals.

Centre number

Candidate number

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE COMPUTER SCIENCE

Paper 1 Computational thinking and programming skills – VB.Net

Time allowed: 2 hours

Materials

- There are no additional materials required for this paper.
- You must **not** use a calculator.

Instructions

- Use black ink or black ball-point pen. Use pencil only for drawing.
- Answer **all** questions.
- You must answer the questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Questions that require a coded solution must be answered in VB.Net.
- You should assume that all indexing in code starts at 0 unless stated otherwise.

Information

The total number of marks available for this paper is 90.

Advice

For the multiple-choice questions, completely fill in the lozenge alongside the appropriate answer.

CORRECT METHOD  WRONG METHODS    

If you want to change your answer you must cross out your original answer as shown. 

If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown. 



For Examiner's Use	
Question	Mark
1	
2–3	
4–5	
6–7	
8–9	
10	
11	
12	
13	
14	
TOTAL	



Answer **all** questions.

0 1

An algorithm, that uses the modulus operator, has been represented using pseudo-code in **Figure 1**.

- Line numbers are included but are not part of the algorithm.

Figure 1

```
1  i ← USERINPUT
2  IF i MOD 2 = 0 THEN
3      OUTPUT i * i
4  ELSE
5      OUTPUT i
6  ENDIF
```

The modulus operator is used to calculate the remainder after dividing one integer by another.

For example:

- 14 MOD 3 evaluates to 2
- 24 MOD 5 evaluates to 4

0 1 . 1

Shade **one** lozenge that shows the line number where selection is **first** used in the algorithm in **Figure 1**.

[1 mark]

A Line number 1

B Line number 2

C Line number 3

D Line number 4



0 1 . 2

Shade **one** lozenge that shows the output from the algorithm in **Figure 1** when the user input is 4

[1 mark]

- A** 0
- B** 2
- C** 4
- D** 8
- E** 16

0 1 . 3

Shade **one** lozenge that shows the line number where assignment is **first** used in the algorithm in **Figure 1**.

[1 mark]

- A** Line number 1
- B** Line number 2
- C** Line number 3
- D** Line number 4

0 1 . 4

Shade **one** lozenge that shows the line number that contains a relational operator in the algorithm in **Figure 1**.

[1 mark]

- A** Line number 1
- B** Line number 2
- C** Line number 3
- D** Line number 4

Question 1 continues on the next page

Turn over ►



Figure 1 has been included again below.

Figure 1

```

1  i ← USERINPUT
2  IF i MOD 2 = 0 THEN
3      OUTPUT i * i
4  ELSE
5      OUTPUT i
6  ENDIF

```

0 1 . 5 Shade **one** lozenge to show which of the following is a **true** statement about the algorithm in **Figure 1**.

[1 mark]

- A** This algorithm uses a Boolean operator.
- B** This algorithm uses a named constant.
- C** This algorithm uses iteration.
- D** This algorithm uses the multiplication operator.

0 1 . 6 **Figure 2** shows an implementation of the algorithm in **Figure 1** using the VB.Net programming language.

- Line numbers are included but are not part of the program.

Figure 2

```

1  Console.WriteLine("Enter a number: ")
2  Dim i As Integer = Console.ReadLine()
3  If i Mod 2 = 0 Then
4      Console.WriteLine(i * i)
5  Else
6      Console.WriteLine(i)
7  End If

```

The program in **Figure 2** needs to be changed so that it repeats five times using **definite** (count controlled) iteration.

Shade **one** lozenge next to the program that does this correctly.

[1 mark]



A	<pre>Dim x As Integer = 1 While x <> 6 Console.WriteLine("Enter a number: ") Dim i As Integer = Console.ReadLine() If i Mod 2 = 0 Then Console.WriteLine(i * i) Else Console.WriteLine(i) End If x = x + 1 End While</pre>	<input type="radio"/>
B	<pre>Dim x As Integer = 6 While x <> 0 Console.WriteLine("Enter a number: ") Dim i As Integer = Console.ReadLine() If i Mod 2 = 0 Then Console.WriteLine(i * i) Else Console.WriteLine(i) End If x = x - 1 End While</pre>	<input type="radio"/>
C	<pre>For x As Integer = 0 To 4 Console.WriteLine("Enter a number: ") Dim i As Integer = Console.ReadLine() If i Mod 2 = 0 Then Console.WriteLine(i * i) Else Console.WriteLine(i) End If Next</pre>	<input type="radio"/>
D	<pre>For x As Integer = 0 To 5 Console.WriteLine("Enter a number: ") Dim i As Integer = Console.ReadLine() If i Mod 2 = 0 Then Console.WriteLine(i * i) Else Console.WriteLine(i) End If Next</pre>	<input type="radio"/>



0 2

Figure 3 shows an algorithm, represented using pseudo-code, that calculates the delivery cost for an order from a takeaway company.

Figure 3

```

orderTotal ← USERINPUT
deliveryDistance ← USERINPUT
deliveryCost ← 0.0
messageOne ← "Minimum spend not met"
messageTwo ← "Delivery not possible"
IF deliveryDistance ≤ 5 AND orderTotal > 0.0 THEN
    IF orderTotal > 50.0 THEN
        deliveryCost ← 1.5
        OUTPUT deliveryCost
    ELSE IF orderTotal > 25.0 THEN
        deliveryCost ← (orderTotal / 10) * 2
        OUTPUT deliveryCost
    ELSE
        OUTPUT messageOne
    ENDIF
ELSE
    OUTPUT messageTwo
ENDIF

```

0 2 . 1

Using **Figure 3**, complete the table.

[2 marks]

Input value of orderTotal	Input value of deliveryDistance	Output
55.5	2	
35.0	5	

0 2 . 2

State how many possible values the result of the comparison
 $\text{deliveryDistance} \leq 5$ could have in the algorithm shown in **Figure 3**.

[1 mark]



0 2 . 3

State the most suitable data type for the following variables used in **Figure 3**.**[2 marks]**

Variable identifier	Data type
deliveryCost	
messageOne	

0 2 . 4

State **one** other common data type that you have **not** given in your answer to Question **02.3**.**[1 mark]**

Turn over for the next question

Turn over ►

0 3

Figure 4 shows a VB.Net program that calculates car park charges.

The user inputs their car registration (eg MA19 GHJ) and the length of the stay. The program then outputs the charge.

- Line numbers are included but are not part of the program.

Figure 4

```

1 Dim charge As Integer = 0
2 Console.Write("Enter your car registration: ")
3 Dim carReg As String = Console.ReadLine()
4 While carReg.Length() > 8
5     Dim displayMessage As String = " is not valid"
6     Console.WriteLine(displayMessage)
7     carReg = Console.ReadLine()
8 End While
9 Console.Write("Enter your stay in hours: ")
10 Dim hours As Integer = Console.ReadLine()
11 If hours < 2 Then
12     charge = 0
13 Else
14     charge = hours * 2
15 End If
16 Console.WriteLine(charge)

```

0 3 . 1

Rewrite **line 5** in **Figure 4** to **concatenate** the car registration with the string " is not valid", and store the result in the variable `displayMessage`.

Your answer must be written in VB.Net.

[1 mark]

0 3 . 2

The charge for parking for two or more hours is changed to include an additional £2 fee.

Rewrite **line 14** in **Figure 4** to show this change.

Your answer must be written in VB.Net.

[1 mark]

8



0 4

The two VB.Net programs in **Figure 5** output the value that is equivalent to adding together the integers between 1 and an integer entered by the user.

For example, if the user entered the integer 5, both programs would output 15

Figure 5**Program A**

```

Console.Write("Enter a number: ")
Dim num As Integer = Console.ReadLine()
Dim total As Integer = 0
For i = 1 To num
    total = total + i
Next
Console.WriteLine(total)

```

Program B

```

Console.Write("Enter a number: ")
Dim num1 As Integer
num1 = Console.ReadLine()
Dim num2 As Integer = num1 + 1
num2 = num1 * num2
num2 = num2 \ 2
Console.WriteLine(num2)

```

0 4 . 1

Shade **one** lozenge to indicate which of the statements is true about the programs in **Figure 5**.

[1 mark]

- A** Both programs are equally efficient.
- B** Program A is more efficient than Program B.
- C** Program B is more efficient than Program A.

0 4 . 2

Justify your answer for Question **04.1**.

[2 marks]

Turn over ►

0 5

A programmer has started to write a program using VB.Net. Their program is shown in **Figure 6**.

The program should generate and output 10 numbers, each of which is randomly selected from the numbers in a data structure called `numbers`.

The program uses the `Random` class.

For example, `r.Next(0, 8)` would generate a random integer between 0 and 7 inclusive.

One possible output from the finished program would be 11, 14, 14, 42, 2, 56, 56, 14, 4, 2

- Line numbers are included but are not part of the program.

Figure 6

```

1 Dim numbers = New Integer() { 11,14,56,4,12,6,42,2 }
2 Dim count As Integer = 0
3 Dim r As Random = new Random()
4 While count < 10
5     count = count + 1
6     Dim number As Integer = r.Next(0, 8
7     Console.WriteLine(numbers(count))
8 End While

```

0 5 . 1

The program shown in **Figure 6** contains a syntax error.

Shade **two** lozenges to indicate the statements that are true about syntax errors.

[2 marks]

- | | | |
|----------|---|--------------------------|
| A | A syntax error can be found by testing boundary values in a program. | <input type="checkbox"/> |
| B | A syntax error is a mistake in the grammar of the code. | <input type="checkbox"/> |
| C | A syntax error is generally harder to spot than a logic error. | <input type="checkbox"/> |
| D | A syntax error will stop a program from running. | <input type="checkbox"/> |
| E | An example of a syntax error is trying to access the fifth character in a string which only contains four characters. | <input type="checkbox"/> |



0 5 . 2 The program shown in **Figure 6** also contains a logic error.

Identify the line number that contains the logic error, and correct this line of the program.

Your corrected line must be written in VB.Net.

[2 marks]

Line number _____

Corrected line _____

0 5 . 3 What type of data structure is the variable `numbers`?

[1 mark]

—
8

Turn over for the next question

Turn over ►



0 6

A program is being developed that allows users to rate and review movies. A user will enter their rating (out of 10) and a written review for each movie they have watched.

Computational thinking skills are used during the development of the program.

0 6 . 1

Define the term **abstraction**.

[1 mark]

0 6 . 2

A user will be able to register, log in and log out of the program. When registering, a new user will enter their details, before confirming their email address.

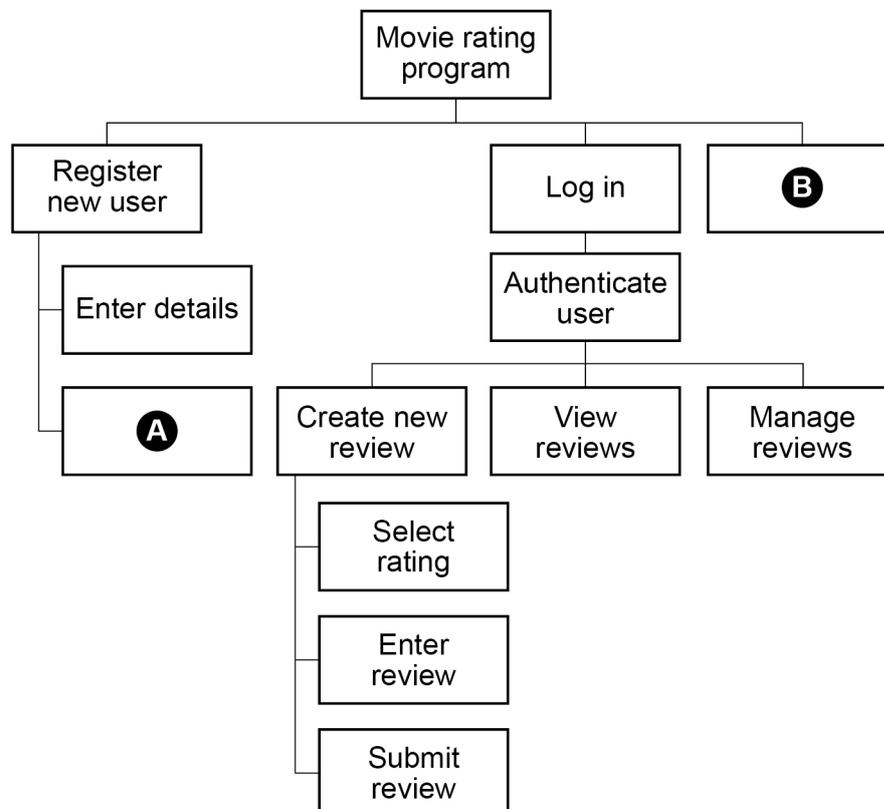
Decomposition has been used to break the problem down into smaller sub-problems.

Figure 7 represents the design of the program.

Complete the decomposition of this program by stating what should be written in boxes **A** and **B**.

[2 marks]

Figure 7



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A

B

Turn over for the next question

Turn over ►



0 9

Figure 8 shows an algorithm represented using pseudo-code.

- Line numbers are included but are not part of the algorithm.

Figure 8

```
1  names ← ['Lily', 'Thomas']
2  name1 ← 'Sarah'
3  name2 ← 'Freddie'
4  OUTPUT name1[0]
5  OUTPUT LEN(names)
6  var ← SUBSTRING(0, 3, name1)
7  OUTPUT var
```

SUBSTRING returns part of a string.

For example, SUBSTRING(3, 5, 'programming') will return the string 'gra'.

0 9 . 1

Shade **one** lozenge which shows the output of **line 4** from the algorithm shown in **Figure 8**.

[1 mark]

- | | | |
|----------|---------|--------------------------|
| A | F | <input type="checkbox"/> |
| B | Freddie | <input type="checkbox"/> |
| C | Lily | <input type="checkbox"/> |
| D | S | <input type="checkbox"/> |
| E | Sarah | <input type="checkbox"/> |



0 9 . 2

Shade **one** lozenge which shows the output of **line 5** from the algorithm shown in **Figure 8**.

[1 mark]

- | | | |
|----------|----|--------------------------|
| A | 1 | <input type="checkbox"/> |
| B | 2 | <input type="checkbox"/> |
| C | 4 | <input type="checkbox"/> |
| D | 5 | <input type="checkbox"/> |
| E | 10 | <input type="checkbox"/> |

0 9 . 3

State the output of **line 7** from the algorithm shown in **Figure 8**.

[1 mark]

0 9 . 4

Two extra lines are being added to the end of the algorithm in **Figure 8**.

Fill in the gaps so the output from the new final line will be the string 'Thomasrah'.

[2 marks]

```
var ← SUBSTRING( _____ , _____ , name1)
```

```
OUTPUT names[ _____ ] + var
```

12

Turn over for the next question

Turn over ►



1 0**Figure 9** shows a subroutine represented using pseudo-code.**Figure 9**

```

SUBROUTINE calculate(n)
  a ← n
  b ← 0
  REPEAT
    a ← a DIV 2
    b ← b + 1
  UNTIL a ≤ 1
  OUTPUT b
ENDSUBROUTINE

```

The DIV operator is used for integer division.

1 0 . 1Complete the trace table for the subroutine call `calculate(50)`

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

[4 marks]

n	a	b	OUTPUT
50			



1 0 . 2

State the value that will be output for the subroutine call `calculate(1)`**[1 mark]**

1 0 . 3

The identifier for the variable `b` in **Figure 9** was not a good choice.

State a better identifier for this variable that makes the algorithm easier to read and understand.

[1 mark]

Question 10 continues on the next page**Turn over ►**

1 0 . 4 A REPEAT...UNTIL iteration structure was used in **Figure 9**.

Figure 9 has been included again below.

Figure 9

```

SUBROUTINE calculate(n)
  a ← n
  b ← 0
  REPEAT
    a ← a DIV 2
    b ← b + 1
  UNTIL a ≤ 1
  OUTPUT b
ENDSUBROUTINE

```

Figure 10 shows another subroutine called `calculate` that uses a WHILE...ENDWHILE iteration structure.

Figure 10

```

SUBROUTINE calculate(n)
  a ← n
  b ← 0
  WHILE a > 1
    a ← a DIV 2
    b ← b + 1
  ENDWHILE
  OUTPUT b
ENDSUBROUTINE

```

One difference in the way the subroutines in **Figure 9** and **Figure 10** work is:

- the REPEAT...UNTIL iteration structure in **Figure 9** loops until the condition is true
- the WHILE...ENDWHILE iteration structure in **Figure 10** loops until the condition is false.



Describe **two** other differences in the way the subroutines in **Figure 9** and **Figure 10** work.

[2 marks]

1 _____

2 _____

8

Turn over for the next question

Turn over ►



1 1 . 1 The size of a sound file is calculated using the following formula:

$$\text{size (in bits)} = \text{sampling rate} * \text{sample resolution} * \text{seconds}$$

To calculate the size **in bytes**, the number is divided by **8**

The algorithm in **Figure 12**, represented using pseudo-code, should output the size of a sound file in **bytes** that has been sampled 100 times per second, with a sample resolution of 16 bits and a recording length of 60 seconds.

A subroutine called `getSize` has been developed as part of the algorithm.

Complete **Figure 12** by filling in the gaps using the items in **Figure 11**.

You will not need to use all the items in **Figure 11**.

[6 marks]

Figure 11

bit	byte	getSize	OUTPUT
rate	res	RETURN	sampRate
seconds	size	size + 8	size * 8
size / 8	size MOD 8	SUBROUTINE	USERINPUT

Figure 12

```
SUBROUTINE getSize(_____, _____, seconds)
```

```
    _____ ← sampRate * res * seconds
```

```
    size ← _____
```

```
    _____ size
```

```
ENDSUBROUTINE
```

```
OUTPUT _____ (100, 16, 60)
```



1 1 . 2 A local variable called `size` has been used in `getSize`.

Explain what is meant by a local variable in a subroutine.

[1 mark]

1 1 . 3 State **three** advantages of using subroutines.

[3 marks]

1

2

3

10

Turn over for the next question

Turn over ►



1	2
---	---

Figure 13 shows an algorithm represented in pseudo-code. A developer wants to check the algorithm works correctly.

- Line numbers are included but are not part of the algorithm.

Figure 13

```
1  arr[0] ← 'c'
2  arr[1] ← 'b'
3  arr[2] ← 'a'
4  FOR i ← 0 TO 1
5      FOR j ← 0 TO 1
6          IF arr[j + 1] < arr[j] THEN
7              temp ← arr[j]
8              arr[j] ← arr[j + 1]
9              arr[j + 1] ← temp
10         ENDIF
11     ENDFOR
12 ENDFOR
```

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1 2 . 1 Complete the trace table for the algorithm shown in **Figure 13**.

Some values have already been entered. You may not need to use all the rows in the table.

[6 marks]

arr			i	j	temp
[0]	[1]	[2]			
c	b	a			

1 2 . 2 State the purpose of the algorithm.

[1 mark]

Question 12 continues on the next page

Turn over ►



1 **2** **3** **Figure 13** has been included again below.

Figure 13

```

1  arr[0] ← 'c'
2  arr[1] ← 'b'
3  arr[2] ← 'a'
4  FOR i ← 0 TO 1
5      FOR j ← 0 TO 1
6          IF arr[j + 1] < arr[j] THEN
7              temp ← arr[j]
8              arr[j] ← arr[j + 1]
9              arr[j + 1] ← temp
10         ENDIF
11     ENDFOR
12 ENDFOR

```

An earlier attempt at writing the algorithm in **Figure 13** had different code for **lines 4** and **5**.

Lines 4 and **5** of the pseudo-code were:

```

FOR i ← 0 TO 2
  FOR j ← 0 TO 2

```

Explain why the algorithm did not work when the value 2 was used instead of the value 1 on these two lines.

[1 mark]

8



1 3 . 2

There are 500 cards within the game in total. Each card is numbered from 1 to 250 and each number appears twice in the whole set of cards.

The player's 100 cards are always stored in numerical order.

When a player has a valid run of five cards within their 100 cards they have won the game.

A valid run:

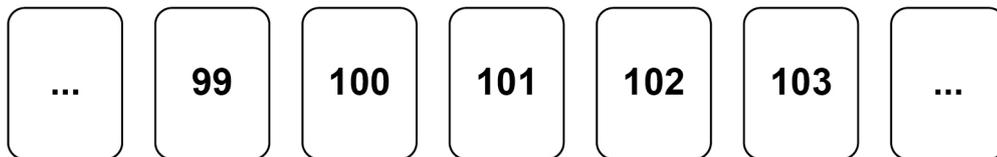
- consists of five cards
- can start from any position in the player's 100 cards
- the second card's value is one more than the first card's value, the third card's value is one more than the second card's value, the fourth card's value is one more than the third card's value, and the fifth card's value is one more than the fourth card's value.

Below are examples of valid runs which means a player has won.

Valid run example 1

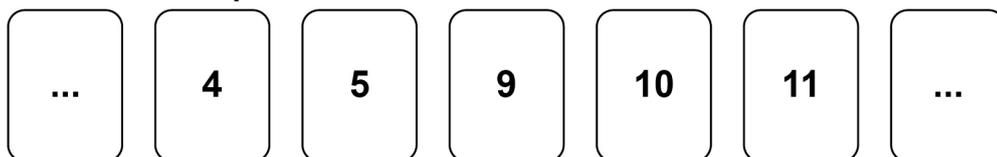


Valid run example 2

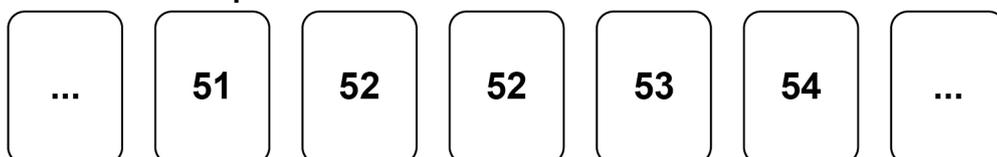


Below are examples of invalid runs.

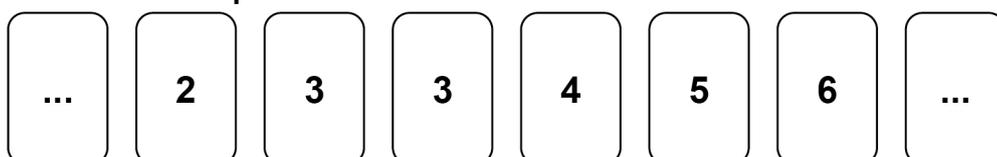
Invalid run example 1



Invalid run example 2



Invalid run example 3



Turn over for the next question

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Turn over ►



1 4

A program is being written to simulate a computer science revision game in the style of bingo.

At the beginning of the game a bingo ticket is generated with nine different key terms from computer science in a 3 x 3 grid. An example bingo ticket is provided in **Figure 15**.

Figure 15

CPU	ALU	Pixel
NOT gate	Binary	LAN
Register	Cache	Protocol

The player will then be prompted to answer a series of questions.

If an answer matches a key term on the player's bingo ticket, then the key term will be marked off automatically.



1 4 . 1

Figure 16 shows an incomplete VB.Net program to create a bingo ticket for a player.

The programmer has used a two-dimensional array called `ticket` to represent a bingo ticket.

The program uses a subroutine called `generateKeyTerm`. When called, the subroutine will return a random key term, eg "CPU", "ALU", "NOT gate" etc.

Complete the VB.Net program in **Figure 16** by filling in the five gaps.

- Line numbers are included but are not part of the program.

[4 marks]**Figure 16**

```

1  Dim ticket As String(,) = new String(, ) {{ "", "", "" },
                                           { "", "", "" },
                                           { "", "", "" }}

2  Dim i As Integer = 0
3  While (i < 3)

4      Dim j As Integer = _____
5      While (j < 3)

6          ticket( _____ , _____ ) = generateKeyTerm()

7          _____
8      End While

9      _____
10 End While

```

Question 14 continues on the next page

Turn over ►



1 4 . 2

Each time a player answers a question correctly the `ticket` array is updated; if their answer is in the `ticket` array then it is replaced with an asterisk (*).

An example of the `ticket` array containing key terms and asterisks is shown in **Figure 17**.

Figure 17

	0	1	2
0	CPU	ALU	*
1	*	*	LAN
2	Register	Cache	*

Write a subroutine in VB.Net called `checkWinner` that will count the number of asterisks.

The subroutine should:

- take the `ticket` array as a parameter
- count the number of asterisks in the `ticket` array
- output the word `Bingo` if there are nine asterisks in the array
- output the total number of asterisks if there are fewer than nine asterisks in the array.

You **must** write your own count routine and not use any built-in count function that might be available in VB.Net.

You **should** use meaningful variable name(s) and VB.Net syntax in your answer.

The answer grid below contains vertical lines to help you indent your code.

[8 marks]



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ANSWER IN THE SPACES PROVIDED**



