Queens College, CUNY, Department of Computer Science

Object Oriented Programming in C++

CSCI 211 / 611

Summer 2018

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July 11, 2018

Random numbers

- The material in this lecture is **not for examination.**
- This lecture explains how to use **pseudorandom number generators** in C++.
- C++ provides a set of good quality routines to generate **pseudorandom numbers.**
- They are called "pseudorandom" because a sequence of truly random numbers is difficult to obtain.
- Computer generated sequences of "random numbers" are approximations to truly random numbers.
- A **pseudorandom number generator** has the acronym **PRNG.**

1 Example program

- Here is a working C++ program to generate pseudorandom sequences of integers and doubles.
  1. The integers are uniformly distributed from 1 to 100.
  2. The doubles are uniformly distributed from -1.0 to 1.0.

```
#include <iostream>
#include <random>

using namespace std;

int random_main()
{
  int iseed = 0;                                          // initial seed
  default_random_engine generator;
  generator.seed( iseed );
  uniform_int_distribution<int> i_prng(1, 100);           // int 1 to 100
  uniform_real_distribution<double> r_prng(-1.0, 1.0);    // double -1.0 to 1.0

  int n = 10;
  for (int i = 0; i < n; ++i) {
    int a = i_prng(generator);                  // call prng for int
    double d = r_prng(generator);               // call prng for double
    cout << a << "    " << d << endl;
  }
  return 0;
}
```

- We require the header file `<random>`.
- We must instantiate a so-called generator.
- We initialize the generator with an input seed.
  1. The value of the seed is up to you.
  2. *If you use the same seed every time, you will obtain the same sequence every time.*
  3. That is why the numbers are "pseudorandom" not truly random.
- Next we declare our random distributions.
  1. The above program demonstrates how to generate uniformly distributed sets of numbers.
  2. Other types of statistical distributions are also supported.
  3. You can find out more online.
- Finally, we call the PRNGs (for `int` and `double`) in a loop to obtain pseudorandom numbers.