



**UNIVERSITY OF COLOMBO, SRI LANKA**



UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

**DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)**  
**Academic Year 2011/2012 – 2nd Year Examination – Semester 3**

***IT3104: Object Oriented Analysis and Design***  
***PART 2 – Structured Question Paper***

**26<sup>th</sup> February, 2012**  
**(ONE HOUR)**

**To be completed by the candidate**

BIT Examination Index No: .....

**Important Instructions:**

- The duration of the paper is 1 (one) hour.
- The medium of instruction and questions is English.
- This paper has 2 questions and 11 pages.
- Answer Both questions.
- Both questions will carry equal marks.
- Write your answers in English using the space provided in this question paper.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper.  
If a page is not printed, please inform the supervisor immediately.
- **Non-programmable Calculators may be used.**

**Questions Answered**

Indicate by a cross (X), (e.g. 

X
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) the numbers of the questions answered.

	Question numbers	
	1	2
<b>To be completed by the candidate by marking a cross (X).</b>		
<b>To be completed by the examiners:</b>		

## Case Study

A well established computer manufacturer is in need of developing an online shopping system to enable purchasing of their computers via the internet. Summary of the requirements of the system is as follows.

Customers should be able to select a computer category from the web page. Available categories at the moment are Desktops and Notebooks. Each category has a different computer series associated with it. For example Notebooks will be available in the series 'Home Premium', 'Business Plus' and 'Gamer'. When the customer picks a series from the web page, different models available under the selected series need to be shown. For example, if 'Home Premium' series is selected, models that come under that series 'Home Premium 2000', 'Home Premium 3000' etc. should be shown. Together with the displayed models, summary of the default configuration (Processor, Memory configuration etc.) and standard price of the computer system needs to be displayed.

Each model contains a default configuration which consists of a sub-set of configuration items available in the system. Each configuration item should hold information about the 'item type' which classifies it into different categories such as 'Processor', 'Memory', 'VGA', 'OS', 'Antivirus Software' etc. Each configuration Item should further hold information to describe the item type further. For example if the item type is 'Processor' then a further description such as '2nd generation Intel® Core™ i7-2860QM processor 2.50 GHz' is needed. Price of the each item should also be available.

When a satisfactory model is picked by a customer, he/she can proceed to place an order for a computer with the default configuration (Standard Computer) or else can customize the configuration by selecting the 'Customize' option (known as a Customized Computer). If customization is selected, the default configuration needs to be shown to the customer in detail under different categories such as 'Processor', 'Memory' with configurable items as pick lists. When each item is selected or changed, the system price needs to be calculated and shown accordingly.

Once the system configuration is decided, customer can place an order by filling out necessary details such as shipping address, billing address and shipping method (standard shipping, Express shipping etc). If shipping address and billing address are the same, option should be there to indicate that both addresses are the same by filling details for shipping address. Before using the system, the customer needs to log into the online system with his/her email address and password. If the customer is a new user then, there should be an option to create a new user account.

Next step of the ordering process is the payment. Full payment needs to be made initially, and only credit card payments are accepted by the system.

Upon successful payment, a new order (known as 'Pending' order) will be created and the order number and details of the system configuration are sent to the customer via e-mail.

Salesperson will process 'Pending' orders (which usually take a working day) and then the order together with configuration details and an invoice is sent to the manufacturing division. Once the assembling is completed, the computer is sent to warehouse and it will be shipped to the customers shipping address together with the invoice using the shipping method selected. Order will be updated accordingly whenever it undergoes these changes so that customer can view his/her order status any time.

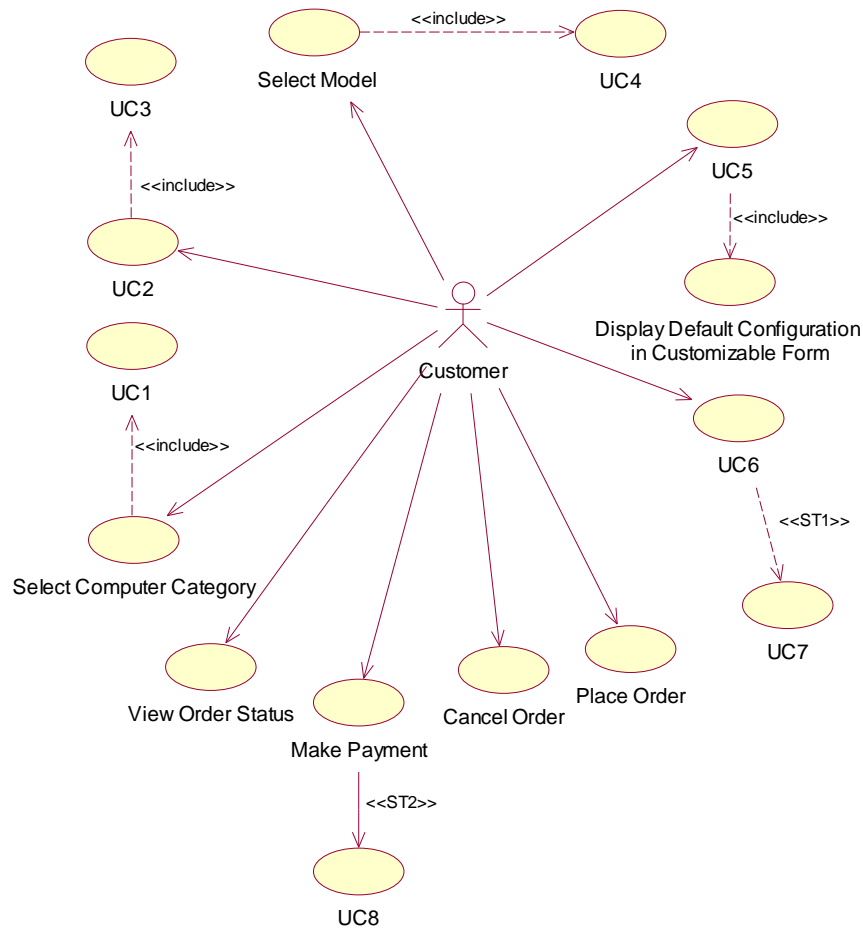
Customer can cancel his/her order any time before the order is shipped and a penalty will be involved for late cancellations.

1)

**Based on the above case study answer question 1.**

(a)

(i.) Identify correct Use Cases from the given list to represent Use Cases designated from UC1 to UC8 in the Use Case diagram shown below.



List of use cases:

A. Display Default Configuration	B. Display Computer Series
C. Send E-Mail	D. Select Customization
E. Select Computer Series	F. Display Computer Model
G. Update System Price	H. Select Customizable Item

**(24 Marks)**

ANSWER IN THIS BOX

UC1 -	B	UC5 -	D
UC2 -	E	UC6 -	H
UC3 -	F	UC7 -	G
UC4 -	A	UC8 -	C

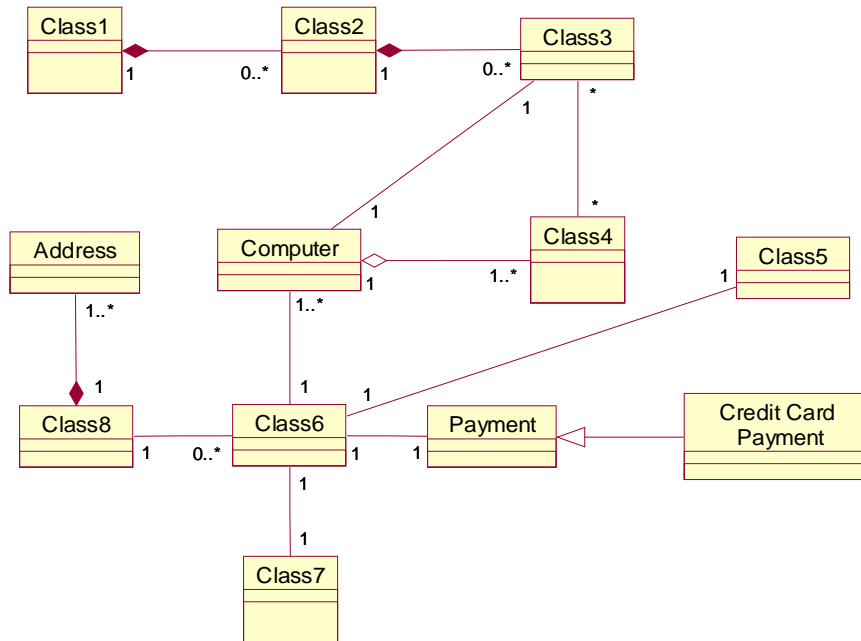
(ii) What are the correct Stereotypes designated as ST1 and ST2 in the class diagram?

**(02 Marks)**

ANSWER IN THIS BOX

ST1 -	<<include>>
ST2 -	<<include>>

(b) Identify the classes from among the given list which are best suited for classes designated from Class1 to Class8 in the class diagram given below.



List :

A. Computer Category	B. Shipping Method
C. Model	D. Invoice
E. Order Status	F. Desktop
G. Computer Series	H. Order
I. System Price	J. Customer
K. Notebook	L. Customized Configuration
M. Configuration Item	N. Customized Computer

(24 Marks)

**ANSWER IN THIS BOX**

Class1 - A

Class2 - G

Class3 - C

Class4 - E

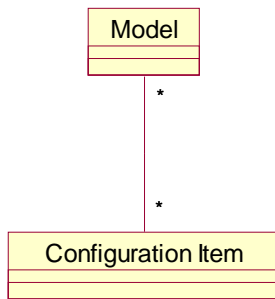
Class5 - D

Class6 - H

Class7 - B

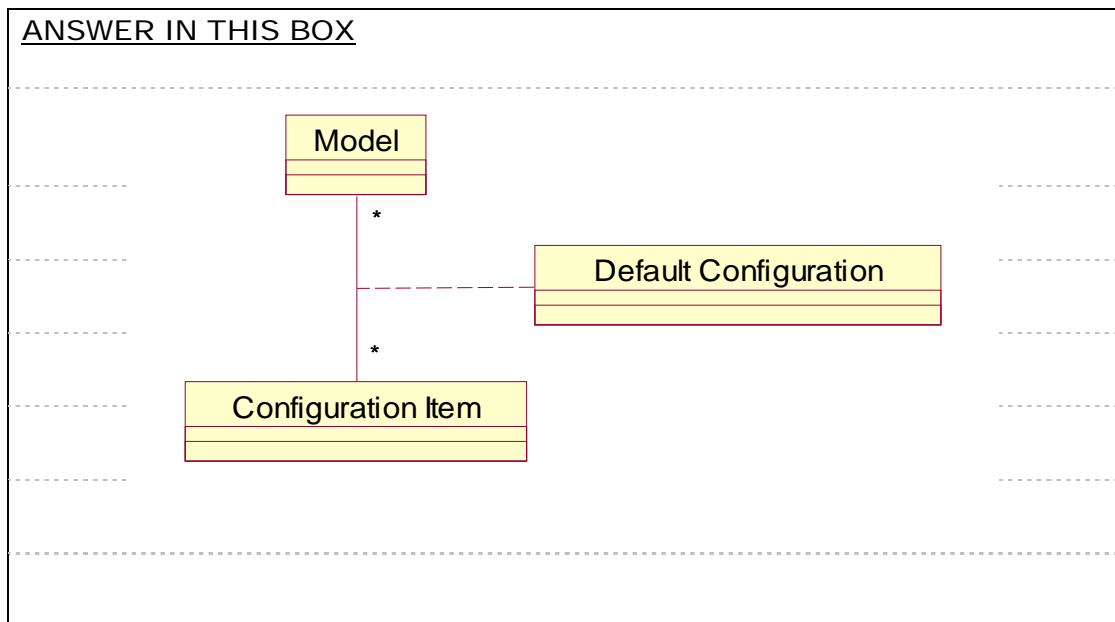
Class8 - J

(c) It was identified that the relationship between 'Model' and 'Configuration Item' classes is many to many as shown in the diagram below (One configuration item such as processor may be available in many models and each model will have many configuration items). Each model will have one 'Default Configuration' associated with it where the relationship between 'Model' and 'Configuration Item' is such that one model identifier and Configuration Item identifier can be present in 'Default Configuration'. How can the many-to-many relationship between above classes be refined with respect to Default configuration? (you may extend the following diagram).

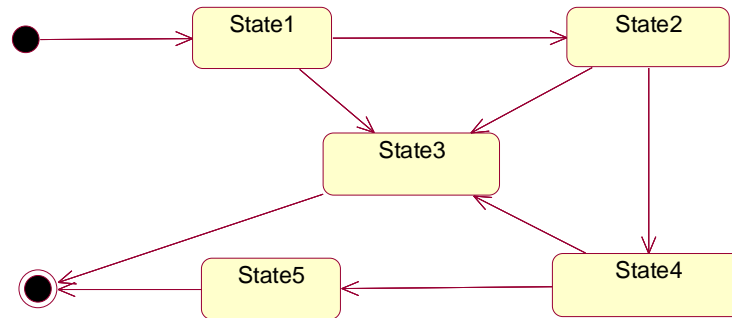


(10 Marks)

ANSWER IN THIS BOX



(d) Following State Chart Diagram has been drawn to Order Class.



Identify the states from State1 to State5.

(15 Marks)

ANSWER IN THIS BOX

State1 - Pending

State 2 - Processing

State 3 - Cancelling

State 4 - Shipped

State 5 - Manufacturing

(e)

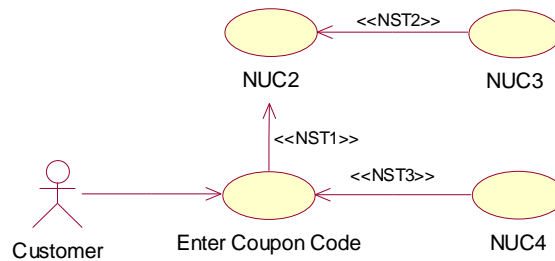
There may be certain promotional periods where the computer manufacturer decides to give discounts by way of providing 'Coupon Codes' (Discount Vouchers).

Coupon Code is a unique code and is made available through certain web sites during promotional periods. There is a validity period for each code (will be valid from a certain date and will expire on a certain date) Customers can find these codes from these web sites and when the computer is ordered, the coupon code can be entered. When a coupon code is entered, the system validates it and if valid, the corresponding discount percentage will be applied to the sytem price and the discount amount and the new price is displayed. If validation failed, the validation routine will display an error message. Same Coupon code may be used for different orders but only one coupon code can be used for a single order.

Answer the given questions regarding the above new requirement.

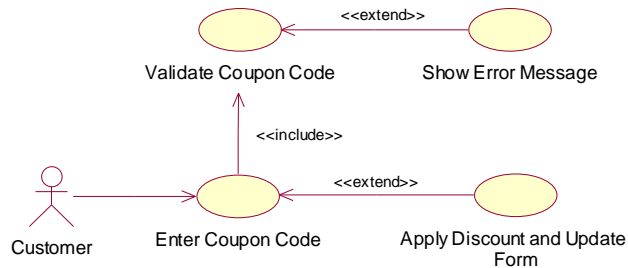


- (i) Following use case diagram is one way of extending the existing use case model to cater for this new requirement. You are required to Name use cases and stereotypes. (Only new use cases are shown)



**(12 Marks)**

**ANSWER IN THIS BOX**



- (ii) What is(are) the new class(es) that should be there to accommodate the above requirement?

**(05 Marks)**

**ANSWER IN THIS BOX**

*CouponCode*

(iii) Write down the attributes of the new class(es)?

(08 Marks)

ANSWER IN THIS BOX

*Code, ValidFromDate, ValidUntilDate,  
DiscountPercentage*

2) (a) Assume that one has identified the following classes for a particular problem domain.

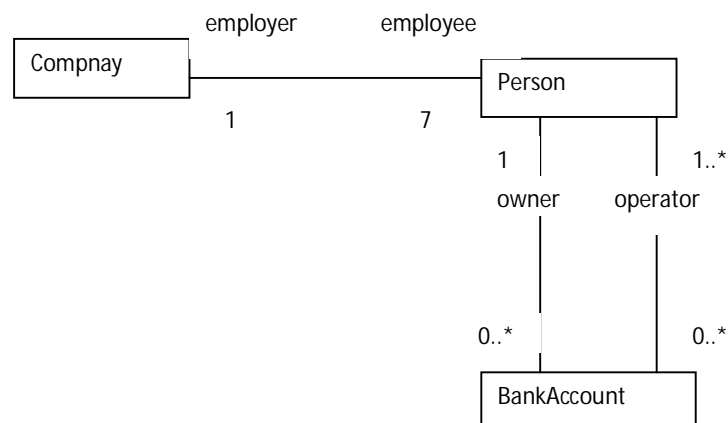
Company, Person, BankAccount

Considering the following business rules, complete the UML model with multiplicity, navigability and role names/ association names.

- A company can have exactly 7 employees.
- A person can't have more than one job at a time.
- A BankAccount can have exactly one owner.
- A BankAccount can have one or many operators.
- A person may have zero to many bank accounts.
- A person may operate zero to many Bank accounts.

(40 Marks)

ANSWER IN THIS BOX



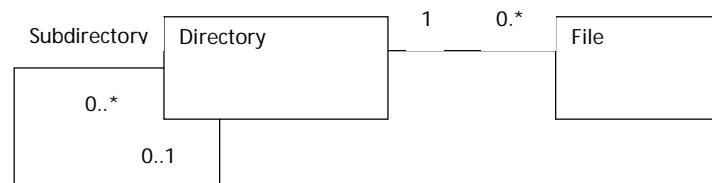
(b) Consider the following paragraph extracted from a requirement statement.

“Each directory object can have links to zero or more directory objects that play the role of sub directory and to zero or one directory object that plays the role of parent. In addition, each directory object is associated with zero or more file objects.”

Draw a class diagram to reflect the above details.

(25 Marks)

ANSWER IN THIS BOX



(C) Consider the following list.

- (i) Money, Australian Dollars
- (ii) Bank, Account
- (iii) Savings Account, Current Account
- (iv) Student, Graduate Student
- (v) Continent, Country
- (vi) Account, Account324567
- (vii) Account, Fixed Deposit Account
- (viii) Region, City
- (ix) Vehicle, Three Wheeler
- (x) Aircraft, Glider
- (xi) Book, Chapter
- (xii) Aircraft , Engine
- (xiii) Car, Tyre
- (xiv) Payment, CreditCard Payment
- (xv) Employee, WeeklyPaid Employee

Which of the above would form super class-subclass pairs? Mark the correct answers.

(35 Marks)

ANSWER IN THIS BOX

- |          |          |
|----------|----------|
| i.    ✓  | ix.   ✓  |
| ii.      | x.    ✓  |
| iii.     | xi.      |
| iv.   ✓  | xii.     |
| v.       | xiii.    |
| vi.      | xiv.   ✓ |
| vii.   ✓ | xv.    ✓ |
| viii.    |          |

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