

## BACS2023 Object-Oriented Programming

**Practical 8: OO Design and Patterns**

**Q1. This question requires students to demonstrate understanding of the concept of inheritance, composition, abstract classes and interfaces.**

ABC Sdn. Bhd. has in employment a total of 50 full-time employees and 20 part-time staff. To inculcate the value of social responsibility among their employees, the management has decided to create 2 ways for full-time employees to contribute, i.e. either through contributing donations to or through doing volunteer work at one permanently adopted charity organization.

As a programmer working in the IT department, you are requested to write an application program to keep track of employees' monthly payslip and social responsibility contribution details.

If a full-time employee chooses to donate, your program should prompt for the amount of donation the employee would like to contribute. Otherwise, employees will opt to volunteer as a "gotong-royong member".

The calculation of monthly salary for employees are as follows:

- A full-time employee's monthly salary is **basic salary + allowance**. If the employee has opted to donate to the charity fund, the donation amount should be deducted from the monthly salary.
- A part-time employee is paid by **hourly rate \* hours worked**. Assume that there is a standard hourly rate for all part-time employees.

Your program should display the total number of full-time employees who choose to contribute as volunteers and the total amount of donation contributed by the staff.

Design the classes required for this problem and draw a class diagram to show your design.

Note: To simplify the solution, ignore all other salary deductions (e.g. for EPF, PCB, etc.)

**Q2. Develop an application for generating invoices. Some samples are shown below:**

INVOICE					
BILL TO: Big Sdn. Bhd. 23 Jalan D9 42100 Selangor			Invoice No: INV0001		
			Date: 29-Jun-2012		
			Cust. ID: C72635		
Product No	Description	Qty	Unit Price (RM)	Line Total (RM)	
1111	Toaster	3	90.00	270.00	
2222	Electric Iron	1	120.00	120.00	
Grand Total:				RM390.00	

INVOICE					
BILL TO: Tiger Sdn. Bhd. 25 Jalan 12 53000 Kuala Lumpur			Invoice No: INV0002		
			Date: 29-Jun-2012		
			Cust. ID: C58751		
Product No	Description	Qty	Unit Price (RM)	Line Total (RM)	
2222	Electric Iron	2	120.00	240.00	
3333	Air-conditioner	1	1200.00	1200.00	
Grand Total:				RM1440.00	

INVOICE					
BILL TO: Big Sdn. Bhd. 23 Jalan D9 42100 Selangor			Invoice No: INV0003		
			Date: 29-Jun-2012		
			Cust. ID: C72635		
Product No	Description	Qty	Unit Price (RM)	Line	Total (RM)
1111	Toaster	1	90.00		90.00
4444	Television	1	3000.00		3000.00
Grand Total:					RM3090.00

- Determine all the necessary classes. Draw an UML class diagram showing the relationships between the classes. For each class, you only need to include the data members.
- Implement the classes on part (a) above.

Q3. Think of a drink vending machine.

- What does the vending machine sell?
- List the steps for using the vending machine.
- What are the inputs and outputs of the vending machine?
- Identify the two main components the vending machine. **IMPORTANT:** Think using the object-oriented approach.
- Identify the properties and operations of the 2 main components. Draw a class diagram to show the relationship between the vending machine and the 2 components, as well as the properties and operations of each class.
- Write the classes for the vending machine. Include a driver program to test your classes.