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**COMPUTER SCIENCE**

**9608/21**

Paper 2 Written Paper

**May/June 2016**

MARK SCHEME

Maximum Mark: 75

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**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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Question	Answer					Marks
1 (a) (i)	<b>Item</b>	<b>Statement</b>	<b>Selection</b>	<b>Iteration</b>	<b>Assignment</b>	6
	1	MyScore = 65			✓	
	2	FOR IndexVal = 0 TO 99		✓		
	3	MyArray[3] = ID(MyString, 3, 2)			✓	
	4	IF MyScore >= 70 THEN	✓			
	5	ENDWHILE		✓		
	6	ELSE Message = "Error"	✓		✓	
One mark per row Additional ticks in any row cancels that row						
(ii)	<b>Item</b>	<b>Purpose of statement</b>				6
	1	Assign <u>65</u> to <u>MyScore</u>				
	2	(Start of) loop with loop counter starting from zero & going to 99 / repeating 100 times				
	3	Assign 2 chars from position 3/4 in MyString to MyArray element 3/4				
	4	Test if MyScore is <u>greater than or equal to</u> 70				
	5	Marks the end of WHILE / precondition loop //Return to top of loop to check condition				
	6	If a condition is FALSE, variable Message is assigned the value "ERROR"				
Exact wording not important Explanation must refer to variables or values used in code (except for row 5)						
(iii)	<b>Expression</b>		<b>Result</b>			2
	"D" & RIGHT(MyString, 4)		"Dance"			
	LEFT(RIGHT(MyString, 7), 3)		"ten"			
Must have correct case Quotation marks optional						

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<b>Question</b>	<b>Answer</b>			<b>Marks</b>
<b>2 (a)</b>	<b>Identifier</b>	<b>Data Type</b>	<b>Description</b>	<b>4</b>
	AlarmState	BOOLEAN	Alarm is set to ON or OFF	
	SensorValue	INTEGER	Value / number from sensor / as input by user // used in calculation of Temperature	
	ThresholdValue	REAL / FLOAT / SINGLE / DOUBLE	Threshold value for comparison	
	Temperature	REAL / FLOAT / SINGLE / DOUBLE	Temperature value calculated from sensor value	
<p>One mark per row  Data types as shown  Descriptions given above are examples only</p>				

Question	Answer	Marks
(b)	<pre> AlarmState ← FALSE ①  INPUT ThresholdValue INPUT SensorValue } ②  Temperature ← SensorValue * 1.135 ③  IF Temperature &gt; ThresholdValue THEN     AlarmState ← TRUE     OUTPUT "Temperature Alarm" } ⑤ ELSE     OUTPUT "Temperature OK" ⑥     AlarmState ← FALSE ⑦ ENDIF ④ </pre> <p>Mark points as circled, descriptions as below:</p> <ol style="list-style-type: none"> <li>Setting AlarmState to FALSE (Cond. check not essential but must be correct if present)</li> <li>Inputting SensorVal and ThresholdVal</li> <li>Correct value assigned to Temperature (must be * not x)</li> <li>IF..THEN..ELSE..ENDIF structure with correct condition (or two separate IF clauses)</li> <li>Correct THEN statements as shown</li> <li>Correct ELSE statement as shown</li> <li>Setting AlarmState to FALSE within ELSE clause <b>only if mark point 1 not given</b></li> </ol>	Max 6

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Question	Answer	Marks
3 (a)	<pre> FUNCTION EncryptString (<u>Lookup : ARRAY, PlainText : STRING</u>) RETURNS STRING  DECLARE <u>OldChar, NewChar</u> : CHAR DECLARE OldCharValue : <u>INTEGER</u> DECLARE OutString: STRING  //first initialise the return string  <u>OutString</u> ← "" //initialise the return string  //loop through PlainText to produce OutString  FOR n ← 1 to <u>LENGTH(PlainText)</u> //from first to last character OldChar ← <u>MID(PlainText, n, 1)</u> //get next character OldCharValue ← <u>ASC(OldChar)</u> //find the ASCII value NewChar ← <u>Lookup[OldCharValue]</u> //look up substitute character <u>OutString</u> ← <u>Outstring &amp; NewChar</u> // concatenate to OutString  ENDFOR  <u>RETURN OutString</u> // <u>EncryptString</u> ← <u>OutString</u>  ENDFUNCTION </pre> <p>One mark for each part-statement (shown underlined and bold)</p>	10
(b) (i)	<p><b>VB:</b> <u>Dim Lookup(0 to 127 / 128) As CHAR</u></p> <p><b>Pascal:</b> <u>Var Lookup: Array[0..127 / 1..128] Of CHAR</u></p> <p><b>Python:</b> Lookup = ["" for i in range(128)]</p> <p>OR</p> <pre> Lookup = [] For i in range(128) : Lookup.append("") </pre> <p>Mark as follows:  VB / Pascal: one mark per part-statement as underlined and bold  Python:  One mark for Lookup <b>and</b> []  One mark for range(128)</p>	2

Question	Answer	Marks
(ii)	<p>'Pseudocode' solution included here for development and clarification of mark scheme. Programming language solutions appear in the Appendix.</p> <pre> INPUT StartPos INPUT NumToChange } ①  ② { FOR n ← 0 to NumToChange - 1       OUTPUT " Input new value for position " ③       INPUT NewChar ④       Lookup[StartPos + n] ← NewChar ⑤     ENDFOR       OUTPUT (NumToChange &amp; " entries changed") ⑥ </pre> <p><b>ALTERNATIVE:</b></p> <pre> INPUT StartPos INPUT NumToChange } ① n ← 0  ② { REPEAT       OUTPUT " Input new value for position " ③       INPUT NewChar ④       Lookup[StartPos + n] ← NewChar ⑤       n ← n + 1     UNTIL n = NumToChange       OUTPUT (NumToChange &amp; " entries changed") ⑥ </pre> <p>Mark points as circled, descriptions as below:</p> <ol style="list-style-type: none"> <li>Two INPUT statements</li> <li>Working loop (using values of n from flowchart)</li> <li>OUTPUT prompt (exact text not specified)</li> <li>INPUT NewChar</li> <li>Assignment of NewChar to correct array element</li> <li>OUTPUT final message after loop (exact text not specified but must include NumToChange or loop counter if value correct at that point)</li> </ol>	6
4 (a)	<ul style="list-style-type: none"> <li>Program code is <u>easier</u> to implement / manage</li> <li>Modules may be given to different people to develop // given to program specialists</li> <li>Program code is <u>easier</u> to test / debug / maintain</li> <li>Encourages the re-usability of program code</li> </ul>	Max 2

Question	Answer	Marks
(b) (i)	<pre> graph TD     A[On-line shopping] --&gt; B[Select Item]     A --&gt; C[Checkout]     A --&gt; D[Dispatch]     B --&gt; E[Search]     B --&gt; F[Add to basket]     C --&gt; G[Card payment]     C --&gt; H[Account payment]     D --&gt; I[Print dispatch label]     D --&gt; J[Print address label]     F --&gt; B     I --&gt; D     </pre> <p>One mark per correct annotation as shown  Arrows may be drawn clockwise or anticlockwise  Diamond symbol may be filled or unfilled but must be in position shown</p>	3
(ii)	A (or B) – Card details / Card number / Card info B (or A) – Cost details / amount payable / product cost / total bill C – (Flag) indicator for successful payment // payment confirmation  Data items for A and B are interchangeable	3
5 (a) (i)	<ul style="list-style-type: none"> <li>• So that the data / information is saved after the program is run / when the computer is switched off</li> <li>• So the data / information can be accessed next time the program is run</li> <li>• So the data information can be "permanently stored"</li> </ul>	Max 1

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Question	Answer	Marks
(ii)	<p><b>Problem:</b></p> <ul style="list-style-type: none"> <li>• When retrieving / searching for / editing (text relating to a particular CD)</li> <li>• Can't tell where the artist name stops and the title begins (or any similar explanation or example)</li> </ul> <p><b>Solution 1:</b></p> <ul style="list-style-type: none"> <li>• Use of a separator character// or by example</li> <li>• Where the separator character does not occur in the original strings</li> </ul> <p><b>Solution 2:</b></p> <ul style="list-style-type: none"> <li>• Use a fixed number of characters for each data item</li> <li>• Data items are padded with e.g. &lt;Space&gt; character where needed</li> </ul> <p><b>Solution 3:</b></p> <ul style="list-style-type: none"> <li>• Convert original data items to CamelCase</li> <li>• ...and add a Space separator</li> </ul> <p>Mark as follows: Two marks for description of problem Two marks for description of solution</p>	4



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Question	Answer	Marks
(b)	<p>'Pseudocode' solution included here for development and clarification of mark scheme. Programming language solutions appear in the Appendix.</p> <pre> PROCEDURE InputData()  DECLARE CDTitle : STRING DECLARE CDArtist : STRING DECLARE CDLocation : STRING DECLARE FileData : STRING  OPENFILE "MyMusic" FOR WRITE  OUTPUT "Input CD Title" INPUT CDTitle  WHILE CDTitle &lt;&gt; "##"     OUPUT "Input CD Artist"     INPUT CDArtist     OUPUT "Input CD Location"     INPUT CDLocation     FileData = CDTitle &amp; ':' &amp; CDArtist &amp; ':' &amp;         CDLocation     WRITEFILE "MyMusic.txt", FileData     OUTPUT "Input CD Title"     INPUT CDTitle ENDWHILE  CLOSEFILE("MyMusic.txt ")  ENDPROCEDURE </pre> <p>One mark for each of the following:</p> <ul style="list-style-type: none"> <li>• Procedure heading and ending</li> <li>• Declaration of CDTitle, CDArtist and CDLocation</li> <li>• Open file for writing (Allow MyMusic or MyMusic.txt)</li> <li>• Working conditional loop structure including test for rogue value (including initial input of CDTitle)</li> <li>• Input of three data values (CDTitle, CDArtist and CDLocation) <b>inside a loop</b></li> <li>• String concatenation of three variables <b>inside a loop</b></li> <li>• Write three variables in single line to file <b>inside a loop</b></li> <li>• Close file</li> <li>• Use of string separator</li> </ul> <p>Solutions may repeatedly OPEN – WRITE – CLOSE within the loop. In this case the first OPEN could be in WRITE or APPEND mode with all others in APPEND.</p>	Max 8

Question	Answer	Marks																																																												
6 (a)	<table border="1"> <thead> <tr> <th>n</th> <th>f</th> <th>x</th> <th>y</th> <th>MID(String1, x, 1)</th> <th>MID(String2, y, 1)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>1</td> <td></td> <td>1</td> <td>1</td> <td>'R'</td> <td>'R'</td> </tr> <tr> <td></td> <td></td> <td>2</td> <td>2</td> <td>'E'</td> <td>'A'</td> </tr> <tr> <td>2</td> <td></td> <td>2</td> <td>1</td> <td>'E'</td> <td>'R'</td> </tr> <tr> <td>3</td> <td></td> <td>3</td> <td>1</td> <td>'T'</td> <td>'R'</td> </tr> <tr> <td>4</td> <td></td> <td>4</td> <td>1</td> <td>'R'</td> <td>'R'</td> </tr> <tr> <td></td> <td></td> <td>5</td> <td>2</td> <td>'A'</td> <td>'A'</td> </tr> <tr> <td></td> <td></td> <td>6</td> <td>3</td> <td>'C'</td> <td>'C'</td> </tr> <tr> <td></td> <td>4</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>One mark per correct column</p> <ul style="list-style-type: none"> <li>• Minus one mark if anything else on first row</li> <li>• Column 2 – '4' must not precede '4' in column 1 (as shown by arrow)</li> <li>• Letters must all be in upper case</li> <li>• Ignore quotation symbol</li> </ul>	n	f	x	y	MID(String1, x, 1)	MID(String2, y, 1)	0	0					1		1	1	'R'	'R'			2	2	'E'	'A'	2		2	1	'E'	'R'	3		3	1	'T'	'R'	4		4	1	'R'	'R'			5	2	'A'	'A'			6	3	'C'	'C'		4					6
n	f	x	y	MID(String1, x, 1)	MID(String2, y, 1)																																																									
0	0																																																													
1		1	1	'R'	'R'																																																									
		2	2	'E'	'A'																																																									
2		2	1	'E'	'R'																																																									
3		3	1	'T'	'R'																																																									
4		4	1	'R'	'R'																																																									
		5	2	'A'	'A'																																																									
		6	3	'C'	'C'																																																									
	4																																																													
(b) (i)	<ul style="list-style-type: none"> <li>• to search for a string within another string / String2 within String1</li> <li>• to return the position of the start of String2 within String1 // by example</li> </ul> <p>First mark point: allow locate / find / calculate position of</p>	2																																																												
(ii)	<p>Value: 0 / zero</p> <p>Meaning: String2 not found in String1</p>	2																																																												
(iii)	<p><b>Option 1</b></p> <ul style="list-style-type: none"> <li>• It is possible to “fall off” the end of String1 (or by example) while string match (for example, String1 = "Retrace", String2 = "Raced")</li> <li>• MID (String1, x, 1) // description of 'subscript out of range'</li> </ul> <p><b>Option 2</b></p> <ul style="list-style-type: none"> <li>• If either string is empty then</li> <li>• subscript out of range error // description</li> </ul> <p><b>Option 3</b></p> <ul style="list-style-type: none"> <li>• If String1 found within String 2</li> <li>• An endless loop will occur</li> </ul>	2																																																												

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### Appendix - Program Code Solutions

#### 3 (b)(ii): VB.NET

```

Console.WriteLine("Enter start position: ")
StartPos = Console.ReadLine()
Console.WriteLine("Enter number to change: ")
NumToChange = Console.ReadLine()
For n = 0 To NumToChange - 1
    Console.WriteLine("Enter new value for position: ")
    NewChar = Console.ReadLine()
    Lookup(StartPos + n) = NewChar
Next
Console.WriteLine(NumToChange & " entries changed")

```

#### ALTERNATIVE:

```

Console.WriteLine("Enter start position: ")
StartPos = Console.ReadLine()
Console.WriteLine("Enter number to change: ")
NumToChange = Console.ReadLine()
n = 0
Do
    Console.WriteLine("Enter new value for position: ")
    NewChar = Console.ReadLine()
    Lookup(StartPos + n) = NewChar
    n = n + 1
Loop Until n = NumToChange
Console.WriteLine(NumToChange & " entries changed")

```

#### 3 (b)(ii): Pascal

```

write('Enter start position: ');
readln(StartPos);
write('Enter number to change: ');
readln(NumToChange);
for n := 0 to NumToChange - 1 do
begin
    write('Input new value for position: ');
    readln(NewChar);
    LookUp[Startpos + n] := NewChar;
end;
writeln(IntToStr(NumToChange) + ' entries changed');

```

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**ALTERNATIVE:**

```
write('Enter start position: ');
readln(StartPos);
write('Enter number to change: ');
readln(NumToChange);
n := 0;
repeat
    write('Input new value for position: ');
    readln(NewChar);
    LookUp[Startpos + n] := NewChar;
    n := n + 1;
until (n = NumToChange);
writeln(IntToStr(NumToChange) + ' entries changed');
```

**3 (b)(ii): Python**

```
StartPos = int(input("Enter start position: "))
NumToChange = int(input("Enter number to change: "))
for n in range(NumToChange) :
    NewChar = input("Input new value for position: ")
    LookUp[StartPos + n - 1] = NewChar
print(str(NumToChange) + " entries changed")
```

**ALTERNATIVE:**

```
StartPos = int(input("Enter start position: "))
NumToChange = int(input("Enter number to change: "))
n = 0
while n < NumToChange :
    NewChar = input("Input new value for position: ")
    LookUp[StartPos + n] = NewChar
    n = n + 1
print(str(NumToChange) + " entries changed")
```

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## 5 (b): VB.NET

### A StreamWriter() solution:

```
Sub InputData()
    Dim CDTitle, CDArtist, CDLocation As String
    Dim FileHandle As IO.StreamWriter
    FileHandle = New IO.StreamWriter("MyMusic.txt") ("MyMusic.txt")
    Console.WriteLine("Input CD Title: ")
    CDTitle = Console.ReadLine()
    Do Until CDTitle = "###"
        Console.WriteLine("Input CD Artist: ")
        CDArtist = Console.ReadLine()
        Console.WriteLine("Input CD Location: ")
        CDLocation = Console.ReadLine()
        FileHandle.WriteLine(CDTitle & ":" & CDArtist & ":" & CDLocation)
        Console.WriteLine("Input CD Title: ")
        CDTitle = Console.ReadLine()
    Loop
    FileHandle.Close()
End Sub
```

### A legacy FileOpen() solution:

```
Sub InputData()
    Dim CDTitle, CDArtist, CDLocation As String
    FileOpen(1, "MyMusic", OpenMode.Output)
    Console.WriteLine("Input CD Title: ")
    CDTitle = Console.ReadLine()
    Do Until CDTitle = "###"
        Console.WriteLine("Input CD Artist: ")
        CDArtist = Console.ReadLine()
        Console.WriteLine("Input CD Location: ")
        CDLocation = Console.ReadLine()
        Print(1, CDTitle & ":" & CDArtist & ":" & CDLocation)
        Console.WriteLine("Input CD Title: ")
        CDTitle = Console.ReadLine()
    Loop
    FileClose(1)
End Sub
```

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### 5 (b): Pascal

```

procedure InputData;
var
    CDTitle, CDArtist, CDLocation : string;
    CDFile : Textfile;
begin
    assign(CDFile, 'MyMusic');
    rewrite(CDFile);
    writeln('Input CD Title: ');
    readln(CDTitle);
    while (CDTitle <> '##') do
    begin
        writeln('Input CD Artist: ');
        readln(CDArtist);
        writeln('Input CD Location: ');
        readln(CDLocation);
        writeln(CDFile, CDTitle + ':' + CDArtist + ':' + CDLocation);
        writeln('Input CD Title: ');
        readln(CDTitle);
    end;
    close(CDFile);
end;

```

### 5 (b): Python

```

def InputData() :
    #CDTitle String (or CDTitle = "")
    #CDArtist String (or CDArtist = "")
    #CDLocation String (or CDLocation = "")

    FileHandle = open("MyMusic", "w")
    CDTitle = input("Input CD Title: ")
    while CDTitle != "##" :
        CDArtist = input("Input CD Artist: ")
        CDLocation = input("Input CD location: ")
        FileHandle.write(CDTitle + ":" + CDArtist + ":" + CDLocation)
        CDTitle = input("Input CD Title: ")
    FileHandle.close()

```