Cambridge International Examinations
Cambridge International Advanced Level

COMPUTER SCIENCE **9608/41**

Paper 4 Written Paper **May/June 2016**

MARK SCHEME

Maximum Mark: 75

Published

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Question			Answer		Marks
1	**(a)**	**(i)**	`TYPE LinkedList` 1 `(DECLARE) Surname : STRING` ⎤ 1 `(DECLARE) Ptr : INTEGER` ⎦ `ENDTYPE` 1 **Accept:** `LinkedList : RECORD` 1 `Surname : STRING` ⎤ 1 `Ptr : INTEGER` ⎦ `ENDRECORD` 1 **Accept:** `TYPE LinkedList = RECORD` 1 `Surname : STRING` ⎤ 1 `Ptr : INTEGER` ⎦ `ENDTYPE / ENDRECORD` 1 **Accept:** `STRUCTURE LinkedList` 1 `(DECLARE) Surname : STRING` ⎤ 1 `(DECLARE) Ptr : INTEGER` ⎦ `ENDSTRUCTURE` 1 Accept `AS` / `OF` instead of `:`		**3**
		(ii)	`(DECLARE) `**`SurnameList[1:5000] : LinkedList`** Accept `AS` / `OF` instead of `:` Accept `()` instead of `[]` Accept without lower bound Index separator can be `,` `:` `...`		**2**
	(b)	**(i)**	`Wu` Accept with quotes		**1**
		(ii)	`6`		**1**
	(c)	**(i)**	`IsFound` + relevant description 1 `BOOLEAN` 1		**2**

Question	Answer	Marks

(ii)	Accept `()` instead of `[]`
	
	`01  Current ← `**`StartPtr`**
	`02  IF Current = 0`
	`03   THEN`
	`04   OUTPUT `**`"Empty List"`**` (or similar message)`
	`                (accept without quotes)  Reject "Error"`
	`05   ELSE`
	`06   IsFound ← `**`FALSE`**
	`07   INPUT ThisSurname`
	`08   REPEAT`
	`09   IF `**`SurnameList[Current].Surname`**` = ThisSurname`
	`10   THEN`
	`11    IsFound ← TRUE`
	`12    OUTPUT "Surname found at position ", Current`
	`13   ELSE`
	`14    // move to the next list item`
	`15   `**`Current ← SurnameList[Current].Ptr`**
	`16   ENDIF`
	`17   UNTIL IsFound = TRUE OR `**`Current = 0`**
	`18   IF IsFound = FALSE`
	`19   THEN`
	`20    OUTPUT "Not Found"`
	`21   ENDIF`
	`22  ENDIF`
		6

	Accept = for assignment	
2 (a) (i)	A procedure which is defined in terms of itself // A procedure which makes a call to itself // A procedure that calls itself	**1**
(ii)	08 // 8	**1**

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Question	Answer	Marks
(b) (i)	 Note: Final mark only if no additional entries in table Accept last row to show all final values	**4**
(ii)	Any one from: Deletes/removes parameter value/ Item (from the array `MyList`) // Deletes the first entry (in `MyList`) that equals or is bigger than `Item` Overwrites `Item` by moving subsequent items up/down/across/left R right	**1**

Question	Answer	Marks
3 (a)		7

Mark as follows:

Label F_TRAILER	1
Label TRANS	1
Customer box (Accept label Customer)	1
Hire box (Accept label Hire)	1
Customer fields : Customer Name, CustomerID/IDnumber	1
Hire fields: Car Reg	1
Hire fields: Hire start date, Number of days hired	1

accept level 5 fields in any order
Ignore parent

Question	Answer	Marks
(b)		5

Mark as follows:

Selection symbol x 2 (Car-hire / No car-hire)   1
Labelling for `CAR_HIRE` / `NO_HIRE` (accept similar labels*)   1
Labelling for <u>Car registration</u> and Car total / Total hires   1
Iteration symbol for `HIRE` (accept in `HIRE_LIST` as a BOD)   1
Labelling for start date and number of days (as per diagram)   1

* For `CAR_HIRE` label:
Accept: Hires / hired / Car data / hire data / hire record / one or more hires

Question			Answer	Marks
4	**(a)**	**(i)**	`a03, h07, a23` accept in any order, must be lower case	1
		(ii)	The car must <u>pass</u> (both) brake test **and** tyres test	1

	(b)		`retestAllowed(`**ThisCar**`)`
			               1
			`If `**`(testBrakes(ThisCar, pass) and testTyres(ThisCar, fail))`**
			                                 1
			 `or (testBrakes(ThisCar, fail) and testTyres(ThisCar, pass))`
			   1
			(one mark per bold underlined all correct)
			accept another variable instead of **ThisCar**, but must be same throughout.
				3

	(c)	**(i)**	`a07`
			`[p03]`
			
			must be `[]`
			must be lower case, but don't penalise twice, so follow through from part(b)
				2

		(ii)	`[p05,m04]`	1
		(iii)	`[ ]`	1
	(d)		`[ ]`	1
5	**(a)**	**(i)**	<table><tr><th>Mark</th><th>Description</th><th>Expected result (Grade)</th></tr><tr><td></td><td>Normal</td><td>FAIL/PASS/MERIT/DISTINCTION</td></tr><tr><td></td><td>Abnormal</td><td>Error</td></tr><tr><td></td><td>Extreme/Boundary</td><td>FAIL/PASS/MERIT/DISTINCTION</td></tr></table> 3 × (mark + matching grade) for abnormal data accept negative values, non-integer values, Expected Result: Error 0 and marks above 100 are still acceptable values Do not accept FAIL in expected result column for Abnormal data	3
		(ii)	(The programmer is) concerned only with the input (i.e. the mark) to the function and monitoring the expected output (i.e. the grade) // can compare expected result and actual result	1
	(b)		Exception: 1. situation causing a crash / run-time error / fatal error 1 Exception handling: 2. code which is called when a run-time error occurs 1 3. … to avoid the program terminating/crashing 1	3

Question	Answer	Marks
(c)	1 Open a non-existent file 2 Directory path does not exist 3 Attempt to read past the end of the file // attempt to read an empty file 4 Array subscript is out of range 5 Non-integer value / corrupt data read 6 File already open in a different mode // wrong file permissions	**Max 3**
(d) (i)	`09` // `9`	**1**

(ii)	1 Line 11 catches exceptions (only) between lines 05 and 10 1
	2 Line 11 stops the program from crashing 1
	3 Different exception types recognised 1
	4 Each exception type has an appropriate message output 1
	5 The program language has an (object) type `EXCEPTION` 1
	6 `ThisException` is the instance of `EXCEPTION` which has been raised 1
	7 `EXCEPTION` objects have a 'Message' property
	   // the message property for `ThisException` is
	   "Arithmetic operation resulted in an overflow" 1
		Max 3

6 (a)	 Max 3 marks if extra states/transitions added.	**4**

Question	Answer	Marks
(b) (i)	Mark as follows: 1 Declaration for array (character or string data type) 2 FOR loop for x going from 1 to 8, generating column index used in array 3 FOR loop for y going from 1–2, 3–6, 7–8 (Accept all squares being set to `'E'` and then overwritten with `'B'`, `'W'` respectively) 4 Setting squares to `'B'`, `'E'`, `'W'` (must be in quotes, accept single or double)	**4**
(ii)	Mark as follows: 1 Procedure heading and declaration of 2 local variables 1 2 Establishing the stopper colour – opposite to the mover 1 3 Test for piece in column 1 (x>1) // column 8 (x<8) 1 4 Test for 'E' 1 5 Correct method for moving left // for moving right 1 6 until edge of board reached 1 7 until other colour (stopper colour) encountered 1 8 until own colour encountered (PieceColour) 1 9 Correct output for cell indexes 1 (accept for moving in 1 direction only) 10 including the 'REMOVE' message 1 Note: must use given parameter identifiers: PieceColour, xCurrent, yCurrent	**Max 5**
(c) (i)	Classes could be designed for : • the board • a piece Containment (Board contains Pieces) The pieces are <u>instances/objects</u> (of the Piece class)	**Max 2**

Question	Answer	Marks
(ii)	Accept any reasonable answer, for example: `BOARD` class: Properties: • Number of squares / size / dimensions • Current state of all squares Methods: – • Set the starting board • Capture the finishing state of the board • Display the state of the board after each move `PIECE` class: Properties: • Starting x position • Starting y position • Current x position • current y position • Colour • State / Removed / Active Methods: • Move piece • Remove piece Mark as follows: two correct responses are worth 1 mark Accept other classes: Game, Player	**Max 2**

Programming code

6 (b) (i)

VB.NET
```
Dim Board(8, 8) As Char
Dim Row, Column As Integer
For Row = 1 To 2
    For Column = 1 To 8
        Board(Row, Column) = "B"
    Next
Next
For Row = 3 To 6
      For Column = 1 To 8
        Board(Row, Column) = "E"
    Next
Next
For Row = 7 To 8
    For Column = 1 To 8
        Board(Row, Column) = "W"
    Next
Next
```

PASCAL
```
var Row, Column : integer;
    Board : array[1..8, 1..8] of char;
begin
    for Row := 1 to 2 do
      for Column := 1 to 8 do
        Board[Row, Column] := 'B';
    for Row := 3 to 6 do
      for Column := 1 to 8 do
         Board[Row, Column] := 'E';
    for Row := 7 to 8 do
      for Column := 1 to 8 do
        Board[Row, Column] := 'W';
end.
```

PYTHON
```
Board = [["" for j in range(9)] for i in range(9)]
for Row in range(1, 3) :
    for Column in range(1, 9) :
        Board[Row][Column] = "B"
for Row in range(3, 7) :
    for Column in range(1, 9) :
        Board[Row][Column] = "E"
for Row in range(7, 9) :
    for Column in range(1, 9) :
        Board[Row][Column] = "W"
```

Alternative declarations of Board array :

```
Board = [[""] * 9 for i in range(9)]

Board = [[]]
for i in range(9) :
    for j in range(9) :
        Board.append("")
```

Instead of initialising with empty string, could initialise with 'E'. this would then only require 'B' and 'W' loops later.

For example:

```
Board = [["E"] * 9 for i in range(9)] // Board =[["E"]*9]*9
for Row in range(1, 3) :
    for Column in range(1, 9) :
        Board[Row][Column] = "B"
for Row in range(7, 9) :
    for Column in range(1, 9) :
        Board[Row][Column] = "W"

Board =[]
for i in range(9):
    Board.append(["E"]*9)
```

6 (b) (ii)

VB.NET
```
Sub ValidMoves(ByVal PieceColour As Char, ByVal xCurrent As Integer,
ByVal yCurrent As Integer)
    Dim i As Integer
    Dim StopperColour As Char
    Dim NoFurther As Boolean
    If PieceColour = "B" Then
        StopperColour = "W"
    Else
        StopperColour = "B"
    End If
    Console.WriteLine("Possible moves are : ")
    If xCurrent <> 1 Then
        Console.WriteLine("Moving LEFT . . .")
        i = xCurrent – 1
        NoFurther = False
        do
            if Board(i, yCurrent) = "E" Then
                Console.WriteLine(i & " " & yCurrent)
            End If
            if Board(i, yCurrent) = StopperColour Then
                Console.WriteLine(i & " " & yCurrent & " REMOVE PIECE")
                NoFurther = True
            End If
            i = i – 1
        Loop Until i = 0 Or NoFurther = True
    End If
    if xCurrent <> 8 Then
        Console.WriteLine("Moving RIGHT . . .")
        i = xCurrent + 1
        NoFurther = False
        do
            if Board(i, yCurrent) = "E" :
                Console.WriteLine(i & " " & yCurrent)
            End If
            if Board(i, yCurrent) = StopperColour Then
                Console.WriteLine(i & " " & yCurrent & " REMOVE PIECE")
                NoFurther = True
            End If
            i = i + 1
        Loop Until i = 9 Or NoFurther = True
    End If
End Sub
```

PASCAL

```pascal
procedure ValidMoves(PieceColour : char; xCurrent, yCurrent : integer);
var StopperColour : char;
    i : integer;
    NoFurther : boolean;
begin
    if (PieceColour = 'B') then
        StopperColour := 'W'
    else
        StopperColour := 'B';
    writeln('Possible moves are : ');
    if (xCurrent <> 1) then
    begin
        writeln('Moving LEFT . . . ');
        i := xCurrent - 1;
        NoFurther := false;
        repeat
            if (Board[i, yCurrent] = 'E') then
                writeln(intToStr(i) + ' ' + intToStr(yCurrent));
            if (Board[i, yCurrent] = StopperColour) then
            begin
                writeln(intToStr(i) + ' ' + intToStr(yCurrent) + ' REMOVE
                PIECE');
                NoFurther := true;
            end;
            i := i - 1;
        until ((i = 0) or (NoFurther = true));
    end;
    if (xCurrent <> 8) then
    begin
        writeln('Moving RIGHT . . . ');
        i := xCurrent + 1;
        NoFurther := false;
        repeat
            if (Board[i, yCurrent] = 'E') then
                writeln(intToStr(i) + ' ' + intToStr(yCurrent));
            if (Board[i, yCurrent] = StopperColour) then
        begin
            writeln(intToStr(i) + ' ' + intToStr(yCurrent) + ' REMOVE
            PIECE');
            NoFurther := true;
        end;
        i := i + 1;
    until ((i = 9) or (NoFurther = true));
    end;
end;
```

PYTHON

```python
def ValidMoves(PieceColour, xCurrent, yCurrent) :
    if PieceColour == "B" :
        StopperColour = "W"
    else :
        StopperColour = "B"
    print("Possible moves are : ")
    if xCurrent != 1 :
        print("Moving LEFT . . .")
        i = xCurrent - 1
        NoFurther = False
        while i > 0 and NoFurther == False :
            if Board[i][yCurrent] == "E" :
                print(str(i) + " " + str(yCurrent))
            if Board[i][yCurrent] == StopperColour :
                print(str(i) + " " + str(yCurrent) + " REMOVE PIECE")
                NoFurther = True
            i = i - 1
    if xCurrent != 8 :
        print("Moving RIGHT . . .")
        i = xCurrent + 1
        NoFurther = False
        while i < 9 and NoFurther == False :
            if Board[i][yCurrent] == "E" :
                print(str(i) + " " + str(yCurrent))
            if Board[i][yCurrent] == StopperColour :
                print(str(i) + " " + str(yCurrent) + " REMOVE PIECE")
                NoFurther = True
            i = i + 1
```