

Fall 2011 Midterm Exam **Sample Solutions**

CS 319 Object-Oriented Software Engineering

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Reminders

- *Time: 120 minutes (2 Hours)*
- Write your name and sign only in the last page as indicated.
- Show your work and reasoning clearly and write legibly, only within the space provided for each question. Do not detach any page(s).
- From the time you receive your exam script, you will have 60 minutes to read all questions and make sure you understand what is expected from you. During this time you may ask your instructor any questions should you require any clarification.

Q1	15	
Q2	08	
Q3	12	
Q4	65	
Total	100 pts	

Question 1: Fill in the blanks [15 pts]

Fill in the blanks below, with a word or more per blank, to form valid statements. When provided with options, choose one and cross others.

- Software engineering aims to build **complex** software systems in the context of frequent **change**.
- A model is **an abstract** representation of a system that enables us to answer questions about the system and to ignore irrelevant details.
- During **requirements elicitation**, the client and developers define the purpose of the system. During **analysis**, developers aim to produce a model of the system that is correct, complete, consistent, and unambiguous by transforming the use cases produced earlier into an object model that completely describes the system as is.
- The dynamic model**, represented in UML with interaction diagrams, state diagrams, and activity diagrams, describes the internal behavior of the system.
- Class diagrams** have two major use cases in software development, one during analysis to model the real-life system as is, and the other during design to model the solution as we want it to be.
- Non-functional requirements** describe aspects of the system that are not directly related to the functional behavior of the system.
- Actors represent external entities that interact with the system. An actor can be **human** or **an external system**.
- A sequence diagram** ties use cases with objects. It shows how the behavior of a use case (or scenario) is distributed among its participating objects.
- Mock-up screens of the user interface are designed during **Analysis** phase.
- Modern software engineering requires lots of human resources due to size and complexity of the projects; therefore good **communication** skills are crucial for success.
- Last but not least, my name is written only on the **last** page of this exam paper as instructed.

Please write your name **only** in the **last page**.

Question 2: OOA/D and UML [8 pts]

What is visual modeling and what are the benefits of visual modeling?

Visual modeling is specification, visualization and documentation of software systems with the help of graphics in order for a better understanding of the system being built. These models are “blueprints” of the system in development. The benefits include:

- Help capture business processes;
- Enhance communication among developers and between the development team and the customers;
- Better manage complexity;
- Help define architecture independent of programming languages;
- Enables reuse.

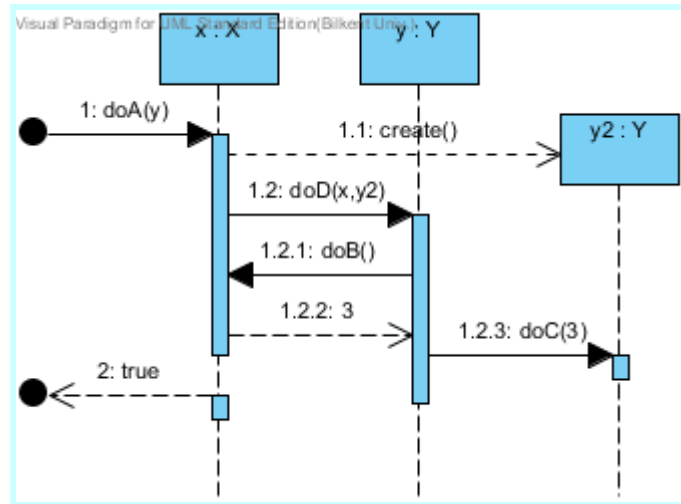
Visual modeling (or UML) is not a tool, method or technique; it’s a type of modeling where graphical notation is used.

Question 3: OOA and UML [12 pts]

Study the following skeletal code for a couple of classes. Draw a Sequence Diagram that describes the code segment in the implementation/body of the method `doA()` of class `X` (the entire duration inclusively from the time the method is invoked until it returns).

```
public class X {
    ...
    boolean doA(Y y) {
        Y y2 = new Y();
        y.doD(this, y2);
        ...
        return true;
    }
    int doB() {
        return 3;
    }
}
```

```
public class Y {
    ...
    void doC(int i) {
        ...
    }
    void doD(X x, Y y) {
        y.doC(x.doB());
    }
}
```



Question 4: OOA and UML [65 pts]

Consider the following problem description:

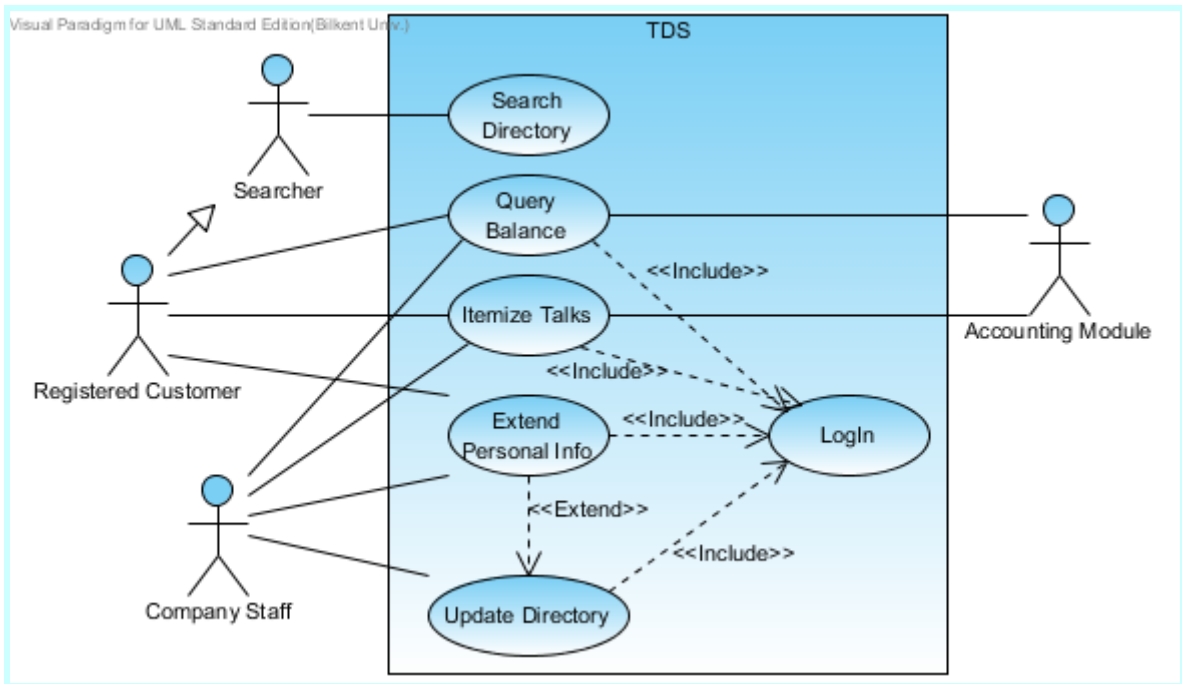
A telephone company has decided to implement an interactive web-based alternative to the telephone directory. The Telephone Directory System (TDS) is to include information about both individual and business customers. Using this service, anybody with access to the Internet shall be able to browse and search the company’s list of telephone customers to find their name, address, phone number, and name & type of business (for business customers only). The customers shall be able to query their outstanding balance and get a listing of itemized calls made during a specified period with this system as well. Such queries will be re-directed to an existing accounting software module. In addition, it shall be possible for the customers listed in the directory to extend this information with their email and web addresses. To access such functionality, customers must authenticate themselves by supplying a password provided by the telephone company. The system must also handle updates of the directory including extension of the customer information with email and web address by company staff. For security reasons, this shall not be done from the web-interface, but only from workstations within the company’s internal network. A user friendly interface for the system is crucial for users of arbitrary computer literacy.

a) [5 pts] List and justify two non-functional requirements for this system.

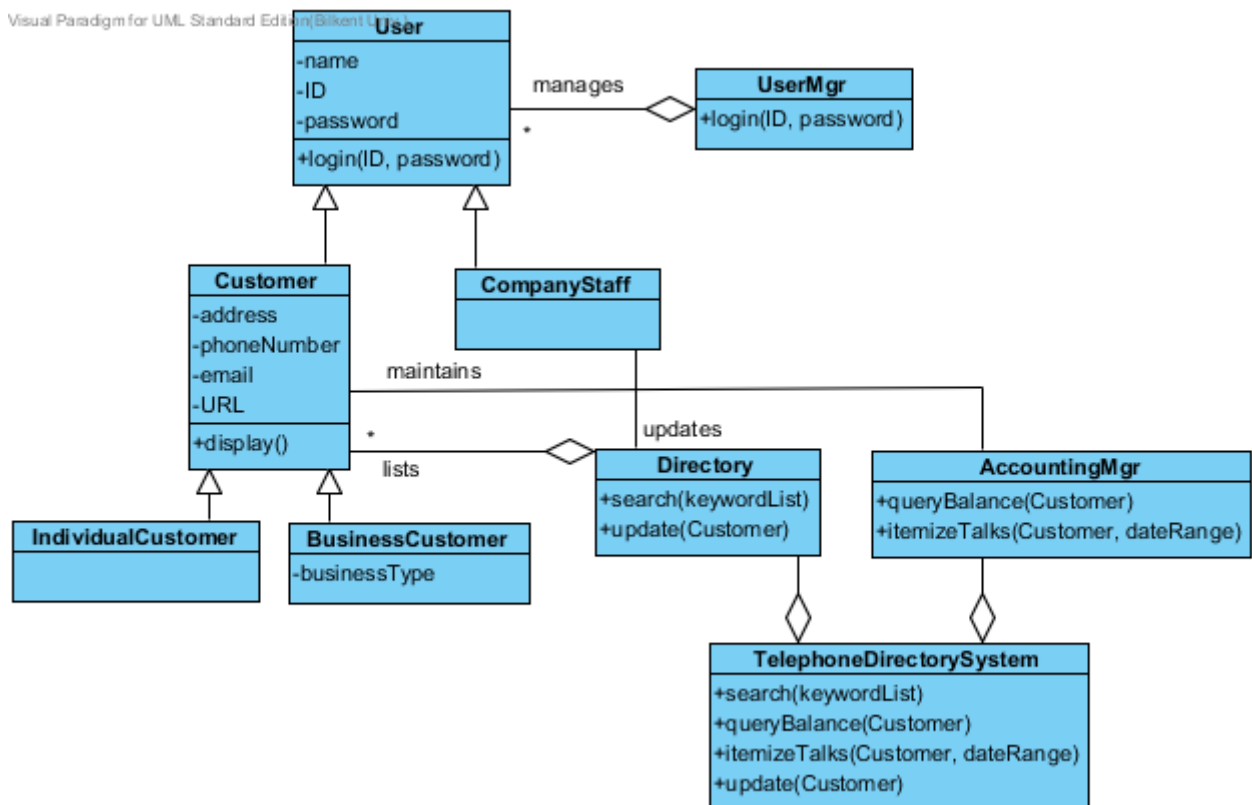
User friendly interface (specified) & immediate/fast response (required by all client/server systems)

Please write your name **only** in the **last page**.

b) [20 pts] Identify actors and use cases for the system described above and show them on a UML Use Case Diagram.



c) [20 pts] Perform a quick application domain analysis to come up with an object model for the above system. Express your findings with a UML Class Diagram, making sure to identify any critical operations of classes.



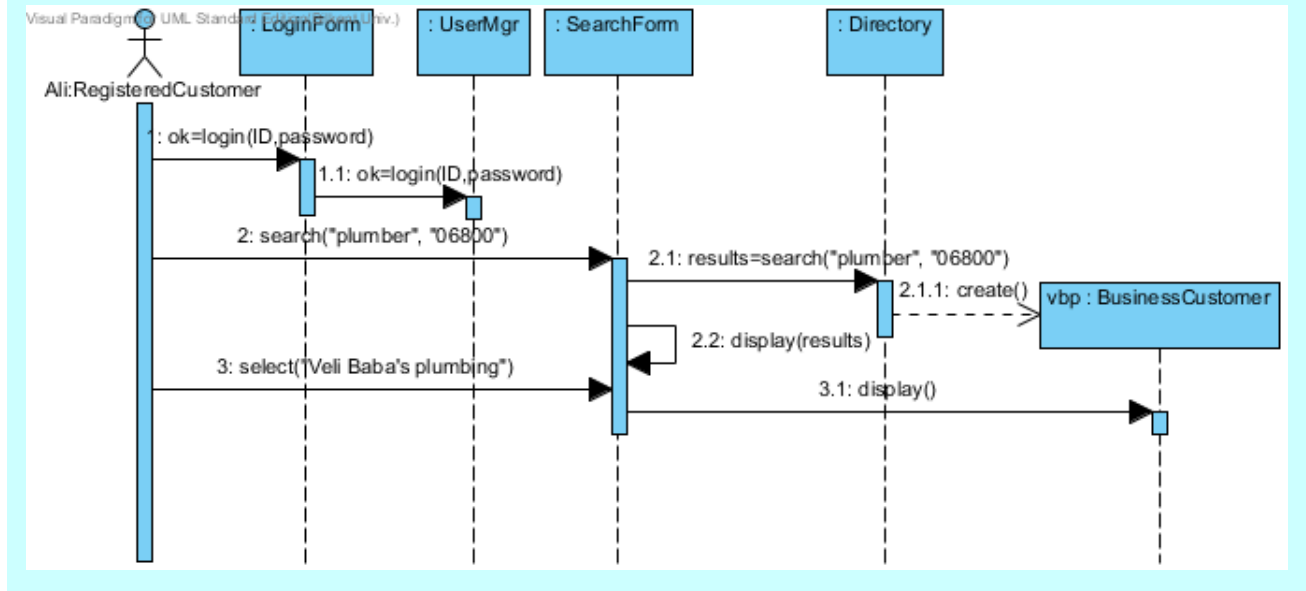
Please write your name **only** in the last page.

d) [20 pts] Consider the following use case scenario:

A business owner, a plumber named Ali Ozcan, successfully logs on to the above telephone directory system. He then browses all plumbers in his area (zip code 06800). Among them, he selects one with name Veli Baba's Plumbing, whose details (address, phone, web page, etc.) are listed.

First, identify the use case that this scenario belongs to. Then, draw a UML Sequence Diagram for this particular scenario. You may use any software/solution domain objects if needed as well.

The scenario looks like an instance of the "Browse Directory" use case.



Mini Dictionary:

authenticate	doğrulamak
to itemize	listelemek, ayrıntı vermek
outstanding balance	ödenmemiş bakiye
plumber	su tesisatçısı
skeletal	çatısal, iskeletsel
zip code	alan kodu

I hereby affirm that the work submitted in this examination is my own exclusively.

Name & Signature: Uğur Doğrusöz Kıvanç Dinçer & Murat K. Güngör