

CS 342: Software Design

*Spring 2015
Project list*

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The group project for CS 342 has two submissions. The first submission, due at 9:00 pm on Monday, April 6, will consist of a design for the project. The second submission, due on Monday, April 20, will be a full implementation. Projects are not required to include a graphical user interface.

A short statement of purpose of each project appears below. Each group of students is assigned one project. Given your project, you should identify the features that you wish to implement for your project. For instance, you may or may not wish to implement a graphical user interface for your project. Also, you should identify the functionality that you plan to design and implement. Of course, you are not required to create a full-blown, commercial-quality product; however, the functionality that you implement should allow a user to perform meaningful interactions with your application.

Your first (design) submission should include a software architecture description, along with a detailed design of each component. All groups are required to include at least three patterns for object-oriented design in their product designs from book by Freeman and Robson. Other patterns from the book by the Gang of Four may also be used. UML class diagrams should be used to describe all classes and their relations in your design. The diagrams should include all methods and fields (i.e., operations and variables) for each class. Minimally, the design should include at least the following of diagrams: (1) one architecture diagram illustrating the main components in your design and their interfaces; (2) UML class diagrams comprising all classes used in the implementation; and (3) UML sequence diagrams as needed. The use of additional kinds of diagrams is welcome, but not required.

The code submitted in the third project stage should conform to the highest standards of on-line documentation. Choose meaningful names for class, method and field identifiers. Make sure to capitalize class names and include meaningful on-line comments in code.

Team member performance will be subjected to a confidential peer evaluation submitted to the instructor at the end of the semester. This evaluation will contribute to each student's final grade for the course. Be a responsible, courteous and professional team member, so that you will receive a good evaluation from your team members.

Each team is responsible for electing a leader. If a team cannot elect a leader, they should report to the instructor who will then choose the leader. Group leaders are responsible for managing and coordinating activities of the various group members. Therefore, the evaluation of a group leader will be based not only on the leader's contribution to the overall work of the group, but also on the leader's ability to divide the workload among group members in an equitable and efficient manner.

1 Projects

1.1 Simple bicycle store (Groups 1 and 9)

Your client is Lance Legstrong, who owns a small bicycle store in a Chicago suburb. Lance is having a hard time keeping track of his inventory, which consists of bicycles and bicycle parts, such as gearsets, brakes (front and back), saddles, chains, computers, helmets and pedals. Lance buys parts by the bulk through wholesale dealers, and sells them for profit to individual store patrons. Lance often runs out of stock because he fails to record (and then forgets) items that he sold. Write an application to record all his purchases and sales, and to remind him when to buy items for sale. The software should also indicate a reasonable price for items that Lance sells. The price should take into account the purchase price that Lance paid for each time, as well as additional costs associated with storage of each item and the cost of holding the item in the store (i.e., based on the item's size). Of course, Lance needs to make a profit too, so that he can support his family.

1.2 Gigabyte Café (Groups 2 and 10)

You have been approached by Mr. Donald McDonald, the owner of the *Gigabyte café*, who is requesting a new application for managing customer orders at the café. The application maintains a restaurant menu allowing a user to maintain a list of food and drink selections for the *Gigabyte cafe*. In particular, your application should be able to create and maintain a list of food and beverage selections for the benefit of café customers.

Food selections fall under the following categories: (1) appetizers, (2) main dishes, and (3) desserts. Appetizers are characterized by a name and a list of ingredients. Main dishes are characterized by a name, ingredient list, and by a side dish. Finally, desserts are characterized by a name and a short description of the appetizer. Also, your menu should show, for each food item, an approximate calorie count and the price of the food item.

Beverage selections fall under the categories of (1) soda selections and (2) long drinks. Each soda selection has a name, a price, and a calorie count. Each long drink has a name, an ingredient list and a price.

You can assume that a user will be working with just one restaurant menu at a time. (This means that your program should not support multiple menus).

1.3 Master the mind (Groups 3 and 11)

Your client is Buzz Gameplayer, the chief technology officer of the software firm *Computer Games 'R' Us*. Buzz sees a valuable market opportunity to develop new games downloadable as apps for a variety of platforms ranging from desktop and laptop computers, to smart phones and tablets. Prospective customers are the users of these platforms; Gameplayer's marketing department believes that the popular *Mastermind* game will be a runaway success. In this game, each player sets up a sequence of four decimal digits, where each digit is not repeated. For instance, 2015 is a legal sequence, but 2012 is not because the digit 2 is repeated. The two players take turns guessing the sequence of digits of their opponent. Each "guess" consists of a 4 digit number, without repeated digits. A player responds to an opponent's guess by specifying the number of digits that were successfully guessed in the correct position and the number of digits that were successfully guessed but in the wrong positions. Thus, if a player's chosen number is 2015 and the opponent guesses 1089, the opponent would be told that one digit was guessed correctly in the correct position (i.e., the 0), and another digit was guessed in the wrong position, (i.e., the 1). You are to write an application that lets a human user play against the computer.

1.4 Computerized rideshare program (Groups 4 and 12)

You have been contacted by Dr. Sidney Bigcheez, the Chancellor of the Southern North Dakota University (SNDU). Dr. Bigcheez is trying to reduce the cost for university employees who commute to the university each day by setting up a Computerized Rideshare Program (CRP). Employees typically must drive to the university due to the lack of public transportation in Southern North Dakota. This drive is time consuming and increasingly expensive due to the rising cost of gas. Dr. Bigcheez would like for a computer program to establish “car pools” of commuters. The commuters in each car pool would agree to share rides to SNDU by taking turns driving to the school. The program would ensure that people in the car pool each do their fair share of the driving.

1.5 Pharmacy inventory manager (Groups 5 and 13)

Dr. Arsenius Alchemist runs a small pharmacy in rural Wisconsin. In the past Dr. Alchemist has lost money because he ran out of popular medications (e.g., Aspirin, Alka-Seltzer, Amoxicillin), which his customers wanted to purchase. Other times, he overstocked on medications, which subsequently expired before he could sell them. Typically, Dr. Alchemist buys medications in bulk. For instance, a box of Advil cans may contain 50 to a 100 cans of different sizes. He would like to have an inventory management system, keeping track at least of his stock of most popular medications (about two dozen in total) and their expiration dates. The system would advise him as to when it is appropriate to buy additional medications either because the current stock is running low or because it is about to expire.

1.6 Tic-tac-toe forever (Groups 6 and 14)

Your client is Bobby Gamer, the chief technology officer of the software firm *Computer Games 'R' Us*. Bobby sees a valuable market opportunity to develop new games downloadable as apps for a variety of platforms ranging from desktop and laptop computers, to smart phones and tablets. Prospective customers are the users of these platforms; Gamer’s marketing department believes that an extended version of the popular tic-tac-toe game will sell like hot cakes. In brief, the game consists of chess-like grid of square positions, with two players alternatively placing naughts and crosses on the board. The purpose of the game is for a player to place five pieces in a consecutive row either horizontally, vertically or diagonally. Thus, this is similar to the tic-tac-toe game, except it is played on a board of indefinite size (instead of 3 by 3 squares) and 5 pieces must be aligned contiguously (instead of 3). Your app will cast the user against the computer.

1.7 Restaurant inventory management (Groups 7 and 15)

Your software firm, *ACME Hacking, Inc.* has been approached by the owner of *Wolfgang Buck*, a famous restaurant in the area. The restaurant has been quite successful, so successful that the current system of maintaining inventory of ingredients for dishes to be served at the restaurant has become inadequate. Every morning an employee checks all the available inventory and writes a shopping list using a word processor. Next, the employee prints the shopping list and goes to various food stores in order to buy needed ingredients. However, the employee sometimes “forgets” to check certain ingredients, meaning that the dishes using those ingredients cannot be served. In other cases, ingredients thought to be available are in fact spoiled, meaning that they cannot be used for dish preparation. Finally, sometimes the employee overestimates the amount of ingredients needed for a dish, resulting in wasted food. Wolfgang would like to have an inventory management system, keeping track of foods in the restaurant and generating appropriate shopping

lists at the beginning of each day. The system knows when foods are purchased and when they will spoil. In addition, the system can infer when ingredients will be needed based on dishes that were served the previous day.

1.8 Battleship game (Groups 8 and 16)

You have been approached Bobby Gamer, the very active chief technology officer of *Computer Games 'R' Us*. This time Bobby thinks that the game 'Battleship' can earn his company a lot of money. In this game, you create two game boards and let each player place a number of war ships. Each player cannot see the other persons board. The players then take turns firing at one another by guessing one of the board squares. If the square they guess contains part of a ship, it is a hit. Otherwise it is a miss. They sink a ship when all squares containing that particular ship have been uncovered. The player wins when all their opponents ships have been sunk. Your application will play against a human user. Make sure that the game is customizable by the size of the board and the number of the ships; however, all ships can have the same size.

2 Grading

Each group must work independently of other groups. Project grades will be based on conformance to the criteria of good software engineering. In particular, your designs will be evaluated based on the criteria of completeness, low coupling and high cohesion. Make sure to indicate whether you followed a structured approach for portions of your design. Make sure to include at least 3 patterns for object-oriented design in your design. An implementation should follow directly from your design.

Your code will be evaluated on the basis of two criteria. First, the instructor and TAs will examine the quality of your coding style. For instance, we expect that you will thoroughly document your code. Variable and unit names should be indicative of the purpose of the variable or unit (use mnemonic names). Avoid, whenever possible, global variables since the use of these variables often results in unnecessary coupling among units. Second, we will check your code for compliance with the appropriate requirement definition verify compliance of your code with the above specifications.

Good luck!!!!