N11/5/COMSC/SP2/ENG/TZ0/XX

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COMPUTER SCIENCE
STANDARD LEVEL
PAPER 2

Friday 18 November 2011 (morning)

1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.

*Answer **all** the questions.*

1. Consider the two-dimensional array `Data` and program fragment shown below.

2	3	4
2	1	5
6	3	8

```
public void amazing(int[][] a, int N)
{
  int t;

  for (int i = 0; i < N; i = i + 1)
  {
    for (int j = i; j < N; j = j + 1)
    {
      t = a[i][j];
      a[i][j] = a[j][i];
      a[j][i] = t;
    }
  }
}
```

(a) (i) Copy and complete the trace table started below for the call `amazing(Data, 3)`. *[3 marks]*

i	j
0	0

(ii) State the contents of the array `Data` after each pass through the outer loop. *[3 marks]*

(b) As written, the method also performs its basic operation on the diagonal elements, which are the elements `Data[0][0]`, `Data[1][1]`, `Data[2][2]`.

(i) Outline why the operation on the diagonal elements is unnecessary. *[1 mark]*

(ii) Outline the changes needed to eliminate the problem in part (i). *[2 marks]*

(c) Construct a method that accepts a two-dimensional array with an equal number of rows and columns and returns the product (multiplication) of the values in the diagonal elements of the array. *[4 marks]*

(d) Construct a method that accepts a two-dimensional array with an equal number of rows and columns and returns an array in which each element contains the sum of the corresponding row in the two-dimensional array. *[7 marks]*

2. CW Express is a parcel delivery service. Customers who send a parcel are not charged until their parcel has been delivered. The amount charged depends on the weight of the parcel. A computer system is used to keep track of the parcels and to charge the customers.

(a) Construct a class for `Parcel` objects (you do not need to write methods). The class contains the following variables:

- parcel ID number (`parcelID`)
- weight of the parcel (`parcelWeight`)
- customer address (`customerAddr`)
- delivery address (`deliveryAddr`)
- the parcel has been delivered (`isDelivered`)
- the customer has paid (`isPaid`). *[4 marks]*

When a driver returns from delivering a parcel, they update the data in the computer to show that delivery was completed successfully.

An accountant uses a computer to get a list of all the parcels that have been successfully delivered and not yet paid for.

(b) Describe **two** types of users who use the CW Express computer system and the type of data access that each needs. *[4 marks]*

(c) Outline why access to some parts of the data should be restricted to particular users. *[2 marks]*

(d) Describe **two** procedures that CW Express employees can follow to prevent unauthorized access to the data. *[4 marks]*

An array `allParcels` is used to store the `Parcel` objects.

(e) Construct a method that outputs a list of parcel ID numbers for all the parcels that have been delivered but not yet paid for. *[6 marks]*

3. *This question requires the use of the case study.*

(a) Each component system in Heathrow Terminal 5 (T5) was tested before the terminal was opened to the public. A variety of testing methods were used.

(i) Define the term *parallel running*. *[2 marks]*

(ii) Explain why simulations were used in testing the new baggage handling system. *[4 marks]*

(iii) Identify **two** factors that should be considered when selecting a testing method. *[2 marks]*

(b) Ground services in T5 include a fleet of electric carts that help disabled passengers to move between different parts of the airport. Each cart has an onboard computer that connects with the airport computer system to indicate its location and to receive instructions.

(i) Outline a suitable method of data communication between carts and the airport system. *[2 marks]*

(ii) Describe **two** potential problems that could arise from this method of implementation. *[4 marks]*

(iii) Describe **two** ways in which the data communication between the carts and the airport computer system could be made secure. *[4 marks]*

(c) Air traffic controllers continue to resist efforts to replace the current method of paper strips for each flight.

(i) With specific reference to the case study, identify **two** features of the paper strips method that air traffic controllers like. *[2 marks]*

(ii) Suggest a way in which a computer-based system could provide the two features you identified in part (i). *[4 marks]*

(iii) Discuss whether the safety concerns associated with replacing the paper strips method with a computer-based system can be overcome. *[6 marks]*