UNIVERSITY OF MAURITIUS

FACULTY OF ENGINEERING

SECOND SEMESTER EXAMINATIONS

MAY 2015

PROGRAMME	**BSc (Hons) Electronics and Computer Science** **BSc (Hons) Information & Communication Technologies**		
MODULE NAME	**Software Engineering**		
DATE	**Friday** **15 May 2015**	**MODULE CODE**	**CSE2001Y(5)**
TIME	**09:30 – 12:30 Hrs**	**DURATION**	**3 hours**
NO. OF QUESTIONS SET	**6**	**NO. OF QUESTIONS TO BE ATTEMPTED**	**5**

INSTRUCTIONS TO CANDIDATES

Answer any Five questions.

All questions carry equal marks.

Class/Interface Information Sheets are attached

Answer any Five questions.

All questions carry equal marks.

Question 1

(a) State the scope of a data member which is declared public, one which is declared private and one which is declared protected.

[3 MARKS]

(b) The class **Transaction** has 3 **private** attributes namely:

TransID	<int>	/ /the id of the product
UnitPrice	<float>	/ /the price of one unit
Quantity	<int>	/ /quantity of item purchased

The class **Transaction** also has a set of methods:

- A constructor that takes the quantity purchased and the unit price, and initializes the data members. The constructor should also set **TransID** automatically (starting from 100000 and incremented for every next transaction). You may add extra data members to implement automatic setting of **TransID.**
- A method **PrintDetails()** that displays the transaction details.
- A method **ComputeAmount()** that returns the total purchase amount.

Implement the **Transaction** class.

[2+1+2 MARKS]

(c) The class **DiscountedTransaction** inherits from the class **Transaction** and has one additional **private** data member **DiscountRate** of type **float**. The discount that applies to a transaction depends on the quantity purchase, as given in the following table:

Purchase Quantity	Discount Rate
0 - 100	Nil
101 – 200	5 %
201 – 300	7.5 %
Above 300	15%

The class **DiscountedTransaction** also has a set of methods:

- A constructor that takes the quantity purchased and the unit price and determines the discount rate that applies to the transaction.
- A method **PrintDetails()** that displays the details of the transaction
- A method **ComputeAmount()** that returns the total purchase amount after application of discount.

Implement the **DiscountedTransaction** class

[3+2+3 MARKS]

(d) Implement a class that reads for a set of items (from the keyboard) the quantity purchased and the unit price, and displays:
- the transaction details of the purchase of each item
- the **total** purchase amount of **all** items (with application of discount)

[4 MARKS]

Question 2

You are to build a library class **ArrayFloat** which provides several methods which can be used without creating an instance of **ArrayFloat**.

The first method is **Sum()** which takes an array of float values and returns the sum. The second method is **SumSquare()** which takes an array of float values and returns the sum of squares. The third method **Filter()** takes an array of float values and two threshold values **T1** and **T2**, and returns another array with only elements whose values are between **T1** and **T2** inclusive.

(a) (i) What is the implication of defining a data member as static?

(ii) What is the implication of defining a member function as static?

[2+ 2 MARKS]

(b) Implement the class **ArrayFloat**. **[10 MARKS]**

(c) Write a program that reads from the keyboard the mark *m* in a module for a set of *n* students. Using the class **ArrayFloat**, your program should then display the mean mark μ and the variance *v* of marks only between 0 and 100, as given below:

$$\mu = \frac{\sum_{i=1}^{n} m_i}{n}$$

and,

$$v = \frac{\sum_{i=1}^{n} m_i^2}{n} - \mu^2$$

[6 MARKS]

Question 3

Read the following problem statement:

An Automated Ticketing System relies on computer processing and large databases to manage the distribution of tickets to entertainment and sporting events. Customers can purchase their tickets from many locations including the counter where the event will be held or any authorized retail locations. Online point-of-sale terminals are used to record the transaction and print the tickets, while at other locations the transaction is recorded and the customer receives the ticket by mail.

When a request is made, the system is designed to determine automatically from its master house calendar whether the performance requested by the user (event and date) is actually scheduled. The system may suggest alternate events on the same date or different dates of the same event. When the customer selects a date and event, the system shows seats that are available from its master seating chart. As seats are given, the master chart is updated.

(a) State four views that UML provides to model a system. **[2 MARKS]**

(b) Give a use-case diagram for the above system **[5 MARKS]**

(c) Give a class diagram for the above system. **[5 MARKS]**

(d) Read the following addendum for the above system:

At the counter, the customer begins by inserting its bank credit card. If the card is valid, a list of different events is displayed. The customer then selects a particular event, specifies a seat or a number of seats from the seating chart, and confirms purchase of the ticket/s. If the transaction is approved, the seating chart is updated and the tickets are printed out and dispensed to the customer.

(i) List all the possible scenarios that may take place while purchasing a ticket from a point-of-sale terminal.

(ii) Draw one interaction diagram for the normal scenario.

[3 + 5 MARKS]

Question 4

Read the following problem statement:

> A new online system is to be developed to maintain customer information and retail transactions. After consultation with the senior management of the retailer shop, several features have been identified. The system shall be fully menu-driven including all relevant information in screen presented to the user and enabling users to use the system with minimal training. Operators will be able to enter information for customers, modify them and delete customer records. The data input shall be fast so that the system is responsive. The system has the option of displaying the information on a specific customer or on customers in alphabetical order. The system shall allow the shop senior operator to list closing-out sales reports (with details on all retail transactions) for a defined period according to the format as laid out in document PrjOuput766x_c. System administration consists of assigning user access rights to each class of users. Users will then enter their passwords and personal details at the command prompt. The system will deny access to unregistered users.

(a) Define who is a stakeholder. List four stakeholders that might be a source of requirements for the above system. **[2 MARKS]**

(b) Identify four functional & four non-functional requirements for the case-study given above. **[4 MARKS]**

(c) State two reasons why requirements may change during development? Using one of the requirements that you have proposed in part (b), suggest a change that might occur and explain why it is plausible. **[3 MARKS]**

(d) After discovering requirements from various stakeholders, these requirements must be analysed and a number of checks made on them. Explain three types of checks that should be performed on requirements? **[3 MARKS]**

(e) What is meant by contradictory requirements? Identify a case of contradiction in the above case-study. **[3 MARKS]**

(f) The development team feels that the requirements are not yet complete. Moreover, for training purposes, the users would like to experiment with the system before the final system is installed. Select a development life-cycle model that will be more appropriate for the above online system. Justify your answer. **[5 MARKS]**

Question 5

(a) The cost of in-house development for a software company averages £400 per day. The company is considering the purchase of a software package that is 8 KLOC (eight thousand lines of code) that will cost £70,000. Initial evaluation of the package indicates it will need a tailored interface to suit the company; this will involve extra coding of 2 KLOC (two thousand lines of code) in house.

Use the parametric equations as shown in Figure 1 below to estimate the software development cost of the following alternative courses of action.

i) buying the basic package for £70,000 and developing the new functionality in-house, where the inhouse development style will need to be SEMI-DETACHED; **[4 MARKS]**

ii) developing the whole functionality in-house (8 KLOC) without reference to any external supplier. In this case, the development style will be ORGANIC. **[4 MARKS]**

Basic Parametric Model for Estimation of Effort and Duration

This basic estimator is a management model that computes effort and duration of a software development as a function of program size estimated in thousands of lines of code (KLOC). Duration is converted to cost using agreed conversion measures.

Effort = a $(KLOC)^b$ in units of person-months, and Duration = c $(Effort)^d$ in terms of elapsed months.

Parameters a, b, c and d are given in the table below:

The Project	a	b	c	d
ORGANIC	2.4	1.05	2.5	0.38
SEMI-DETACHED	3.0	1.12	2.5	0.35
EMBEDDED	3.6	1.20	2.5	0.32

Common values for estimating time:

number of working days in a year (excl. holidays, sickness, etc.) = 220

number of working days in a month (excl. weekends, holidays etc.) = 20

Figure 1

(continued next page)

(Question 5 continued)

(b) Consider the following task dependencies:

Task	Duration (Weeks)	Predecessor
A	2	None
B	2	A
C	6	A
D	5	A
E	6	D
F	4	B
G	3	F
H	2	C, E, G

i) State the strength of Activity Network diagram over Gantt chart.

[1 MARK]

ii) Using the information from the above table, draw the Activity Network diagram.

[5 MARKS]

iii) Define the critical path. Estimate the duration of the project.

[3 MARKS]

iv) Suppose there is a pressure to shorten the project duration time and the company is not in a position to recruit new staff or to purchase new resources. State a feasible means of how the project duration time can be reduced with the available staff.

[3 MARKS]

Question 6

(a) (i) A good design will have minimum coupling. State what do you understand by coupling?

(ii) Describe briefly the different types coupling. **[1+4 MARKS]**

(b) Describe any four activities that form part of the Software Quality Assurance process. **[6 MARKS]**

(c) Read the following module specification:

MODULE:	**CalculateTax( )**
INPUTS:	TAN_No Total emoluments Number of children
OUTPUTS:	-1, if the earner is not registered 0, if earner's taxable income is less than 0 positive amount, if earner's taxable income > 0
DESCRIPTION:	From the TAN_No, the function first checks if the earner is registered with the Revenue Authority. If he is not, the function returns -1. Otherwise, the function calculates the taxable income by deducting from the total emoluments a tax exemption amount based on the number of children. If the earner has no child, the earner is exempted from tax for the first Rs 275000. If the earner has one child, the exemption amount Rs 325000. If the earner has two children, the exemption amount is Rs 400000. If the earner has three or more children, the exemption amount is Rs 450000. After deduction, if the taxable income is less than zero, the earner does not pay any tax. If the taxable income is greater than zero, he pays a 15% tax on that amount.

From the above specification,

(i) State which type of testing would you adopt, black-box testing or white-box testing? Justify your answer.

(ii) Derive a complete set of test-cases.

[2+7 MARKS]

END OF QUESTION PAPER

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