National University of Computer and Emerging Sciences

Lahore Campus

Software Design & Analysis (CS3004)

Final Exam

Total Time: 2h 30m

Total Marks: 50

Total Questions: 5

Date: Jun 7, 2024

Course Instructor(s)

Mr. Aamir Raheem

Roll No Section Student Signature

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CLO 2 : Implement object-oriented principles for software analysis and design

Q1:

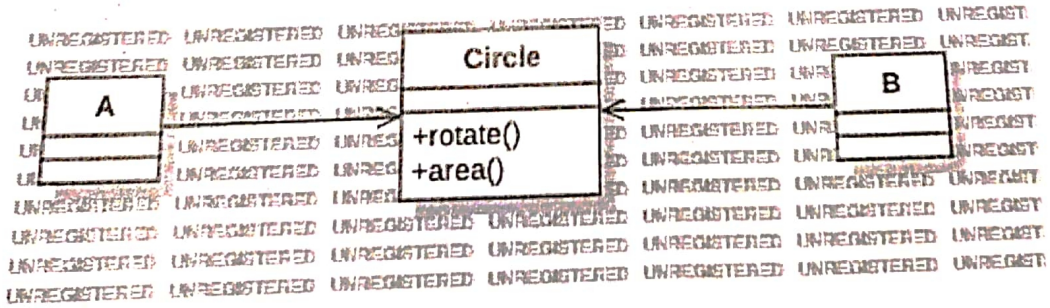
a) A client class is using the following two data structures: vector (class Vector) and linked list (class List). There is also a parent class named Container. Additionally a height-balanced tree is required. A class HBT is available; however we cannot modify its source code.
How the client class can use all these data structures uniformly? Show a class diagram.

b) All the data structures except HBT, have a common function named "search". The name of HBT's function is "find". If the client calls the "search" function how this call would translate into the "find"? Show using a sequence diagram. You do not need to use any loop in this diagram.

CLO 5 : Describe software design guidelines and principles

Q2:

a) Consider the following class diagram:



The class A uses function "rotate" only, while the class B calls method "area" only. Improve this design in the light of the SOLID principles.

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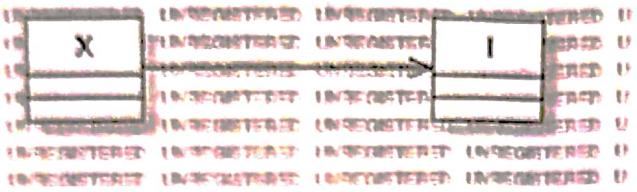
b) Consider the following class diagram:



In future, the class I can be replaced by some other class, such as J or K. Improve the design to make it more maintainable.

CLO 4 : Develop software design artifacts based on requirements specifications

Q5:

a) Give state diagram for a bike's gear. Assume it has four gears. The transmission is manual, not automatic. Secondly it is sequential: one cannot select the fourth gear directly for example; rather he/she needs to put the vehicle in first gear, then in second, and so on. Similarly the driver cannot jump from fourth gear to the first one. When no gear is selected, the system is in a neutral state.

b) Consider a robot that can prepare a particular breakfast (tea and eggs) for you. As you turn it on, the bot fetches required food items such as milk and eggs. Then it prepares tea and boils eggs (these two tasks are done in parallel). Finally it servers the breakfast on your table.
Give an activity diagram for this process.

CLO 3 : Use different UML notations for software design

Q4:

Give a class diagram for an information system of a simple hotel. The system records information about guests and the rooms in which they stay. Duration of their stay is also recorded.
Each room has some furniture and appliances. The system records information about this equipment. The furniture may include beds, chairs and tables. The appliances can be TV, fridge and room-cooler. For each equipment, the system stores various attributes. For example size of a table, or capacity of a fridge, etc.
The system is required to answer various queries, such as which rooms are available at this time or which customers have been staying for more than a week, etc. It keeps records of at least previous one year.
Show any important data members; however you do not need to provide the functions.

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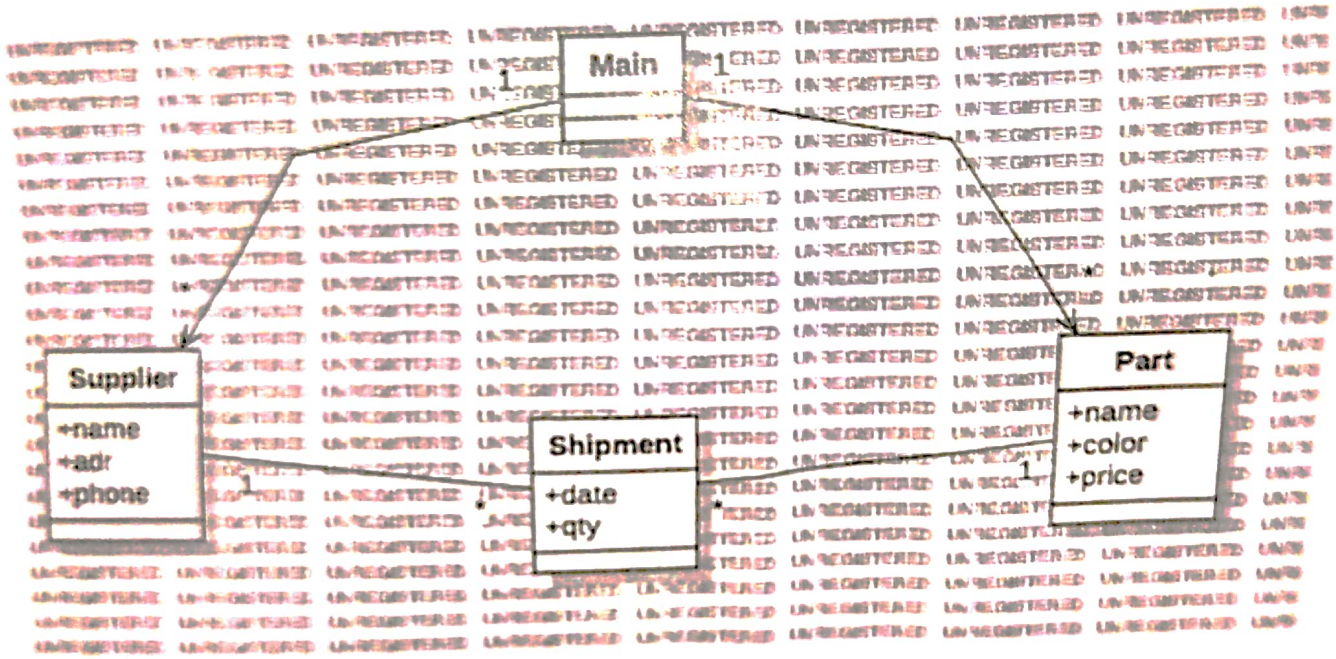
CLO 4 : Develop software design artifacts based on requirements specifications

Q5:

Consider the following class diagram:



A large organization needs various parts for different machines on a regular basis. There are many suppliers available. A supplier supplies multiple parts, and a part can be supplied by more than one suppliers. For each shipment, date and quantity (supplied) is recorded.

The system may generate an invoice for a given supplier. The invoice includes total amount owed to the supplier.

Your task is to identify functions required to compute the total bill for a given supplier. Show the object interactions required using a sequence diagram.