

UNIVERSITY OF MAURITIUS

FACULTY OF ENGINEERING



SECOND SEMESTER EXAMINATIONS

MAY 2016

PROGRAMME	BSc (Hons) Information and Communication Technologies BSc (Hons) Electronics with Computer Science		
MODULE NAME	Software Engineering		
DATE	Monday 09 May 2016	MODULE CODE	CSE2001Y(5)
TIME	13:30 – 16:30 Hrs	DURATION	3 Hours
NO. OF QUESTIONS SET	6	NO. OF QUESTIONS TO BE ATTEMPTED	5

INSTRUCTIONS TO CANDIDATES

Section A consists of 3 questions.

Section B consists of 3 questions.

Answer any FIVE (5) questions.

All questions carry equal marks.

Class Information Sheet is attached.

SECTION A**Question 1**

(a) Explain the meaning of the following object-oriented concepts:

- (i) Encapsulation
- (ii) Inheritance

[4 Marks]

(b) Implement a class named **Order** with the following **private** fields:

itemname <int> name of item
price <float> price per unit item
freightcost <float> cost of shipping order

The class contains

- a constructor that requires as arguments the name of the item, the unit price, the method of freight and sets the freight cost depending on the method of delivery, as given the following table, as given the following table:

	By Air	By Sea	By Truck
Shipping cost Rs	25	8	10

- a method *Display()* that displays the order details
- a method *Cost()* that returns that the cost of the item including the freight.

[2+2+2 Marks]

(c) An order where the item is out of stock and cannot be delivered until the inventory is replenished is referred to as a backorder. The number of days till the inventory is replenished is the number of backorder days. A backorder carries a penalty, that is, the customer gets a discount if the item he ordered is backordered. If the number of backorder days is less than a week, the customer gets a discount of 10% on the price of the item, otherwise he gets a discount of 25%.

Implement a class **BackOrder** which inherits from the class **Order** and which has an additional private field, namely:

days <int> number of backorder days

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(Question 1 continued)

The class contains

- a constructor that requires as arguments the name of the item, the unit price, the method of freight, and the number of backorder days:
- a method *Display()* that displays the order details
- a method *Cost()* that returns that the cost of the item including the freight and discount.

[2 + 2 + 3 Marks]

- (d) Write a section of code that will create an instance of order and another instance of a backorder with the following data:

Type of order	Item Name	Price	Transport	Number of backorder days
order	pendrive	300	air	
backorder	blanket	70	sea	8

Your program should finally display the total of the freight costs of both orders.

[3 Marks]

Question 2

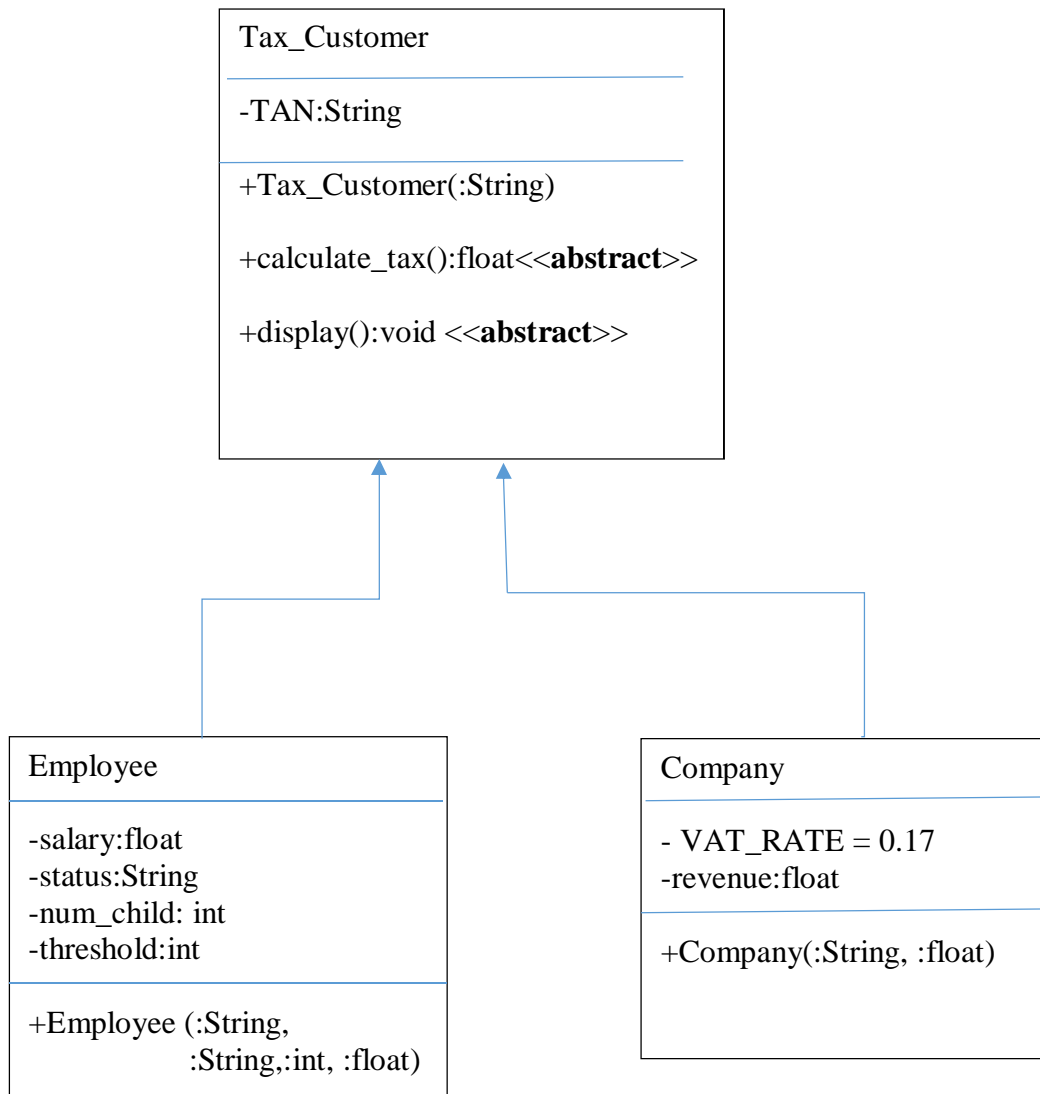
Mauritius Revenue Authority (MRA) is a public organization that collects taxes from employees and profit-making companies. An Employee will pay tax amounting to 15% of their monthly salary above some tax-exemption threshold. This threshold is Rs 20000 for a single person and Rs 25000, Rs 30000 and Rs 35000 for parents with one child, two children and three (or more) children, respectively. For example, if a particular employee has two children and earns a monthly salary of Rs 50000, he will pay a tax of 15% on the bracket of Rs 50000 – 30000.

On the other hand, a company will pay to MRA a straight-forward value-added tax (VAT) of 17% on total revenue obtained from sales of items or services.

The following diagram shows a class diagram of a system.

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(Question 2 continued)



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(Question 2 continued)

In the above diagram, the constructor in the Company class takes the TAN number and the monthly revenue of the company while the constructor in the Employee class takes the TAN number of the customer, his status (single or married), his number of children and his monthly salary and sets the tax exemption threshold accordingly.

- (i) State why at the level of Tax_Customer class, it is not appropriate to have an implementation of calculate_tax().

[3 Marks]

- (ii) Abstract classes and methods are useful to exploit one of the following:

- Encapsulation
- Overloading
- Polymorphism
- Interfaces

With justifications, state which one.

[2 Marks]

- (iii) Implement all of the classes shown in the above class diagram.

[12 Marks]

- (iv) State the amendment you would make if the above problem was to be implemented with interfaces.

[3 Marks]

Question 3

Consider the following scenario where a user uses an electronic calendar to schedule a work event.

The event can be a work meeting, training, brainstorming session or any work-related activity which is usually scheduled in a common meeting room. To create an event, the user interacts with a browser to access the event request form presented by the server over the local area network(LAN). After the event request form is displayed, the user enters the event data into the text fields and clicks on the submit button. The browser validates the user input and informs the user if data is missing. Then, the data is submitted to the server which checks whether the date and time requested is available. If the slot is not available, a message is sent back to the user. Otherwise, a new event is created and a mail alert is sent by the mail server to all staffs who have been associated to that event. The electronic calendar also keeps track of all events and sends a reminder mail alert one day before the event occurs.

Once an event has been created, the user can no longer make changes to that event. If the user needs to edit an event, he/she shall contact the administrator who will modify or cancel the event. The administrator is also responsible adding and removing staff members who are associated with an event.

Draw the following UML diagrams:

- a) Use-Case diagram to model the **whole system**.
- b) Interaction Sequence diagram for **Creating an event**. Assume the interaction is taking place among the user, the browser, the event and the mail server.
- c) State Chart diagram for **Creating an event**

[5 + 8 + 7 Marks]

SECTION B

Question 4

The Multimedia University of Mauritius has a reputation for being a vanguard when it comes to technology. As part of a larger effort to improve its mobility infrastructure and offer students and staff a broader array of mobility services the university is planning to deploy a Mobile Learning System (MLS) across the campus. The system will be available free to staff, students and invited guests and will offer a flexible way to access online resources.

The ultimate goal of MLS is to improve the learning experience of students through innovative features that will not only support traditional methods of learning but also raise the interest of users in discovering new subjects. The system will bring a new dimension in the learning process through initiative of knowledge acquisition, interactivity of the learning process, mobility while learning and through the use of state-of-the-art technologies. A number of applications will need to be developed so that students and lecturers can have easy interaction with each other using their wireless devices such as laptops, mobile phones, PDAs and personal computers. A new user would require an average of 30 minutes training to start using the system effectively.

MLS will consist of a wireless file transfer subsystem that will allow lecturers and students to communicate in an ad hoc fashion. Students will submit assignments wirelessly while lecturers will post lecture notes and other important documents to student using this file transfer subsystem. Large files sharing and transmission will be done using the WiFi technology and smaller files like a picture or short additional notes will use Bluetooth transmission. All wireless transmission will be encrypted using the WEP protocol. The system is password authenticated and passkeys are used to validate Bluetooth devices.

MLS should provide an interactive whiteboard facility for users to share ideas and sketches. Group discussions in classes become more interesting especially when the expected outcome is graphical, therefore the whiteboard facility should provide a user-friendly graphical interface. Moreover, MLS will consist of an audio and video conferencing facility for group discussion on campus. Audio media will help students listen to lectures whilst they are on the move while video would extend to them an additional facility of visualising a lecture or a demonstration. Teleconferencing would greatly facilitate mobile learning as students and tutors can log in at any time for an interactive class in the comfort of their homes.

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(Question 4 continued)

- (a) Identify three functional and three non-functional requirements for the Mobile Learning System from the case-study given above. Ensure your non-functional requirements are phrased in a way they are testable.
[6 Marks]
- (b) Why do requirements change during development? Using one of the requirements that you have proposed in part (a), suggest a change that might occur and explain why it is plausible.
[4 Marks]
- (c) After discovering requirements from various stakeholders, these requirements must be analysed and a number of checks made on them. Explain two types of checks that should be performed on requirements.
[4 Marks]
- (d) Your software company has been chosen for the development of the Mobile Learning System. You are required to develop the software quickly in an environment of rapidly-changing requirements. You have been requested to focus on specific functionalities without adding any that are not specifically requested, which may slow down the process. The development course should be kept simple through systematic and regular testing and design improvements. State the development life-cycle model that will be more appropriate for the Mobile Learning System. Justify your answer by explaining the benefits of the chosen life cycle model.
[6 Marks]

Question 5

- a) Risk mitigation, monitoring & management (RMMM) plan is used to assist the project team in developing a strategy for dealing with risk. For a particular project it has been noted that there is a high risk of late delivery of the project. To deal with the above risk, propose one strategy in each of the following category:

- Avoidance
- Minimisation
- Contingency

[3 Marks]

- b) Consider the following tasks, their duration and their dependencies:

Task	Duration (Weeks)	Predecessor
A	3	None
B	1	A
C	14	A
D	8	B
E	2	B
F	5	E
G	2	E,D
H	2	F, G, C

- (i) Draw the activity diagram.
- (ii) Identify the critical path and determine the project duration time.
- (iii) Suppose there is a pressure to shorten the project duration time and the company is not in a position to recruit new staff. State a feasible means of how the project duration time can be reduced with the available staff.

[4 + 3 + 2 Marks]

- (b) The following table provides information about several projects that were implemented in the past:

Project	LKOC	Budget (\$)	people	Duration (months)	Pages of documentation	errors
aaa-01	12.1	168	5	11	36	29
fff-09	67.9	550	15	9	41	12

Given that the estimated size of a new project ccc-06 is 98 KLOC and the number of team members is now 12, estimate for the new project:

- the duration
- the cost
- the number of errors
- the number of pages of documentation

[8 Marks]

Question 6

- (a) Read the following pseudocode of a function called fees():

```
double fees (AccountDB acc, int acct_id){

    //searching for the account that match with acct_id
    get list of account, acct_list, from database acc
    for each account in acct_list
        if (id of account matches with acct_id)
            save position of match

    //calculating the sum of fees to charge
    if (there is a match)
        //get list of transactions, trans_list,
        //from account which matched
        initialize fees to 0
        for each transaction in trans_list
            if (type of transaction is withdrawal)
                increment fees by Rs 50
        return (fees)
    else
        return (0.0)
}
```

- (a) (i) Define functional cohesion.
- (ii) With justifications, state whether the above function exhibits functional cohesion.
- (iii) How would you modify the above pseudocode so as to achieve higher cohesion.

[2 + 4 + 4 Marks]

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(Question 6 continued)

(b) Read the following module specification:

MODULE:	DetermineDegreeClassification()
INPUTS:	student_id array of modules and their respective marks
OUTPUTS:	A character indicative of degree classification OR "I" if student has not the number of required credits OR "X" if student is not enrolled
DESCRIPTION:	The function first checks if the student is enrolled in the programme of studies. If he is not, the function returns "X". Otherwise, the function computes the Cumulative Point Average (CPA) and the total number of credits acquired. Any module above pass mark carries a credit of 3 hours. If the number of credits is not satisfied, the function returns "I". Otherwise the function returns: - "F" if $CPA \geq 70$ (first-class division) - "S" if $50 \leq CPA < 70$ (second-class division) - "T" if $40 \leq CPA < 50$ (third-class division) - "U" if $CPA < 40$ (no award)

- (i) For the above specification, state with justifications which testing strategy is more appropriate, white box or black box?
- (ii) For the above specification, derive a complete set of test-cases.

[2 + 8 Marks]

END OF QUESTION PAPER