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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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This document consists of **15** printed pages.

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Question	Answer	Marks
1 (a) (i)	TYPE LinkedList 1 (DECLARE) Surname : STRING 1 (DECLARE) Ptr : INTEGER } 1 ENDTYPE 1 Accept: LinkedList : RECORD 1 Surname : STRING } 1 Ptr : INTEGER 1 ENDRECORD 1 Accept: TYPE LinkedList = RECORD 1 Surname : STRING } 1 Ptr : INTEGER 1 ENDTYPE / ENDRECORD 1 Accept: STRUCTURE LinkedList 1 (DECLARE) Surname : STRING } 1 (DECLARE) Ptr : INTEGER 1 ENDSTRUCTURE 1 Accept AS / OF instead of :	3
(ii)	(DECLARE) <u>SurnameList[1:5000]</u> : <u>LinkedList</u> 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

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Question	Answer	Marks
(ii)	Accept () instead of [] <pre> 01 Current ← <u>StartPtr</u> 02 IF Current = 0 03 THEN 04 OUTPUT "<u>Empty List</u>" (or similar message) (accept without quotes) Reject "Error" 05 ELSE 06 IsFound ← <u>FALSE</u> 07 INPUT ThisSurname 08 REPEAT 09 IF <u>SurnameList[Current].Surname</u> = ThisSurname 10 THEN 11 IsFound ← TRUE 12 OUTPUT "Surname found at position ", Current 13 ELSE 14 // move to the next list item 15 <u>Current ← SurnameList[Current].Ptr</u> 16 ENDIF 17 UNTIL IsFound = TRUE OR <u>Current = 0</u> 18 IF IsFound = FALSE 19 THEN 20 OUTPUT "Not Found" 21 ENDIF 22 ENDIF </pre>	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)	<table><thead><tr><th>Index</th><th>Item</th></tr></thead><tbody><tr><td>1</td><td>9</td></tr><tr><td>2</td><td></td></tr><tr><td>3</td><td></td></tr><tr><td>4</td><td></td></tr><tr><td>5</td><td></td></tr><tr><td>6</td><td></td></tr><tr><td>7</td><td></td></tr><tr><td>8</td><td></td></tr></tbody></table><table><thead><tr><th colspan="10">MyList</th></tr><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th></tr></thead><tbody><tr><td>3</td><td>5</td><td>8</td><td>9</td><td>13</td><td>16</td><td>27</td><td>0</td><td>0</td><td>0</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td>13</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td>16</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>27</td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table> Note: Final mark only if no additional entries in table Accept last row to show all final values	Index	Item	1	9	2		3		4		5		6		7		8		MyList										1	2	3	4	5	6	7	8	9	10	3	5	8	9	13	16	27	0	0	0																								13											16											27											0														4
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(ii)	Any one from: Deletes/removes parameter value/ Item (from the array <code>MyList</code>) // Deletes the first entry (in <code>MyList</code>) that equals or is bigger than <code>Item</code> Overwrites <code>Item</code> by moving subsequent items up/down/across/left R right	1																																																																																																																						

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Question	Answer	Marks
3 (a)	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	7

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Question	Answer	Marks										
(b)	<pre>graph TD CAR_REPORT[CAR_REPORT] --> CAR[CAR*] CAR -- "No hires" --> NO_HIRE[NO_HIRE] CAR -- "One or more hires" --> CAR_HIRE[CAR_HIRE] subgraph Box1 [] NO_HIRE CAR_HIRE end subgraph Box2 [] CR[Car registration] HL[HIRE_LIST] CT[Car total] end Box1 --> Box2 HL --> HIRE[HIRE*] HIRE --> subgraph Box3 [] SD[Start date] ND[Number of days] end</pre> <i>Mark as follows:</i> <table><tr><td>Selection symbol x 2 (Car-hire / No car-hire)</td><td>1</td></tr><tr><td>Labelling for <u>CAR_HIRE</u> / <u>NO_HIRE</u> (accept similar labels*)</td><td>1</td></tr><tr><td>Labelling for <u>Car registration</u> and Car total / Total hires</td><td>1</td></tr><tr><td>Iteration symbol for <u>HIRE</u> (accept in <u>HIRE_LIST</u> as a BOD)</td><td>1</td></tr><tr><td>Labelling for start date and number of days (as per diagram)</td><td>1</td></tr></table> * For <u>CAR_HIRE</u> label: Accept: Hires / hired / Car data / hire data / hire record / one or more hires	Selection symbol x 2 (Car-hire / No car-hire)	1	Labelling for <u>CAR_HIRE</u> / <u>NO_HIRE</u> (accept similar labels*)	1	Labelling for <u>Car registration</u> and Car total / Total hires	1	Iteration symbol for <u>HIRE</u> (accept in <u>HIRE_LIST</u> as a BOD)	1	Labelling for start date and number of days (as per diagram)	1	5
Selection symbol x 2 (Car-hire / No car-hire)	1											
Labelling for <u>CAR_HIRE</u> / <u>NO_HIRE</u> (accept similar labels*)	1											
Labelling for <u>Car registration</u> and Car total / Total hires	1											
Iteration symbol for <u>HIRE</u> (accept in <u>HIRE_LIST</u> as a BOD)	1											
Labelling for start date and number of days (as per diagram)	1											

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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)	<pre> retestAllowed(ThisCar) 1 If (testBrakes(ThisCar, pass) and testTyres(ThisCar, fail)) 1 or (testBrakes(ThisCar, fail) and testTyres(ThisCar, pass)) 1 </pre> (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 border="1"> <thead> <tr> <th>Mark</th><th>Description</th><th>Expected result (Grade)</th></tr> </thead> <tbody> <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> </tbody> </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	Mark	Description	Expected result (Grade)		Normal	FAIL/PASS/MERIT/DISTINCTION		Abnormal	Error		Extreme/Boundary	FAIL/PASS/MERIT/DISTINCTION	3
Mark	Description	Expected result (Grade)												
	Normal	FAIL/PASS/MERIT/DISTINCTION												
	Abnormal	Error												
	Extreme/Boundary	FAIL/PASS/MERIT/DISTINCTION												
(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												

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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 2 Line 11 stops the program from crashing 3 Different exception types recognised 4 Each exception type has an appropriate message output 5 The program language has an (object) type <code>EXCEPTION</code> 6 <code>ThisException</code> is the instance of <code>EXCEPTION</code> which has been raised 7 <code>EXCEPTION</code> objects have a 'Message' property // the message property for <code>ThisException</code> is "Arithmetic operation resulted in an overflow"	1 1 1 1 1 1 1 Max 3
6 (a)	Max 3 marks if extra states/transitions added.	4

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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

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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

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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';
        end for;
    end for;
    for Row := 3 to 6 do
        for Column := 1 to 8 do
            Board[Row, Column] := 'E';
        end for;
    end for;
    for Row := 7 to 8 do
        for Column := 1 to 8 do
            Board[Row, Column] := 'W';
        end for;
    end for;
end.

```

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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])
```

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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

```

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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;
end;

```

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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

```