
COMPUTER SCIENCE

9608/22

Paper 2 Written Paper

May/June 2018

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.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks												
1(a)	<table border="1" data-bbox="336 282 1267 730"> <thead> <tr> <th data-bbox="336 282 903 338">Description of data item</th> <th data-bbox="903 282 1267 338">Suitable identifier name</th> </tr> </thead> <tbody> <tr> <td data-bbox="336 338 903 427">The temperature inside the greenhouse</td> <td data-bbox="903 338 1267 427">GreenhouseTemperature</td> </tr> <tr> <td data-bbox="336 427 903 517">The temperature outside the greenhouse</td> <td data-bbox="903 427 1267 517">OutsideTemperature</td> </tr> <tr> <td data-bbox="336 517 903 629">The greenhouse identification number</td> <td data-bbox="903 517 1267 629">GreenhouseID</td> </tr> <tr> <td data-bbox="336 629 903 730">The time the temperature was measured</td> <td data-bbox="903 629 1267 730">SampleTime</td> </tr> </tbody> </table> <p data-bbox="300 763 906 831">The above are examples only. Names must be meaningful and unambiguous</p>	Description of data item	Suitable identifier name	The temperature inside the greenhouse	GreenhouseTemperature	The temperature outside the greenhouse	OutsideTemperature	The greenhouse identification number	GreenhouseID	The time the temperature was measured	SampleTime	4		
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1(b)(ii)	<table border="1" data-bbox="360 1339 1243 1704"> <thead> <tr> <th data-bbox="360 1339 699 1395">Variable</th> <th data-bbox="699 1339 1243 1395">Data type</th> </tr> </thead> <tbody> <tr> <td data-bbox="360 1395 699 1462">Mark</td> <td data-bbox="699 1395 1243 1462">INTEGER</td> </tr> <tr> <td data-bbox="360 1462 699 1529">Subject</td> <td data-bbox="699 1462 1243 1529">STRING</td> </tr> <tr> <td data-bbox="360 1529 699 1597">Grade</td> <td data-bbox="699 1529 1243 1597">CHAR</td> </tr> <tr> <td data-bbox="360 1597 699 1664">CourseCompleted</td> <td data-bbox="699 1597 1243 1664">BOOLEAN</td> </tr> <tr> <td data-bbox="360 1664 699 1704">AverageMark</td> <td data-bbox="699 1664 1243 1704">REAL</td> </tr> </tbody> </table> <p data-bbox="300 1738 592 1771">One mark per answer</p>	Variable	Data type	Mark	INTEGER	Subject	STRING	Grade	CHAR	CourseCompleted	BOOLEAN	AverageMark	REAL	5
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Question	Answer	Marks																		
2(a)(i)	<ul style="list-style-type: none"> Keywords in capitals White Space / blank lines / grouping Comments Sensible function names 	Max 2																		
2(a)(ii)	<ul style="list-style-type: none"> Indentation Meaningful identifier names 	2																		
2(b)	<table border="1"> <thead> <tr> <th data-bbox="333 557 949 618">Feature</th> <th data-bbox="949 557 1270 618">Answer</th> </tr> </thead> <tbody> <tr> <td data-bbox="333 618 949 734">A line number containing an example of an assignment statement</td> <td data-bbox="949 618 1270 734">08 / 09 / 13 / 14 / 15 / 21</td> </tr> <tr> <td data-bbox="333 734 949 819">A line number containing the start of a 'pre-condition' loop</td> <td data-bbox="949 734 1270 819">11</td> </tr> <tr> <td data-bbox="333 819 949 913">A line number containing the end of a 'pre-condition' loop</td> <td data-bbox="949 819 1270 913">24</td> </tr> <tr> <td data-bbox="333 913 949 1005">A line number containing the start of a selection statement</td> <td data-bbox="949 913 1270 1005">17</td> </tr> <tr> <td data-bbox="333 1005 949 1099">The number of parameters of the <code>LEFT()</code> function</td> <td data-bbox="949 1005 1270 1099">2</td> </tr> <tr> <td data-bbox="333 1099 949 1160">The Boolean operator used</td> <td data-bbox="949 1099 1270 1160">OR</td> </tr> <tr> <td data-bbox="333 1160 949 1364">The number of times the function <code>LEFT()</code> is called from within <code>CountDigits()</code> resulting from the call: <code>Result ← CountDigits("AB27C4")</code></td> <td data-bbox="949 1160 1270 1364">6</td> </tr> <tr> <td data-bbox="333 1364 949 1424">The number of local variables</td> <td data-bbox="949 1364 1270 1424">3</td> </tr> </tbody> </table>	Feature	Answer	A line number containing an example of an assignment statement	08 / 09 / 13 / 14 / 15 / 21	A line number containing the start of a 'pre-condition' loop	11	A line number containing the end of a 'pre-condition' loop	24	A line number containing the start of a selection statement	17	The number of parameters of the <code>LEFT()</code> function	2	The Boolean operator used	OR	The number of times the function <code>LEFT()</code> is called from within <code>CountDigits()</code> resulting from the call: <code>Result ← CountDigits("AB27C4")</code>	6	The number of local variables	3	8
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2(c)(i)	<ul style="list-style-type: none"> Mistake: function header returns a <code>CHAR</code> but last line of code returns an <code>INTEGER</code> Correction: Function should return an <code>INTEGER</code> // Change line 26 to return <code>c</code> as <code>CHAR</code> 	2																		

Question	Answer	Marks
2(c)(ii)	<pre> IF (nc >= '0') AND (nc <= '9') THEN c ← c + 1 ENDIF </pre> <p>One mark for each of:</p> <ul style="list-style-type: none"> • Single IF THEN ENDIF statement (no ELSE) • Switching OR to AND • Lower value comparison • Upper value comparison <p>ALTERNATIVE:</p> <pre> IF NOT ((nc < '0') OR (nc > '9')) THEN c ← c + 1 ENDIF </pre> <p>One mark for each of:</p> <ul style="list-style-type: none"> • Single IF THEN ENDIF statement (no ELSE) • Inverting test using NOT... • ... correct use of brackets • ... both comparisons unchanged 	4

Question	Answer	Marks
3	<p>Example Program Flowchart</p> <pre> graph TD Start([START]) --> InitCount[Count ← 0] InitCount --> InitIndex[Index ← 1] InitIndex --> Dec1{Is BarWeight[Index] > MaxWeight?} Dec1 -- YES --> IncCount[Count ← Count + 1] Dec1 -- NO --> Dec2{Is Index = 100?} Dec2 -- YES --> Dec3{Is Count > Threshold?} Dec2 -- NO --> IncIndex[Index ← Index + 1] IncIndex --> Dec1 Dec3 -- YES --> CallService[CALL ServiceCheck()] Dec3 -- NO --> Output[/OUTPUT "ShippingBox OK - maximum weight exceeded & Count & " times."/] CallService --> End([END]) Output --> End </pre>	10

Question	Answer	Marks
3	One mark for each of: 1 START and END / STOP 2 Initialising <code>Count</code> to 0 3 Initialising <code>Index</code> to 1 or 0 4 Decision box comparing <code>BarWeight[Index] > MaxWeight</code> 5 Decision box comparing <code>Index</code> to 100 6 Decision box comparing <code>Count > Threshold</code> 7 Correct increment of <code>Index</code> 8 Correct increment of <code>Count</code> 9 Output message (concatenation of text and value) if threshold not exceeded 10 Calling <code>ServiceCheck()</code> if <code>Threshold</code> exceeded (without text message)	10

Question	Answer	Marks
4(a)(i)	<p>Mark as follows:</p> <ul style="list-style-type: none"> • One mark for three arrows all labelled X (with filled circles) • One mark for diamond symbol 	2

Question	Answer	Marks												
4(a)(ii)	<table border="1" data-bbox="317 282 1287 781"> <thead> <tr> <th data-bbox="317 282 528 342">Parameter</th> <th data-bbox="528 282 1287 342">Information</th> </tr> </thead> <tbody> <tr> <td data-bbox="317 342 528 405">A</td> <td data-bbox="528 342 1287 405">BasketID</td> </tr> <tr> <td data-bbox="317 405 528 468">B</td> <td data-bbox="528 405 1287 468" rowspan="3">BasketID, ItemID, Quantity (In any order)</td> </tr> <tr> <td data-bbox="317 468 528 530">C</td> </tr> <tr> <td data-bbox="317 530 528 593">D</td> </tr> <tr> <td data-bbox="317 593 528 656">E</td> <td data-bbox="528 593 1287 656" rowspan="3">BasketID, DeliveryAddress, PaymentDetails (In any order)</td> </tr> <tr> <td data-bbox="317 656 528 719">F</td> </tr> <tr> <td data-bbox="317 719 528 781">G</td> </tr> </tbody> </table> <p data-bbox="304 817 517 846">Mark as follows:</p> <ul data-bbox="304 887 815 987" style="list-style-type: none"> • One mark for parameter A • One mark for parameters B, C & D • One mark for parameters E, F & G 	Parameter	Information	A	BasketID	B	BasketID, ItemID, Quantity (In any order)	C	D	E	BasketID, DeliveryAddress, PaymentDetails (In any order)	F	G	3
Parameter	Information													
A	BasketID													
B	BasketID, ItemID, Quantity (In any order)													
C														
D														
E	BasketID, DeliveryAddress, PaymentDetails (In any order)													
F														
G														

Question	Answer	Marks
5(a)	<p data-bbox="304 1133 592 1162">One mark for each of:</p> <ul data-bbox="304 1202 1251 1375" style="list-style-type: none"> • Same data type using a single identifier / more efficient coding / less declaration statements needed • Access of individual elements (using subscript / index) • Ability to iterate through the data // easier to search / sort the data • Code easier to understand / maintain / modify 	Max 2
5(b)	<p data-bbox="304 1408 592 1438">One mark for each of:</p> <ul data-bbox="304 1478 1174 1615" style="list-style-type: none"> • (Dynamic) syntax checking / Errors are highlighted / underlined • Type checking • Parameter checking • Identification of unused variables 	Max 2

Question	Answer	Marks
5(c)	<p>Example 'Pseudocode' solution included here for development and clarification of mark scheme. Programming language example solutions appear in the Appendix.</p> <pre> FUNCTION GetNumber() AS STRING DECLARE Valid : BOOLEAN DECLARE MemberNumber : INTEGER REPEAT Valid ← TRUE OUTPUT "Please input a valid member number" INPUT MemberNumber IF (MemberNumber > 9999) OR (MemberNumber < 1111) THEN Valid ← FALSE ENDIF UNTIL Valid = TRUE RETURN STR(MemberNumber) ENDFUNCTION </pre> <p>1 mark for each of the following:</p> <ol style="list-style-type: none"> 1 Function heading (as above) and ending 2 Conditional loop structure 3 Condition to check valid membership number 4 Returning string value 	4

Question	Answer	Marks
5(d)	<p>'Pseudocode' solution included here for development and clarification of mark scheme. Programming language solutions appear in the Appendix.</p> <pre> PROCEDURE OutputLowestScore() DECLARE FileData, FileMembershipNumber : STRING DECLARE FileScore, LowestScore : INTEGER DECLARE LowestScoreDate, MembershipNumber : STRING MembershipNumber ← GetNumber() OPENFILE "ScoreDetails.txt" FOR READ LowestScore ← 100 WHILE NOT EOF("ScoreDetails.txt") READFILE "ScoreDetails.txt", FileData FileMembershipNumber ← LEFT(FileData, 4) IF FileMembershipNumber = MembershipNumber THEN FileScore ← INT(RIGHT(FileData,2)) IF FileScore < LowestScore THEN LowestScore ← FileScore LowestScoreDate ← MID(FileData(5,6)) ENDIF ENDIF ENDWHILE OUTPUT ("The lowest score was " & LowestScore & " on " & LowestScoreDate) CLOSEFILE("ScoreDetails.txt ") ENDPROCEDURE </pre> <p>1 mark for each of the following:</p> <ol style="list-style-type: none"> 1 Declare variables to store <code>LowestScore</code> as <code>INTEGER</code> and <code>FileData</code> as <code>STRING</code> (commented in Python) (variable names may be different) 2 Function call <code>GetNumber()</code> for membership number 3 Initialisation of <code>LowestScore</code> to 99 or above 4 Open file in <code>READ</code> mode 5 Loop until <code>EOF()</code> 6 Read a line from the file in a loop 7 Use of substring operations to extract at least one data item 8 Compare the membership numbers 9 Convert score to <code>INTEGER</code> 10 Compare and assign (if appropriate) new value to <code>LowestScore</code> 11 Output the lowest score message including lowest score and date (outside the loop) 12 Close the file 	Max 10

Question	Answer	Marks
6(a)	<ul style="list-style-type: none"> • lower bound • upper bound 	2
6(b)	<p>Example using single temp variable:</p> <pre> PROCEDURE Flip() //Use of Single temp value DECLARE temp : INTEGER DECLARE i : INTEGER //i is the row DECLARE j : INTEGER //j is the column FOR i ← 1 TO 5 FOR j ← 1 to 4 //swap element 1&8, 2&7, 3&6, 4&5 temp ← Picture[i,j] Picture[i,j] ← Picture[i, 9 - j] Picture[i, 9 - j] ← temp ENDFOR ENDFOR ENDPROCEDURE </pre> <p>Alternative Solution – Use of temp array row:</p> <pre> PROCEDURE Flip() //Use of temporary row (8 elements) DECLARE temp : ARRAY[1:8] OF INTEGER DECLARE i : INTEGER //i is the row DECLARE j : INTEGER //j is the column FOR i ← 1 to 5 FOR j ← 1 to 8 temp[j] ← Picture[i, 9 - j] //temp is row i reversed ENDFOR FOR j ← 1 to 8 Picture[i,j] ← temp[j] //copy temp back to row i ENDFOR ENDFOR ENDPROCEDURE </pre>	8

Question	Answer	Marks
6(b)	<p>Alternative Solution – Use of new array:</p> <pre> PROCEDURE Flip() //Flip to New array DECLARE NewPic : ARRAY[1:5, 1:8] OF INTEGER DECLARE i : INTEGER //i is the row DECLARE j : INTEGER //j is the column FOR i ← 1 to 5 FOR j ← 1 to 8 NewPic[i, 9 - j] ← Picture[i, j] //NewPic row is Pic row flipped ENDFOR ENDFOR END PROCEDURE </pre> <p>1 mark for each of the following (all methods):</p> <ol style="list-style-type: none"> 1 Correct procedure heading and ending 2 Declaring local variables for loop counter(s) 3 Declaring a temporary storage variable for swap or new duplicate 2D array 4 A nested loop including attempt at flip operation ... 5 ... Correct number of iterations 6 Assign element to temp (single var or temp array) or to new array 7 Selection of correct source element (row, column) 8 Selection of correct destination element (row, column) 	8

*** End of Mark Scheme – program code solutions follow ***

Appendix**Program Code Example Solutions****Q5 (c): Visual Basic**

```
Function GetNumber() As String
    Dim Valid As Boolean
    Dim MemberNumber As Integer
    Do
        Valid = True
        Console.Write("Please enter a valid member number: ")
        MemberNumber = Console.ReadLine()
        If MemberNumber > 9999 Or MemberNumber < 1111 Then
            Valid = False
        End If
    Loop Until Valid = True
    Return MemberNumber.ToString()
End Function
```

Q5 (c): Pascal

```
function GetNumber() : string;
var
    Valid : boolean;
    MemberNumber : integer;
begin
    repeat
        Valid := true;
        write('Please enter a valid member number: ');
        readln(MemberNumber);
        if (MemberNumber > 9999) or (MemberNumber < 1111) then
            Valid := false;
        until Valid = true;
        GetNumber := IntToStr(MemberNumber);
    end;
```

Q5 (c): Python

```
def GetNumber() :
    # Valid : boolean
    # MemberNumber : integer
    Valid = False
    while not Valid :
        Valid = True
        MemberNumber = int(input("Please enter a valid member number: "))
        if MemberNumber > 9999 or MemberNumber < 1111 :
            Valid = False
    return str(MemberNumber)
```

Q5 (d): Visual Basic

```
Sub OutputLowestScore()  
    Dim FileData As String  
    Dim FileMembershipNumber As String  
    Dim FileScore As Integer  
    Dim LowestScore As Integer  
    Dim LowestScoreDate As String  
    Dim MembershipNumber As String  
    MembershipNumber = GetNumber()  
    FileOpen(1, "ScoreDetails.txt", OpenMode.Input)  
    LowestScore = 100  
    While Not EOF(1)  
        FileData = LineInput(1)  
        FileMembershipNumber = Left(FileData, 4)  
        If FileMembershipNumber = MembershipNumber Then  
            FileScore = Integer.Parse(Right(FileData, 2))  
            If FileScore < LowestScore Then  
                LowestScore = FileScore  
                LowestScoreDate = Mid(FileData, 5, 6)  
            End If  
        End If  
    End While  
    Console.WriteLine("The lowest score was " & LowestScore & " on " &  
LowestScoreDate)  
    FileClose(1)  
End Sub
```

Q5 (d): Pascal

```
procedure OutputLowestScore();
var
  FileData : string;
  FileMembershipNumber : string;
  FileScore : integer;
  LowestScore : integer;
  LowestScoreDate : string;
  MembershipNumber : string;
  Scores : textFile;
begin
  MembershipNumber := GetNumber();
  assignFile(Scores, 'ScoreDetails.txt');
  reset(Scores);
  LowestScore := 100;
  while not eof(Scores) do
  begin
    readln(Scores, FileData);
    FileMembershipNumber := copy(FileData, 1, 4);
    if FileMembershipNumber = MembershipNumber then
    begin
      FileScore:= StrToInt(copy(FileData, 11, 2));
      if FileScore < LowestScore then
      begin
        LowestScore := FileScore;
        LowestScoreDate := copy(FileData, 5, 6)
      end;
    end;
  end;
  writeln('The lowest score was ', LowestScore, ' on ', LowestScoreDate);
  close(Scores);
end;
```

Q5 (d): Python

```
def OutputLowestScore() :
    # FileData : string
    # FileMembershipNumber : string
    # FileScore : integer
    # LowestScore : integer
    # LowestScoreDate : string
    # MembershipNumber : string
    # File : file handle
    MembershipNumber = GetNumber()
    File = open("ScoreDetails.txt", "r")
    LowestScore = 100
    FileData = File.readline()
    while FileData != "":
        FileMembershipNumber = FileData[:4]
        if FileMembershipNumber == MembershipNumber :
            FileScore = int(FileData[10:12])
            if FileScore < LowestScore :
                LowestScore = FileScore
                LowestScoreDate = FileData[4:10]
        FileData = File.readline()
    print("The lowest score was ", LowestScore, " on ", LowestScoreDate)
    File.close()
```