OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL GCSE

COMPUTER SCIENCE

9210/1

Paper 1 Programming

Mark scheme

November 2021

Version: 1.0 Final

21BY92101/MS

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from oxfordaqaexams.org.uk

Section A

Question	Part	Marking guidance	Total marks
01	**1**	`GetBinary` / `GetDecimal` / `BinaryToDecimalConvert` / `DecimalToBinaryConvert`	**1** **AO3=1**

Question	Part	Marking guidance	Total marks
01	**2**	A condition / test / check is used to decide which code should be executed;	**1** **AO3=1**

Question	Part	Marking guidance	Total marks
01	**3**	`BinaryToDecimalConvert` / `ShiftRight` / `LoadExamples` / `LoadQuiz` / `RandomQuiz`	**1** **AO3=1**

Question	Part	Marking guidance	Total marks
02	**1**	So that a number of any magnitude / size / length can be converted; We do not know how many times the loop will iterate / it is indefinite; A `FOR` loop can only be used when we know how many times to iterate / used for definite iteration; **Max 1**	**1** **AO3=1**

Question	Part	Marking guidance	Total marks
02	**2**	The program needs to know (exactly) how many times 2 goes into the (decimal) integer/number; Integer division is used as we only want the whole number answer; **A.** because `DecimalInteger` / the variable the result is stored in is an integer (type) **Max 1**	**1** **AO3=1**

Question	Part	Marking guidance	Total marks
03	1		6 **AO3=6**

BinaryString	DecimalNumber	Position	Bit
1100	0	0	
	0		1
	1		
		1	
	2		1
	3		
		2	
	6		0
		3	
	12		0

1 mark `DecimalNumber` and `Position` starting at 0

1 mark First entry in `Bit` column is 1

1 mark `Position` column runs across 0,1,2,3

1 mark `Bit` column runs across 1,1,0,0

1 mark `DecimalNumber` runs across 1,2,3,6,12

Max 4 if any errors / missing values

1 mark for value returned = 12

I. Use of ' or " in `Bit` column

Question	Part	Marking guidance	Total marks
03	**2**	Erroneous; Boundary; **A.** Extreme	**2** **AO3=2**

Question	Part	Marking guidance	Total marks
03	**3**	Validation;	**1** **AO3=1**

Question	Part	Marking guidance	Total marks
03	**4**	`Bit`;	**1** **AO3=1**

Question	Part	Marking guidance	Total marks
04	**1**	A text file is made up of characters; Characters encoded using ASCII / Unicode; With no special formatting; Can be opened by text editors; **Max 2**	**2** **AO3=2**

Question	Part	Marking guidance	Total marks
04	**2**	An identifier for a location in memory // a name given to a value; The value cannot be changed (during program execution);	**2** **AO3=2**

Question	Part	Marking guidance	Total marks
05	**1**	Generates a string of 0s of length `ShiftAmount`; Calculates how many bits from the binary string to keep; Combines / concatenates the 0s to the kept bits // Copies the bits to keep to the new string; **Max 2**	**2** **AO3=2**

Question	Part	Marking guidance	Total marks
05	**2**	The (second) `FOR` loop will repeat more times than the length of the binary string; This will access / index elements outside of the binary string;	**2** **AO3=2**

Section B

<table>
<tr><th>Question</th><th>Part</th><th>Marking guidance</th><th>Total marks</th></tr>
<tr><td>06</td><td>1</td><td>1 mark: Program displays correct message.
A. minor typos and incorrect case.

1 mark: Statement at a position so that message is displayed after the user selects the quit option from the main menu;

1 mark: Blank line is printed before the message is displayed;

Python
<pre>
def Main():
    UserChoice = ""
    while UserChoice != 'Q':
        DisplayMenu()
        UserChoice = input("Please enter your
choice: ").upper()
        while UserChoice not in ['1', '2', '3', '4',
'5', '6', 'Q']:
            print("Not a valid option")
            UserChoice = input("Please enter your
choice: ").upper()
        if UserChoice == '1':
            BinaryToDecimal()
        elif UserChoice == '2':
            DecimalToBinary()
        elif UserChoice == '3':
            RandomQuiz()
        elif UserChoice == '4':
            LoadQuiz()
        elif UserChoice == '5':
            ShiftRight()
        elif UserChoice == '6':
            LoadExamples()
    print()
    print("Goodbye")
</pre>
C#
<pre>
private static void Main(string[] args)
{
  string UserChoice = "";
  while (UserChoice != "Q")
  {
    DisplayMenu();
    Console.Write("Please enter your choice: ");
    UserChoice = Console.ReadLine().ToUpper();
    while (UserChoice.Length != 1 || !(UserChoice[0]
>= '1' && UserChoice[0] <= '6' || UserChoice[0] ==
'Q'))
    {
      Console.WriteLine("Not a valid option");
      Console.Write("Please enter your choice: ");
      UserChoice = Console.ReadLine().ToUpper();
    }
</pre>
</td><td>3

AO3=3</td></tr>
</table>

```
    if (UserChoice == "1") { BinaryToDecimal(); }
    else if (UserChoice == "2") { DecimalToBinary();
}
    else if (UserChoice == "3") { RandomQuiz(); }
    else if (UserChoice == "4") { LoadQuiz(); }
    else if (UserChoice == "5") { ShiftRight(); }
    else if (UserChoice == "6") { LoadExamples(); }
  }
  Console.WriteLine();
  Console.WriteLine("Goodbye");
  Console.ReadKey();
}
```

Visual Basic

```
Sub Main()
  Dim UserChoice As String = ""
  While UserChoice <> "Q"
    DisplayMenu()
    Console.Write("Please enter your choice: ")
    UserChoice = Console.ReadLine().ToUpper()
    While UserChoice.Length <> 1 Or Not (UserChoice
>= "1" And UserChoice <= "6" Or UserChoice = "Q")
      Console.WriteLine("Not a valid option")
      Console.Write("Please enter your choice: ")
      UserChoice = Console.ReadLine().ToUpper()
    End While
    If UserChoice = "1" Then
      BinaryToDecimal()
    ElseIf UserChoice = "2" Then
      DecimalToBinary()
    ElseIf UserChoice = "3" Then
      RandomQuiz()
    ElseIf UserChoice = "4" Then
      LoadQuiz()
    ElseIf UserChoice = "5" Then
      ShiftRight()
    ElseIf UserChoice = "6" Then
      LoadExamples()
    End If
  End While
  Console.WriteLine()
  Console.WriteLine("Goodbye")
  Console.ReadKey()
End Sub
```

Question	Part	Marking guidance	Total marks

06	**2**	Screen capture(s) must match code from Q6.1
		
		1 mark: Correct message displayed after menu.
		
		`** Menu **`
		
		`1...Convert binary to decimal`
		`2...Convert decimal to binary`
		`3...Take a random quiz`
		`4...Load in a quiz`
		`5...Right shift a binary number`
		`6...Convert values from a file`
		`Q...Quit`
		`Please enter your choice: Q`
		
		`Goodbye`
			1
			
			AO3=1

Question	Part	Marking guidance	Total marks

07	**1**	1. **1 mark:** Variable declared with appropriate identifier and of data type (integer) that will be used to store the count of correct answers
		
		2. **1 mark:** Variable initialised to 0 in appropriate place
		
		3. **1 mark:** Count of correct answers incremented by 1 in one of the selection statements
		
		4. **1 mark:** Count of correct answers incremented by 1 in both selection statements when answer is correct
		
		5. **1 mark:** Output message displays the correct message
		
		A. minor typos and incorrect case.
		
		Max 4 if not fully working
		
		Note to examiners
		If a language allows variables to be used without explicit declaration (eg Python) then mark point 1 should be awarded if the correct variables exist in the program code and the first value they are assigned is of the correct data type.
		
		Python
		`def LoadQuiz():`
		`    Filename = "examples.txt"`
		`    File = open(Filename, 'r')`
		`    print()`
		`    print("Welcome to the quiz")`
		`    Correct = 0`
		`    for Line in File:`
		`        Code = Line[0]`
		`        Value = Line[2 : len(Line) - 1]`
		`        if Code == 'B':`
		`            print(f"What is the decimal value of this binary number {Value}?")`
		`            UserAnswer = input()`
		`            if UserAnswer == BinaryToDecimalConvert(Value):`
		`                print("Correct")`
		`                Correct = Correct + 1`
		`            else:`
		`                print("Incorrect")`
		`        elif Code == 'D':`
		`            print(f"What is the binary value of this decimal number {Value}?")`
		`            UserAnswer = input()`
		`            if UserAnswer == DecimalToBinaryConvert(Value):`
		`                print("Correct")`
		`                Correct = Correct + 1`
		`            else:`
		`                print("Incorrect")`
		`    File.close()`
			5
			
			AO3=5

```
    print(f"You managed to get {Correct} correct
answers")
```

C#

```
private static void LoadQuiz()
{
  string Filename = "examples.txt";
  int Correct = 0;
  Console.WriteLine();
  Console.WriteLine("Welcome to the quiz");
  foreach (string Line in File.ReadLines(Filename))
  {
    char Code = Line[0];
    string Value = Line.Substring(2);
    if (Code == 'B')
    {
      Console.WriteLine($"What is the decimal value
of this binary number {Value}?");
      string UserAnswer = Console.ReadLine();
      if (UserAnswer ==
BinaryToDecimalConvert(Value))
      {
        Console.WriteLine("Correct");
        Correct = Correct + 1;
      }
      else
      {
        Console.WriteLine("Incorrect");
      }
    }
    else if (Code == 'D')
    {
      Console.WriteLine($"What is the binary value
of this decimal number {Value}?");
      string UserAnswer = Console.ReadLine();
      if (UserAnswer ==
DecimalToBinaryConvert(Value))
      {
        Console.WriteLine("Correct");
        Correct = Correct + 1;
      }
      else
      {
        Console.WriteLine("Incorrect");
      }
    }
  }
  Console.WriteLine($"You managed to get {Correct}
correct answers");
}
```

Visual Basic

```
Sub LoadQuiz()
  Dim Filename As String = "examples.txt"
  Dim Correct As Integer = 0
  Console.WriteLine()
  Console.WriteLine("Welcome to the quiz")
  For Each Line In File.ReadLines(Filename)
    Dim Code As Char = Line.Substring(0)
    Dim Value As String = Line.Substring(2)
```

```
    If Code = "B" Then
      Console.WriteLine($"What is the decimalvalue
of this binary number {Value}?")
      Dim UserAnswer As String = Console.ReadLine()
      If UserAnswer = BinaryToDecimalConvert(Value)
Then
        Console.WriteLine("Correct")
        Correct = Correct + 1
      Else
        Console.WriteLine("Incorrect")
      End If
    ElseIf Code = "D" Then
      Console.WriteLine($"What is the binary value
of this decimal number {Value}?")
      Dim UserAnswer As String = Console.ReadLine()
      If UserAnswer = DecimalToBinaryConvert(Value)
Then
        Console.WriteLine("Correct")
        Correct = Correct + 1
      Else
        Console.WriteLine("Incorrect")
      End If
    End If
  Next
  Console.WriteLine($"You managed to get {Correct}
correct answers")
End Sub
```

Question	Part	Marking guidance	Total marks
07	**2**	Screen capture(s) must match code from **Q7.1** **1 mark:** Correct final total for answers is shown ** Menu ** 1...Convert binary to decimal 2...Convert decimal to binary 3...Take a random quiz 4...Load in a quiz 5...Right shift a binary number 6...Convert values from a file Q...Quit Please enter your choice: 4 Welcome to the quiz What is the decimal value of this binary number 1010? 10 Correct What is the binary value of this decimal number 23? 1100 Incorrect What is the decimal value of this binary number 001110? 14 Correct What is the binary value of this decimal number 45? 101101 Correct What is the decimal value of this binary number 110011? 40 Incorrect What is the binary value of this decimal number 98? 1100010 Correct You managed to get 4 correct answers	**1** **AO3=1**

Question	Part	Marking guidance	Total marks

08	**1**	1. **1 mark:** Selection statement used
		
		2. **1 mark:** Check against being a shift amount of less than 1
		
		3. **1 mark:** Check against being a shift amount of greater than or equal to length of binary string
		
		4. **1 mark:** Combines both checks correctly
		
		5. **1 mark:** Outputs invalid message in correct circumstances
		
		6. **1 mark:** Binary shift performed under correct circumstances
		
		A. minor typos and incorrect case.
		
		Max 5 if not fully working
		
		Python
		`def ShiftRight():`
		`  print()`
		`  BinaryString = GetBinary()`
		`  ShiftAmount = int(input("How many places to shift? "))`
		`  if ShiftAmount < 1 or ShiftAmount > len(BinaryString):`
		`  print("Invalid shift amount")`
		`  else:`
		`  NewBinaryString = ""`
		`  for Count in range(ShiftAmount):`
		`  NewBinaryString = NewBinaryString + "0"`
		`  for Count in range(len(BinaryString) - ShiftAmount):`
		`  NewBinaryString = NewBinaryString + BinaryString[Count]`
		`  print(f"Entered binary string {BinaryString} has the decimal value {BinaryToDecimalConvert(BinaryString)}")`
		`  print(f"After a shift of {ShiftAmount}")`
		`  print(f"Shifted binary string {NewBinaryString} has the decimal value {BinaryToDecimalConvert(NewBinaryString)}")`
		`  print()`
		
		C#
		
		`private static void ShiftRight()`
		`{`
		`  Console.WriteLine();`
		`  string BinaryString = GetBinary();`
		`  Console.Write("How many places to shift? ");`
			6
			
			AO3=6

```
  int ShiftAmount =
Convert.ToInt32(Console.ReadLine());
  if (ShiftAmount < 1 || ShiftAmount >
BinaryString.Length)
    Console.WriteLine("Invalid shift amount");
  else
  {
    string NewBinaryString = "";
    for (int Count = 1; Count <= ShiftAmount;
Count++)
    {
      NewBinaryString = NewBinaryString + "0";
    }
    for (int Count = 0; Count < BinaryString.Length
- ShiftAmount; Count++)
    {
      NewBinaryString = NewBinaryString +
BinaryString[Count];
    }
    Console.WriteLine($"Entered binary string
{BinaryString} has the decimal value
{BinaryToDecimalConvert(BinaryString)}");
    Console.WriteLine($"After a shift of
{ShiftAmount}");
    Console.WriteLine($"Shifted binary string
{NewBinaryString} has the decimal value
{BinaryToDecimalConvert(NewBinaryString)}");
  }
  Console.WriteLine();
}
```

Visual Basic

```
Sub ShiftRight()
  Console.WriteLine()
  Dim BinaryString As String = GetBinary()
  Console.Write("How many places to shift? ")
  Dim ShiftAmount As Integer =
Convert.ToInt32(Console.ReadLine())
  If ShiftAmount < 1 Or ShiftAmount >
BinaryString.Length Then
    Console.WriteLine("Invalid shift amount")
  Else
    Dim NewBinaryString As String = ""
    For Count = 1 To ShiftAmount
      NewBinaryString = NewBinaryString + "0"
    Next
    For Count = 0 To BinaryString.Length() -
ShiftAmount - 1
      NewBinaryString = NewBinaryString +
BinaryString(Count)
    Next
    Console.WriteLine($"Entered binary string
{BinaryString} has the decimal value
{BinaryToDecimalConvert(BinaryString)}")
    Console.WriteLine($"After a shift of
{ShiftAmount}")
```

		Console.WriteLine($"Shifted binary string {NewBinaryString} has the decimal value {BinaryToDecimalConvert(NewBinaryString)}") **End If** Console.WriteLine() End Sub	

Question	Part	Marking guidance	Total marks
08	**2**	Screen capture(s) must match code from **Q8.1** **1 mark:** Correct messages for two of the tests **1 mark:** Correct messages for all of the tests ** Menu ** 1...Convert binary to decimal 2...Convert decimal to binary 3...Take a random quiz 4...Load in a quiz 5...Right shift a binary number 6...Convert values from a file Q...Quit Please enter your choice: 5 Please enter a binary number: 110011 How many places to shift? -2 Invalid shift amount ** Menu ** 1...Convert binary to decimal 2...Convert decimal to binary 3...Take a random quiz 4...Load in a quiz 5...Right shift a binary number 6...Convert values from a file Q...Quit Please enter your choice: 5 Please enter a binary number: 110011 How many places to shift? 7 Invalid shift amount ** Menu ** 1...Convert binary to decimal 2...Convert decimal to binary 3...Take a random quiz 4...Load in a quiz 5...Right shift a binary number 6...Convert values from a file	**2** **AO3=2**

		Q...Quit Please enter your choice: 5 Please enter a binary number: 110011 How many places to shift? 3 Entered binary string 110011 has the decimal value 51 After a shift of 3 Shifted binary string 000110 has the decimal value 6	

Question	Part	Marking guidance	Total marks

09	**1**	1. **1 mark:** New variable `Valid` declared
		
		2. **1 mark:** Iteration construct setup
		
		3. **1 mark:** Iteration construct will loop across all the characters
		
		4. **1 mark:** Selection statement inside loop
		
		5. **1 mark:** Comparison made to both characters '1' and '0'
		
		6. **1 mark:** Correct logic for comparison statement
		
		7. **1 mark:** `Valid` variable changed appropriately
		
		8. **1 mark:** Displays the message `Invalid binary number` only under the correct circumstances
		
		9. **1 mark:** Code will return `BinaryString` appropriately
		
		10. **1 mark:** Code will return '0' appropriately
		
		Max 9 if not fully working
		
		Python
		`def GetBinary():`
		`    BinaryString = input("Please enter a binary number: ")`
		`    Valid = True`
		`    for Bit in BinaryString:`
		`        if Bit != '1' and Bit != '0':`
		`            Valid = False`
		`    if Valid:`
		`        return BinaryString`
		`    else:`
		`        print('Invalid binary number')`
		`        return '0'`
		
		C#
		`private static string GetBinary()`
		`{`
		`  Console.Write("Please enter a binary number: ");`
		`  string BinaryString = Console.ReadLine();`
		`  bool Valid = true;`
		`  foreach (char Bit in BinaryString)`
		`    if (Bit != '1' && Bit != '0')`
		`      Valid = false;`
		`  if (Valid)`
		`    return BinaryString;`
		`  else`
		`  {`
		`    Console.WriteLine("Invalid binary number");`
		`    return "0";`
			10
			
			AO3=10

```
  }
}
```

Alternative

```
for (int Position = 0; Position <
BinaryString.Length; Position++)
  if (BinaryString[Position] != '1' &&
BinaryString[Position] != '0')
  Valid = false;
```

Visual Basic

```
Function GetBinary() As String
  Console.Write("Please enter a binary number: ")
  Dim BinaryString As String = Console.ReadLine()
  Dim Valid As Boolean = True
  For Position = 0 To BinaryString.Length - 1
    If BinaryString(Position) <> "1" And
BinaryString(Position) <> "0" Then
      Valid = False
    End If
  Next
  If Valid Then
    Return BinaryString
  Else
    Console.WriteLine("Invalid binary number")
    Return "0"
  End If
End Function
```

Alternative

```
For Each Bit In BinaryString
  If Bit <> "1" And Bit <> "0" Then
    Valid = False
  End If
Next
```

Question	Part	Marking guidance	Total marks
09	**2**	Screen capture(s) must match code from **09.1** **1 mark**: Correct output is displayed ** Menu ** 1...Convert binary to decimal 2...Convert decimal to binary 3...Take a random quiz 4...Load in a quiz 5...Right shift a binary number 6...Convert values from a file Q...Quit Please enter your choice: 1 Binary to Decimal conversion Please enter a binary number: 1234 Invalid binary number 0 is the decimal number 0 ** Menu ** 1...Convert binary to decimal 2...Convert decimal to binary 3...Take a random quiz 4...Load in a quiz 5...Right shift a binary number 6...Convert values from a file Q...Quit Please enter your choice: 1 Binary to Decimal conversion Please enter a binary number: banana Invalid binary number 0 is the decimal number 0 ** Menu ** 1...Convert binary to decimal 2...Convert decimal to binary 3...Take a random quiz 4...Load in a quiz 5...Right shift a binary number 6...Convert values from a file Q...Quit Please enter your choice: 1 Binary to Decimal conversion	**1** **AO3=1**

		Please enter a binary number: 10010 10010 is the decimal number 18	

Section C

Question	Part	Marking guidance	Total marks

10	**1**	1. **1 mark:** Appropriate selection structure for the character 'C'
		2. **1 mark:** Call to `BinaryToDecimalConvert(Value)`
		3. **1 mark:** Conversion to integer
		4. **1 mark:** Use of selection structure to check value
		5. **1 mark:** Correct conditions for selection structure
		6. **1 mark:** Conditions combined correctly
		7. **1 mark:** Use of method appropriate to language to convert integer to character
		8. **1 mark:** Conversion is supplied with the correct integer decimal value of the binary string in the text file
		9. **1 mark:** Display appropriate message when converting the character
		10. **1 mark:** Else part or second selection statement for checking value
		11. **1 mark:** `Invalid character found` displayed only under correct conditions
		
		Max 10 if not fully working
		
		Python
		
		`def LoadExamples():`
		`    FileName = "examples.txt"`
		`    File = open(TextFile, 'r')`
		`    print()`
		`    print("Converting examples from file")`
		`    print()`
		`    for Line in File:`
		`        Code = Line[0]`
		`        Value = Line[2 : len(Line) - 1]`
		`        if Code == 'B':`
		`            print(f"The binary value {Value} is the decimal number {BinaryToDecimalConvert(Value)}")`
		`        elif Code == 'D':`
		`            print(f"The decimal value {Value} is the binary number {DecimalToBinaryConvert(Value)}")`
		`        elif Code == "C":`
		`            BinaryValue = int(BinaryToDecimalConvert(Value))`
		`            if BinaryValue >= 35 and BinaryValue <= 126:`
			11
			
			AO3=11

```
                print(f"The binary value {Value}
represents the character {chr(BinaryValue)}")
            else:
                print("Invalid character found")
        else:
            print("Invalid line to process")
    File.close()
```

C#

```
private static void LoadExamples()
{
  string Filename = "examples.txt";
  Console.WriteLine();
  Console.WriteLine("Converting examples from
file");
  Console.WriteLine();
  foreach (string Line in File.ReadLines(Filename))
  {
    char Code = Line[0];
    string Value = Line.Substring(2);
    if (Code == 'B')
    {
      Console.WriteLine($"The binary value {Value}
is the decimal number
{BinaryToDecimalConvert(Value)}");
    }
    else if (Code == 'D')
    {
      Console.WriteLine($"The decimal value {Value}
is the binary number
{DecimalToBinaryConvert(Value)}");
    }
    else if (Code == 'C')
    {
      int BinaryValue =
Convert.ToInt32(BinaryToDecimalConvert(Value));
      if (BinaryValue >= 35 && BinaryValue <= 126)
        Console.WriteLine($"The binary value {Value}
represents the character
{Convert.ToChar(BinaryValue)}");
      else
        Console.WriteLine("Invalid character
found");
    }
    else
    {
      Console.WriteLine("Invalid line to process");
    }
  }
}
```

Visual Basic

```
Sub LoadExamples()
  Dim Filename As String = "examples.txt"
  Console.WriteLine()
  Console.WriteLine("Converting examples from file")
  Console.WriteLine()
  For Each Line As String In
File.ReadLines(Filename)
    Dim Code As Char = Line(0)
    Dim Value As String = Line.Substring(2)
```

```
    If Code = "B" Then
      Console.WriteLine($"The binary value {Value}
is the decimal number
{BinaryToDecimalConvert(Value)}")
    ElseIf Code = "D" Then
      Console.WriteLine($"The decimal value {Value}
is the binary number
{DecimalToBinaryConvert(Value)}")
    ElseIf Code = "C" Then
      Dim BinaryValue As Integer =
Convert.ToInt32(BinaryToDecimalConvert(Value))
      If BinaryValue >= 35 And BinaryValue <= 126
Then
        Console.WriteLine($"The binary value {Value}
represents the character {Chr(BinaryValue)}")
      Else
        Console.WriteLine("Invalid character found")
      End If
    Else
      Console.WriteLine("Invalid line to process")
    End If
  Next
End Sub
```

Question	Part	Marking guidance	Total marks
10	**2**	Screen capture(s) must match code from **Q10.1** **1 mark:** Correct output is displayed when valid character **1 mark:** Correct output is displayed when invalid character ** Menu ** 1...Convert binary to decimal 2...Convert decimal to binary 3...Take a random quiz 4...Load in a quiz 5...Right shift a binary number 6...Convert values from a file Q...Quit Please enter your choice: 6 Converting examples from file Invalid line to process The binary value 1010 is the decimal number 10 The binary value 1100010 represents the character b The decimal value 23 is the binary number 10111 Invalid line to process The binary value 001110 is the decimal number 14 The binary value 0100100 represents the character $ The decimal value 45 is the binary number 101101 Invalid line to process The binary value 110011 is the decimal number 51 Invalid character found The decimal value 98 is the binary number 1100010	**2** **AO3=2**

Question	Part	Marking guidance	Total marks

11	**1**	1. **1 mark:** A subroutine with the correct name (`Complement`) is created.
		2. **1 mark:** Subroutine has one correct parameter (`BinaryString`).
		3. **1 mark:** Attempt at creating an iteration structure
		4. **1 mark:** Iteration structure will iterate across all characters
		5. **1 mark:** Selection statement within iteration structure
		6. **1 mark:** Selection statement has a correct condition (comparing character to either 1 or 0)
		7. **1 mark:** Appropriate change of 1 to 0
		8. **1 mark:** Appropriate change of 0 to 1
		9. **1 mark:** Returns value of appropriate data type
		10. **1 mark:** Subroutine will return the correct complement
		Max 9 if not fully working
		Python
		`def Complement(BinaryString):`
		`  NewString = ""`
		`  for Bit in BinaryString:`
		`  if Bit == "1":`
		`  NewString = NewString + "0"`
		`  else:`
		`  NewString = NewString + "1"`
		`  return NewString`
		C#
		`private static string Complement(string BinaryString)`
		`{`
		`  string NewString = "";`
		`  foreach (char Bit in BinaryString)`
		`  if (Bit == '1')`
		`  NewString = NewString + '0';`
		`  else`
		`  NewString = NewString + '1';`
		`  return NewString;`
		`}`
		Visual Basic
		`Function Complement(ByVal BinaryString As String) As String`
		`  Dim NewString As String = ""`
		`  For Each Bit In BinaryString`
		`  If Bit = "1" Then`
		`  NewString = NewString + "0"`
		`  Else`
		`  NewString = NewString + "1"`
			10
			AO3=10

		`    End If`
		`  Next`
		`  Return NewString`
		`End Function`	

Question	Part	Marking guidance	Total marks

11	2	**1 mark:** Prompt asking about complement.
		1 mark: Selection statement with correct condition ('Y')
		1 mark: `Complement` subroutine with correct parameter called in selection statement.
		1 mark: Value of `Complement` is displayed
		
		Python
		`def DecimalToBinary():`
		`  print()`
		`  print("Decimal to Binary conversion")`
		`  print()`
		`  DecimalString = GetDecimal()`
		`  BinaryString = DecimalToBinaryConvert(DecimalString)`
		`  print(f"{DecimalString} is the binary number {BinaryString}")`
		`  Choice = input("Do you want the one's complement of this number? ")`
		`  if Choice == "Y":`
		`  print(Complement(DecimalToBinaryConvert(DecimalString)))`
		
		C#
		`private static void DecimalToBinary()`
		`{`
		`  Console.WriteLine();`
		`  Console.WriteLine("Decimal to Binary conversion");`
		`  Console.WriteLine();`
		`  string DecimalString = GetDecimal();`
		`  string BinaryString = DecimalToBinaryConvert(DecimalString);`
		`  Console.WriteLine($"{DecimalString} is the binary number {BinaryString}");`
		`  Console.Write("Do you want the one's complement of this number? ");`
		`  string Choice = Console.ReadLine();`
		`  if (Choice == "Y")`
		`  Console.WriteLine(Complement(DecimalToBinaryConvert(DecimalString)));`
		`}`
		
		Visual Basic
		`Sub DecimalToBinary()`
		`  Console.WriteLine()`
		`  Console.WriteLine("Decimal to Binary conversion")`
		`  Console.WriteLine()`
		`  Dim DecimalString As String = GetDecimal()`
		`  Dim BinaryString As String = DecimalToBinaryConvert(DecimalString)`
		`  Console.WriteLine($"{DecimalString} is the binary number {BinaryString}")`
		`  Console.Write("Do you want the one's complement of this number? ")`
		`  Dim Choice As String = Console.ReadLine()`
		`  If Choice = "Y" Then`
			4
			
			AO3=4

		Console.WriteLine(Complement (DecimalToBinaryConvert(DecimalString))) **End If** End Sub	

Question	Part	Marking guidance	Total marks
11	**3**	Screen capture(s) must match code from **Q11.1** and **Q11.2** **1 mark:** Correct output is displayed. ** Menu ** 1...Convert binary to decimal 2...Convert decimal to binary 3...Take a random quiz 4...Load in a quiz 5...Right shift a binary number 6...Convert values from a file Q...Quit Please enter your choice: 2 Decimal to Binary conversion Please enter a decimal number: 100 100 is the binary number 1100100 Do you want the one's complement of this number? Y 0011011	**1** **AO3=1**