*Answer **all** the questions.*

1. (a) In the context of *data structures*, explain what is meant by a

(i) *queue*; *[2 marks]*

(ii) *stack*. *[2 marks]*

(b) State **one** computer application for which a queue is a suitable data structure. *[1 mark]*

Consider the following class.

```
class Node
{
  public int item;
  public Node next;

  public Node(int d)
  {
    item = d;
    next = null;
  }

  public void displayNode()
  {
    output(item + " ");
  }
}
```

(c) Statement `Node x = new Node(5);` creates an object of class type `Node`. State the output produced by the call `x.displayNode();`. *[1 mark]*

(This question continues on the following page)

(Question 1 continued)

Examine the following linked list implementation of a queue.

```
class MyQueue
{ private Node first;
  private Node last;
  public MyQueue() { first = null;  last = null; }
  public boolean isEmpty() { return first == null; }

  public void enqueue(int x)
  { Node newNode = new Node(x);
    if (isEmpty())
    { first = newNode; }
    else
    { last.next = newNode; }
    last = newNode;
  }

  public int dequeue()
  {
    // Code missing that will remove a node from the queue
  }

  public void displayQueue()
  { if (first == null)
    { output("The queue is empty!"); }
    else
    { Node temp = first;
      while (temp != null)
      { temp.displayNode();
        temp = temp.next;
      }
    }
  }
}
```

(d) The statement `MyQueue x = new MyQueue();` creates an empty queue.

(i) State the output that will be produced after execution of the following statement.

```
x.displayQueue();
```

[1 mark]

(ii) Construct the code for the method `dequeue()`. The method should remove one item from `x` and return the value of the removed item. *[4 marks]*

(iii) State the output that will be produced after execution of the following statements.

```
x.enqueue(2);
x.enqueue(4);
int y = x.dequeue();
output("Deleted item: " + y);
x.enqueue(1);
x.enqueue(7);
output("Items in the queue: ");
x.displayQueue();
```

[3 marks]

(e) Explain how the elements in a non-empty queue could be reversed using a stack. *[6 marks]*

Turn over

2. A car company sells five different models of cars and employs four salesmen. A record of sales for each month can be represented by a table. The first row of the table contains the number of sales of each model by Salesman 1; the second row contains the number of sales of each model by Salesman 2, and so on.

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Salesman 1	12	0	0	5	6
Salesman 2	11	1	3	1	3
Salesman 3	10	11	5	3	0
Salesman 4	9	8	5	4	5

(a) (i) Calculate the total number of sales for Salesman 2. *[1 mark]*

(ii) Calculate the total number of sales of Model 3. *[1 mark]*

The sales data as given above is input into a two-dimensional array named `Sales`, declared as `int[][] Sales = new int[4][5];` that can be logically represented as follows.

Sales	[0]	[1]	[2]	[3]	[4]
[0]	12	0	0	5	6
[1]	11	1	3	1	3
[2]	10	11	5	3	0
[3]	9	8	5	4	5

Examine the following code.

```
public void mystery(int[][] Sales)
{
  for (int n = 0; n < 4; n = n + 1)
  {
    int total = 0;
    for (int m = 0; m < 5; m = m + 1)
    {
      total = total + Sales[n][m];
    }
    output("Total number of sales for Salesman " + (n + 1) + " is " + total);
  }
}
```

(b) State the output of the method call `mystery(Sales)`. *[4 marks]*

(This question continues on the following page)

(Question 2 continued)

(c) Construct the method that will output the total number of sales for each of the five car models. *[6 marks]*

Assume that the prices of cars are given in the following one-dimensional array.

```
double[] ModelPrice = {10288.00, 12999.99, 18456.00, 20345.00, 45799.00}
```

For example:
`ModelPrice[1]` holds value `12999.99`.
This means that the price of Model 2 is 12999.99.

(d) Construct a method that will accept a one-dimensional array `ModelPrice` and a two-dimensional array `Sales`. The method should determine the best salesman (the one with the highest total number of sales); and it should output the best salesman and the highest total number of sales. Assume there will not be a tie for best salesman. *[8 marks]*