

**THE OPEN UNIVERSITY OF SRI LANKA  
DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING  
BACHELOR OF TECHNOLOGY**



**ECX4262 - OBJECT ORIENTED DESIGN AND PROGRAMMING**

**FINAL EXAMINATION – 2012/2013**

**CLOSE BOOK TEST**

**Date: 10<sup>th</sup> August 2013**

**Time: 09:30 – 12:30**

**<INSTRUCTIONS>**

Answer Q1 (**compulsory question**) and any other **three** questions from Q2 to Q6.

**[Q1] (Compulsory Question) [40 Marks]**

A company holds the following information about the vehicles it owns.

- Registration number (all vehicles)
- Engine capacity (cc) (all vehicles)
- Next vehicle test date (all vehicles)
- Laden weight (vans and Lorries only)
- Unladen weight (Vans only)
- Carrying capacity (Vans only)
- Number of wheels (Lorries only)
- Towing capacity (Lorries only)
- Licence grade required (Lorries only)

The company also holds information about the trailers that can be used on a lorry. Each trailer has a trailer number, a load capacity and a date of last service. The company has 40 Lorries and 120 trailers. The company needs to record which trailers can be attached to which Lorries. A lorry may not be allocated a certain trailer, or it may be allocated one or more trailers. A trailer may be allocated to more than one lorry, but it has to be allocated to at least one lorry.

The manufacturer of each vehicle has to be recorded. The company may have many vehicles made by the same manufacturer (e.g. Ford), but it does not store information about manufacturers for which the company does not have a vehicle. A vehicle (such as a Transit) is only made by one manufacturer.

There are two types of employees, contractors and permanent. The attributes driver name, date of birth and address are held for all drivers. The attributes company name, start date and contract length are held for contractors. The attributes national insurance number, salary and references are held for contract staff. Vans and Lorries can be allocated to a permanent employee and not to contractors. Each van or lorry is allocated to just one permanent employee. A permanent employee has a maximum of one lorry or one van allocated to them. However, there are some permanent employees (office staff) who do not have a lorry or van allocated to them.

- a) Draw a class diagram for this scenario, explicitly showing the data items of each class and sub-class. (21 marks)
- b) State two types of modeling in UML. (4 Marks)
- c) State five types of UML diagrams (other than the class diagram and the use case diagram) and describe the main purpose of each. (15 marks)

**[Q2] [20 Marks]**

- a) What is the difference between an “*interface*” and “*abstract class*”? (5 Marks)
- b) Briefly explain the following concepts (10 Marks)
  - Polymorphism
  - Constructor
  - Synchronization
  - Protected
  - static
- c) Write Java program to reverse a String in Java without using API functions. (5 Marks)

**[Q3] [20 Marks]**

- a) State three advantages of using design patterns (5 marks)
- b) Briefly describe the three main categories of design patterns (9 marks)
- c) What are the uses of following design patterns? (6 marks)
  - Factory Pattern
  - Singleton Pattern
  - MVC Pattern

**[Q4] [20 Marks]**

Consider an online reservation system for a bus company. The bus company includes several buses and realizes trips to different cities. Each bus is identified by its plate number and a separately assigned bus number. The trips are based on a predefined schedule and stop at predefined bus stations. Each bus can have only one trip per day. Each bus includes a driver and one hostess. For long trips, the bus will have breaks at service and rest areas. There are two types of trips, normal trips and express trips. Express trips do not stop at intermediate stations.

Seats can be reserved by customers on the web site of the bus company. The customer has the option to directly pay for the seat through the website. In that case, the seat cannot be cancelled (neither by the customer nor by the bus company). If the customer has not paid for the seat, the bus company can cancel the seat if the customer does not show up one hour before the trip. When the reservation is cancelled, the seat will become free and can be sold to another customer. Both the customer and the company staff must authenticate themselves for performing operations with the system.

- a) Draw a use case diagram for describing the functional requirements of the above system. (8 marks)
- b) Passenger Ali lists all scheduled busses from Colombo to Kankasanturai on December 31, 2012. He selects the one that departs at 13:00. The system displays all the seats with their status. Ali chooses seat numbered 9, which happens to be free. He completes the reservation by entering his contact information. We assume Ali had already logged on to the system prior to this scenario.

Construct a sequence diagram for the above scenario. Show any boundary, control, and entity objects explicitly. (12 marks)

**Q5] [20 Marks]**

- a) Explain the access modifiers 'public', 'private' and 'protected' in Java. (6 marks)
- b) Explain the following terms with respect to exception handling. (6 marks)
  - try/catch
  - throw
  - finally
- c) What is an Anonymous class in java? (4 marks)
- d) What do you understand by scope and lifetime of a variable? Explain with examples. (4 marks)

[Q6]

- a) Briefly describe dynamic initialization of a variable in Java? Give an example. (5 marks)
- b) What is “bytecode”? Explain its usefulness while translating a Java program in a wide variety of environments. (5 marks)
- c) Write a Java program that will perform the following operations
1. Create an object of type *ArrayList* that will contain a list of floating-point numbers.
  2. Now insert the following data: 12.34, 34.5, 5.6, 7.89, 10.12 and 3.45
  3. Show the number of elements in the object.
  4. Remove 5.6 and 10.12
  5. Display the content of the object.

(10 marks)