Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

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COMPUTER SCIENCE **9608/21**

Paper 2 Written Paper **October/November 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.

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

Question	Answer	Marks
1(a)(i)	<table><tr><th>Data value</th><th>Data type</th></tr><tr><td>27</td><td>INTEGER</td></tr><tr><td>"27"</td><td>STRING</td></tr><tr><td>"27.3"</td><td>STRING</td></tr><tr><td>TRUE</td><td>BOOLEAN</td></tr><tr><td>27/3/2015</td><td>DATE // DATETIME</td></tr><tr><td>27.3</td><td>REAL</td></tr></table> One mark for each data type Mark first data type given in each case	**6**
1(a)(ii)	1D Array // 1DList	**2**
1(a)(iii)	• Each character is represented by an <u>unique</u> / <u>corresponding</u> • binary code / integer / value	**2**
1(b)	• 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 One mark per answer	**Max 2**
| 1(c) | ```
CASE OF MyVar
    1: CALL Proc1()
    2: CALL Proc2()
    3: CALL Proc3()
    OTHERWISE OUTPUT "Error"
ENDCASE
```<br><br>One mark for:<br><br>•   First line and ENDCASE<br>•   **All** clauses for 1, 2 and 3<br>•   'OTHERWISE' clause<br>•   OUTPUT statement | **4** |

Question	Answer	Marks
1(d)	Ability to recognise: • 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 Mark as follows: Any two from above, or valid alternative Accept by example	**Max 2**

Question	Answer	Marks
2(a)	 One mark for correct Number column One mark for correct Remainder column One mark for correct Output	3
2(b)	Mark as follows: • 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 Accept by example No mark for: • ...calculate the remainder • ...add one to `NumberFound`	3

The table image in 2(a):

StartNumber	EndNumber	Divisor	NumberFound	Number	Remainder	Output
11	13	2	0	11	1	
				12	0	12
			1			
				13	1	
						Count: 1

Question	Answer	Marks
2(c)		**10**

Question	Answer	Marks
2(c)	Mark as follows: • 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) 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) No mark for symbol (or pair) if parent missing or logically incorrect (except for START/END) Full marks should be awarded for functionally equivalent solutions.	

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>
	
	Mark as follows:
	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)	Pseudocode solution included here for development and clarification of mark scheme. Programming language example solutions appear in the Appendix.
	
	``
	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
	``
	
	Mark as follows (all must be correct syntax for chosen language):
	
	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)	• 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)	Examples include: • 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><tr><th>Value</th><th>Formatted String</th></tr><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></table> Leading spaces must be present	**2**
4(b)	<table><tr><th>Value</th><th>Required output</th><th>Mask</th></tr><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></table> Currency and 'punctuation' symbols must be as shown	**3**

Question	Answer	Marks
| 5(a) | ```
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
```<br><br>Mark as follows:<br>1.   Variable declaration of `STRING` for `OldFileLine` (or equivalent)<br>2.   Open `EmailDetails` for `READ`<br>3.   Open `NewEmailDetails` for `WRITE`<br>4.   Correct loop checking for `EOF(EmailDetails)`<br>5.   Reading a line from `EmailDetails` **in a loop**<br>6.   Correct concatenation **in a loop**<br>7.   Writing a line to `NewEmailDetails` **in a loop**<br>Closing both files | 8 |
| 5(b) | **Invalid string examples:**

A string with nothing **before** '@'
A string with nothing **after** '@'
A string with 1 or 2 characters after '@'
A string with no '@'symbol
A string with more than one '@' symbol

Explanation
Sensible explanation mapping each given string to an individual rule

One mark for string
One mark for explanation
Each rule should be tested once only | 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

```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;
```

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')
```