

**HWA CHONG INSTITUTION  
C2 PRELIMINARY EXAMINATION 2011**

**COMPUTING**

**Higher 2**

**26 September 2011**

**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 file that stores details of all the Library's books is organized as a sequential file. This file is ordered on the book's 5 digit identification number.
  - (a) What are the Characteristics of a sequential file? [2]
  - (b) Describe an algorithm to deleting an old book from a file [4]
  - (c) All loan records from students and teachers are placed in the loan file.
    - i. Describe how the loan file is arranged as a random file. [4]
    - ii. If there is a collision, describe a method to resolve the issue. [4]
    - iii. Explain why the file is designed to be random access rather than sequential access. [2]
2.
  - (a) Each computer's CPU can have different cycles based on different instruction sets, but generally they will all run a similar cycle. Elaborate on the concept of cycle time and how it handles instructions? [5]
  - (b) Explain what is meant by memory access time. How will it affect the performance of a computer? [2]
  - (c) Devices connected to the computer function at different speeds, explain the followings:
    - i. How will this be a problem to the operating system while handling multiple devices/programs? [1]
    - ii. Suggest and explain a method to improve on the above problem. [3]

3. The School's human resource department keeps track of information on students and teachers in a flat file. Records are added as students and teachers joined the school. Some of the records in the flat file are shown below.

Name	Address	Date_Of_Birth	Mobile	ID	Type	Date Joined	Access_Lvl
Hon Yew Peng	67 Pasir Ris	09-Sep-67	97654534	12	Principal	01/03/1988	5
Smith Jones	212 Holland Rd	01-Jan-77	97865431	35	Teacher	01/03/2003	3
Tan Hock Joo	19 Steven Rd	03-Mar-65	67654321	34	Teacher	02/03/1999	4
Janice Tan	56 Clementi Road	12-Dec-95	97896541	1345	Student	01/01/2009	1
Clarence Teo	123 Ang Mo Kio	04-Mar-96	98653431	2768	Student	02/01/2010	2
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
Smith Jones	212 Holland Road	01-Jan-77	97865431	100	Teacher	01/03/2007	3
Clarence Teo	122 Ang Mo Kio	04-Mar-96	98653431	3245	Student	02/01/2011	2

Table 1

- (a) Suggest 2 problems that have occurred as a result of storing the records in this kind of structure. Give specific examples from Table 1 as evidence. [4]
- (b) Improve on the flat file design. Write your answers in shorthand notations with key fields/foreign keys indicated clearly. Justify your answers. [6]
- (c) From the records in Table 1, show all records that should appear in your improved design. [3]

4. The following items are to be placed on a binary tree structure:

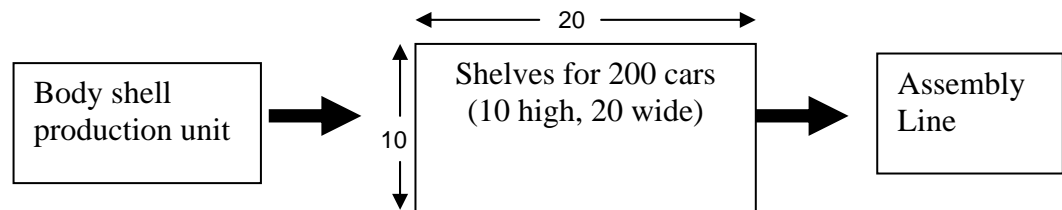
tian, ben, ming, wei, ang and van.

- (a) Draw the alphabetically ordered binary tree after all the items have been added. [2]
- (b) Write an algorithm for the insertion of an item into an alphabetically ordered binary tree. [5]
- (c) Write down the output if the tree is traversed using: [6]
- In-order
  - Pre-order
  - Post-order.

A binary tree abstract data type (ADT) is to be implemented using three one-dimensional arrays.

- (d) Show how the above binary tree would be implemented using these three arrays. [5]
- (e) State **two** operations that would be required for the ADT. [2]

5. An automated car factory is to be built to work on the basis that body shells are produced, stacked on shelves and then transferred when required to the assembly line for complete construction.



The body shell type is defined by 3 parameters:

COLOUR: Blue, Green, Red, White, Yellow

DOORS: 2, 4

SUNROOF: Yes, No

Every combination of these 3 parameters is possible. An example of a body shell type is:

***Green, 2, Yes***

The steps in the body production and storage process are:

- A body shell is made and painted.
- An automated truck collects the body shell, senses its type and puts it on a shelf.
- The body shell type and location are stored in the computer.

When a body shell is placed on a shelf, it is placed in the lowest available space.

When a body shell is removed, the highest one of the required type is chosen.

When the assembly line is ready for a shell, the computer will call on the automatic truck to deliver one of a particular type.

Software will be required which will hold the current state of the system and which will:

- find a suitable free shelf point in which to put a body shell;
- find a body shell of a particular type for removal from the shelves;
- output, upon demand, the quantity of each type of body shell on the shelves in the form:

COLOUR	DOORS	SUNROOF	QUANTITY
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- Describe, with aid of diagrams, suitable data structures for use in this application.
- Describe algorithms which will provide the facilities (i) to (iii) above.

[16]

- (c) Each car code is a letter followed by a one or two digit number that must not start with a zero, or an unlimited string of letters. Given that

$\langle \text{Letter} \rangle ::= A|B|C|D|E|F|G|H|I|J|K|L|M|N|O|P|Q|R|S|T|U|V|W|X|Y|X$

$\langle \text{Digit} \rangle ::= 0|1|2|3|4|5|6|7|8|9$

Define  $\langle \text{car code} \rangle$  using

- i. Backus-Naur Form (BNF)
- ii. syntax diagram

[6]

Note:  $\langle \text{Letter} \rangle$  and  $\langle \text{Digit} \rangle$  are given in the question and need not be defined again.

6. (a) Give three different methods of implementing repetitive processes and explain under what circumstances each would be used. [3]
- (b) State what is meant by a recursive function & when is it suitable to be used. [3]
- (c) Give 2 advantages and 2 disadvantages of using recursive functions. [4]
- (d) When a procedure is called by a program, describe the information which must be stored in order to return to the program at the end of the procedure. [2]
- (e) Suggest a suitable data structure for storing this information. [2]
- (f) The algorithm for function Magic is given below. Give the value of Magic(5) by drawing a diagram to show all the steps that are executed when the function is called.

```
Magic (n)
If n=1 then
    Magic = 1
Else
    Magic = n * (n + 1) / 2 + Magic (n - 1)
Endif
End of Magic
```

[4]

--- THE END ---