Cambridge International AS & A Level

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COMPUTER SCIENCE **9608/23**

Paper 2 Written Paper **October/November 2017**

MARK SCHEME

Maximum Mark: 75

Published

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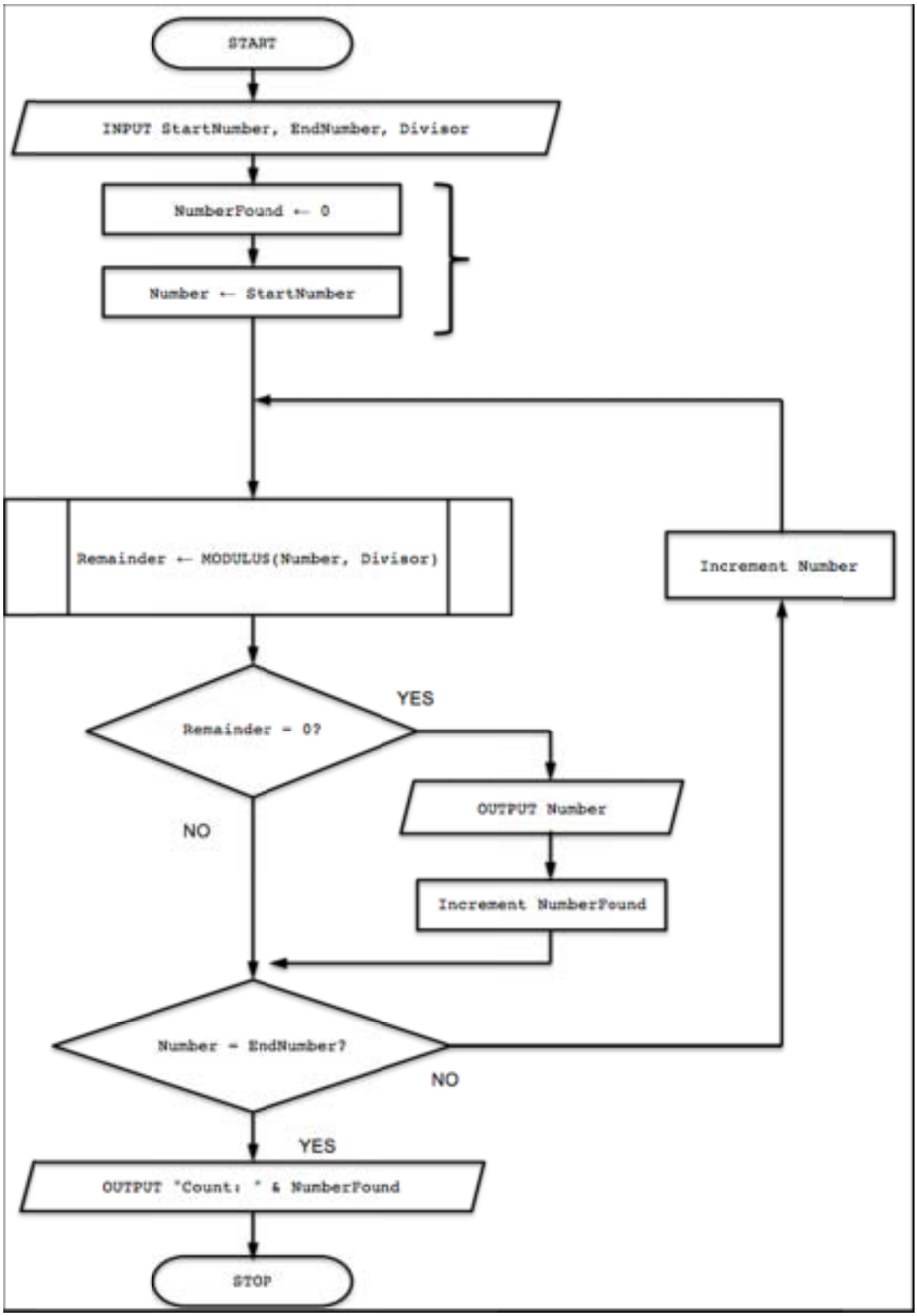
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)(i)</td><td>
<table>
<tr><th>Data value</th><th>Data type</th></tr>
<tr><td>27</td><td>INTEGER</td></tr>
<tr><td>"27"</td><td>STRING</td></tr>
<tr><td>"27.3"</td><td>STRING</td></tr>
<tr><td>TRUE</td><td>BOOLEAN</td></tr>
<tr><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</td><td>6</td></tr>
<tr><td>1(a)(ii)</td><td>1D Array // 1DList</td><td>2</td></tr>
<tr><td>1(a)(iii)</td><td>• Each character is represented by an <u>unique</u> / <u>corresponding</u>
• binary code / integer / value</td><td>2</td></tr>
<tr><td>1(b)</td><td>• 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</td><td>Max 2</td></tr>
<tr><td>1(c)</td><td>
<pre>CASE OF MyVar
   1: CALL Proc1()
   2: CALL Proc2()
   3: CALL Proc3()
   OTHERWISE OUTPUT "Error"
ENDCASE</pre>
One mark for:

• First line and ENDCASE
• All clauses for <code>1</code>, <code>2</code> and <code>3</code>
• <code>'OTHERWISE'</code> clause
• <code>OUTPUT</code> statement</td><td>4</td></tr>
</table>

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)	<table><tr><th>StartNumber</th><th>EndNumber</th><th>Divisor</th><th>NumberFound</th><th>Number</th><th>Remainder</th><th>Output</th></tr><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></table> 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**

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.	**Max 8**

```
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

Question	Answer	Marks
3(c)(i)	• Problem definition • Design • Coding / programming • Testing • Documentation • Implementation • Maintenance	**3**
3(c)(ii)	Integrated Development Environment 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)	<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>
	Mark as follows:
	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**
	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

```
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')
```