Random Numbers and Files

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Yu's Elite Education

Homework: Compute square root of number

- If r is the square root of X, then

  r = X/r

- Can find r by starting with a guess, then keep averaging r and X/r

  X = 10

  r = 1

  r = (r + X/r)/2 = 5.5

  r = (r + X/r)/2 = 3.659…

  …

Random Numbers

- Why would we want to generate random numbers?
  - Simulating the real world
  - Testing a program
  - Art and games
  - Cryptography and security
  - Initializing algorithms

Generating randomness

- Computers are designed to be totally predictable – how can we get randomness?
  - Use a real-world measurement: www.random.org uses atmospheric noise
    - Downside: need some real-world sensor, limited number of random numbers per second
  - Use “pseudo-random” numbers
    - We will generate a stream of numbers that are predictable but look random

Pseudorandom Numbers

- One method: Linear congruential generator

  $X0 = 1$

  $X1 = (2^{31}-1)*X0 \% 48271$

  $X2 = (2^{31}-1)*X1 \% 48271$

  $X3 = (2^{31}-1)*X2 \% 48271$

  $X4 = (2^{31}-1)*X3 \% 48271$

Pseudorandom Numbers

- Python uses a pseudorandom generator called the “Mersenne Twister”
- Like LCG, we give it some “seed” value to get it started, and then it will generate a series of numbers based on that seed

Python Random Module

- import random
- Main functions:
  - random.seed(a=None)
  - random.randint(a,b)
  - random.uniform(a,b)
  - random.shuffle(x)

Examples

- RPG battle engine
- Random music using winsound.Beep
- Deal from a deck of cards
- Dizzy turtle

Using files

- How do we get information into and out of our programs?
- So far: typing input, printing output to screen
- For bigger chunks of data, we'll need to read and write to files on disk

Reading from a text file

- Very easy in python, just two steps
- tFile = **open**(filename.txt, '**r**')
- lines = tFile.readlines()

Examples

- Filter first names
- Check for common passwords

Writing to text file

- To write to a file, we open it in “write” mode
- outFile = open(filename.txt, ‘w’)
- outFile.write(‘First Line\n’)
- outFile.write(‘Second Line\n’)
- outFile.close()

Examples

- Combine random first and last names, write to file
- Generate nonsense text

Homework: Table of Contents

- Download Alice in Wonderland text file from the course website
- Write a TableOfContents.txt file with all the chapter names from the book