

**HWA CHONG INSTITUTION  
C2 PRELIMINARY EXAMINATION 2011**

**COMPUTING**

**Higher 2**

**14 September 2011**

**Paper 1 ( 9754 / 01 )**

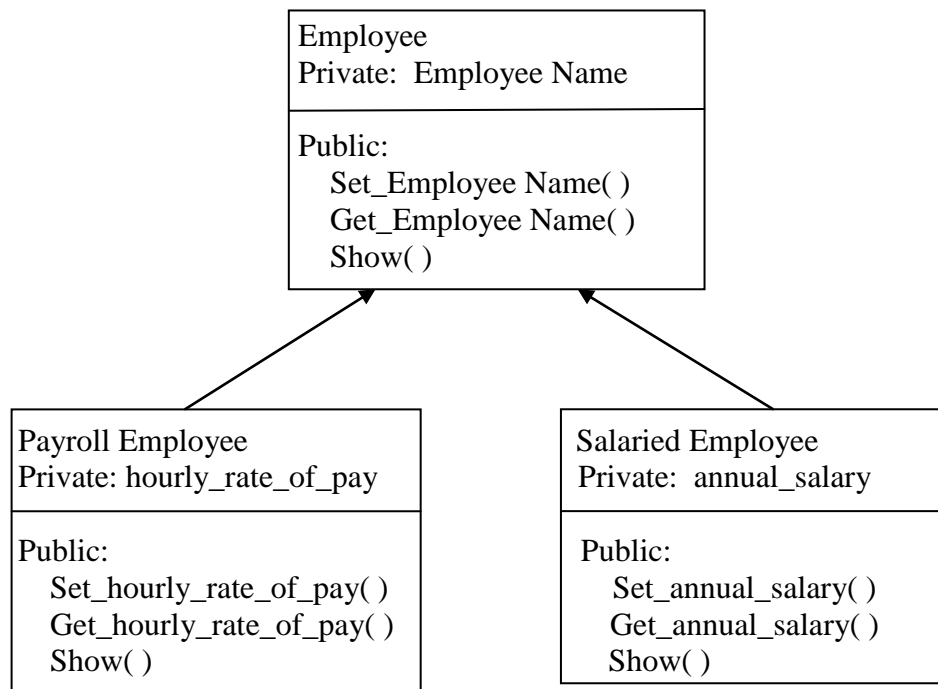
**0815 -- 1115 hrs**

Answer *ALL* questions.

Begin *EACH QUESTION* on a *FRESH SHEET* of paper.

**The maximum mark for this paper is 120.**

1. The following figure shows three classes and some of their private attributes and public methods.



- (a) Use this example to explain the following terms:
- i. encapsulation,
  - ii. inheritance,
  - iii. polymorphism. [6]
- (b) How is data hiding achieved in a class? [2]
- (c) Some employees who earn a salary can receive a yearly bonus which is some fixed percentage of their salary. Describe what changes should be made to the above diagram to accommodate this possibility. [2]
- (d) Explain what is meant by method overloading? [2]

2. The details about staff, students, courses and rooms in a college are as follows:

Students may take a number of courses.

Each course has only one member of staff teaching that course.

Staff can teach more than one course.

Each member of staff has their own teaching room which is not used by any other member of staff.

The date that a student enrolls on a course is recorded.

4 tables can be identified: Student, Course, Course List and Staff.

- (a) Specify the attributes (fields) required and state the primary key for each table. [6]
- (b) Explain how the details of all the students taught by a named member of staff can be found. [4]

3. A bank is worried about computer crime. One major concern is on-line access to customer accounts.

- (a) Give two ways that a customer's on-line access details could be discovered by a criminal. [4]
- (b) Describe one other way in which a bank customer could be the victim of computer crime. [2]
- (c) Explain why a customer using a bank card for on-line shopping may be more of a security issue to the bank than customers using cards in shops. [3]

The bank decides that another level of security is required for on-line customers. Each customer is given a bank card reader.

If they wish to do an on-line transaction:

- They have to put their bank card in the card reader
- Input their pin
- The card reader produces a unique number which has to be entered into the computer if the transaction is to be carried out successfully

There is no connection between the card reader and the computer.

- (d) Explain how this new system improves security. [3]
- (e) Suggest another two methods local banks have put in place to ensure on-line banking is secure. Illustrate how the measures enhanced security. [4]

4. The company has a warehouse, two shops and an office building.

Each of the four buildings has a local area network (LAN). The office building has two separate LANs for the accounts office and the administration office. The company has decided to connect the four buildings into a wide area network (WAN).

- (a) State two differences between a LAN and a WAN. [2]
- (b) State how each of the following is used in a network. Give an example of the use of each in this application:
- i. File Server [2]
  - ii. Print Server [2]
  - iii. Switch [2]
  - iv. Router [2]
- (c) One of the labs in the warehouse will be set up in a BUS topology. What is topology and what is the key characteristic of a Bus topology? [2]
- (d) The data is subjected to corruption when it passes from one device to another. Describe how a check sum can be used to detect such errors. Give an example of when it might be used in this application. [3]
- (e) The company uses its own intranet for communication between the buildings. Explain why this is preferable to using the internet. [4]

5. An examination system requires that each candidate has a unique ID consisting of six digits. The first two digits are the school code and the next three digits are the candidate's unique number within the school. The sixth digit is a check digit. The validity of the check digit is computed by the following process:

- multiply each digit by its position in the number (counting from the right);
- summing the results of the multiplications;
- calculating the sum mod 11;
- if the final result is zero then the ID is valid.

- (a) Show whether the following IDs are valid in this system.
- i. 280410 [2]
  - ii. 503313 [2]
- (b) Describe, with examples, **two** data entry errors that a check digit helps to detect. [4]
- (c) Write an algorithm, in any appropriate form, that will calculate the correct check digit for a new candidate. [4]

6. (a) Describe the difference between a binary search and a sequential search. [2]
- (b) An array X contains N integers stored in ascending order. The following pseudo code describes a function for finding the position, in X, of an integer whose value is stored in a variable called item.
- ```

first = 1
last = N
while first <= last
    mid = int ((first + last) / 2)
    if X(mid) = item then
        return mid
    if X(mid) < item then
        first = mid + 1
    else
        last = mid - 1
    endif
endwhile
return not found

```
- i. If N = 200 then state the elements of array X that are examined when searching for an integer which is in the 87<sup>th</sup> element. [3]
- ii. If the search is for an integer which is not present, then explain how many elements have to be examined before 'not found' is returned. [2]
- iii. State the difference between global and local variables. Give an example of a local variable in this function. [3]
- iv. For this function state **two** parameters that would be used and how they would be passed. [4]
- (c) A list of N numbers is to be stored in locations 1 to N of an array in ascending order, by means of an insertion sort as follows. As the numbers are entered, the first is stored in location 1. Then, before each succeeding number is inserted, as many as necessary of those already stored are moved to the next location to leave space in the correct position for the next number.
- The numbers 13, 11, 24, 12, 20 are entered using this method so that they occupy the locations 1 to 5 in ascending order. Show the contents of the locations immediately **after** each number is inserted (that is, on 5 occasions in all). [2]
- (d) Using pseudocode, write a detailed algorithm for the process described in (c) above, adding comments to show your method clearly. [5]

7. An Abstract Data Type (ADT) consists of both data and associated operations.

A linked list ADT has the following operations defined:

- Create(*L*) – creates an empty linked list *L*;
- Insert(*L*, *Item*, *P*) – insert new value, *Item*, into linked list *L* so that it is at position *P* in the linked list;
- Retrieve(*L*, *P*) – returns the item at position *P* in the linked list *L*;
- Delete(*L*, *P*) – delete the item at position *P* in the linked list *L*;
- IsEmptyList(*L*) – returns true if linked list *L* is empty;
- Length(*L*) – returns the number of items in the linked list *L*.

The following operations have been carried out:

```
Create(Individual)
Create(Group)
Insert(Individual, Jack, 1)
Insert(Individual, Monica, 1)
Insert(Group, May, 1)
Insert(Individual, Jill, 3)
Insert(Individual, Sally, 2)
Delete(Individual, 3)
Insert(Group, Grace, 2)
```

- (a) With the aid of the diagram, describe the state of the lists when the above operations are executed. [4]
- (b) Using pseudocode, describe how to append all the items in *Individual* to *Group* by making use of the operations given above. [4]
- (c) Show how to implement the following operations for a queue ADT, called QList, using the linked list ADT operations: [4]
- i. add item to queue;
  - ii. delete item from queue.

8. Autocar Pte Ltd. is engaging a software house to develop an integrated system to handle all its financial transactions, which include payments from customers, to suppliers, and producing the payroll for staff.

The solution contains a number of modules.

- (a) What are the advantages of modular programming? [3]
- (b) Describe how the software house should test the system? [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]
- (d) Three of the modules are
  - A module to input relevant data to the system
  - A module to calculate the pay for individual workers
  - A module to output payslips and electronic transfer to pay to workers' bank accounts

State the parameters that would be passed between

- i. the input module and the pay calculation module, giving a reason why each parameter is necessary.
- ii. the calculation module and the output module, giving a reason why each parameter is necessary. [5]

**--- THE END ---**