

Candidate Name: _____

CT Group: _____

Index no. _____



**PIONEER JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION**

COMPUTING H2

9754/02

Tuesday

18 SEPTEMBER 2012

TIME 2 hours 30 minutes (0800 - 1030)

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, CT Group, and Index No. in the spaces provided on this cover page and on your answer scripts.

Write your answers on the writing paper provided and **NOT** on the question paper

Answer **all** questions.

INFORMATION FOR CANDIDATES

This question paper consists of **4** printed pages (inclusive of this page).

The number of marks is given in brackets [] at the end of each question or part question.

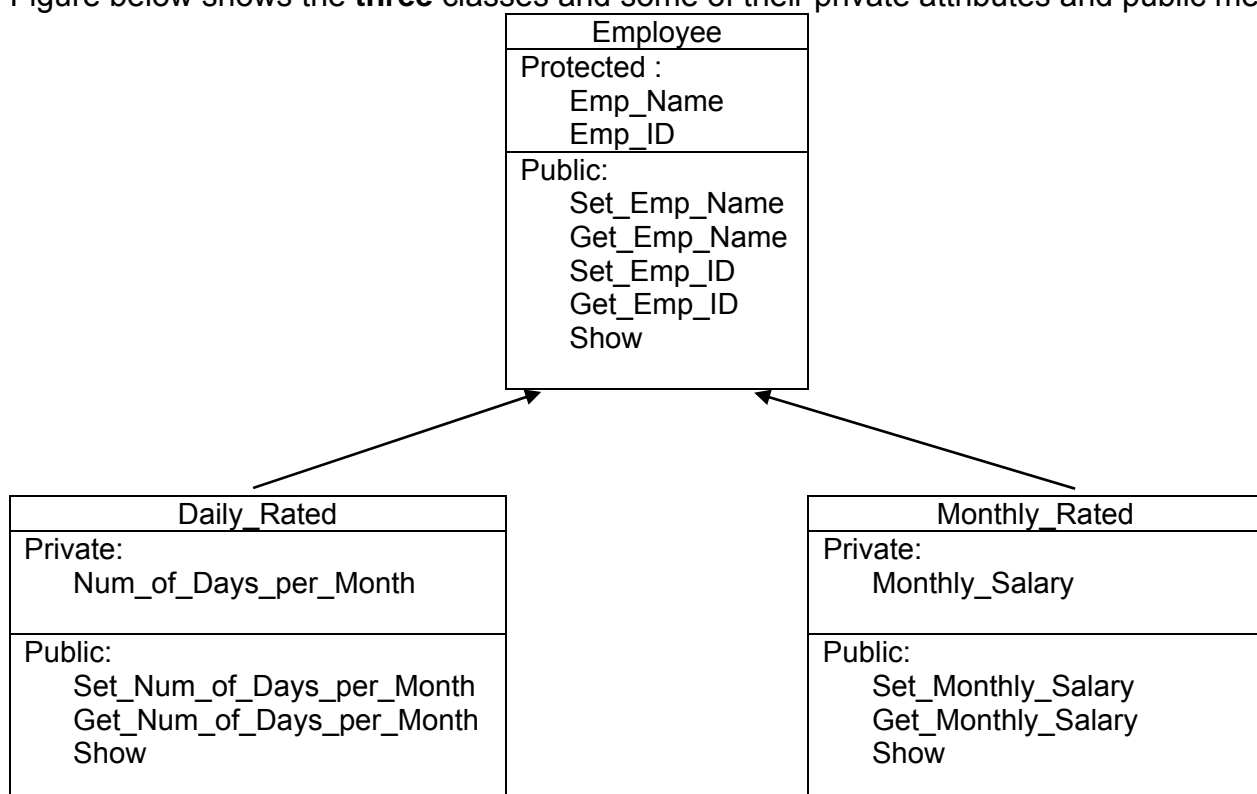
The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

Pioneer Hypermarket is a retail superstore combining a supermarket and a department store. It has three branches in Singapore and carries a wide range of products which allows customers to meet their shopping needs in one trip.

1. (a) Each branch has its own group of computers for processing the transactions from the customers. A LAN will be used within each branch. What is LAN? [2]
 - (b) Explain why the hypermarket uses an intranet for communications rather than the Internet. [4]
 - (c) Why should a WAN be used between branches? [2]
 - (d) Draw diagrams to show the bus and star network topologies for the LAN. Your diagram should include a suitable position for the file server, relevant hardware and the direction of data flow. [8]
 - (e) Give **one** advantage and **one** disadvantage of the topology you have described. [2]
 - (f) Data will be uploaded and downloaded between all branches. It is important that data is not lost or corrupted. Describe two distinct means of ensuring this does not happen. [2]
2. (a) At the end of each month, the hypermarket will print thousands of promotional letters to the customers with their details on the letter. What system should be used to produce these letters? [2]
 - (b) A Multi-users Operating Systems will be provided for customers to access the latest promotions in the hypermarket on-line. What is Multi-users Operating Systems? [2]

3. Figure below shows the **three** classes and some of their private attributes and public methods.



Using this example, explain the terms

- (a) encapsulation, [2]
- (b) inheritance, [2]
- (c) polymorphism. [2]
- (d) Explain, using the above example, the relationship between a class and an object. [4]
- (e) How is data hiding achieved in a class? [2]

With the classes defined above, the software was designed using an object-oriented language.

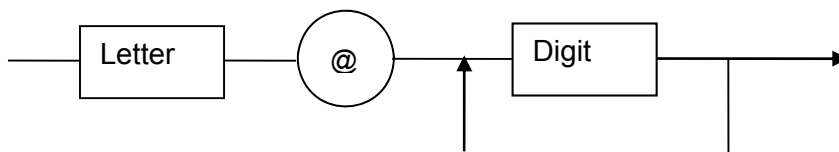
- (f) Explain why object-oriented programming would be a suitable type of programming. [4]

4. The syntax diagram defines a label for the products sold in the hypermarket.

Digit ::= 1|2|3|4

Letter ::= A|B|C|D

Label:



State why each of the following examples is not a label according to this definition.

- (a) AB@2 [1]
- (b) A@B [1]
- (c) A@45 [1]

Using the definitions given above, draw syntax diagrams to show

- (d) **thing**: thing has one # symbol followed by at least one letter [2]
- (e) **value**: value has one digit followed by any number of @ symbols [2]
- (f) **here**: here has one @ symbol, then at least one digit, then one letter and at least one # symbol [3]

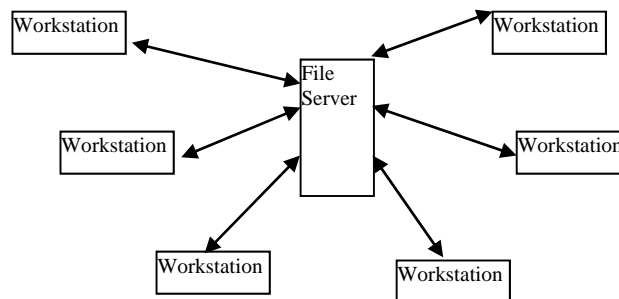
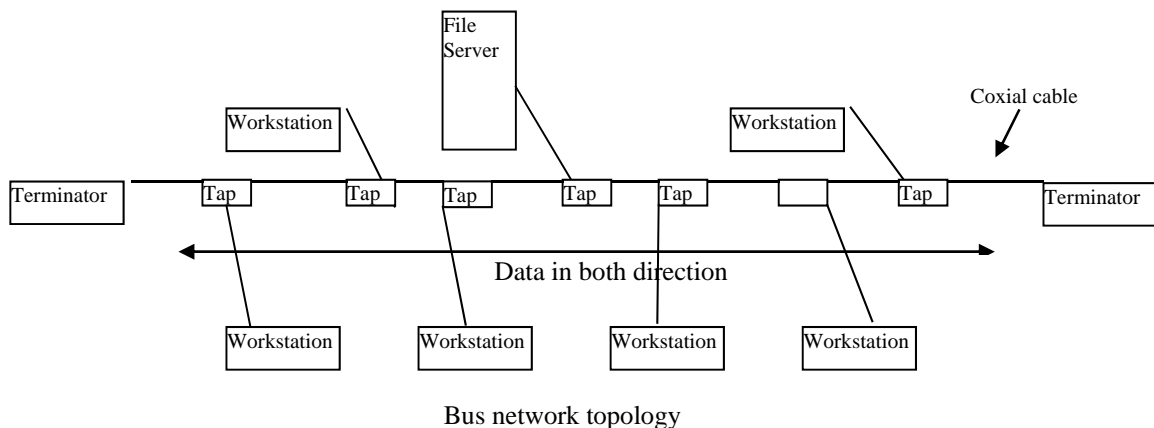
5. (a) Employees names are stored in a file. Show how a binary tree can be used to store the employee names: **Jansen, Harry, Lester, Spencer, David, Kieran** in alphabetic order. [3]
- (b) Explain why problems may arise if Lester is deleted from the tree and how such problems may be overcome. [2]
- (c) Describe an algorithm for reading the complete set of names, stored in the tree, in alphabetical order. [3]
- (d) As a result of many additions and deletions, the tree has become very unbalanced. For most nodes in the tree, the left and right subtrees are of significantly different sizes. Describe how a new balanced tree may be created. [4]
- (e) Explain why a binary tree is known as an Abstract Data Type (ADT). [3]
6. The hypermarket has a membership scheme and offer discounts to members who make purchases. The rules that apply to its customers making purchases and offered discounts are as follows:
- if a customer spends \$50 or more in a single transaction, a 3% discount would be given,
 - if a customer spends \$150 or more in a single transaction, a 10% discount would be given,
 - for payment by cash, an additional 1% discount would be given.
- (a) Create a decision table and simplify it by removing redundancies. [5]
- (b) A programmer writes a program to implement the discounts given to members. State **three** elementary data types the programmer will need to use in the program, giving an example of the use of each. [6]
- (c) Explain what is meant by 'composite data type'. Give two examples of composite data type that might be used in this program. [4]
7. The hypermarket allows members to do online shopping using the Internet.
- (a) Discuss the social and economic impacts of this measure. [4]
- (b) Discuss the problems of maintaining confidentiality of information on the Internet and the ways to address this issue. [4]
8. A file of products sold is kept by the hypermarket. Each product has a product code, stored as an array $C(1 \dots n)$, which is sorted into ascending order.
- (a) Produce an algorithm to sort the array into ascending order using bubble sort. [6]
- (b) Given two sorted lists of products sold by the hypermarket, write in pseudocode, an algorithm for merging them into a sorted list. [6]

End of Paper

Answers

1. (a) • A local area network (LAN) is a computer network that spans a relatively small area (branch). Most LANs are confined to a single building or group of buildings. [2]
- (b) • intranet is an in-house website / client-server system / LAN (Local Area Network) which serves the people in the supermarket. The main purpose of an intranet is solely for internal use (e.g. sharing of information and resources) within the supermarket and not accessible by the general public. [4]
- Intranet (LAN) enables sharing of resources (e.g. software);
 - No cost for sending data around LAN;
 - Localised processing in local office;
 - All computers/terminals located in closed proximity
 - Internet is much difficult to manage in terms of security.
- (c) • Computers/terminals are spread over a wide area [2]
- Too expensive to cable
 - Enables sharing of resources

(d) [8]



- (e) one advantage of a bus network compared with a star network. Give a reason. [2]

Star: advantage,

- if one cable fails, other stations not affected;
- consistent performance even when network heavily used,
- data transmission speeds / methods of transmission can vary from one spoke to another;
- reliable. market proven system;
- no problems with 'collisions'; of data - each station has own cable to server;
- high degree of security control;
- easy to add new stations;

Star: Disadvantage :

- maybe costly to install because of length of cable / expensive technology at hub;
- network vulnerable to hub failure;
- terminals cannot share files

Bus. advantage.:

- easy, inexpensive to install - least amount of cable;
- easy to add more stations;
- all terminals can share files

Bus. Disadvantage:

- whole network goes down if cable fails at any point;
- cable failure hard to isolate;
- performance degrades under heavy load/ collisions;
- not very secure

- (f) • block check characters/parity bit check - for identifying corruption during data transmissions; [2]
- transmission acknowledged by receiver - to confirm reception;
- anti-virus software - applied to all files entering system;
- duplicate hardware - data written to both;
- read after write check – to confirm data recorded correctly
- 2 (a) Batch operating systems are used that take a set of commands for print thousands of promotional letters to the customers with their details on the letter, execute them and return the letters without human intervention. [2]
- (b) • Multi-users operating systems are those that provide access to the computer system to more one user at a time. [2]
- The online system in the supermarket, where there can be a few terminals located within the supermarket and different customers can have the access to the latest promotions in the supermarket.
- 3 (a) • encapsulation is combining together methods and attributes as a single object type [2]
- e.g. in the class Employee, there is one method Set_Emp_Name which sets the attribute Emp_Name.
- (b) • inheritance means that classes can inherits the attributes and methods from parent class [2]
- e.g. classes Daily_Rated and Monthly_Rated inherit the attribute Emp_Name and Emp_ID from class Employee and doesn't need to be declared in Daily_Rated and Monthly_Rated
- (c) • polymorphism means that inherited methods don't have to behave in exactly the same way [2]
- eg. Show method for Daily_Rated may not display in exactly the same manner as Show method for class Monthly_Rated
- (d) • A class is a general description of an object including data and methods [4]
- An object is an instance of a class (and has actual values)
- e.g Employee, Daily_Rated, Monthly_Rated are classes. During runtime variables like an_Employee, a_Daily_Rated_Employee and, a_Monthly_Rated_Employee are object and may have assigned values.
- (e) • Restricted access to the internal representations (Emp_Name, Emp_ID) of objects. [2]
- Objects have a 'private' part of hidden internal detail (state data and internal processes), and
- a 'public' interface (Set_Emp_Name, Get_Emp_Name), which clearly defines the set of possible behaviors of the object (the messages to which it can respond).
- (f) • Hides data – can only access data via methods [4]
- Reuse of code is easier
- Methods of objects can be changed without affecting code which uses them.
- complexity can be reduced as programmers need not be bothered with too many details when using existing classes

- 5d.** To get a balanced binary tree:
- Copy all nodes to a list using in-order traversal. The codes will then be in an ordered list.
 - Select middle of ordered list to be root node. The ordered list will now be divided into two equal lists – the left and right lists.
 - From the left list, select the middle and let it be the left child of the root node, of the left subtree.
 - From the right list, select the middle and let it be the right child of the root node, of the right subtree.
 - Repeat the above steps to form the subsequent left and right subtrees.
- Draw diagrams to aid explanation.

- 5e.** ADT is implementation independent. For example, it only describes what a binary tree consists (data) and what are the operations (insert, delete) it can perform, but it has no information about how the binary tree is actually implemented, whether by using array or a linked list

6a.

Conditions	1	2	3	4	5
Customer spend \$50 or more in a single transaction?	Y	Y	Y	Y	N
Customer spend \$150 or more in a single transaction?	N	Y	N	Y	-
Customer pay by cash?	N	N	Y	Y	-
Actions					
3% discount given	X		X		
10% discount given		X		X	
Additional 1% discount given			X	X	

- 6b.**
- | | | |
|--------------|-------------------|--------------------------------|
| Discount | Numeric (integer) | Discount given in whole number |
| Pay_cash | Boolean | Either true or false |
| Total_amount | Numeric (real) | Total given in decimal |
- 6c.** A composite data type is any data type which can be constructed in a program using its programming language's primitive data types and other composite types.
- 7a.** Hypermarket allows members to do online shopping using the Internet:
- Social Impact:
- Do shopping from home, save a trip to the hypermarket, less travelling
 - Possible anxiety over possibility of credit card fraud, when credit card is used for transaction of products
 - Workers retrained to do other jobs, besides shelving and stock taking
- Economic Impact:
- Huge saving on overheads:
 - cut down on space to display products on shelf, which means that more variety of products can be displayed
 - less employees employed at hypermarket to do shelving
 - Savings passed on to customers
 - Valuable market research tool – list of customers' names and addresses, purchases, likes, dislikes and suggestions can be built up and used to improve services provided to increase sales

7b. Problem of hackers gaining unauthorised access to sensitive data
Measures to combat:

- Encryption of all data communications
- Use of digital signatures to provide authenticity of source
- Passwords to control users' access to data
- Firewalls to block authorised access to the bank's network
- Portable storage devices not permitted in the workplace
- Workers subject to a strict Code of Conduct

8a. A bubble sort algorithm to sort an array $C(1 \dots n)$ into ascending order:
Procedure BubbleSort

```
    REPEAT
        Flag  $\leftarrow$  False
        FOR Count = 1 to  $n-1$ 
            IF  $C(\text{Count}) > C(\text{Count} + 1)$ 
                THEN
                    Temp  $\leftarrow C(\text{Count})$ 
                     $C(\text{Count}) \leftarrow C(\text{Count} + 1)$ 
                     $C(\text{Count} + 1) \leftarrow \text{Temp}$ 
                    Flag  $\leftarrow$  True
            ENDIF
        ENDFOR
        Subtract 1 from  $n$ 
    UNTIL Flag = False or  $N = 1$ 
EndProcedure
```

8b. Select first value from each list
While neither list is empty
 Compare the values in the lists
 Copy the smaller value to the new list
 Read the next value in the list that had a value copied
End loop
When one list is empty copy the remainder of the other list to the new list