HWA CHONG INSTITUTION
C2 PRELIMINARY EXAMINATION 2008

COMPUTING
Higher 2

16 September 2008 **Paper 2 (9754 / 02)** **0815 -- 1045 hrs**

Answer ***ALL*** questions.
Begin ***EACH QUESTION*** on a ***FRESH SHEET*** of paper.

The maximum mark for this paper is 100.

1. The management of Majestic Hotel acquired the service of a software house to look into computerizing some of its business functions.

   The project leader assigned to this project is to propose an appropriate programming language for its development.

   (a) Most commonly-used programming languages are imperative languages. Some other programming languages are known as declarative languages. Examples are logic languages and functional languages. State 3 major differences between declarative and imperative languages. [3]

   (b) Describe the criteria that should be considered when choosing a programming language for an application, in general. [3]

2. The computerized system for Majestic Hotel will assist in handling queries about the availability of rooms, making room bookings and billing customers. The system is also to be integrated among the various departments e.g. spa, laundry and dining services, so that these charges can be consolidated and billed to the customer together with the room charges during check-out. When a customer asks to book a room with Majestic Hotel, the receptionist will be able to call details of all suitable rooms and enter the booking. When the customer leaves the hotel, the system will print a bill giving details of all charges incurred during the stay.

   (a) Make a list of all the essential data items the system will need to store and show clearly how this data could be structured. [7]

   (b) Draw an ER-diagram to show the relationship between the tables. [4]

   (c) Use a diagram to show the data flows, processes, data stores and external links in the system. [9]

3. The application development process involves programming, testing as well as documentation.

(a) Explain why local and global variables will be important in the production of the software

[2]

(b) Devise and describe a complete testing strategy for an application which adopted a modular design.

[6]

(c) Give 3 examples of diagrams (each for a different purpose) that may be used in the technical documentation and explain why they are included.

[6]

4. Online banking (or Internet banking) allows customers to conduct financial transactions on a secure website operated by their retail or virtual bank, credit union or building society.

The Royal Bank provides both traditional banking and online banking services. It has many branches in the country and has customers all over the world.

(a) Identify TWO online banking services, which the bank can provide for its customers. [2]

(b) Outline the advantages for the customer of an online bank over a traditional bank. [2]

(c) Suggest with example the TWO basic important steps that you can take to help protect your confidential information and prevent online fraud and identity theft for online banking. [4]

(d) Outline the social and/or ethical concerns that customers should have about storage of their personal data. Evaluate your arguments. [4]

5. Engineers have designed a new aeroplane called UltraJet that will be the biggest aeroplane ever produced. The pilots will require training before they can fly the UltraJet prototype.

The engineers have also used complex software and powerful computers to create a flight-training simulator to train UltraJet pilots.

(a) Explain why powerful computers are essential for flight-training simulators and describe the difficulties in producing a realistic simulator.

[4]

(b) Describe the benefits of using flight-training simulators to train UltraJet pilots.

[3]

The engines are controlled by a computer system called the engine control unit (ECU). The ECU has several inputs. The ECU uses feed-back to control the engine.

(c) Explain in detail what is meant by the term feed-back. [2]

(d) Describe one benefit of using a computer system to control the engine. [1]

(e) Explain the difference between analogue and digital signals. [2]

(f) One input to the ECU is the engine temperature. Explain why analogue to digital conversion will be required to monitor the engine temperature. [2]

6. An office has installed a LAN connected to a file server. This LAN includes one fast colour printer and four black and white laser printers distributed around the office.

(a) What is meant by a Distributed Network System? [2]

(b) Identify TWO peripherals, other than printers, that could be connected to the LAN. [2]

(c) Describe the advantages of having a network of computers in the office instead of several stand-alone computers. [2]

(d) Describe TWO ways in which a network administrator could protect the computers in the network against virus attack. [2]

(e) Data can be transmitted using parallel or serial transmission. Give **TWO** reasons why data is normally transmitted over long distances using serial transmission. [2]

(f) In the context of serial data transmission describe what is meant by

(i) Baud Rate;
(ii) Bit Rate;
(iii) Bandwidth [3]

(g) What is the relationship between bit rate and bandwidth? [1]

7. A collection of up to 1000 records is stored in an array organised as a hash table with collisions handled by linked lists. The key of each record is hashed to give a value between 0 and 255. Elements 0 to 255 of the array are therefore used to store the first record with any particular hash value, further records being linked and stored in elements 256 to 999 of the array. A variable, **free**, holds the number of an unused element in the array. The structure is initialised by the following algorithm:

```
declare  table: array[0 to 999] of  (used: boolean,  data: record,  link: integer)
declare  free : integer
declare  i : integer
for  i  from 0 to 255
       used of table[i] = false
       link of table[i] = -1
for  i  from 256 to 998
       used of table[i] = false
       link of table[i] = i +1
used of table[999] = false
link of table[999] = -1
free = 256
```

After initialisation of the structure, the following records are entered.

data (symbolised by a letter)	*hash value*
A	27
B	29
C	30
D	27
E	30
F	26
G	27

(a) Use a diagram to show the contents of the structure (**table** and **free**) after these seven records have been entered. [7]

(b) During operations using this structure, it is sometimes necessary to remove a record with a given key. By considering the various different cases that can arise:

the record is the only one with that hash value;
the record is the first with that hash value;
the record is not the first with that hash value;

Outline the steps of the algorithm needed to remove the record. [6]

(c) The algorithms for other processes using this form of hash table are similarly made more complex because the data structure is not uniform. This is because the array elements 0 to 255 serve a different purpose to those from 256 upwards.

These problems can be overcome by introducing a new array **head**[0 to 255] of integers, where each element serves as the head of the linked list of records with the relevant hash value. All the records are then stored in a simplified version of the array **table**. Explain how this works, illustrating your answer by drawing a new version of the diagram that you drew in part (a). [7]

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