Agenda

- Templates
- Shallow Copy and Deep Copy
- Copy Constructor
- Friend Function and class
- Manipulators
- ~~STL~~

Template

- If we want to write generic program in C++ then we should use template.
- Using template we can not reduce code size or execution time but we can reduce developers effort.
- It is designed for implementing generic data structure and algorithms
- Types of template:
    1. Function Template
    2. Class Template

1. Function Template

```
//template<typename T>//T : Type Parameter
template<class T> //T : Type Parameter
void swap_number( T &o1, T &o2 )
{
    T temp = o1;
    o1 = o2;
    o2 = temp;
}
int main( void )
{
    int num1 = 10;
    int num2 = 20;
    swap_number<int>( num1, num2 );
    //Here int is type argument
    cout<<"Num1 : "<<num1<<endl;
    cout<<"Num2 : "<<num2<<endl;
    return 0;
}
```

- Type inference : It is ability of compiler to detect type of argument at compile time and passing it as a argument to the function.

```
template<class X, class Y>
void swap_number( X &o1, Y &o2 )
{
    X temp = o1;
    o1 = o2;
```

```
    o2 = temp;
}
int main( void )
{
    float num1 = 10.5f;
    double num2 = 20.5;
    swap_number<float, double>(num1,num2 );
    cout<<"Num1 : "<<num1<<endl;
    cout<<"Num2 : "<<num2<<endl;
    return 0;
}
```

- We can pass multiple type arguments to the function.
- Using template argument list, we can pass data type as a argument to the function.
- Using template we can write type safe generic code.

2. Class Template

- In C++, by passing data type as a argument, we can write generic code hence parameterized type is called template.

```
template<class T>
class Array // Parameterized type
{
    private:
    int size;
    T *arr;
    public:
    Array( void ) : size( 0 ), arr( NULL )
    {
    }
    Array( int size )
    {
    this->size = size;
    this->arr = new T[ this->size ];
    }
    void acceptRecord( void ){
    }
    void printRecord( void ){
    }
    ~Array( void ){ }
};
int main( void )
{
    Array<char> a1( 3 );
    a1.acceptRecord();
    a1.printRecord();
    return 0;
}
```

Friend function & class

- If we want to access private members inside derived class
- Either we should use member function(getter/setter).
- Or we should declare a facilitator function as a friend function.
- Or we should declare derived class as a friend inside base class.
- Friend function is non-member function of the class, that can access/modify the private members of the class.
- It can be a global function.
- Or member function of another class.
- Friend functions are mostly used in operator overloading.
- If class C1 is declared as friend of class C2, all members of class C1 can access private members of C2.
- Friend classes are mostly used to implement data struct like linked lists.

Manipulator

- It is a function which is used to format the output.
- Manipulators are of two types

1. Without arguments
2. With arguments

- Following are the manipulators in C++

1. endl
2. setw
3. fixed
4. scientific
5. setprecision
6. hex
7. dex
8. oct
9. left
10. right

- To use manipulators it is necessary to include header file.