# CIS 6 :: Lab 09 - Simulation and Design

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## Task 1: Definitions & Concepts - Homework

**Instructions:** Answer the questions below.

1. What is a computer simulation?
   **=>Works to solve real world problems by modeling real world processes in a computer**
2. Describe Pseudo Random Numbers:
   **=>Starts with a "seed" value, and uses that value to produce a random number**
3. Describe what "top-down design" is:
   **=>Separating a larger problem into smaller, simpler problems that are more manageable to solve, then putting the pieces back together to solve the initial problem**
4. Describe "bottom-up implementation"
   **=> Bottom-up is coding the individual components without fully understanding how they'll fit together**
5. How does  spiral development method work?
   **=>**

## Research - Homework

In your own words, describe what factors might lead a designer to choose spiral development over a top-down approach.

**=>**

## Task 2: Understanding Programs

1. **Draw** the top levels of a structure chart for a program having the following main function (you can go to Insert -> Drawing):

```
def main():
    printIntro()
    length, width = getDimensions()
    amtNeeded = computeAmount(length,width)
    printReport(length, width, amtNeeded)
```

2. Write an expression using either random or randrange to calculate the following:
   a. A random int in the range 0–10
      **=>randint(0,10)**
   b. A random float in the range -0.5–0.5
      **=>randrange( -0.5,0.5)**

c. A random number representing the roll of a six-sided die
**=>randint(1,6)**

d. A random number representing the sum resulting from rolling two six-sided dice
**=>randint(2,12)**

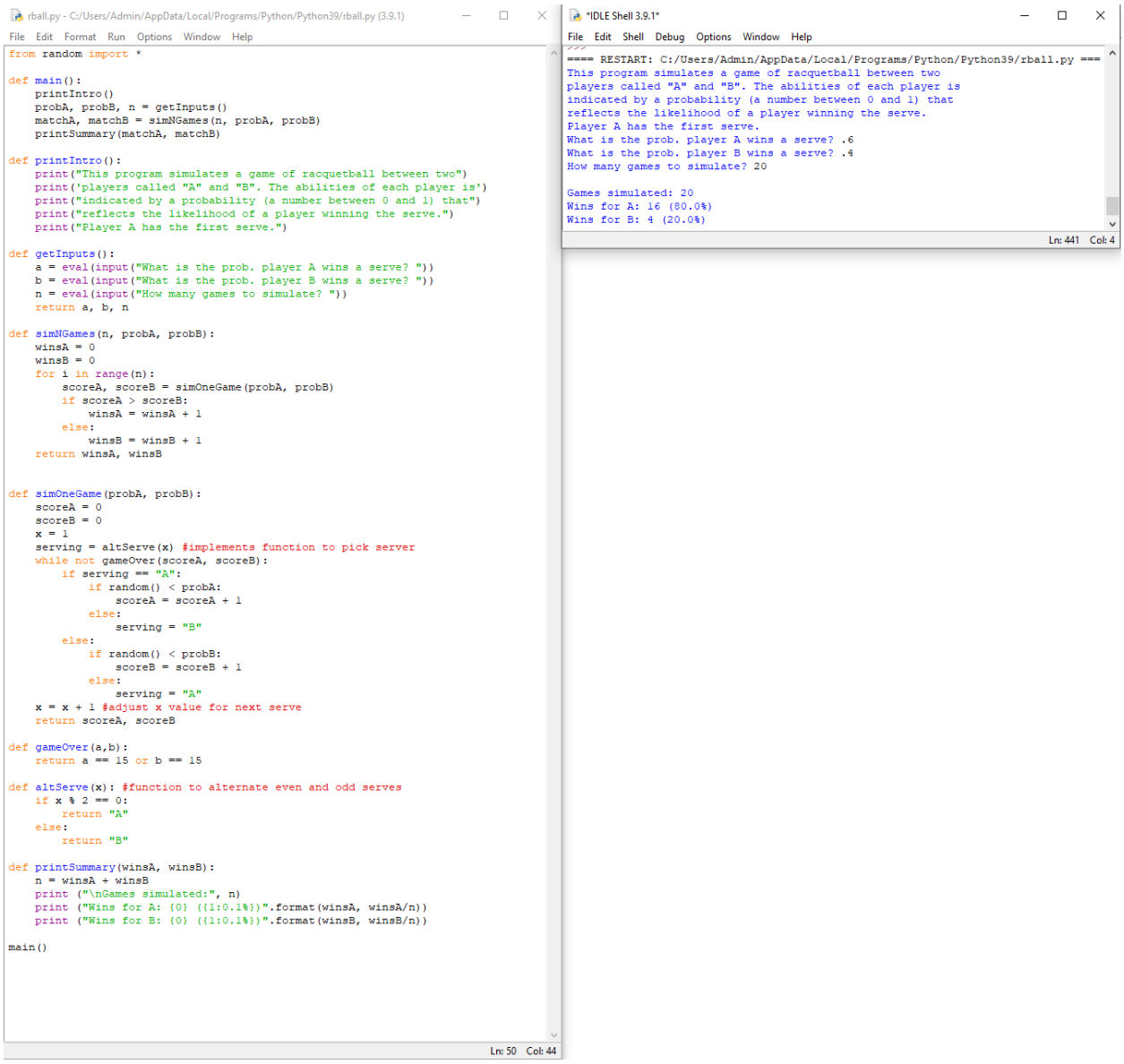
e. A random float in the range -10.0–10.0
**=>randrange( -10,10)**

## Part 3: LAB ASSIGNMENTS

Instructions: Use Python IDLE to write and execute below exercises from the book chapter 9. Attach Snipping photos of your **source code and executions of the code** in Python shell. Make sure to create separate files for each exercise.

### Task 1 - Book Chapter 9: Write and execute below program from the book.

1. rball.py



rball.py - C:/Users/Admin/AppData/Local/Programs/Python/Python39/rball.py (3.9.1)

File Edit Format Run Options Window Help

```
from random import *

def main():
    printIntro()
    probA, probB, n = getInputs()
    matchA, matchB = simNGames(n, probA, probB)
    printSummary(matchA, matchB)

def printIntro():
    print("This program simulates a game of racquetball between two")
    print('players called "A" and "B". The abilities of each player is')
    print("indicated by a probability (a number between 0 and 1) that")
    print("reflects the likelihood of a player winning the serve.")
    print("Player A has the first serve.")

def getInputs():
    a = eval(input("What is the prob. player A wins a serve? "))
    b = eval(input("What is the prob. player B wins a serve? "))
    n = eval(input("How many games to simulate? "))
    return a, b, n

def simNGames(n, probA, probB):
    winsA = 0
    winsB = 0
    for i in range(n):
        scoreA, scoreB = simOneGame(probA, probB)
        if scoreA > scoreB:
            winsA = winsA + 1
        else:
            winsB = winsB + 1
    return winsA, winsB


def simOneGame(probA, probB):
    scoreA = 0
    scoreB = 0
    x = 1
    serving = altServe(x) #implements function to pick server
    while not gameOver(scoreA, scoreB):
        if serving == "A":
            if random() < probA:
                scoreA = scoreA + 1
            else:
                serving = "B"
        else:
            if random() < probB:
                scoreB = scoreB + 1
            else:
                serving = "A"
    x = x + 1 #adjust x value for next serve
    return scoreA, scoreB

def gameOver(a,b):
    return a == 15 or b == 15

def altServe(x): #function to alternate even and odd serves
    if x % 2 == 0:
        return "A"
    else:
        return "B"

def printSummary(winsA, winsB):
    n = winsA + winsB
    print ("\nGames simulated:", n)
    print ("Wins for A: {0} ({1:0.1%})".format(winsA, winsA/n))
    print ("Wins for B: {0} ({1:0.1%})".format(winsB, winsB/n))

main()
```

Ln: 50 Col: 44

*IDLE Shell 3.9.1*

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```
>>>
==== RESTART: C:/Users/Admin/AppData/Local/Programs/Python/Python39/rball.py ===
This program simulates a game of racquetball between two
players called "A" and "B". The abilities of each player is
indicated by a probability (a number between 0 and 1) that
reflects the likelihood of a player winning the serve.
Player A has the first serve.
What is the prob. player A wins a serve? .6
What is the prob. player B wins a serve? .4
How many games to simulate? 20

Games simulated: 20
Wins for A: 16 (80.0%)
Wins for B: 4 (20.0%)
```

Ln: 441 Col: 4

**Task 2 - Chapter 9 - Programming Exercises. Do as many as you can.**

Exercise 3:

Exercise 7:

**Optional:** Do any **<u>one</u>** exercise from 8 to 14