Randomization in C++ (p. 128)

• C++ provides a library function rand() that generates random numbers

• You need to include the cstdlib library

• Example:
  \[ y = \text{rand}(); \]

• In reality it’s a pseudorandom number!!!
Example

```cpp
#include <iostream>
#include <cstdlib>

using namespace std;

int main()
{
    cout << rand() << endl;
    cout << rand() << endl;
    cout << rand() << endl;
    cout << rand() << endl;
    
    return 0;
}
```

Run 1

Run 2

Run 3
Seeding the Generator

- We need to randomize the results of \texttt{rand()}.
- To do that, we use \texttt{srand()} to seed the random number generator.
- Different seed values will result in different random numbers.
Example

#include <iostream>
#include <cstdlib>

using namespace std;

int main()
{
    unsigned seed;

    cout << "Enter a seed value: ";
    cin >> seed;

    srand(seed);

    cout << rand() << endl;
    cout << rand() << endl;
    cout << rand() << endl;
    return 0;
}
Example

• What happens if we use a seed value of 1?

• Note that the random numbers generated may be different on your computer.
Better Seeding

• What would be a better way of seeding the random number generator?
  ○ Use the time!

• You must include \texttt{ctime}

• Set the seed to \texttt{time(0)}
  ○ \texttt{seed = time(0);}

• \texttt{time(0)} returns the number of seconds that have elapsed since January 1, 1970
Example

```cpp
#include <iostream>
#include <cstdlib>
#include <ctime>

using namespace std;

int main()
{
    unsigned seed;

    seed = time(0);
    srand(seed);

    cout << rand() << endl;
    cout << rand() << endl;
    cout << rand() << endl;
    return 0;
}
```
Specifying a Range

- A lot of the times we would like to specify a range for the random numbers being generated
  - Between 1 and 6 inclusive for faces of a dice for example
- To do that we add one to the random number and % it by the maximum
  - `diceFace = 1 + rand() % 6;`