

CS264 Laboratory Session 7

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28th November 2017

Deadline: Solutions to be submitted by 5pm 11th Dec 2017.

1 Lab objectives

In this lab you will be given two sets of software specifications. The first is a simple description of a software system for controlling an automatic teller machine (ATM) and the second is the functional specification for an asteroid game. Your task will be to identify and design a set of classes for providing a solutions for each of the systems.

Learning Outcomes

Having completed this lab you will know how to transform a set of requirements into a software design consisting of the specification of a set of classes (including methods and attributes) and the relationships between those classes.

2 Questions:

In this lab you will develop solutions for each of the two scenarios detailed below.

1. Given these scenarios your first task is to define candidate classes using either
 - Noun & Verb approach
 - CRC approach
2. Define a list of classes that fit your scenario
 - Find critical/major classes.
 - Eliminate irrelevant items.
 - Review leftover items to ensure that the system spec is covered.
3. Finally you will use StarUML or any other UML software package to create a class diagram for your scenario.

You are required to fully document the above steps. This document must contain:

- Name and student ID number
- Full list of candidate classes
- List of critical/major classes along with reasoning why you identified these as of importance
- List of items which you deemed to be irrelevant or outside the scope of the system along with reasons
- UML class diagram illustrating the overall structure of the system

Your work for this assignment should be submitted via the associated link on the moodle course page that will be available a few days before the deadline.

Exercise 2.1: Design a software system to control a new automatic teller machine (ATM) with the following requirements : Users of the ATM will be able to access their account using their ATM card and PIN number. Account Holders will get three attempts to enter the correct pin number, after which the machine will retain the card, notify bank officials and freeze the customers account. If the customer successfully enters the correct pin number associated with the bank card, depending upon the type of account they will get a number of options. Savings account holders may deposit money into their account and withdraw a designated amount of money once per month. Current account holders may deposit money into their accounts, transfer money to their savings account, withdraw cash up to a daily limit of 700 euro, and check the last 10 transactions on their account. All account holders may check their balance.

Exercise 2.2: You have been asked to design a multiplayer asteroids game. The game environment will consist of three game objects: spaceships, laser pulses, and asteroids. All objects will have a 2D position, orientation, and velocity.

The game will consist of between 1-4 players each of which is associated with a separate spaceship. At the beginning of the game a collection of asteroids will be created with random positions, orientations, velocities, and sizes. During operation of the game, when the user fires their ship's cannon it will emit a laser pulse. Each laser pulse will have a fixed velocity and an associated player (i.e. the player associated with the ship that fired the laser).

Each player will be identified by a username which will be input at the beginning of the game. For each game, each player will start with 3 lives. Players will also maintain a score which will start at zero and can be updated by the game system as the game progresses.

In games of less than 4 human players additional computer controlled players will be added in order to bring the total number of players to 4. At anytime each player can be queried for their next move. The next move of human players will be determined by polling their associated controller for its current state (e.g. which buttons are pressed). Computer controlled players on the other hand will have an associated AI engine which will provide a think method that will make the decision on the next move. Three levels of AI will be provided: naive, medium, and advanced.

The operation of the game will be driven by a game loop that updates the system state 60 times per second. To do this the system calls will call an update method for each asteroid, laser pulse, and spaceship which will then in turn updates themselves. Asteroids and laser pulses can be updated using standard physics models. A spaceships update method computes the new position by first requesting the player's next move.

After each iteration of the game loop a collision detection system is employed to detect collisions between objects. If a collision occurs between a spaceship and an asteroid, the collision detection system kills the player, thereby deducting a life. If the player still has lives remaining the position of the spaceship is set to a random position of freespace. If a collision occurs between a laser pulse and an asteroid the system deletes the laser pulse and increments the score of the player associated with the laser pulse. The collision detection system also reduces the size of the current asteroid to half its current size or deletes the asteroid if it has reached a minimum size.