

*Simulation and Game Development*  
*Assignment 02*

This assignment is to be completed individually.

### **Dice, Card Shuffling and Pendulum**

The assignment is in three parts: one part explores the probabilities of rolling two dice; another part simulates shuffling a deck of cards; and the third animates the motion of a pendulum.

You may use any programming environment for Parts 1 and 2; you must use DirectX in Part 3 and demonstrate the use of a simple game framework. (You may use the one discussed in class as a basis.)

#### **Part 1 - Rolling two dice**

Problem: How many times do you need to roll a pair of dice to prove the theoretical probabilities?

##### Minimum Requirements

1. You must simulate the rolling of two dice.
2. You must keep track of the frequency that each rolled total occurs.
3. You must have an adjustable tolerance that will determine the range of acceptable values. For example, if the theoretical probability is 15%, and the tolerance is 2%, then a frequency percentage of 13-17% is considered equal to 15%.
4. You must report the number of rolls it took to achieve the theoretical probability of the entire distribution (not just one specific roll). In other words, all of the combinations must meet the probability criteria within the tolerance.

#### **Part 2 - Shuffling a deck of cards**

Problem: How many shuffles does it take to randomize a deck of cards.

##### Minimum Requirements

1. You must develop a method of measuring the randomness of a shuffled deck. (Call this the RFactor.)
2. You must be able to simulate "shuffling". You should physically shuffle a deck to determine how many cards move with each shuffle, and use this in your simulation.
3. You must be able to riffle your deck. This is the act of combining a split deck into one pile.
4. Simulate the act of simple shuffling repeatedly to determine the number of shuffles needed to randomize the deck.
5. Simulate the successive acts of shuffling and riffling to determine the number needed to randomize the deck.

#### **Part 3 - Animate a Swinging Pendulum**

##### Minimum Requirements

1. You must research the formula that governs the motion of a pendulum
2. Create an animation of the motion that shows the pendulum swinging in real time
3. Provide a way to change the length of the arm and the starting point on the arc of motion. If necessary, you may add other parameters
4. Assume the pivot is frictionless and the arm is without any mass (to simplify the calculations)
5. The swinging action should generate a sound. The sound must be in 3D so you can hear a "whoosh" from side to side.