PROBLEMS

CASE STUDY 1: Dental office software:
Tom is starting a dental practice in a small town. He will have a dental assistant, a dental hygienist, and a receptionist. He wants a system to manage the appointments.
When a patient calls for an appointment, the receptionist will check the calendar and will try to schedule the patient as early as possible to fill in vacancies. If the patient is happy with the proposed appointment, the receptionist will enter the appointment with the patient name and purpose of appointment. The system will verify the patient name and supply necessary details from the patient records, including the patient's ID number. After each exam or cleaning, the hygienist or assistant will mark the appointment as completed, add comments, and then schedule the patient for the next visit if appropriate.
The system will answer queries by patient name and by date. Supporting details from the patient's records are displayed along with the appointment information. The receptionist can cancel appointments. The receptionist can print out a notification list for making reminder calls 2 days before appointments. The system includes the patient's phone numbers from the patient records. The receptionist can also print out daily and weekly work schedules with all the patients.

CASE STUDY 2: B&B Software
Tom and Sue are starting a bed-and-breakfast in a small New England town.
They will have three bedrooms for guests. They want a system to manage the reservations and to monitor expenses and profits. When a potential customer calls for a reservation, they will check the calendar, and if there is a vacancy, they will enter the customer name, address, phone number, dates, agreed upon price, credit card number, and room number(s). Reservations must be guaranteed by 1 day's payment.
Reservations will be held without guarantee for an agreed upon time. If not guaranteed by that date, the reservation will be dropped.

CASE STUDY 3: Automobile Dealership problem.
An automobile dealer wants to automate its inventory. It can record all of the cars that a customer purchases. It records all repairs. It records all arriving shipments of repair parts. The dealer wants daily reports on total daily repairs, daily sales, and total inventory. This report is called ''dailyreport.'' The dealer also keeps track of all customers and potential customers that visit the dealership.
The dealer also wants a monthly report showing all visits and purchases by customers listed by day of the month. The dealer also wants the ability to query about any customer or potential customer.

Questions:
These are the general questions that you have to solve for each of the case studies given before:

1. **Write Scenarios for the problem.**
2. **Draw a USE CASE Diagram.**
3. **Draw state diagrams of the problem.**
4. **Draw a DFD for the problem. (Activity Diagram)**
5. **Draw an object model for the problem. (Class Diagram)**

Other questions in exam may be done to draw also for Entity Relationship (ER), Class Diagrams and other explained UML diagrams, so practice yourself even with them.

Case 1:
You are hired to develop an automatic patient monitoring system for a home-bound patient. The system is required to read out the patient's heart rate and blood pressure and compare them against specified safe ranges. The system also has activity sensors to detect when the patient is exercising and adjust the safe ranges. In case an abnormality is detected, the system must alert a remote hospital. (Note that the measurements cannot be taken continuously, since heart rate is measured over a period of time, say 1 minute, and it takes time to inflate the blood-pressure cuff.) The system must also (*i*) check that the analog devices for measuring the patient's vital signs are working correctly and report failures to the hospital; and, (*ii*) alert the owner when the battery power is running low.

Case 2:

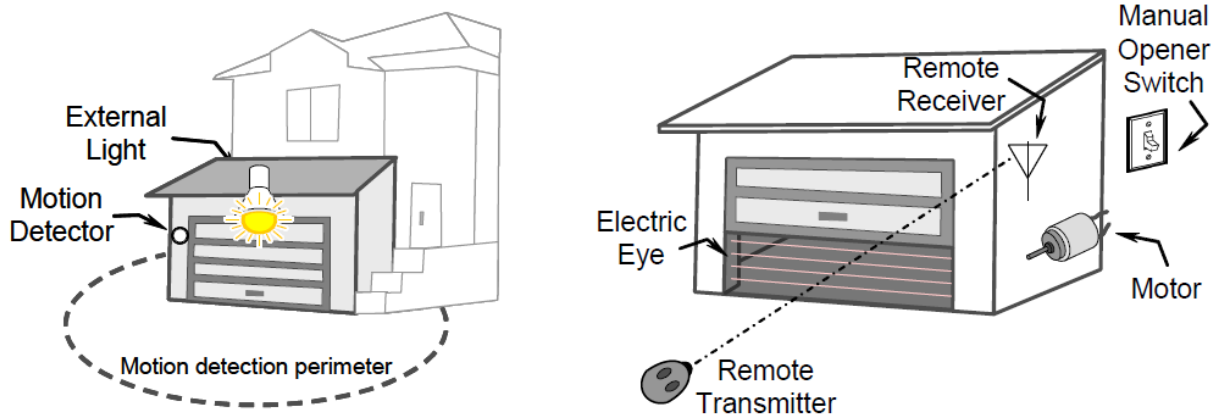
Consider an online auction site, such as eBay.com, with selling, bidding, and buying services. Assume that you are a buyer, you have placed a bid for an item, and you just received a notification that the bidding process is closed and you won it. Write a *single use case* that represents the subsequent process of purchasing the item with a credit card. Assume the business model where the funds are immediately transferred to the seller's account, without waiting for the buyer to confirm the receipt of the goods. Also, only the seller is charged selling fees. Start from the point where you are already logged in the system and consider only what happens during a *single sitting* at the computer terminal. (Unless otherwise specified, use cases are normally considered only for the activities that span a single sitting.) List also some alternate scenarios.

Consider the online auction site described in Case 2. Suppose that by observation you determine that the generic Buyer and Seller roles can be further differentiated into more specialized roles:

- Occasional Buyer, Frequent Buyer, and Collector
- Small Seller, Frequent Seller, and Corporate Seller

Identify the use cases for both situations: generic Buyers and Sellers vs. differentiated Buyers and Sellers. Discuss the similarities and differences. Draw the use case diagrams for both situations.

Case 3:



You are hired to develop a software system for motion detection and garage door control.
The system should turn the garage door lights on automatically when it detects motion within a given perimeter.

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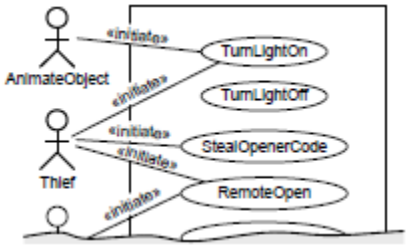
The garage door opener should be possible to control either by a remote radio transmitter or by a manual button switch. The opener should include the following safety feature. An “electric eye” sensor, which projects invisible infrared light beams, should be used to detect if someone or something passes under the garage door while it closes. If the beam is obstructed while the door is going down, the door should not close—the system should automatically stop and reverse the door movement.
The relevant hardware parts of the system are as follows (see Figure above):

- motion detector
- external light bulb
- motor for moving the garage door
- “electric eye” sensor
- remote control radio transmitter and receiver
- manual opener button switch

Assume that all the hardware components are available and you only need to develop a software system that controls the hardware components.
(a) Identify the actors for the system and their goals
(b) Derive only the use cases relevant to the system objective and write brief or casual text description of each
(c) Draw the use case diagram for the system
(d) For the use case that deals with the remote-controlled garage door *opening*, write a fully dressed description
(e) Draw the Behavioral diagram(s) for the use case selected in (d)
(f) Draw the domain model with concepts, associations, and attributes
[Note: derive the domain model using only the information that is available so far—do not elaborate the other use cases]
(g) Show the operation contracts for the operations of the use case selected in (d)



For the system described in Case 3, consider the following security issue. If the remote control supplied with the garage door opener uses a fixed code, a thief may park near your house and steal your code with a code grabber device. The thief can then duplicate the signal code and open your garage at will. A solution is to use so called rolling security codes instead of a fixed code. Rolling code systems automatically change the code each time you operate your garage door.
(f) Given the automatic external light control, triggered by motion detection, and the above security issue with fixed signaling codes, a possible use case diagram is as depicted in Figure above. Are any of the shown use cases legitimate? Explain clearly your answer.
(g) For the use case that deals with the remote-controlled garage door *closing*, write a fully dressed description.

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(h) Draw the system sequence diagram(s) for the use case selected in (b).
(i) Draw the domain model with concepts, associations, and attributes.
[Note: derive the domain model using only the information that is available so far—do not elaborate the other use cases.
(j) Show the operation contracts for the operations of the use case selected in (b).

Case 4:

Most diabetics are currently treated by injections of insulin 2 or 3 times a day but this leads to peaks and troughs in their level of insulin. A portable insulin pump measures the level of blood sugar at regular intervals and delivers doses of insulin depending on the actual level of sugar in the blood. This will lead to a situation where the sufferer's blood sugar levels are much closer to those of people without diabetes. The complications and long-term effects of diabetes can therefore be reduced.

The system measures the level of blood sugar every 10 minutes and if this level is above a certain value and is increasing then the dose of insulin to counteract the increase is computed and injected into the diabetic. The system can also detect abnormally low levels of blood sugar and, if these occur, an alarm is sounded to warn the diabetic that they should take some action.

This case study focuses on the control software for the insulin pump which is concerned with reading the blood sugar (glucose) sensor, computing the insulin requirements and controlling the micro pump which causes the insulin to be delivered.

Case 5:

The department of public works for a large city has decided to develop a Web-based pothole tracking and repair system (PHTRS). A description follows:
"Citizens can log onto a website and report the location and severity of potholes. As potholes are reported they are logged within a "public works department repair system" and are assigned an identifying number, stored by street address, size (on a scale of 1 to 10), location (middle, curb, etc.), district (determined from street address), and repair priority (determined from the size of the pothole). Work order data are associated with each pothole and include pothole location and size, repair crew identifying number, number of people on crew, equipment assigned, hours applied to repair, hole status (work in progress, repaired, temporary repair, not repaired), amount of filler material used, and cost of repair (computed from hours applied, number of people, material and equipment used). Finally, a damage file is created to hold information about reported damage due to the pothole and includes citizen's name, address, phone number, type of damage, and dollar amount of damage. PHTRS is an online system; all queries are to be made interactively."

a. Draw a UML use case diagram for the PHTRS system. You'll have to make a number of assumptions about the manner in which a user interacts with this system.
b. Develop a class model for the PHTRS system.

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