

Cambridge  
International  
AS & A Level

**Cambridge International Examinations**  
Cambridge International Advanced Subsidiary and Advanced Level

---

**COMPUTER SCIENCE**

**9608/21**

Paper 2

**May/June 2017**

MARK SCHEME

Maximum Mark: 75

---

**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2017 series for most Cambridge IGCSE<sup>®</sup>, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

---

© IGCSE is a registered trademark.

This document consists of **13** printed pages.

Question	Answer	Marks								
1(a)	<p><b>Input:</b></p> <ul style="list-style-type: none"> <li>• Enter data into the system // get / receive / read data</li> <li>• INPUT MyVar // READFILE MyFile, MyString</li> </ul> <p><b>Process:</b></p> <ul style="list-style-type: none"> <li>• Manipulate / change data in some way // perform a calculation / find a result</li> <li>• MyChar ← 'X' // MyNum ← MyNum + 1</li> </ul> <p><b>Output:</b></p> <ul style="list-style-type: none"> <li>• Send data out from the system // display / print / transmit / show data</li> <li>• OUTPUT "Hello World" // WRITEFILE MyFile, MyString</li> </ul> <p>Mark as follows: 1 mark for each type (in bold) 1 mark for each description and pseudocode example</p>	<b>7</b>								
1(b)(i)	Boolean	<b>1</b>								
1(b)(ii)	Logical / Boolean	<b>1</b>								
1(b)(iii)	<table border="1"> <thead> <tr> <th>Expression</th> <th>Evaluates to</th> </tr> </thead> <tbody> <tr> <td>FlagA AND (FlagB OR FlagC)</td> <td><b>TRUE</b></td> </tr> <tr> <td>FlagA AND (FlagB AND FlagC)</td> <td><b>FALSE</b></td> </tr> <tr> <td>(NOT FlagA) OR (NOT FlagC)</td> <td><b>FALSE</b></td> </tr> </tbody> </table> <p>1 mark per answer</p>	Expression	Evaluates to	FlagA AND (FlagB OR FlagC)	<b>TRUE</b>	FlagA AND (FlagB AND FlagC)	<b>FALSE</b>	(NOT FlagA) OR (NOT FlagC)	<b>FALSE</b>	<b>3</b>
Expression	Evaluates to									
FlagA AND (FlagB OR FlagC)	<b>TRUE</b>									
FlagA AND (FlagB AND FlagC)	<b>FALSE</b>									
(NOT FlagA) OR (NOT FlagC)	<b>FALSE</b>									
1(c)	<pre>MyCount ← 100  WHILE MyCount &lt; 201      Output MyCount      MyCount ← MyCount + 2  ENDWHILE</pre> <p>1 mark for each of the following:</p> <ul style="list-style-type: none"> <li>• Counter initialisation</li> <li>• While ... End loop</li> <li>• Method for choosing (correct range of) even numbers</li> <li>• Output all even numbers in the range</li> </ul> <p>Note: Counter variable name must be consistent</p>	<b>4</b>								

Question	Answer	Marks
2(a)	Stepwise refinement	1
2(b)	1 mark for first 2 data types – String  1 mark for last 2 data types – Boolean  1 mark for each description: PasswordInput      Stores password <u>entered</u> UserIDFound        True if user ID found in the <u>file</u> PasswordValid      True if password entered matches password from <u>file</u> //Input password matches stored password	5
2(c)	<ol style="list-style-type: none"> <li>1. LOOP through the file until EOF...</li> <li>2. ...OR UserIDInput is found</li> <li>3. READ text line from Password.txt file <b>in a loop</b></li> <li>4. SPLIT into UserID and password <b>in a loop</b></li> <li>5. IF UserIDInput matches UserID from file THEN <b>in a loop</b></li> <li>6. SET UserIDFound to TRUE <b>in a loop</b></li> <li>7. IF UserIDFound = TRUE AND PasswordInput matches value from file THEN</li> <li>8. Set PasswordValid to TRUE</li> </ol> <p>Mark as follows:</p> <p>1 mark per functional equivalent of each numbered statement.</p>	8

Question	Answer	Marks
3	<pre> FUNCTION StringClean(<u>Instring</u> <u>STRING</u>) RETURNS <u>STRING</u>   DECLARE NextChar : <u>CHAR</u>   DECLARE <u>OutString</u> : STRING   <u>OutString</u> ← "" // initialise the return string    // loop through Instring to produce OutString   FOR n ← 1 TO <u>LENGTH(InString)</u> // from first to last     NextChar ← <u>MID(Instring, n, 1)</u> //get next                                      character and     NextChar ← <u>LCASE(NextChar)</u> //convert to lower                                      case      IF <u>NextChar &gt;= 'a' AND NextChar &lt;= 'z'</u> //check if                                      alphabetic       THEN         <u>OutString</u> ← <u>OutString &amp; NextChar</u> //add to                                      OutString       ENDIF     ENDFOR    <u>RETURN OutString</u> // return value ENDFUNCTION </pre> <p>One mark per <u>underlined</u> word / expression</p>	11

Question	Answer	Marks
4(a)	<ul style="list-style-type: none"> <li>• The <u>hierarchy</u> of modules</li> <li>• <u>Parameters</u> that are passed between modules // The <u>interface</u> between the modules /</li> <li>• The <u>sequence</u></li> <li>• Iteration / selection</li> </ul> <p>One mark per item</p>	3
4(b)	<pre> <u>FUNCTION</u> <u>CardPayment</u> (<u>ParamA</u> : REAL, <u>ParamB</u> : STRING) RETURNS <u>BOOLEAN</u> </pre> <p>One mark per underlined part Order not significant for ParamA and ParamB</p> <p>Function name and parameter names not important but must be present</p>	3

Question	Answer	Marks
5	<p>Pseudocode solution included here for development and clarification of mark scheme. Programming language <b>example</b> solutions appear in the <b>Appendix</b>.</p> <pre> PROCEDURE SearchFile()  DECLARE FileData : STRING DECLARE MyArrayRow : INTEGER DECLARE SearchID : STRING MyArrayRow ← 0 / 1 OPEN "Loginfile.txt" FOR READ INPUT SearchID  WHILE NOT EOF("Loginfile.txt")   READFILE "Loginfile.txt", Filedata   IF SearchID = LEFT(FileData,5)     THEN       LoginEvents[MyArrayRow,1] ← MID(Filedata, 6, 4)       LoginEvents[MyArrayRow,2] ← RIGHT(Filedata, 14)       MyArrayRow ← MyArrayRow + 1     ENDIF   ENDWHILE  CLOSEFILE("LoginFile.txt")  ENDPROCEDURE </pre> <p>1 mark for each of the following:</p> <ol style="list-style-type: none"> <li>1. Procedure heading and ending</li> <li>2. Declare MyArrayRow as integer // commented in python</li> <li>3. Initialising MyArrayRow</li> <li>4. Input SearchID</li> <li>5. Open file "LoginFile.txt" for input / read</li> <li>6. Correct loop incorporating EOF( )</li> <li>7. Read a line from the file <b>in a loop</b></li> <li>8. Compare SearchID with correct data from file <b>in a loop</b></li> <li>9. Assign both values to LoginEvents[MyArray] <b>in a loop</b></li> <li>10. Increment MyArrayRow correctly <b>in a loop</b></li> <li>11. Close the file <b>not in a loop</b></li> </ol>	10

Question	Answer	Marks
6(a)	<p>Pseudocode solution included here for development and clarification of mark scheme. Programming language solutions appear in the Appendix.</p> <pre> FUNCTION ValidatePassword(InString : STRING) RETURNS BOOLEAN DECLARE LCaseChar, UCaseChar, NumChar, n : INTEGER DECLARE NextChar : CHAR DECLARE ReturnFlag : BOOLEAN ReturnFlag ← TRUE LCaseChar ← 0, UCaseChar ← 0, NumChar ← 0  FOR n ← 1 TO LENGTH(InString)   NextChar ← MID(InString,n,1)   IF NextChar &gt;= 'a' AND NextChar &lt;= 'z'     THEN       LCaseChar ← LCaseChar + 1     ELSE       IF NextChar &gt;= 'A' AND NextChar &lt;= 'Z'         THEN           UCaseChar ← UCaseChar + 1         ELSE           IF NextChar &gt;= '0' AND NextChar &lt;= '9'             THEN               NumChar ← NumChar + 1             ELSE               ReturnFlag ← False //invalid                                 character           ENDIF         ENDIF       ENDIF     ENDIF   ENDFOR  IF Not (LCaseChar&gt;=2 AND UCaseChar&gt;= 2 AND NumChar&gt;= 3)   THEN     ReturnFlag ← FALSE   ENDFOR RETURN (ReturnFlag) ENDFUNCTION </pre> <p>1 mark for each of the following:</p> <ol style="list-style-type: none"> <li>1. Correct Function heading and ending</li> <li>2. Declaring three counter variables (upper, lower, numeric)</li> <li>3. Initialising counters</li> <li>4. Correct loop</li> <li>5. Picking up NextChar from InString</li> <li>6. Check and count number of lower case</li> <li>7. Check and count number of upper case</li> </ol>	10

Question	Answer	Marks
6(a)	8. Check and count number of numeric 9. Check for invalid character 10. Combine all four tests into a single Boolean value 11. Returning correct Boolean value	
6(b)(i)	<p><b>String1: (e.g. "AAbb123")</b></p> <p>One mark for a valid string having:</p> <ul style="list-style-type: none"> <li>• at least 2 uppercase alphabetic</li> <li>• at least 2 lowercase alphabetic</li> <li>• at least 3 numeric characters</li> <li>• No other character</li> </ul> <p><b>String2 – String5:</b></p> <p>One mark for correct string <b>and</b> explanation (testing different rules of the function)</p> <p>Test strings breaking <b>different</b> rules:</p> <ul style="list-style-type: none"> <li>• With incorrect numbers of:               <ul style="list-style-type: none"> <li>• Lower case characters</li> <li>• Upper case characters</li> <li>• Numeric characters</li> </ul> </li> <li>• Containing an invalid character</li> </ul>	<b>5</b>
6(b)(ii)	White Box	<b>1</b>
6(b)(iii)	<ul style="list-style-type: none"> <li>• Testing may be carried out before the modules are developed // not ready for full testing</li> <li>• Module stubs contain simple code to provide a known response // temporary replacement for a called module</li> </ul>	<b>2</b>

**Programming Solutions****Programming Code Example Solutions****Q5 : Visual Basic**

```

Sub SearchFile()
    Dim FileData As String
    Dim SearchID As String
    Dim ArrayIndex As Integer

    ArrayIndex = 1
    FileOpen(1, "LoginFile.txt", OpenMode.Input)
    SearchID = Console.ReadLine()

    Do While Not EOF(1)
        FileData = LineInput(1)
        If SearchID = LEFT(FileData, 5) Then
            LoginEvents(ArrayIndex, 1) = Mid(Filedata, 6, 4)
            LoginEvents(ArrayIndex, 2) = Right(Filedata, 14)
            ArrayIndex = ArrayIndex + 1
        End If
    Loop
    FileClose(1)
End Sub

```

**Alternative:**

```

Sub SearchFile()
    Dim FileData As String
    Dim SearchID As String
    Dim ArrayIndex As Integer
    Dim MyFile As System.IO.StreamReader

    ArrayIndex = 1
    MyFile = Mycomputer.FileSystem.OpenTextFileReader("Loginfile.txt")
    SearchID = Console.ReadLine()

    Do While MyFile.Peek < > -1
        FileData = MyFile.ReadLine()
        If SearchID = LEFT(FileData, 5) Then
            LoginEvents(ArrayIndex, 1) = Mid(Filedata, 6, 4)
            LoginEvents(ArrayIndex, 2) = Right(Filedata, 14)
            ArrayIndex = ArrayIndex + 1
        End If
    Loop
    MyFile.Close
End Sub

```



**Q5 : Pascal**

```
Procedure SearchFile();

var FileData      : String;
var SearchID      : String;
var ArrayRow      : Integer;
Var MyFile        : Text;

Begin
  ArrayRow := 1;
  Assign(MyFile, "Loginfile.txt");
  Reset(MyFile);
  Readln(SearchID);

  While NOT EOF(MyFile) do
  Begin
    Readln(MyFile, FileData)
    IF SearchID = LeftStr(FileData,5) then
      Begin
        LoginEvents[ArrayRow,1] = Copy(FileData,6,4);
        LoginEvents[ArrayRow,2] = Rightstr(FileData,14);
        ArrayRow = ArrayRow + 1
      End;
    End;

  Close(MyFile);
End.
```

**Q5 : Python**

```
def SearchFile():

    # FileData : STRING
    # ArrayRow : INTEGER
    # SearchID : STRING

    ArrayRow = 0
    MyFile = open("Loginfile.txt", 'r')
    SearchID = input()
    FileData = MyFile.readline()

    While FileData != ""
        If SearchID == FileData[:5]           #First 5 characters
            LoginEvents[ArrayRow][1] = FileData[5:9] #next 4 characters
            LoginEvents[ArrayRow][2] = FileData[-14:] #last 14 characters
            ArrayRow = ArrayRow + 1
            FileData = MyFile.readline()

    myFile.close()
    return()
```

**Alternative:**

```
def SearchFile():

    # FileData : STRING
    # ArrayRow : INTEGER
    # SearchID : STRING

    ArrayRow = 0
    Myfile = open("Loginfile.txt", 'r')
    SearchID = input()
    For FileData in MyFile
        IF SearchID == FileData[:5]           #First 5 characters
            LoginEvents[ArrayRow][1] = FileData[5:9] #next 4 characters
            LoginEvents[ArrayRow][2] = FileData[-14:] #last 14 characters
            ArrayRow = ArrayRow + 1

    MyFile.close()
    return()
```

**Q6 (a): Visual Basic**

```
Function ValidatePassword(InString As String) As Boolean
    Dim LCaseChar, UCaseChar, NumChar As Integer
    Dim NextChar As Char
    Dim ReturnFlag As Boolean
    Dim n As Integer
    ReturnFlag = TRUE
    LCaseChar = 0
    UCaseChar = 0
    NumChar = 0

    For n = 1 to Len(InString)
        NextChar = Mid(InString, n, 1)
        If NextChar >= 'a' And NextChar <= 'z' Then
            LCaseChar = LCaseChar + 1
        Else
            If NextChar >= 'A' And NextChar <= 'Z' Then
                UCaseChar = UCaseChar + 1
            Else
                If NextChar >= '0' And NextChar <= '9' Then
                    NumChar = NumChar + 1
                Else
                    ReturnFlag = False    //invalid character
                End If
            End If
        End If
    Next

    If NOT (LCaseChar >= 2 And UCaseChar >= 2 And NumChar >= 3)Then
        ReturnFlag = FALSE
    End If

    Return(ReturnFlag)

End Function
```

**Q6 (a): Pascal**

```
Function ValidatePassword(InString : String): Boolean;
  Var LCaseChar, UCaseChar, NumChar : Integer;
  Var NextChar : Char;
  Var ReturnFlag : Boolean;
  Var n : Integer;

  begin
    ReturnFlag := TRUE;
    LCaseChar := 0;
    UCaseChar := 0;
    NumChar := 0;

    For n := 1 to Length(InString) do
      begin
        NextChar := Copy(InString,n,1);
        If NextChar >= 'a' And NextChar <= 'z' Then
          LCaseChar := LCaseChar + 1
        Else If NextChar >= 'A' AND NextChar <= 'Z' Then
          UCaseChar := UCaseChar + 1
        Else If NextChar >= '0' AND NextChar <= '9' Then
          NumChar := NumChar + 1
        Else
          ReturnFlag := False //invalid character
      end
    end

    If NOT(LCaseChar >= 2 And UCaseChar >= 2 And NumChar >=3)then
      ReturnFlag := False;

    ValidatePassword := ReturnFlag
  end;
```

**Q6 (a): Python**

```
def ValidatePassword(InString):
    # lCaseChar, uCaseChar, numChar : INTEGER
    # nextChar : CHAR
    # returnFlag : BOOLEAN
    # n : INTEGER
    returnFlag = TRUE
    lCaseChar = 0
    uCaseChar = 0
    numChar = 0

    for n in range (0, Len(InString))
        nextChar = InString[n]
        If nextChar >= 'a' and nextChar <= 'z':
            lCaseChar = lCaseChar + 1
        ELSE:
            IF nextChar >= 'A' and nextChar <= 'Z':
                uCaseChar = uCaseChar + 1
            ELSE:
                IF nextChar >= '0' and nextChar <= '9':
                    numChar = numChar + 1
                ELSE:
                    returnFlag = False    //invalid character

    IF Not (lCaseChar >= 2 and uCaseChar >= 2 and numChar >= 3):
        returnFlag = FALSE

    Return (returnFlag)

#next code block
```