COP 3223 Program #2:
Due date: Please consult WebCourses for your section

Objectives

1. To practice the if statement (in python).
2. To learn how to look up math function calls and use these in a program.
3. To learn how to long up random function calls and use these in a program.
4. To learn how to use a basic for loop and use it in a program.

Introduction: Big Money

Many students like playing the lottery, since it's one of the things they are allowed to do once they turn 18. However, probabilistically, lotteries are not good investments. In fact, many mathematicians often refer to them as a "stupid tax". In this assignment you will take a look at figures simulating the Florida lottery and make up your own mind!

Part A: Calculate Winnings (winnings.py)

In the regular Florida Lotto, players select 6 unique integers in the range [1, 52] for each ticket they buy. The winnings for a ticket are based on how many matching numbers are on a ticket. Players win money if they match 3, 4, 5 or all 6 numbers. In this program, you will ask the user how many numbers they matched and output their winnings. For the purposes of this assignment, please use the actual winnings for the August 31, 2013 Lotto, which are as follows:

3 numbers:	$5.00
4 numbers:	$49.50
5 numbers:	$4189.00
6 numbers:	$3,000,000.00

Input Specification

The one input value will be a positive integer in between 0 and 6, inclusive, representing the number of matched numbers on a single ticket.

Output Specification

Output a single line with the following format:

```
You win $X.
```

where X represents the winnings for the given ticket.

Sample Program Run (User Input in Bold)

```
How many numbers did you match on your ticket?
4
You win $49.50.
```

Part B: Probability of Winning (prob.py)

For this portion of the assignment you will write a program that calculates the probability of matching a certain number of values on a single lottery ticket. In particular, we can use some basic probability to show that if we are choosing from the set of integers in the range [1, n] and there is a single combination of k integers from the set that we want to match, our probability of correctly choosing exactly m of those k integers in a single combination of k integers is:

$$\frac{\binom{k}{m}\binom{n-k}{k-m}}{\binom{n}{k}}$$

Input Specification

The one input value will be a positive integer in between 0 and 6, inclusive, representing the number of matched numbers on a single ticket.

Output Specification

Output a single line with the following format:

```
The probability of matching X values is Y.
```

where X is the user's input value and Y is the corresponding probability as a decimal. (Thus, if the probability was 1%, you should print 0.01 or an equivalent for the result.)

Sample Program Run (User Input in Bold)

```
How many numbers do you want to match on your ticket?
4
Your probability of matching 4 values is 0.0007625799910799017.
```

Part C: Lottery Simulation (sim.py)

In this part of the program you will use some given code to simulate buying lots of lottery tickets to see what your winnings would be. Since you don't know how to use lists yet, which are very helpful for the simulation, you will be given code to use for your simulation. All you have to do is use the given functions and simulate buying the desired number of tickets to determine the return on investment. The given code will be in a separate posted file, simhelp.py. Please copy and paste this code into your solution, sim.py.

In running your simulation, please use the payoffs from part A.

Input Specification

The one input value will be a positive integer, representing the number of tickets the user wants to buy. (Each ticket costs $1.)

Output Specification

If the user made money off buying the tickets, output a single line with this format:

```
You won $X, for a net earnings of $Y.
```

Otherwise, if the user lost money off buying the tickets, output a single line with this format:

```
You won $X, for a net loss of $Y.
```

Sample Program Run (User Input in Bold)

```
How many tickets do you want to buy?
1000000
You won $187612.0 for a net loss of $812388.0
```

Note: it takes a few seconds for python to generate a million lottery tickets and check for matches using the given code (which is somewhat inefficient).

Deliverables

Three source files: *winnings.py*, for your solution to problem A, *prob.py* for your solution to problem B, and *sim.py* for your solution to problem C. All files are to be submitted over WebCourses.

Restrictions

Although you may use other compilers and coding environments, your program must run in IDLE.

Grading Details

Your programs will be graded upon the following criteria:

1) Your correctness

2) Your programming style and use of white space. Even if you have a plan and your program works perfectly, if your programming style is poor or your use of white space is poor, you could get 10% or 15% deducted from your grade.