CSE116 Introduction to Computer Science II Fall2002

Project 2: Board Game Scotland Yard
Phase 1: Design, Implementation and Testing of The Model

1. Requirements:

You will work alone or with a partner to design and implement a software application that lets you play a game called Scotland Yard. This is a board game developed by Ravensburger Spieleverlag Inc. The application you build will setup a board for playing a game of Scotland Yard, process players responses, maintain a running commentary as the players respond (move), support any player queries for information, handle illegal moves, determine and display the outcome of the game. You should be able to suspend the game, save the game after any round of play and restore the state later for resuming the play from where it was suspended.

Phase 1: Design and implement the model.
Phase 2: Design and implement the view/controller. (Due date: 12/4)
Phase 3: Field-test it and document and package it. (Due date: 12/9)

2. Objectives (for the entire Project2):

- Learn UML methods (Ex: use case diagram) for analyzing requirements and transform the requirements into design (Ex: class diagram).
- Designing with a variety of **abstract data types**.
- Explore and reuse Java Collection package.
- Examine, understand and master art of tapping into pre-existing solutions: **algorithms** (Ex: search, min-max, visualization) and **design patterns** (Ex: strategy, state patterns) to solve problems. Write your own algorithms to solve problems.
- Build robust software using (Java) exception handling.
- Practice separation of Interface and Implementation, Model and View/Controller.
- Realizing persistence using Java Serialization.
- GUI using (only) Java Swing.
- Produce a professional documentation package.

3. Description:

An Overview: Mr. X, one of the most wanted criminals is on the run in downtown London. Mr. X moves around secretly, occasionally (4 times in the game) revealing himself. Detectives (3 to 5 in number) of Scotland Yard are on hot pursuit of the Mr.X. Mr.X and the detectives move around from one location to another using bus, taxi or underground. Mr. X also has an additional means of transport, a boat across the river Thames.

The Goal:
The goal for Mr. X is to evade capture till the end of the game, which consists of maximum of 22 rounds. Each round is consists of one move each by Mr. X and the detectives. Mr. X also can move twice in a turn on two occasions.
The goal for the detectives is to move into and capture Mr. X by deducing his location from the hints revealed during the game.

The Components: The game consists of: 1 game board, 6 playing figures, 16 starting station (location) cards, tickets (54 for taxi, 43 for bus, 23 for underground train, 2 double move tickets for Mr.X and 5 black tickets for Mr. X) to ride the transport, and 1 travel log for Mr. X to record his moves.

The Board: (Unfortunately you don't need to know anything about London or Scotland Yard to play this game!) The board has a background of busy London downtown with 199 stations indicated by a small circle and a number (1 – 199). Points with all white are stops only for taxi, points with white and green are stops for taxi and bus and points with red rectangle are stops for underground (train). Each point may be a combination of one or more of these kinds of stops.
Besides these common transportation there are black lines for Mr.X alone to use to cross Thames river by boat from between pairs of points 194-157, 157-115 and 115 –108.

The Setup:

1. The tickets are distributed as follows:
   - Mr. X gets 4 taxi, 3 bus, 3 underground tickets, 2 double move tickets ('2X'), as many black tickets as there are detectives, a travel log, and a colorless game figure.
   - Each detective gets 10 taxi, 8 bus, 4 underground train tickets, 1 colored game figure.
2. Each player including Mr.X picks a card from the starting location deck that determines his or her respective starting location. Each player except Mr.X places the game figure on the location to start the game. Mr. X's starting location is kept a secret from other detectives.

Playing the Game:

- Mr.X moves first by writing the destination on the travel log and covering it with the ticket meant for the transportation used. Mr. X may use taxi, bus, underground or boat as transportation depending on the location. He may also choose not to reveal the means of transportation by using a black ticket. He may also use a 2X ticket to move two hops in a single turn. (You will have to research more on these combinations.)
- The detectives work together in choosing their move destination and means of transportation. They give up a ticket for the transportation chosen and move their respective game figures to the next stop along the selected route. Mr. X gets the spent ticket! **Beware**: Not all the transportation is possible from every station. Some may have taxi only. Some may have only bus and taxi, and so on. If towards the end of the game a detective is at a station that has only taxi but he/she does not have a taxi

ticket, the detective is stuck/lost. He/she is of no use to the game. Also no two players can be at the same station at any time.

- Mr. X shall reveal his whereabouts when he reaches the travel log entries 3, 8, 13 and 18.
- The common strategy for the detectives is to keep covering the various regions of the board until Mr. X reveals himself first. Then move towards the vicinity of Mr. X and then onwards try to deduce the location from the means of transportation Mr. X uses if and when he/she reveals it.

The Outcome:
Mr.X wins if (i) the detectives are no longer able to move and/or (ii) Mr. X reaches the last space in the travel log without getting captured.
The detectives win, (i) if one on of them moves into Mr. X's undercover location or (ii) if Mr. X is cornered by the detectives with no where to go.

3. Design and Implementation

You are required to use the Model View Controller (MVC) methodology for designing the solution to the Minesweeper application. See the calculator example discussed in class. We will implement only the model in this phase 1.

Model: Analyze the requirements using the UML use case diagram. Develop the class diagram using this use case diagram. Design the interface before implementing the actual class that implements the interface. We will place all the model related classes in a package called *model*. You must be able to test the setup, basic moves, validity of moves in the form of exception handling, saving and restoring the game, test for winning or losing given a snap shot of the board. Simple text interface tester or simple GUI tester would do. We will plan and design the visualization of the game in the next phase. Attend lectures and recitations to get more information on the project.

View and Controller: Will be discussed after Phase 1's due date.

4. Partners

You may choose to work on your own or with a partner. You will choose your own partner to work with. Choose your partner carefully. Good friends do not necessarily make good partners. **Everyone** in the class *must* submit (using the regular on-line submission command) a file named Project2Partner containing your username and the username of your partner, separated by a single space. For example, if Alex Keaton (username: AlexK) and Ray Motana (username: RayM) were partners Alex would submit a file containing the following single line:

```
AlexK RayM
```

Ray would, on the other hand, submit a file containing the following single line:

```
RayM AlexK
```

If you choose to do the project on your own you cannot join with a partner later on. Please do submit a file containing your username twice.
This must be submitted by 5:00 pm on Monday, September 30, 2002.

If the two in a group split in the middle of the project then each of you will work on the project individually and may not join other partners.

5. Submission

Create a directory *scotlandyard* and sub-directories *model* and *viewController* within it. Let the design be represented by an integrated class diagram and presented in a file scotlandyard.dia, scotlandyard.pdf or scotlandyard.doc in the scotlandyard directory. Provide internal documentation using javadoc style comments.
Zip the scotlandyard directory and submit the resulting zip file, scotlandyard.zip. Making sure that you current directory contains your scotlandyard directory, you can create this file as follows:

```
zip -r scotlandyard.zip scotlandyard
```

Use the electronic submission program that corresponds to your section. For instance students in section A will submit by typing

```
submit_cse116a scotlandyard.zip
```

at the Unix prompt.

6. Due date

October 30, 2002 by midnight.