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

Spring 2014 Midterm Exam Sample Solutions

CS 319 Object-Oriented Software Engineering

Instructor: Uğur Doğrusöz

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	*08*	
Q2	*10*	
Q3	*17*	
Q4	*65*	
Total	***100 pts***	

Q1 [8 pts]

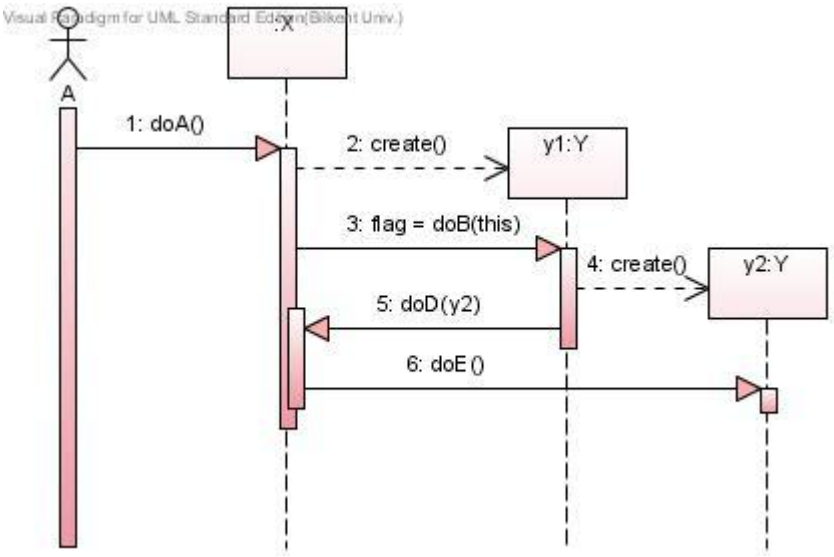
Describe **iterative** development approach and contrast it to sequential or "waterfall" lifecycle approach.

The iterative approach involves early programming and testing of a partial system (not all requirements addressed), in repeating cycles. It also assumes development starts before all the requirements are defined in detail; feedback is used to clarify and improve the evolving specifications.

We rely on short quick development steps, feedback, and adaptation to clarify the requirements and design. To contrast, waterfall values promoted big upfront speculative requirements and design steps before programming. Research supports that the iterative methods are associated with higher success and productivity rates, and lower defect levels.

Q2 [10 pts]

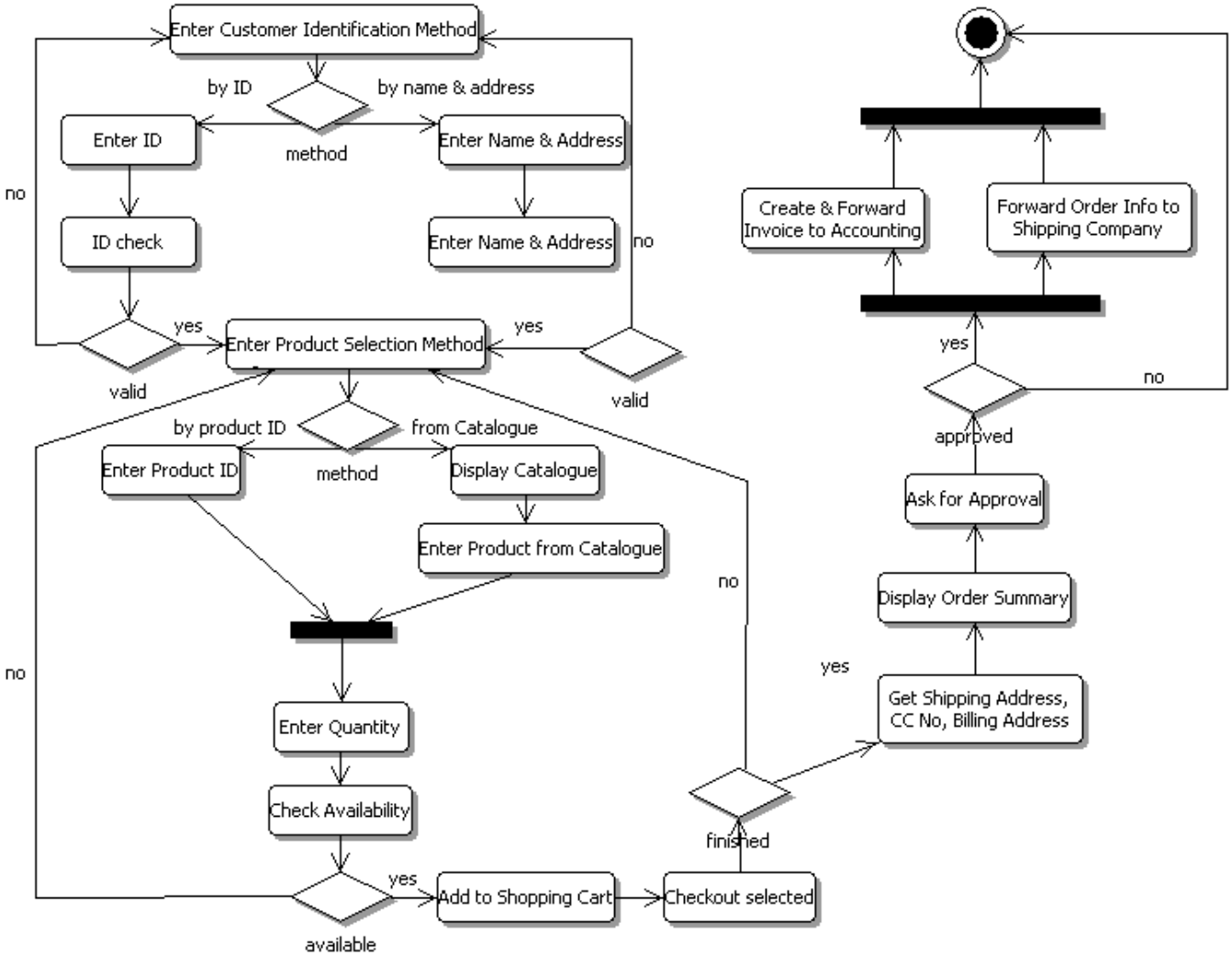
Consider the following sequence diagram. Write skeletal code (i.e., code that can be derived from this diagram) for any **non-boundary** objects/classes involved in the below diagram. Specify only what is conveyed in the diagram.



```
public class Y {
    …
    boolean doB(X x) {
        Y y2 = new Y();
        x.doD(y2);
        …
        return flag;
    }
    void doE() {…}
}
```

Q3 [17 pts]

A mail-order company wants to automate its order processing. The order processing system should be accessible to customers via the web. Customers can also call the company by phone and interact with the system via a customer representative. The use-case analysis reveals use-cases such as "Place Order", "Check Status", and "Cancel Order" for a customer and use-cases such as "Return Product" and "Cancel Order" for a customer representative. Below is an activity diagram for detailing out part of the use (business logic) of this mail-order company.



(a) Identify any problems with the diagram, and fix them **on** the diagram.

- "Enter" -> "Get" (activities of the system, not user)
- "ID Check" -> "Check ID"
- "Checkout selected" is not an activity, should be removed
- Synchronization bars are not used when there is no concurrent activities
- No start point is specified

(b) Describe in "plain English", without using any technical/UML terminology (i.e., using language understandable by the customer), the information the diagram conveys about the real life system being modeled.

This activity diagram details out the processes and workflow for the use case "Place Order". First the customer is identified either by ID or by name & address. Then as many products as desired with specified quantity are selected either by product ID or by browsing the catalogue if available, and added to the shopping cart. When selection is finished, shipping info is taken, and upon approval of the order, an invoice is created and forwarded to the accounting department while the order information is forwarded to the shipping company.

Q4 [65 pts]

Consider the following problem description:

A private neighborhood health clinic wants to automate management of their operations by implementing an interactive web-based software system using the html5 standard, which should make the system run on tablets and smart phones as well as desktop and laptop machines. The Clinic Management System (CMS) is to be used by both patients and the clinic personnel (doctors, nurses, and administrative staff).

A patient will be able to make on-line appointments for an examination, cancel an existing appointment, inspect lab results, check their outstanding balance and make payments using their credit cards.

A doctor will be able to record their schedules including the time periods they are busy and periods they have time-off. They will also be able to browse their schedules for any appointments for examinations. The doctors could also ask to cancel appointments during a specified period, in case they become unavailable for unexpected reasons, subject to approval by clinic director, who is also a doctor with management responsibilities. A doctor may browse a list of his/her patients, including past patients. Initially only some brief information is displayed for each patient but the doctor may ask for details (including picture and patient records in chronological order).

A nurse will be able to request time-off using CMS, subject to approval by the head nurse (head nurse herself/himself reports to the clinic director).

The administrative staff can also help patients, doctors and nurses to perform operations on their behalf, in situations where such a user does not have access to the Internet.

The accounting of the clinic for both customers (balances due) and clinic personnel (their salaries and other compensation) are to be managed by an existing software module put in place by the clinic when they first started operation.

User authentication is especially critical for such a system with sensitive information for both patients and clinic personnel. In addition, clinic currently has only about a couple of hundred active patients but as time goes by, especially after the automated system is in place, the clinic management expects to have at least thousands of patients if not more.

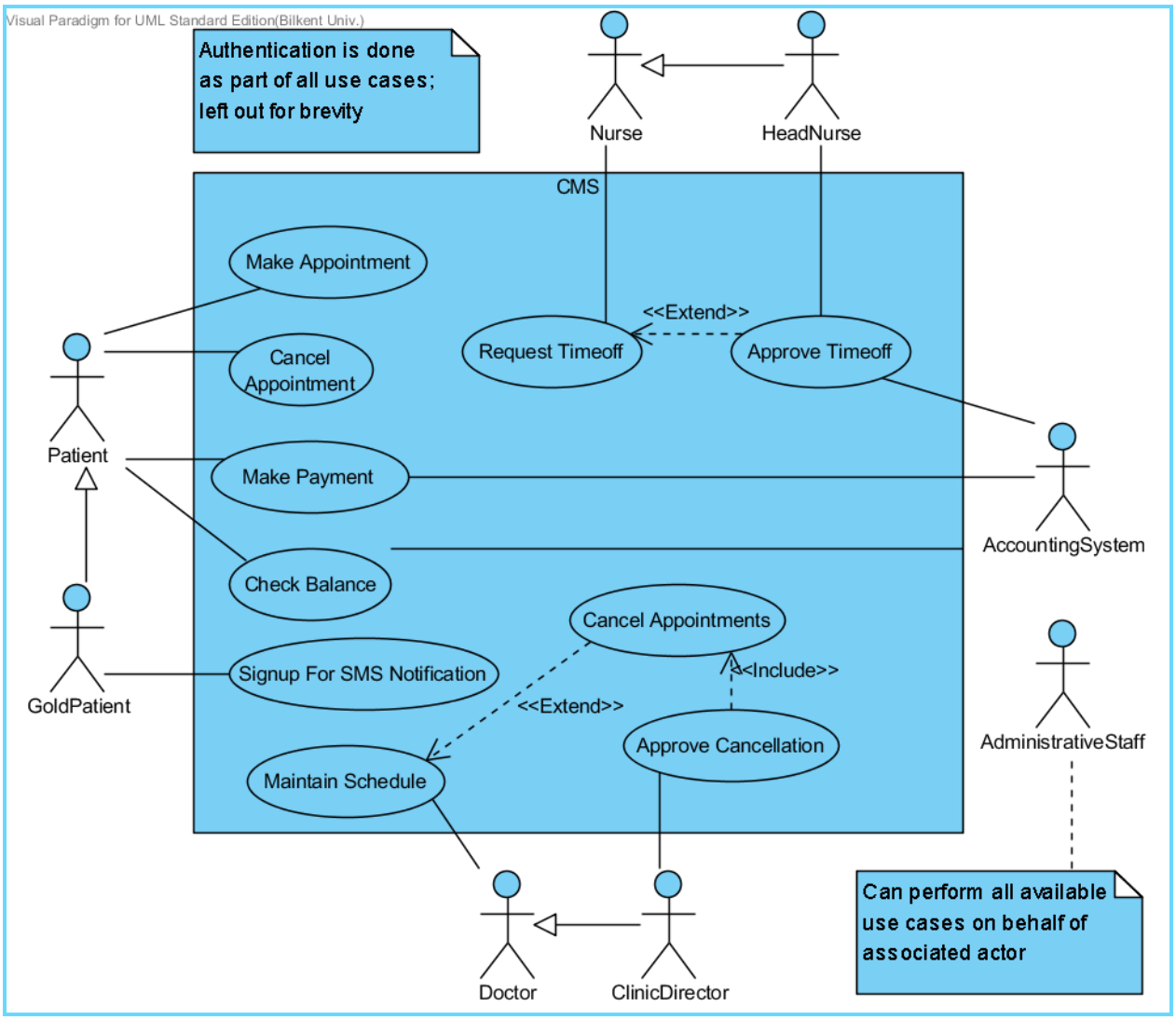
To attract more customers, the clinic management has also decided to put two types (silver and gold) of memberships in place with varying privileges. One can become a silver customer if they have used clinic

facilities pretty regularly for at least two years. A customer who has been a silver customer for at least two years gets to be a gold customer, assuming they have never failed to make payments past their due dates. Both silver and gold customers are provided with more flexible time slots for making appointments. Gold customers get additional privileges such as getting an SMS notification when their lab results are ready.

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

Response time (web-based) and scalability (simultaneously used by many)

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.

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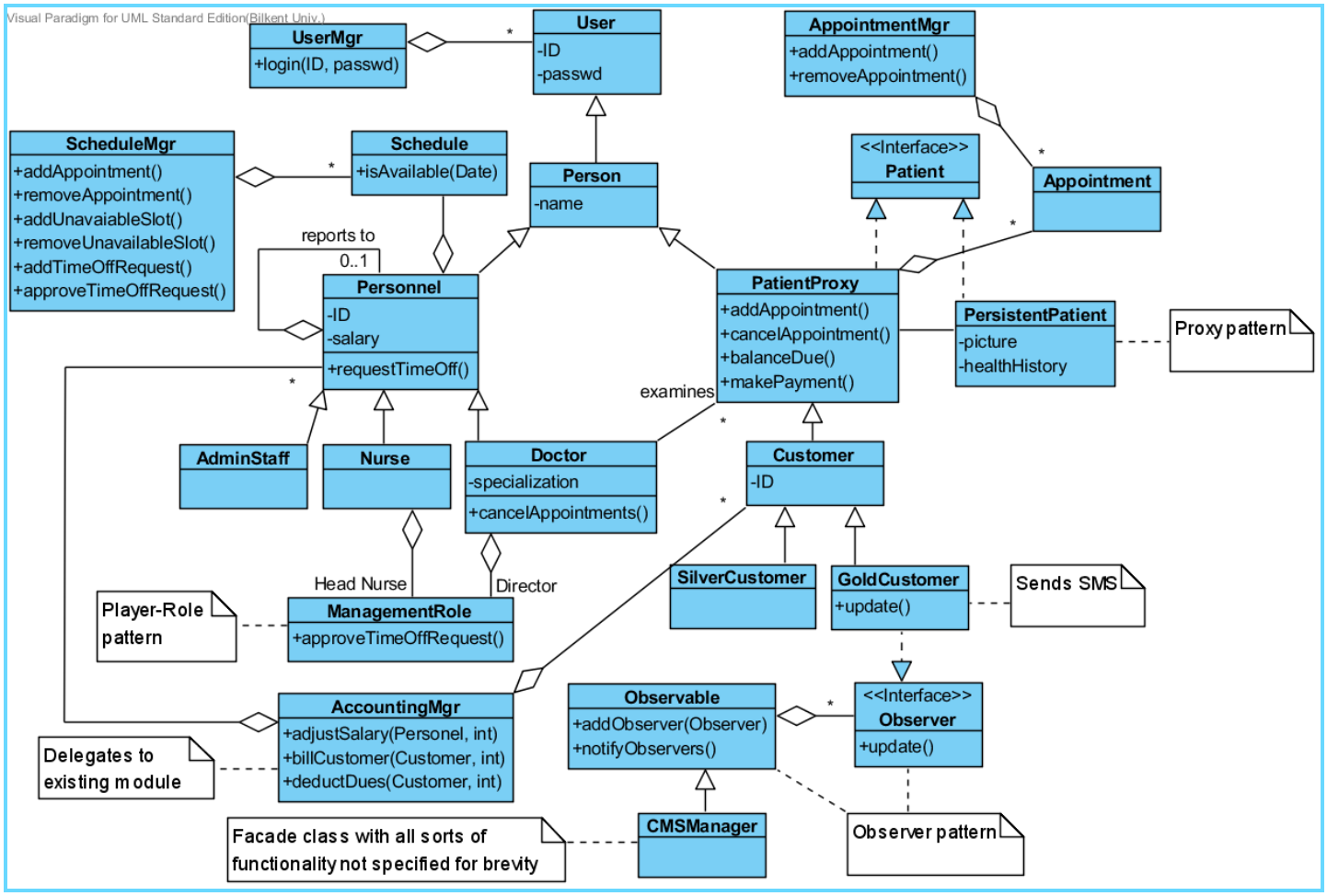

d) Consider the following use case scenario:

Mr. Smith is a registered patient of a clinic using CMS. Lately he is feeling back pain and decides to go to the clinic for an examination on upcoming Monday (March 31, 2014). Among the doctors available he prefers Dr. Clark. Since he is not very computer friendly, he prefers to call the clinic and ask Mrs. Black (clinic staff) to help him set up an appointment. As he is a morning person, he asks to get the first morning appointment (8:30) but Dr. Clark doesn't seem to be available at this hour. He then asks for the following day and successfully books an appointment with Dr. Clark. The system displays Mr. Smith's current address ("123 York Ave, NY") and health insurance information ("FirstHealth",456) and asks whether or not an update would be needed. Mr. Smith tells Mrs. Black that there is no change in this information, and Mrs. Black completes the task. You may skip any authentication steps.

- *[2 pts]* First, identify the use case that this scenario belongs to.

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

- *[18 pts]* Then, draw a UML Sequence Diagram for this particular scenario. You may use any software/solution domain objects if needed as well.

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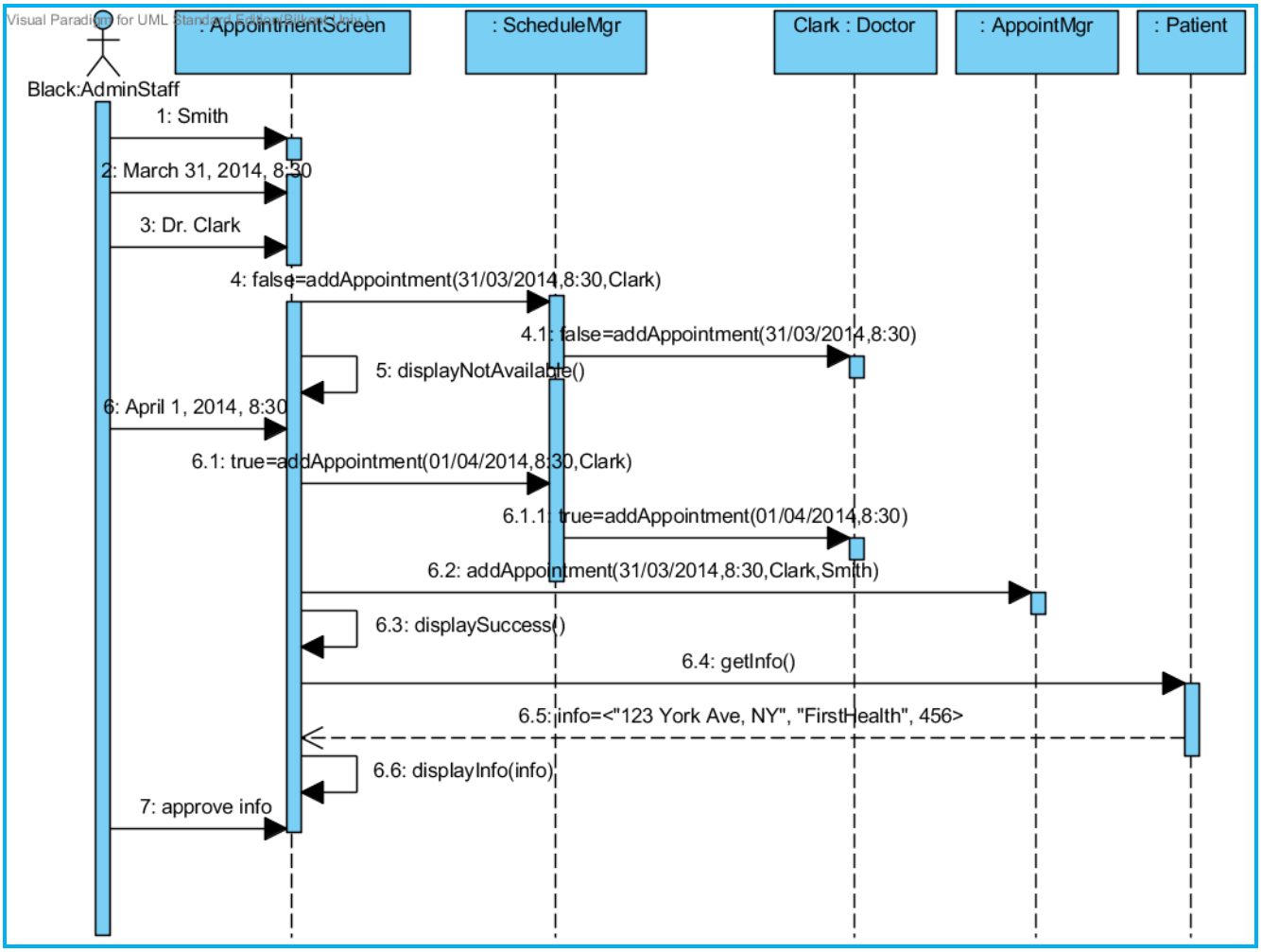

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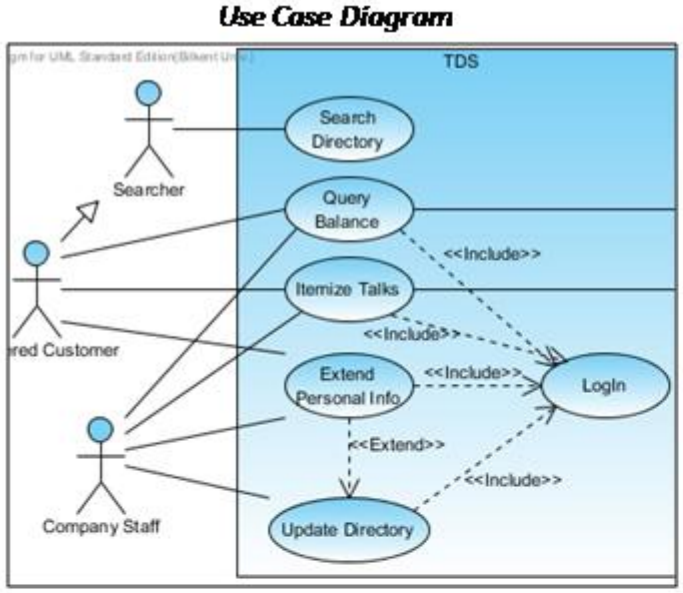
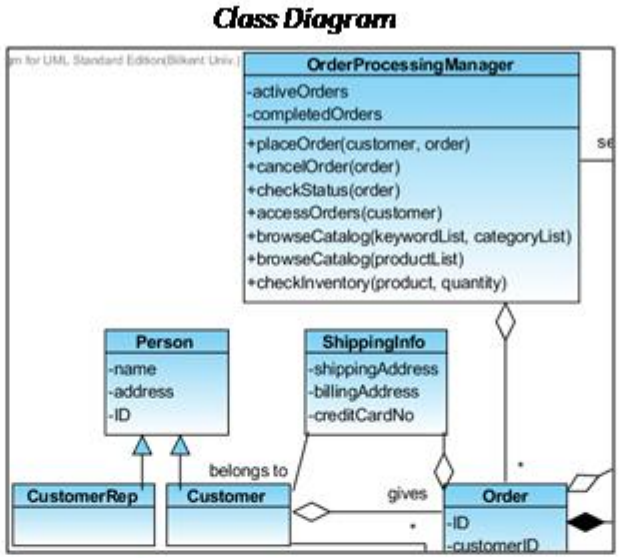
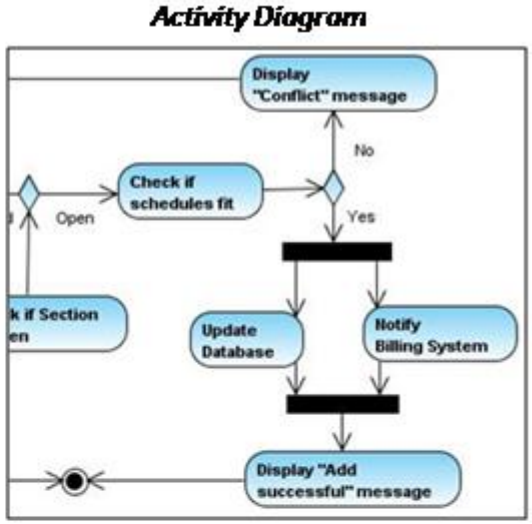
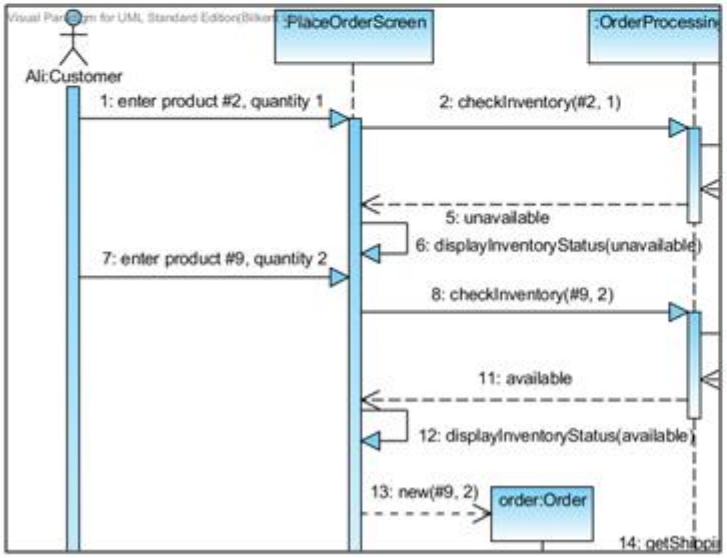
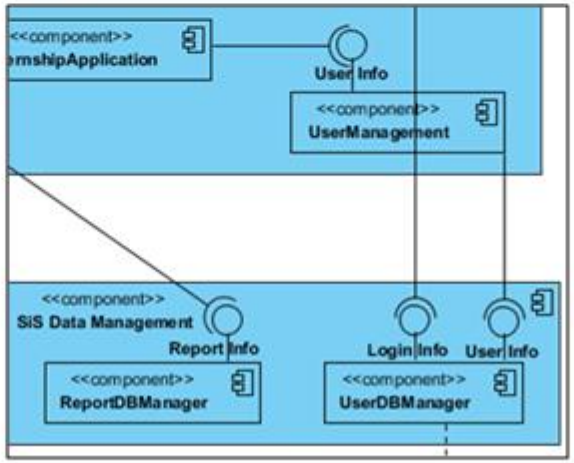


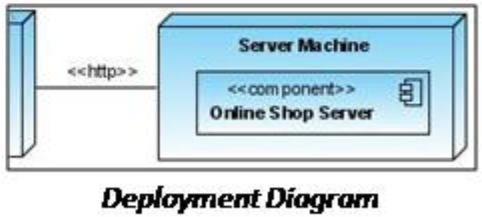




Sample UML Notation







Mini Dictionary:

To authenticate	Doğrulamak
To approve	Onaylamak
Available	Uygun, mevcut
Business logic	İşleme mantığı
Customer representative	Müşteri temsilcisi
Balance due	Borç
Compensation	Tazminat/maaş/telafi
To convey	Taşımak, iletmek
Examination	Muayene/tetkik
Flexible	Esnek
Head nurse	Başhemşire
To inspect	İncelemek
To justify	Doğrulamak, haklı göstermek
Mail order	Posta ile yapılan mal siparişi
Outstanding balance	Ödenmemiş bakiye
To place an order	Bir sipariş vermek
Privilege	Ayrıcalık/imtiyaz
To report to	Karşı sorumlu olmak/rapor etmek
To return a product	Bir ürünü iade etmek
Salary	Maaş
Sensitive	Duyarlı/hassas
Skeletal	iskelet gibi, çatısal
Staff	Çalışan
Time-off	İzin, çalışılmayan zaman
Time period/slot	Süre/zaman aralığı

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

Name & Signature: Uğur Doğrusöz **Section:**