Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

COMPUTER SCIENCE **9608/21**

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

MARK SCHEME

Maximum Mark: 75

Published

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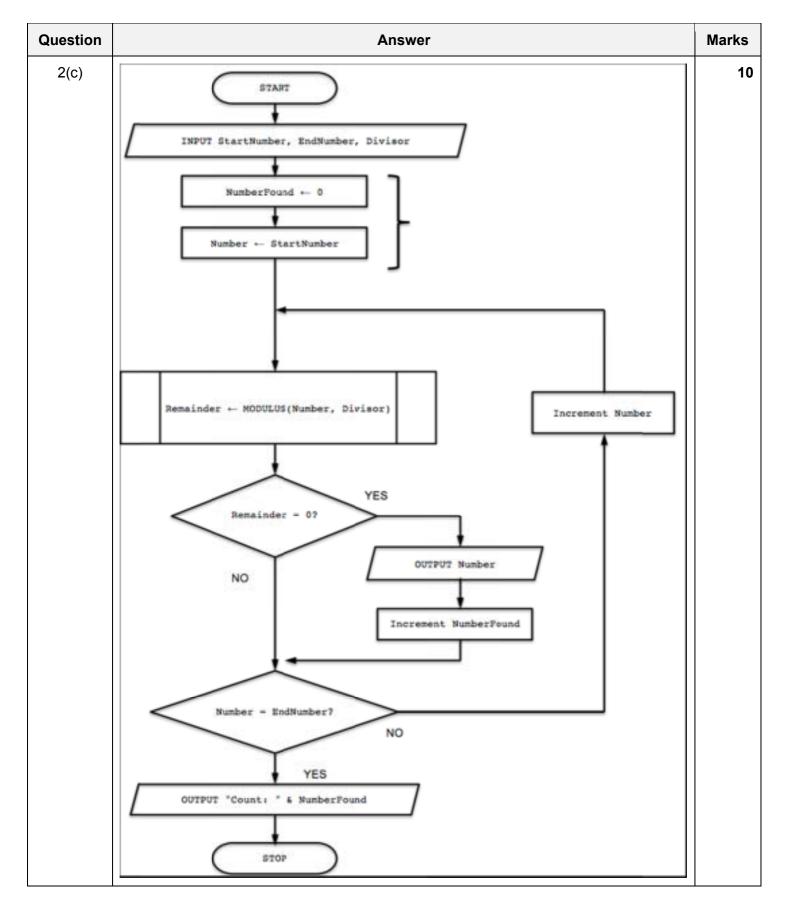| Question	Answer	Marks
1(a)(i)	<table><tr><th>Data value</th><th>Data type</th></tr><tr><td>27</td><td>INTEGER</td></tr><tr><td>"27"</td><td>STRING</td></tr><tr><td>"27.3"</td><td>STRING</td></tr><tr><td>TRUE</td><td>BOOLEAN</td></tr><tr><td>27/3/2015</td><td>DATE // DATETIME</td></tr><tr><td>27.3</td><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
	``
	One mark for:
	
	• First line and ENDCASE
	• **All** clauses for 1, 2 and 3
	• 'OTHERWISE' clause
	• 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

Question	Answer	Marks
2(c)		10

The flowchart shows:

START

INPUT StartNumber, EndNumber, Divisor

NumberFound ← 0

Number ← StartNumber

Remainder ← MODULUS(Number, Divisor)

Remainder = 0? — YES → OUTPUT Number → Increment NumberFound

NO

Number = EndNumber? — NO → Increment Number

YES

OUTPUT "Count: " & NumberFound

STOP

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)	```
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
```

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)	<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
	``
	
	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

```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:

```python
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')
```