
COMPUTER SCIENCE

9608/21

Paper 2 Written Paper

October/November 2017

MARK SCHEME

Maximum Mark: 75

Published

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This document consists of **12** printed pages.

Question	Answer	Marks														
1(a)(i)	<table border="1" data-bbox="392 280 1171 696"> <thead> <tr> <th data-bbox="392 280 603 331">Data value</th> <th data-bbox="603 280 1171 331">Data type</th> </tr> </thead> <tbody> <tr> <td data-bbox="392 331 603 394">27</td> <td data-bbox="603 331 1171 394">INTEGER</td> </tr> <tr> <td data-bbox="392 394 603 456">"27"</td> <td data-bbox="603 394 1171 456">STRING</td> </tr> <tr> <td data-bbox="392 456 603 519">"27.3"</td> <td data-bbox="603 456 1171 519">STRING</td> </tr> <tr> <td data-bbox="392 519 603 582">TRUE</td> <td data-bbox="603 519 1171 582">BOOLEAN</td> </tr> <tr> <td data-bbox="392 582 603 645">27/3/2015</td> <td data-bbox="603 582 1171 645">DATE // DATETIME</td> </tr> <tr> <td data-bbox="392 645 603 696">27.3</td> <td data-bbox="603 645 1171 696">REAL</td> </tr> </tbody> </table> <p data-bbox="244 730 751 801">One mark for each data type Mark first data type given in each case</p>	Data value	Data type	27	INTEGER	"27"	STRING	"27.3"	STRING	TRUE	BOOLEAN	27/3/2015	DATE // DATETIME	27.3	REAL	6
Data value	Data type															
27	INTEGER															
"27"	STRING															
"27.3"	STRING															
TRUE	BOOLEAN															
27/3/2015	DATE // DATETIME															
27.3	REAL															
1(a)(ii)	1D Array // 1DList	2														
1(a)(iii)	<ul data-bbox="244 898 1091 969" style="list-style-type: none"> • Each character is represented by an <u>unique</u> / <u>corresponding</u> • binary code / integer / value 	2														
1(b)	<ul data-bbox="244 1010 1067 1182" style="list-style-type: none"> • When a section of code would be repeated • When a piece of code is needed to perform a specific task • To support modular programming / step wise refinement • Easier to debug / maintain • Built-in / library routines are tried and tested <p data-bbox="244 1218 533 1249">One mark per answer</p>	Max 2														
1(c)	<pre data-bbox="244 1285 724 1473">CASE OF MyVar 1: CALL Proc1() 2: CALL Proc2() 3: CALL Proc3() OTHERWISE OUTPUT "Error" ENDCASE</pre> <p data-bbox="244 1509 429 1541">One mark for:</p> <ul data-bbox="244 1581 639 1727" style="list-style-type: none"> • First line and ENDCASE • All clauses for 1, 2 and 3 • 'OTHERWISE' clause • OUTPUT statement 	4														

Question	Answer	Marks
1(d)	<p>Ability to recognise:</p> <ul style="list-style-type: none"> • selection statement • iteration statement • assignment statements • data declarations / structures / data types / use of variables or objects • modular structure / functions / procedures / subroutines • subroutine parameters • Specific types of statement, e.g. Input, Output, File operations • Code format • Operators <p>Mark as follows: Any two from above, or valid alternative Accept by example</p>	Max 2

Question	Answer	Marks																																										
2(a)	<table border="1"> <thead> <tr> <th>StartNumber</th> <th>EndNumber</th> <th>Divisor</th> <th>NumberFound</th> <th>Number</th> <th>Remainder</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>11</td> <td>13</td> <td>2</td> <td>0</td> <td>11</td> <td>1</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>12</td> <td>0</td> <td>12</td> </tr> <tr> <td></td> <td></td> <td></td> <td>1</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>13</td> <td>1</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Count: 1</td> </tr> </tbody> </table> <p>One mark for correct Number column One mark for correct Remainder column One mark for correct Output</p>	StartNumber	EndNumber	Divisor	NumberFound	Number	Remainder	Output	11	13	2	0	11	1						12	0	12				1								13	1								Count: 1	3
StartNumber	EndNumber	Divisor	NumberFound	Number	Remainder	Output																																						
11	13	2	0	11	1																																							
				12	0	12																																						
			1																																									
				13	1																																							
						Count: 1																																						
2(b)	<p>Mark as follows:</p> <ul style="list-style-type: none"> • For a (given) range of values • Counts the number of times one number (numerator) is an exact divisor of the other • Outputs each numerator (only) • Outputs the count <p>Accept by example No mark for:</p> <ul style="list-style-type: none"> • ...calculate the remainder • ...add one to NumberFound 	3																																										

Question	Answer	Marks
2(c)	<pre> graph TD Start([START]) --> Input[/INPUT StartNumber, EndNumber, Divisor/] Input --> Init1[NumberFound ← 0] Init1 --> Init2[Number ← StartNumber] Init2 --> LoopStart(()) LoopStart --> CalcRem[Remainder ← MODULUS(Number, Divisor)] CalcRem --> Dec1{Remainder = 0?} Dec1 -- YES --> OutNum[/OUTPUT Number/] OutNum --> IncFound[Increment NumberFound] Dec1 -- NO --> Dec2{Number = EndNumber?} IncFound --> LoopStart Dec2 -- NO --> IncNum[Increment Number] Dec2 -- YES --> OutCount[/OUTPUT "Count: " & NumberFound/] IncNum --> LoopStart OutCount --> Stop([STOP]) </pre>	10

Question	Answer	Marks
2(c)	<p>Mark as follows:</p> <ul style="list-style-type: none">• One mark for START and STOP / END• One mark for bracketed pair• One mark for each of other labelled boxes (shape must be correct for decision box) <p>Decision box outputs must have two outputs and at least one label (Yes / No) Different statement categories should not appear in the same symbol (e.g. assignment and I/O)</p> <p>No mark for symbol (or pair) if parent missing or logically incorrect (except for START/END)</p> <p>Full marks should be awarded for functionally equivalent solutions.</p>	

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Question	Answer	Marks
3(a)	<pre> PROCEDURE BubbleSort DECLARE Temp : STRING DECLARE FirstID, SecondID : INTEGER DECLARE NoSwaps : BOOLEAN DECLARE Boundary : INTEGER Declare J : INTEGER Boundary ← 99 REPEAT NoSwaps ← TRUE FOR J ← 1 TO Boundary FirstID ← UserNameArray[J] SecondID ← UserNameArray[J + 1] IF FirstID > SecondID THEN Temp ← UserNameArray[J] UserNameArray[J] ← UserNameArray[J + 1] UserNameArray[J + 1] ← Temp NoSwaps ← FALSE ENDIF ENDFOR Boundary ← Boundary - 1 UNTIL NoSwaps = TRUE ENDPROCEDURE </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1. Procedure heading and ending (allow array as input parameter) 2. Variable declaration for counter / index (integer) or temp (string) 3. Outer working loop 4. Inner loop with suitable range 5. Correct comparison in a loop 6. Correct swap of complete array element in a loop 7. Set flag to indicate swap in inner loop and resetting in outer loop 8. Reducing Boundary in a loop 	8

Question	Answer	Marks
3(b)	<p>Pseudocode solution included here for development and clarification of mark scheme. Programming language example solutions appear in the Appendix.</p> <pre> PROCEDURE FindRepeats DECLARE i, RepeatCount: INTEGER DECLARE FirstID, SecondID: STRING RepeatCount ← 0 FOR i ← 2 TO 100 FirstID ← LEFT(UsernameArray[i - 1],6) SecondID ← LEFT(UsernameArray[i],6) IF FirstID = SecondID THEN RepeatCount ← RepeatCount + 1 OUTPUT(UsernameArray[i]) ENDIF ENDFOR IF RepeatCount = 0 THEN OUTPUT "The array contains no repeated UserIDs" ELSE OUTPUT "There are " & RepeatCount & " repeated userIDs" ENDIF ENDPROCEDURE </pre> <p>Mark as follows (all must be correct syntax for chosen language):</p> <ol style="list-style-type: none"> 1. Procedure heading and ending 2. Variable declaration for INTEGER (comment in Python) and initialisation for RepeatCount (or equivalent name) 3. Loop 4. Extraction of UserID in a loop 5. Correct comparison of consecutive elements... in a loop 6. ...output correct array element (NOT original, only duplicates) in a loop 7. increment RepeatCount following a comparison in a loop 8. Correct conditional statement checking RepeatCount (or equivalent) and then two correct final OUTPUT statements 	Max 8

Question	Answer	Marks
3(c)(i)	<ul style="list-style-type: none"> • Problem definition • Design • Coding / programming • Testing • Documentation • Implementation • Maintenance 	3
3(c)(ii)	<u>Integrated Development Environment</u> or a suitable description	1
3(c)(iii)	<p>Examples include:</p> <ul style="list-style-type: none"> • context sensitive prompts • (dynamic) syntax checking • use of colours to highlight key words / pretty printing • Formatting • Single-stepping • Breakpoints • Report / watch window • (UML) modelling • Compiler/interpreter • Text editor 	Max 2
3(c)(iv)	Run-time	1

Question	Answer	Marks												
4(a)	<table border="1"> <thead> <tr> <th>Value</th> <th>Formatted String</th> </tr> </thead> <tbody> <tr> <td>1327.5</td> <td>"□ 1327.50"</td> </tr> <tr> <td>1234</td> <td>"□ 1234.00"</td> </tr> <tr> <td>7.456</td> <td>"□□□ 07.45"</td> </tr> </tbody> </table> <p>Leading spaces must be present</p>	Value	Formatted String	1327.5	"□ 1327.50"	1234	"□ 1234.00"	7.456	"□□□ 07.45"	2				
Value	Formatted String													
1327.5	"□ 1327.50"													
1234	"□ 1234.00"													
7.456	"□□□ 07.45"													
4(b)	<table border="1"> <thead> <tr> <th>Value</th> <th>Required output</th> <th>Mask</th> </tr> </thead> <tbody> <tr> <td>1234.00</td> <td>"1,234.00"</td> <td>"0,000.00"</td> </tr> <tr> <td>3445.66</td> <td>"£3,445.66"</td> <td>"£0,000.00"</td> </tr> <tr> <td>10345.56</td> <td>"\$□□10,345"</td> <td>"\$##00,000"</td> </tr> </tbody> </table> <p>Currency and 'punctuation' symbols must be as shown</p>	Value	Required output	Mask	1234.00	"1,234.00"	"0,000.00"	3445.66	"£3,445.66"	"£0,000.00"	10345.56	"\$□□10,345"	"\$##00,000"	3
Value	Required output	Mask												
1234.00	"1,234.00"	"0,000.00"												
3445.66	"£3,445.66"	"£0,000.00"												
10345.56	"\$□□10,345"	"\$##00,000"												

Question	Answer	Marks
5(a)	<pre>PROCEDURE MakeNewfile DECLARE OldFileLine : STRING DECLARE NewFileLine : STRING OPENFILE "EmailDetails" FOR READ OPENFILE "NewEmailDetails" FOR WRITE WHILE NOT EOF("EmailDetails") READFILE "EmailDetails", OldFileLine NewFileLine ← "00" & OldFileLine WRITEFILE "NewEmailDetails", NewFileLine ENDWHILE CLOSEFILE "EmailDetails" CLOSEFILE "NewEmailDetails" ENDPROCEDURE</pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1. Variable declaration of STRING for OldFileLine (or equivalent) 2. Open EmailDetails for READ 3. Open NewEmailDetails for WRITE 4. Correct loop checking for EOF (EmailDetails) 5. Reading a line from EmailDetails in a loop 6. Correct concatenation in a loop 7. Writing a line to NewEmailDetails in a loop <p>Closing both files</p>	8
5(b)	<p>Invalid string examples:</p> <p>A string with nothing before '@'</p> <p>A string with nothing after '@'</p> <p>A string with 1 or 2 characters after '@'</p> <p>A string with no '@' symbol</p> <p>A string with more than one '@' symbol</p> <p>Explanation</p> <p>Sensible explanation mapping each given string to an individual rule</p> <p>One mark for string</p> <p>One mark for explanation</p> <p>Each rule should be tested once only</p>	6

Programming Example Solutions**Q3(b): Visual Basic**

```
Sub FindRepeats()  
    Dim Repeats As Integer  
    Dim i As Integer  
    Dim FirstID As String  
    Dim SecondID As String  
  
    Repeats = 0  
    For i = 1 To 99  
        FirstID = Left(UsernameArray(i), 6)  
        SecondID = Left(UsernameArray(i + 1), 6)  
        If FirstID = SecondID Then  
            Console.WriteLine(UsernameArray(i + 1))  
            Repeats = Repeats + 1  
        End If  
    Next i  
  
    If Repeats = 0 Then  
        Console.WriteLine("The array contains no repeated UserIDs")  
    Else  
        Console.WriteLine("There are " & Repeats & " repeated UserIDs")  
    End If  
  
End Sub
```

Alternative:

```
Sub FindRepeats ()  
  
    Dim RepeatCount, i As Integer  
    Dim FirstID, SecondID As String  
  
    RepeatCount = 0  
    For i = 1 to 99  
        FirstID = Left(UsernameArray(i-1),6)  
        SecondID = Left(UsernameArray(i),6)  
        If FirstID = SecondID then  
            Console.WriteLine (UsernameArray(i))  
            RepeatCount = RepeatCount + 1  
        End If  
    Next i  
  
    If RepeatCount = 0 then  
        Console.WriteLine ("The array contains no repeated UserIDs")  
    Else  
        Console.WriteLine ("There are "& RepeatCount & " repeated UserIDs")  
    End If  
  
End Sub
```

Q3(b): Pascal

```
procedure FindRepeats ();  
  
var  
  RepeatCount, i : integer;  
  FirstID, SecondID : string;  
  
begin  
  RepeatCount := 0;  
  for i := 1 to 99 do  
    begin  
      FirstID := Copy(UsernameArray[i-1],1,6);  
      SecondID := Copy(UsernameArray[i],1,6);  
      if FirstID = SecondID then  
        begin  
          writeln (UsernameArray[i]);  
          RepeatCount := RepeatCount + 1;  
        end;  
      end;  
  
      if RepeatCount = 0 then  
        writeln ('The array contains no repeated UserIDs')  
      else  
        writeln ('There are ', RepeatCount, ' repeated UserIDs')  
    end;  
end;
```

Q3(b): Python

```
def FindRepeats():
    #Repeats, i Integer
    #FirstID, SecondID string
    Repeats = 0
    for i in range(0, len(UsernameArray)-1):
        FirstID = (UsernameArray[i])[:6]
        SecondID = (UsernameArray[i+1])[:6]
        if FirstID == SecondID:
            print(UsernameArray[i+1])
            Repeats = Repeats + 1
        if Repeats == 0:
            print("The array contains no repeated UserIDs")
        else:
            print("There are ", Repeats, " repeated UserIDs")
```

Alternative:

```
def FindRepeats ():

    RepeatCount = 0                                ## Defined as an integer

    for i in range (1,100):                        ## depending on next two
lines(0,99) (2,101)
        FirstID = UsernameArray[i-1]              ## Defined as string
        SecondID = UsernameArray[i]               ## Defined as string
        if FirstID[0:6] == SecondID[0:6]:        ## Using split
            print (UsernameArray[i])
            RepeatCount += 1

    if repeatCount == 0:
        print ('The array contains no repeated UserIDs')
    else:
        print ('There are ', RepeatCount, ' repeated UserIDs')
```