Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

COMPUTER SCIENCE **9608/21**

Paper 2 Written Paper **May/June 2016**

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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Question 1 (a) (i) — Marks: 6

Item	Statement	Selection	Iteration	Assignment
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) — Marks: 6

Item	Purpose of statement
1	Assign 65 to `MyScore`
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 greater than or equal to 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"`

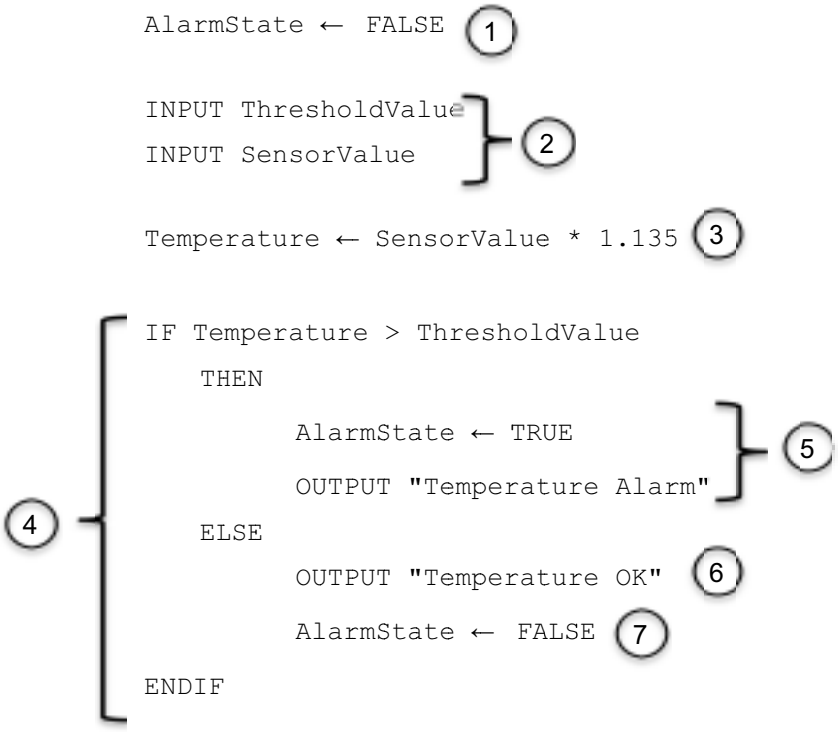
Exact wording not important
Explanation must refer to variables or values used in code (except for row 5)

(iii) — Marks: 2

Expression	Result
`"D" & RIGHT(MyString, 4)`	**"Dance"**
`LEFT(RIGHT(MyString, 7), 3)`	**"ten"**

Must have correct case
Quotation marks optional

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

Question	Answer	Marks
(b)		Max 6

Mark points as circled, descriptions as below:

1. Setting `AlarmState` to `FALSE` (Cond. check not essential but must be correct if present)
2. Inputting `SensorVal` and `ThresholdVal`
3. Correct value assigned to `Temperature` (must be `*` not `x`)
4. `IF..THEN..ELSE..ENDIF` structure with correct condition (or two separate `IF` clauses)
5. Correct `THEN` statements as shown
6. Correct `ELSE` statement as shown
7. Setting `AlarmState` to `FALSE` within `ELSE` clause **only if mark point 1 not given**

Question	Answer	Marks

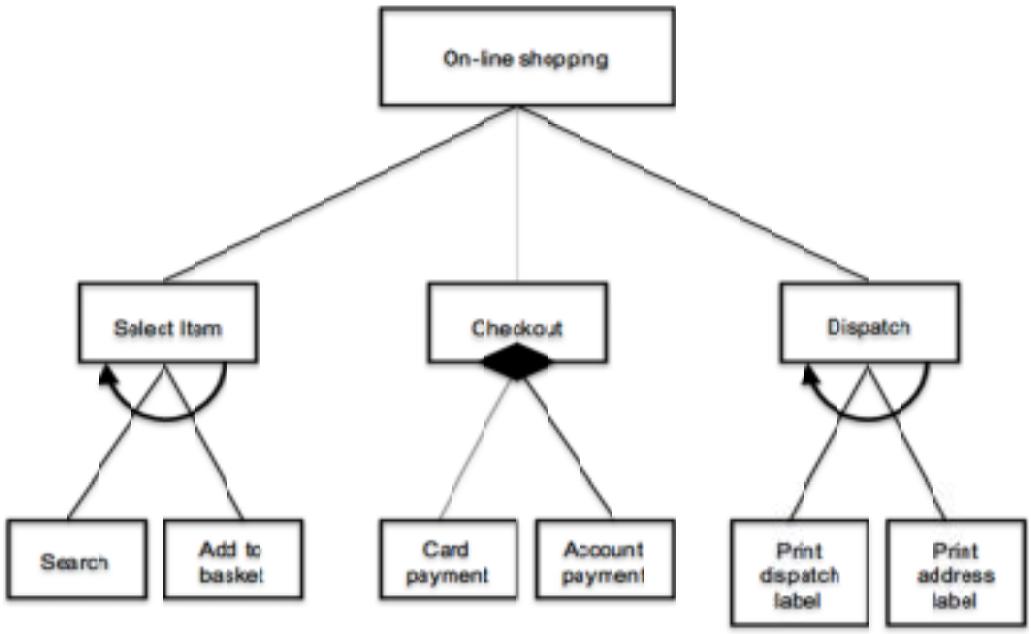
3 (a)	FUNCTION EncryptString (**LookUp : ARRAY, PlainText : STRING**)
	RETURNS STRING
	
	DECLARE **OldChar, NewChar** : CHAR
	DECLARE OldCharValue : **INTEGER**
	DECLARE OutString: STRING
	
	//first initialise the return string
	
	OutString ← "" //initialise the return string
	
	//loop through PlainText to produce OutString
	
	FOR n ← 1 to **LENGTH(PlainText)** //from first to last character
	OldChar ← **MID(PlainText, n, 1)** //get next character
	OldCharValue ← **ASC(OldChar)** //find the ASCII value
	NewChar ← **Lookup[OldCharValue]** //look up substitute character
	OutString ← Outstring & NewChar // concatenate to OutString
	
	ENDFOR
	
	RETURN OutString // **EncryptString ← OutString**
	
	ENDFUNCTION
	
	One mark for each part-statement (shown underlined and bold)
		10

(b) (i)	**VB**: **Dim Lookup(0 to 127 / 128) As CHAR**
	
	Pascal: **Var Lookup: Array[0..127 / 1..128] Of CHAR**
	
	Python: `Lookup = ["" for i in range(128)]`
	
	OR
	
	`Lookup = []`
	`For i in range(128) :`
	`Lookup.append("")`
	
	Mark as follows:
	VB / Pascal: one mark per part-statement as underlined and bold
	Python:
	One mark for `Lookup` **and** `[]`
	One mark for `range(128)`
		2

Question	Answer	Marks

(ii)	'Pseudocode' solution included here for development and clarification of mark scheme.
	Programming language solutions appear in the Appendix.
	
	`INPUT StartPos` ① `INPUT NumToChange`
	② `FOR n ← 0 to NumToChange - 1`
	`  OUTPUT " Input new value for position "` ③
	`  INPUT NewChar` ④
	`  Lookup[StartPos + n] ← NewChar` ⑤
	`ENDFOR`
	
	`OUPUT (NumToChange & " entries changed")` ⑥
	
	ALTERNATIVE:
	
	`INPUT StartPos` ① `INPUT NumToChange`
	`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 & " entries changed")` ⑥
	
	Mark points as circled, descriptions as below:
	
	1. Two `INPUT` statements
	2. Working loop (using values of n from flowchart)
	3. `OUTPUT` prompt (exact text not specified)
	4. `INPUT NewChar`
	5. Assignment of `NewChar` to correct array element
	6. `OUTPUT` final message after loop (exact text not specified but must include `NumToChange` or loop counter if value correct at that point)
		6

4 (a)	• Program code is easier to implement / manage • Modules may be given to different people to develop // given to program specialists • Program code is easier to test / debug / maintain • Encourages the re-usability of program code	Max 2

Question	Answer	Marks
(b) (i)	 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	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)	• So that the data / information is saved after the program is run / when the computer is switched off • So the data / information can be accessed next time the program is run • So the data information can be "permanently stored"	Max 1

Question	Answer	Marks
(ii)	**Problem:** • When retrieving / searching for / editing (text relating to a particular CD) • Can't tell where the artist name stops and the title begins (or any similar explanation or example) **Solution 1:** • Use of a separator character// or by example • Where the separator character does not occur in the original strings **Solution 2:** • Use a fixed number of characters for each data item • Data items are padded with e.g. <Space> character where needed **Solution 3:** • Convert original data items to CamelCase • …and add a Space separator Mark as follows: Two marks for description of problem Two marks for description of solution	4

Question	Answer	Marks

(b)	'Pseudocode' solution included here for development and clarification of mark scheme.
	Programming language solutions appear in the Appendix.
	
	`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 <> "##"`
	`  OUPUT "Input CD Artist"`
	`  INPUT CDArtist`
	`  OUPUT "Input CD Location"`
	`  INPUT CDLocation`
	`  FileData = CDTitle & ':' & CDArtist & ':' &`
	`  CDLocation`
	`  WRITEFILE "MyMusic.txt", FileData`
	`  OUTPUT "Input CD Title"`
	`  INPUT CDTitle`
	`ENDWHILE`
	
	`CLOSEFILE("MyMusic.txt ")`
	
	`ENDPROCEDURE`
	
	One mark for each of the following:
	
	• Procedure heading and ending
	• Declaration of `CDTitle`, `CDArtist` and `CDLocation`
	• Open file for writing (Allow `MyMusic` or `MyMusic.txt`)
	• Working conditional loop structure including test for rogue value (including initial input of `CDTitle`)
	• Input of three data values (`CDTitle`, `CDArtist` and `CDLocation`) **inside a loop**
	• String concatenation of three variables **inside a loop**
	• Write three variables in single line to file **inside a loop**
	• Close file
	• Use of string separator
	
	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`.
		Max 8

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6 (a)</td><td>
<table>
<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>
<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></td><td></td><td></td><td></td><td></td></tr>
</table>


One mark per correct column

• Minus one mark if anything else on first row
• Column 2 – '4' must not precede '4' in column 1 (as shown by arrow)
• Letters must all be in upper case
• Ignore quotation symbol
</td><td>6</td></tr>
<tr><td>(b) (i)</td><td>
• to search for a string within another string / <code>String2</code> within <code>String1</code>
• to return the position of the start of <code>String2</code> within <code>String1</code> // by example

First mark point: allow locate / find / calculate position of
</td><td>2</td></tr>
<tr><td>(ii)</td><td>
Value: 0 / zero

Meaning: <code>String2</code> not found in <code>String1</code>
</td><td>2</td></tr>
<tr><td>(iii)</td><td>
Option 1

• It is possible to “fall off” the end of <code>String1</code> (or by example) while string match (for example, String1 = "Retrace", String2 = "Raced")
• <code>MID (String1, x, 1)</code> // description of 'subscript out of range'

Option 2

• If either string is empty then
• subscript out of range error // description

Option 3

• If String1 found within String 2
• An endless loop will occur
</td><td>2</td></tr>
</table>

Appendix - Program Code Solutions

3 (b)(ii): VB.NET

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

ALTERNATIVE:

```
Console.Write("Enter start position: ")
StartPos = Console.ReadLine()
Console.Write("Enter number to change: ")
NumToChange = Console.ReadLine()
n = 0
Do
      Console.Write("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');
```

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")
```

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
```

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()
```