

## Random Number Generation

### ➤ **rand** function

```
i = rand();
```

- use the `#include <cstdlib>`
- Generates a **pseudorandom** number between **0** and **RAND\_MAX** (usually 32767)
  - A pseudorandom number is a preset sequence of "random" numbers
  - The same sequence is generated upon every program execution

### ➤ **srand** function

- Jumps to a seeded location in a "random" sequence

```
srand( seed );  
srand( time( 0 ) ); //must include <ctime>
```

- **time( 0 )**
  - The time at which the program was compiled.
- Changes the seed every time the program is compiled, thereby allowing **rand** to generate random numbers

### ➤ **Scaling**

- Reduces random number to a certain range
- **Modulus** ( `%` ) operator
  - Reduces number between 0 and **RAND\_MAX** to a number between 0 and the scaling factor
- **Example**

```
i = rand() % 6 + 1;
```

- Generates a number between **1** and **6**

### Programming Examples

//Example 1: Roll dice

```
#include <iostream>  
#include <cstdlib>  
#include <ctime>  
using namespace std;  
int rollDice(int num);  
int main()  
{  
    cout << "The number of times the dice are rolled to "  
        << "get the sum 10 = " << rollDice(10) << endl;  
    cout << "The number of times the dice are rolled to "  
        << "get the sum 6 = " << rollDice(6) << endl;  
    return 0;  
}  
int rollDice(int num)  
{  
    int die1;  
    int die2;  
    int sum;  
    int rollCount = 0;  
    srand(time(0));
```

```

do
{
    die1 = rand() % 6 + 1;
    die2 = rand() % 6 + 1;
    sum = die1 + die2;
    rollCount++;
}
while (sum != num);
return rollCount;
}

```

**//Example 2:**

```

// Shifted, scaled integers produced by 1 + rand() % 6
#include <iostream>
using namespace std;
#include <iomanip>
#include <cstdlib>
int main()
{
    for ( int i = 1; i <= 20; i++ ) {
        cout << setw( 10 ) << ( 1 + rand() % 6 );
        if ( i % 5 == 0 )
            cout << endl;
    }
    return 0;
}

```

**//Example 3:**

```

// Roll a six-sided die 6000 times
#include <iostream>
using namespace std;
#include <iomanip>
#include <cstdlib>
int main()
{
    int frequency1 = 0, frequency2 = 0,
        frequency3 = 0, frequency4 = 0,
        frequency5 = 0, frequency6 = 0,
        face;
    for ( int roll = 1; roll <= 6000; roll++ ) {
        face = 1 + rand() % 6;
        switch ( face ) {
            case 1:
                ++frequency1;
                break;
            case 2:
                ++frequency2;
                break;
            case 3:

```

```
        ++frequency3;
        break;
    case 4:
        ++frequency4;
        break;
    case 5:
        ++frequency5;
        break;
    case 6:
        ++frequency6;
        break;
    default:
        cout << "should never get here!";
    }
}
cout << "Face" << setw( 13 ) << "Frequency"
    << "\n  1" << setw( 13 ) << frequency1
    << "\n  2" << setw( 13 ) << frequency2
    << "\n  3" << setw( 13 ) << frequency3
    << "\n  4" << setw( 13 ) << frequency4
    << "\n  5" << setw( 13 ) << frequency5
    << "\n  6" << setw( 13 ) << frequency6 << endl;
return 0;
}
```