Experiment: Bowling game user stories using Test-driven development method

Goal

Before conducting an experiment please fill the "**Pre_experiment_Qs_TDD**". During the experiment you will write the source code for user stories of a bowling game given below and also fill the "**Post_experiment_Qs_TDD**" form for time taken to complete the each user story as you code along. Once you are done with the source code fill rest of the form as well.

We appreciate your participation in this experiment.

Method

You should use the **Eclipse IDE** (Integrated Development Environment) during development and the **Java** programming language. **Test Driven Development** approach is obligatory for software development and usage of **JUnit** framework for automating testing scripts. You should have at least one test case for each user story / user requirement. Please follow development steps as defined in next section. A brief tutorial on how to use Eclipse with Java and TDD could be found at:

http://eclipsetutorial.sourceforge.net/totalbeginnerlessons.html

Steps to use for development

1. Write one single test-case
2. Run this test-case. If it fails continue with step 3. If the test-case succeeds, continue with step 1.
3. Implement the minimal code to make the test-case run
4. Run the test-case again. If it fails again, continue with step 3. If the test-case succeeds, continue with step 5.
5. Refactor the implementation to achieve the simplest design possible.
6. Run the test-case again, to verify that the refactored implementation still succeeds the test-case. If it fails, continue with step 5. If the test-case succeeds, continue with step 1, if there are still requirements left in the specification
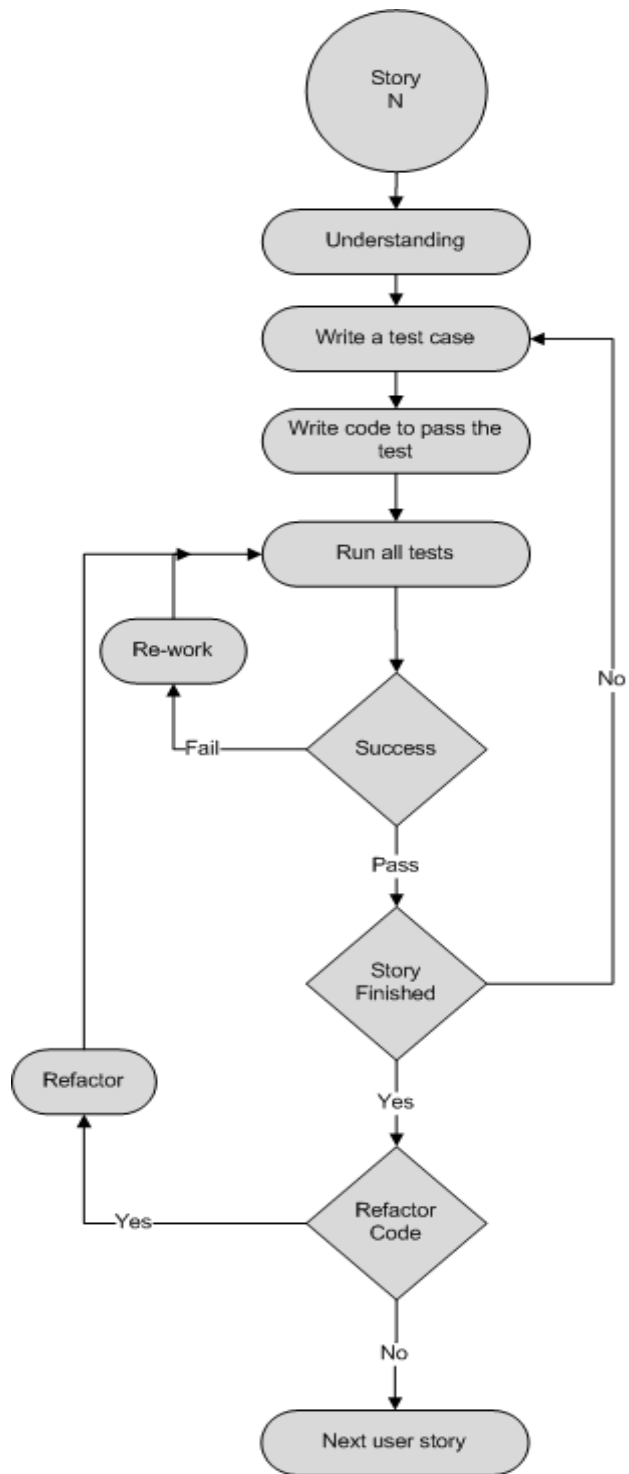
Figure 1 TDD flow chart

Result

Before starting an experiment please fill the "**pre-experiment questionnaire form"** and then start writing code for the bowling game user stories. After finishing with all user stories please fill the "**post-experiment questionnaire form**". Once you are done with the experiment please send following items to either of the email addresses at hassanmunirr@hotmail.com or misagh_moayyed@hotmail.com:

1. **Pre-experiment questionnaire form**

2. **Source code for bowling game user stories (Zipped folder)**

3. **post-experiment questionnaire form**

Note: Please follow the user story requirements in the order given below. Do not forget to fill out the 2 small questionnaires before and after the experiment.

User stories

1. Frame

Each turn of a bowling game is called a frame. 10 pins are arranged in each frame. The goal of the player is to knock down as many pins as possible in each frame. The player has two chances, or throws, to do so. The value of a throw is given by the number of pins knocked down in that throw.

Requirement: Define a frame as composed of two throws. The first and second throws should be distinguishable.

Example: [2, 4] is a frame with two throws, in which two pins were knocked down in the first throw and four pins were knocked down in the second.

2. Frame Score

An ordinary frame's score is the sum of its throws.

Requirement: Compute the score of an ordinary frame.

Examples: The score of the frame [2, 6] is 8. The score of the frame [0, 9] is 9.

3. Game

A single game consists of 10 frames.

Requirement: Define a game, which consists of 10 frames.

Example: The sequence of frames [1, 5] [3, 6] [7, 2] [3, 6] [4, 4] [5, 3] [3, 3] [4, 5] [8, 1] [2, 6] represents a game. You will reuse this game from now on to represent different scenarios, modifying only a few frames each time.

4. Game Score

The score of a bowling game is the sum of the individual scores of its frames.

Requirement: Compute the score of a game.

Example: The score of the game [1, 5] [3, 6] [7, 2] [3, 6] [4, 4] [5, 3] [3, 3] [4, 5] [8, 1] [2, 6] is 81.

5. Strike

A frame is called a strike if all 10 pins are knocked down in the first throw. In this case, there is no second throw. A strike frame can be written as [10, 0]. The score of a strike equals 10 plus the sum of the next two throws of the subsequent frame.

Requirement: Recognize a strike frame. Compute the score of a strike. Compute the score of a game containing a strike.

Examples: Suppose [10, 0] and [3, 6] are consecutive frames. Then the first frame is a strike and its score equals 10 + 3 + 6 = 19. The game [10, 0] [3, 6] [7, 2] [3, 6] [4, 4] [5, 3] [3, 3] [4, 5] [8, 1] [2, 6] has a score of 94.

6. Spare

A frame is called a spare when all 10 pins are knocked down in two throws. The score of a spare frame is 10 plus the value of the first throw from the subsequent frame.

Requirement: Recognize a spare frame. Compute the score of a spare. Compute the score of a game containing a spare frame.

Examples: [1, 9], [4, 6], [7, 3] are all spares. If you have two frames [1, 9] and [3, 6] in a row, the spare frame's score is 10 + 3 = 13. The game [1, 9] [3, 6] [7, 2] [3, 6] [4, 4] [5, 3] [3, 3] [4, 5] [8, 1] [2, 6] has a score of 88.

7. Strike and Spare

A strike can be followed by a spare. The strike's score is not affected when this happens.

Requirement: Compute the score of a strike when it's followed by a spare. Compute the score of a game with a spare following a strike.

Examples: In the sequence [10, 0] [4, 6] [7, 2], a strike is followed by a spare. In this case, the score of the strike is 10 + 4 + 6 = 20, and the score of the spare is 4 + 6 + 7 = 17. The game [10, 0] [4, 6] [7, 2] [3, 6] [4, 4] [5, 3] [3, 3] [4, 5] [8, 1] [2, 6] has a score of 103.