IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
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N07/5/COMSC/SP2/ENG/TZ0/XX

COMPUTER SCIENCE
STANDARD LEVEL
PAPER 2

Tuesday 13 November 2007 (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 following *algorithm*, which represents a particular sort routine. The algorithm will sort an integer array `a[]` into ascending order.

```
public void sorter (int [] a, int n)  // n represents the
{                                      // number of data items
                                       // in the array
  int temp;
  do
  {
    for (int j = 1; j < n; j++)
    {
      if (a [j-1] > a[j])
      {
        temp = a[j-1];
        a[j-1]= a[j];
        a[j] = temp;
      }
    }
    n = n-1;
  }
  while (n>1);
}
```

Assume that `n` represents the number of elements in the array, and that the array `a[]` already contains the following 4 items:

`a[0] = 8,  a[1] = 2,  a[2] = 5, a[3] = 1`

(a) Complete the trace table showing the result of the first pass through this sort routine. *[3 marks]*

j	j < n ?	a[0]	a[1]	a[2]	a[3]
1	true	2	8	5	1
2					
3					
4					

The choice of an algorithm for a particular process, will often depend upon its efficiency in dealing with that process.

(b) (i) Identify the characteristics of this algorithm that determine its efficiency. *[2 marks]*

(ii) Discuss the choice of this sort routine for a company that regularly sorts large amounts of data. *[2 marks]*

(This question continues on the following page)

(Question 1 continued)

At the moment, this algorithm will not terminate early, even if the array becomes sorted.

(c) By making use of a boolean variable, rewrite the algorithm including the code that will allow the algorithm to terminate if the array becomes sorted. *[4 marks]*

Consider an application which holds integer data, sorted in ascending order, in the array `b[]`. At times, a new value, `item`, is passed to the method `addItem()`, which places this value in its correct (sorted) position in this array.

You can assume that there are enough spaces in the array to hold the new data.

(d) Construct the method `addItem()`, that has been started below. *[9 marks]*

```
public void addItem (int[] b, int item, int n)
                                  // n represents the number
                                  // of elements in the array
```

2. A bus company that provides services within a city has decided to equip all its routes with 'intelligent' bus-stops. These bus stops will include a continually-updated visual display giving limited information regarding the arrival of the buses for each of the routes that use each stop.

(a) State **two** items, relating to the arrival of a particular bus, which might be displayed. *[2 marks]*

Whenever a bus passes a bus-stop, it automatically sends data to the central computer regarding its current location. The computer immediately processes this information and then sends appropriate data out to the bus-stops on the same route.

(b) State which type of processing is taking place. *[1 mark]*

All processing is carried out at the company's central computer, where 2-D arrays are used to store the times (in minutes) between bus-stops for each route.

For example, for Route A, the following array, `timesA[][]` contains data as shown below.

future stops

current stop	[0]	[1]	[2]	[3]	[4]
[0]	0	5	8	10	13
[1]	–1	0	3	5	8
[2]	–1	–1	0	2	5
[3]	–1	–1	–1	0	3
[4]	–1	–1	–1	–1	0

e.g. `timesA[2][4]` stores the number of minutes that a bus would take travelling from bus-stop # 2 to bus-stop # 4. From the above table this would be 5 minutes.

(c) (i) Identify, from the table, the number of minutes to travel from bus-stop # 0 to bus-stop # 4. *[1 mark]*

(ii) Explain the use of the data `-1` in the table. *[2 marks]*

(d) Explain why this system should be tested thoroughly before being put into operation. *[3 marks]*

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(Question 2 continued)

The system is first tested using one bus on Route A.

Whenever the central computer receives data from the bus on Route A the method `findTimes()` is called. This method receives the current location of the bus (`currentStop`) and the array `timesA`, and then sends out the number of minutes until arrival to each bus-stop that has not yet been passed by the bus.

(e) Construct the method `findTimes()`.

It can be assumed that a method `sendTimes()` exists, which sends the time in minutes to a particular bus-stop. *[6 marks]*

(f) Explain how the system could be improved so as to give more accurate data regarding the arrival of the buses *[2 marks]*

(g) Suggest, with reasons, **one** other way in which the system could be expanded to be of benefit to their customers. *[3 marks]*

3. *This question requires the use of the Case Study*.

(a) Identify a problem that a disabled person might have in using a keyboard, and suggest a possible modification to the keyboard that might help that person. *[3 marks]*

Voice recognition is now widely used in situations where manual entry of data is not possible.

(b) Explain why a limited vocabulary set is normally used with voice recognition software that controls wheelchair movement. *[2 marks]*

(c) Explain the need for the conversion of sound data in a speech recognition system. *[3 marks]*

Screen readers use a speech synthesiser to read aloud text that is displayed on a monitor.

(d) (i) Explain **two** problems that might arise when a screen reader reads text from a normal web page. *[4 marks]*

(ii) Suggest, with reasons, a feature that could be incorporated into a web page design, which will help to eliminate these problems. *[2 marks]*

(iii) Apart from screen reading, describe two other features that should be available for use on the computer of a partially sighted person. *[4 marks]*

Most lectures in schools and colleges are given verbally, which provides obvious problems for students with a hearing impairment.

(e) Outline **three** ways in which technology can help the hearing impaired to gain the same benefits from the lectures as other students. *[6 marks]*

(f) Discuss possible problems for people with disabilities of the use of the following in web site design:

(i) Unusual font faces and sizes *[2 marks]*

(ii) Scrolling (horizontal or vertical movement required to view a page) *[2 marks]*

(iii) Sounds *[2 marks]*