Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

COMPUTER SCIENCE **9608/42**

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

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

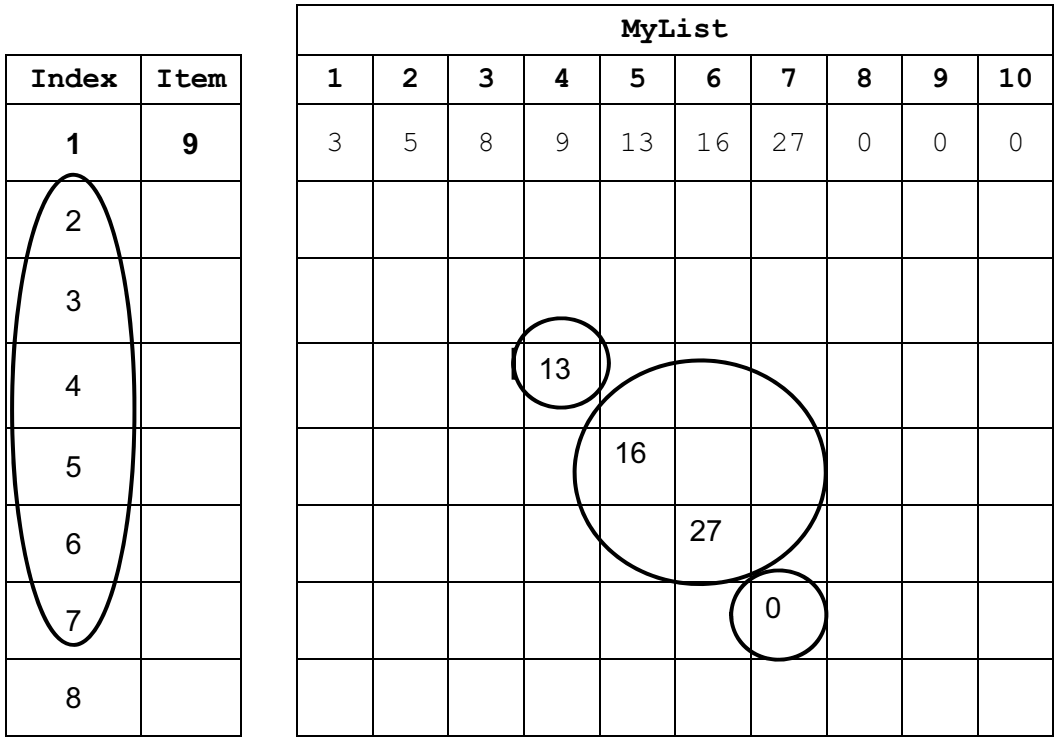
Cambridge is publishing the mark schemes for the May/June 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

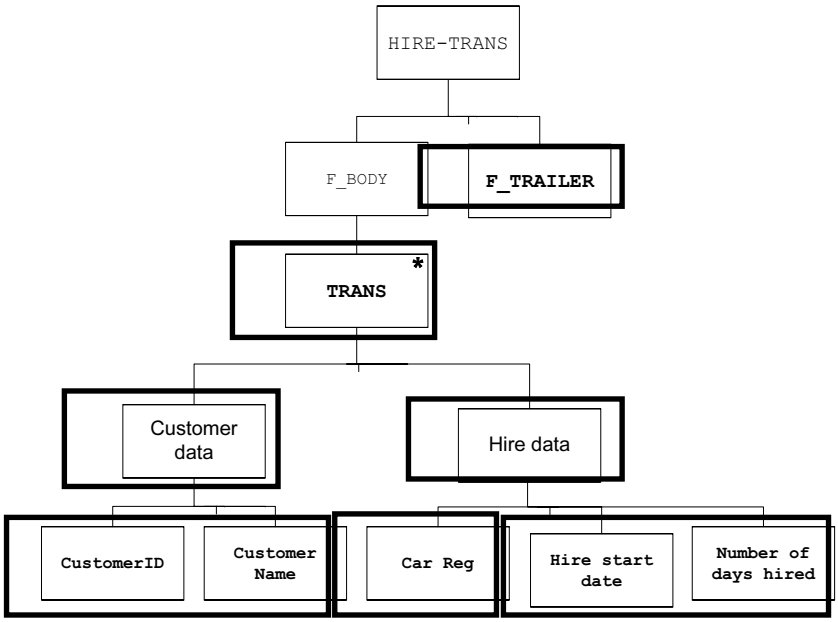
Question	Answer	Marks

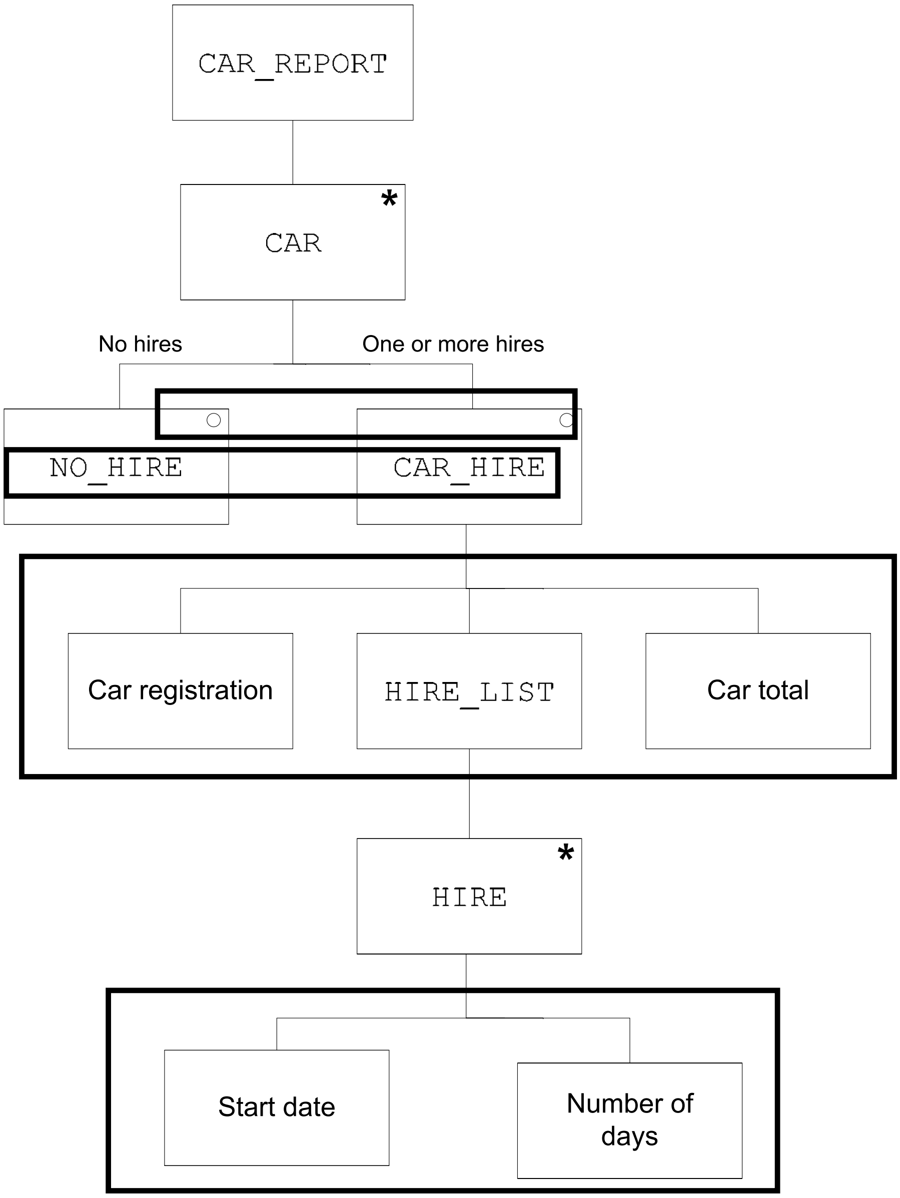
1 (a) (i)	`TYPE LinkedList` 1
	
	`(DECLARE) Surname : STRING` 1
	`(DECLARE) Ptr : INTEGER`
	
	`ENDTYPE` 1
	
	Accept:
	`LinkedList : RECORD` 1
	
	`Surname : STRING` 1
	`Ptr : INTEGER`
	
	`ENDRECORD` 1
	
	Accept:
	`TYPE LinkedList = RECORD` 1
	
	`Surname : STRING` 1
	`Ptr : INTEGER`
	
	`ENDTYPE / ENDRECORD` 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

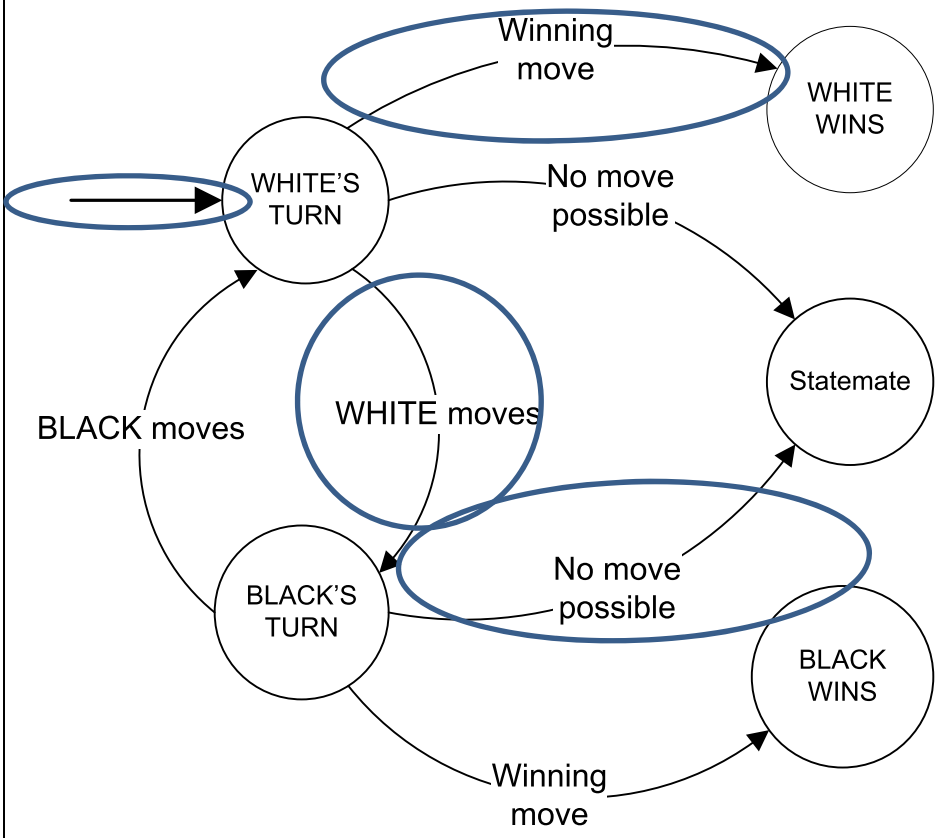
Question	Answer	Marks
(ii)	Accept `()` instead of `[]` 01 Current ← **StartPtr** 02 IF Current = 0 03 THEN 04 OUTPUT **"Empty List"** (or similar message) (accept without quotes) Reject "Error" 05 ELSE 06 IsFound ← **FALSE** 07 INPUT ThisSurname 08 REPEAT 09 IF **SurnameList[Current].Surname** = ThisSurname 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
	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)	 *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	5

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
```