Cambridge International A Level

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

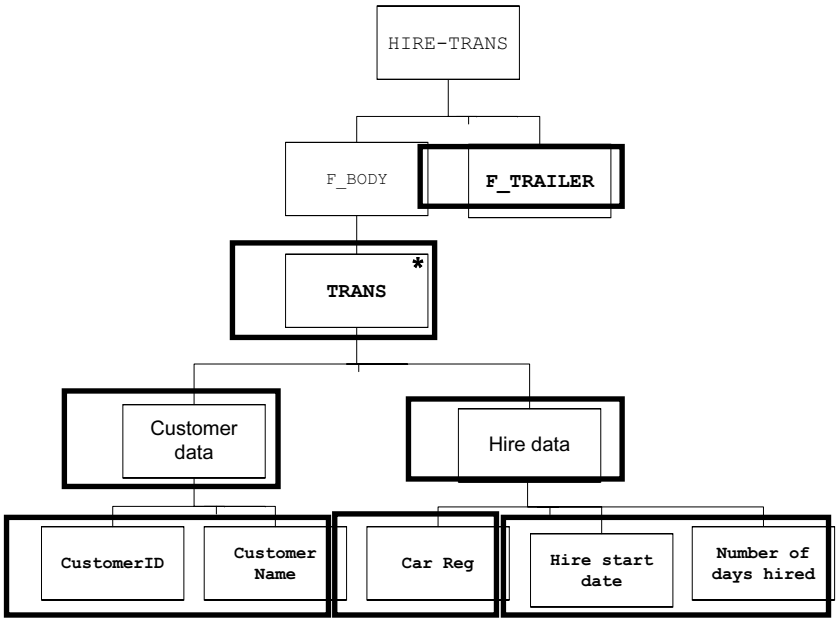
Question	Answer	Marks
(b) (i)		4

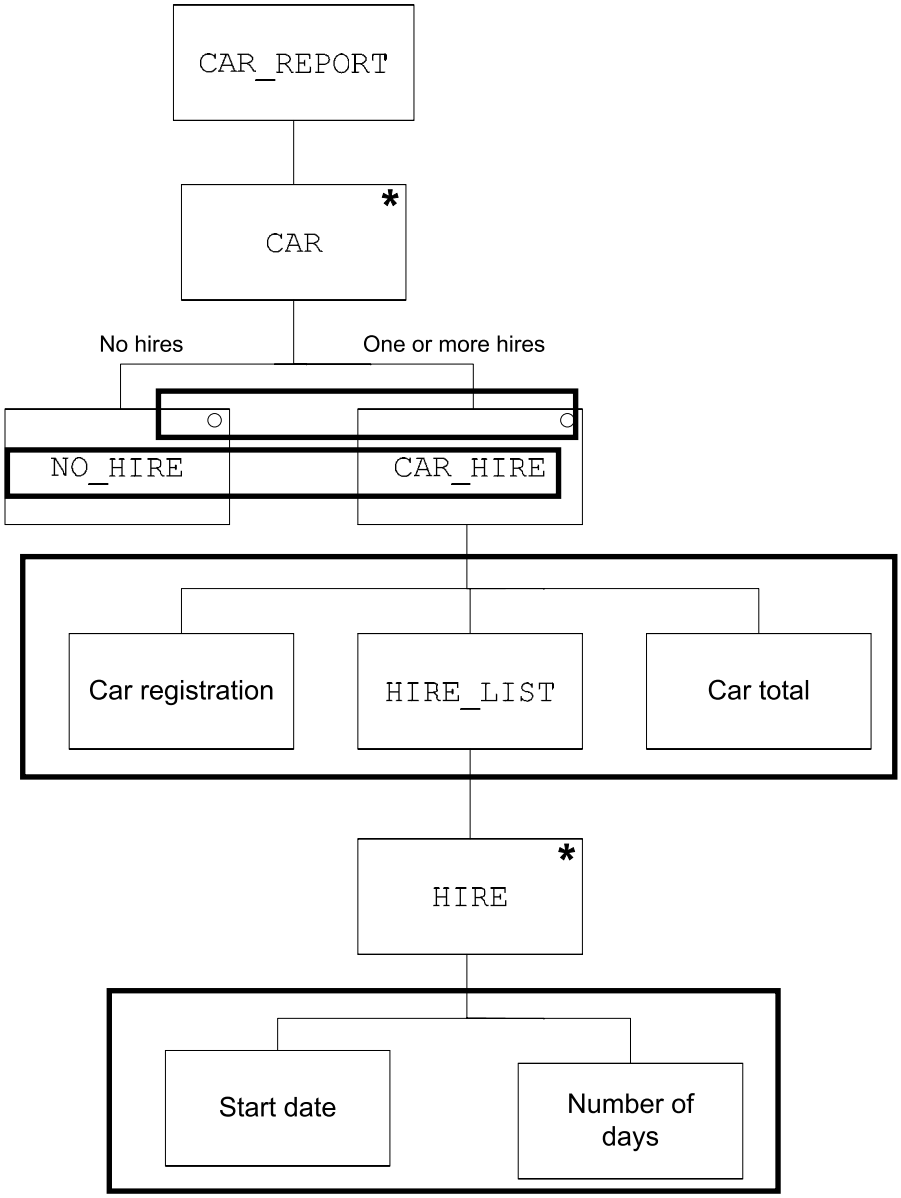
Index	Item
1	**9**
2	
3	
4	
5	
6	
7	
8	

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			

Note: Final mark only if no additional entries in table
Accept last row to show all final values

(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)	 *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

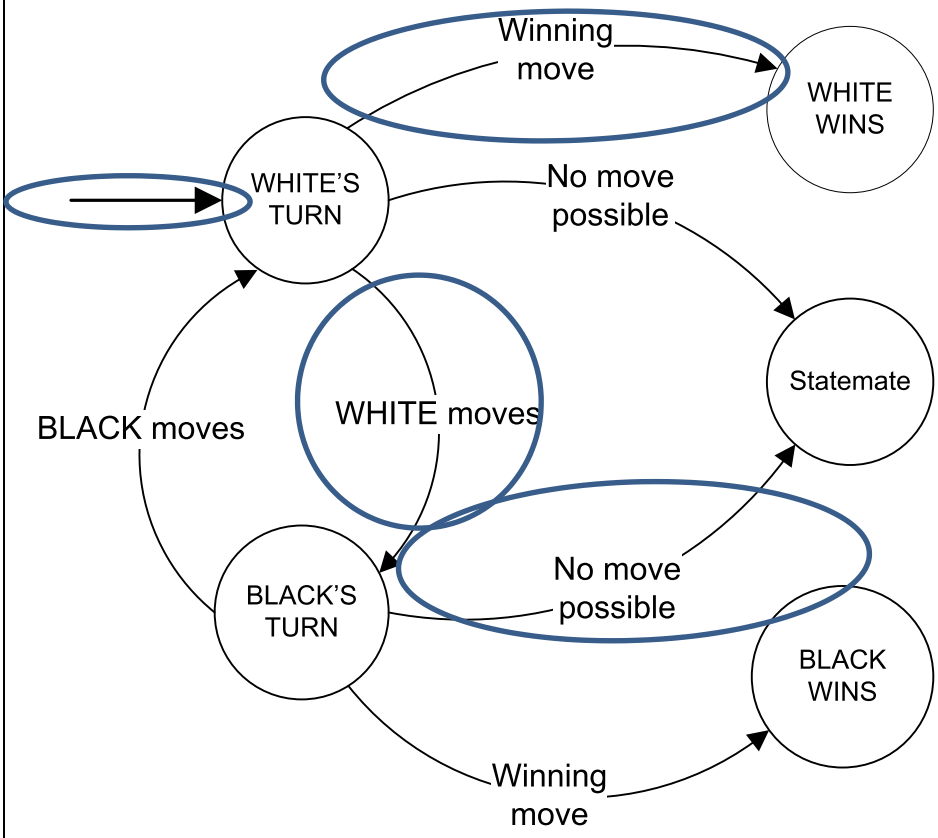
Question	Answer	Marks
(b)		5

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 Car registration 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 pass (both) brake test **and** tyres test	1
(b)	retestAllowed(**ThisCar**) 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

```
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

```
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
```