Shallow Copy and Deep Copy in C++

Difficulty Level : Easy • Last Updated : 16 Jun, 2022

In general, creating a copy of an object means to create an exact replica of the object having the same literal value, data type, and resources.

- Copy Constructor
- Default assignment operator

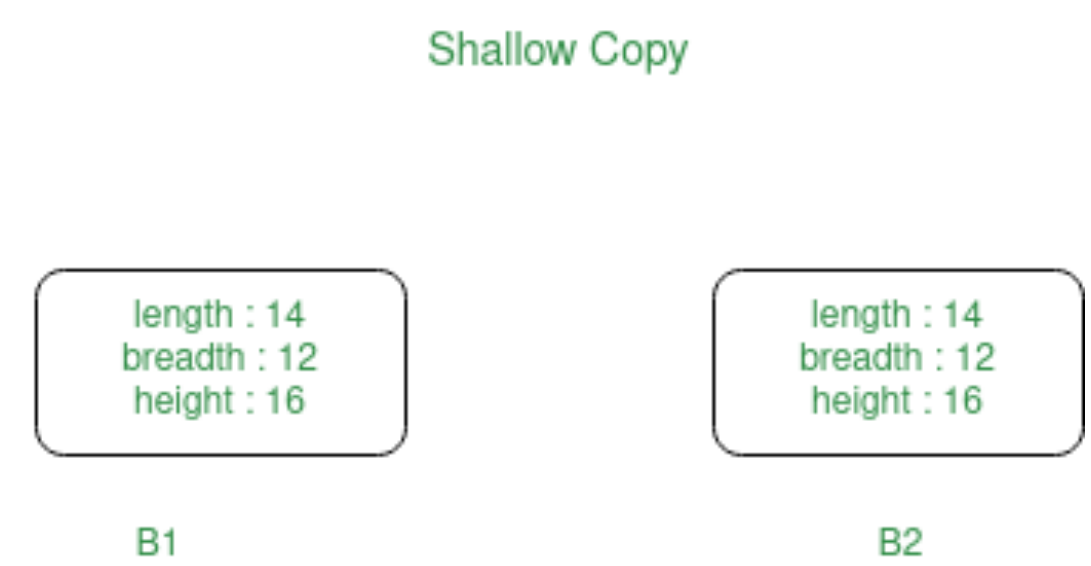
```
// Copy Constructor
Geeks Obj1(Obj);
or
Geeks Obj1 = Obj;

// Default assignment operator
Geeks Obj2;
Obj2 = Obj1;
```

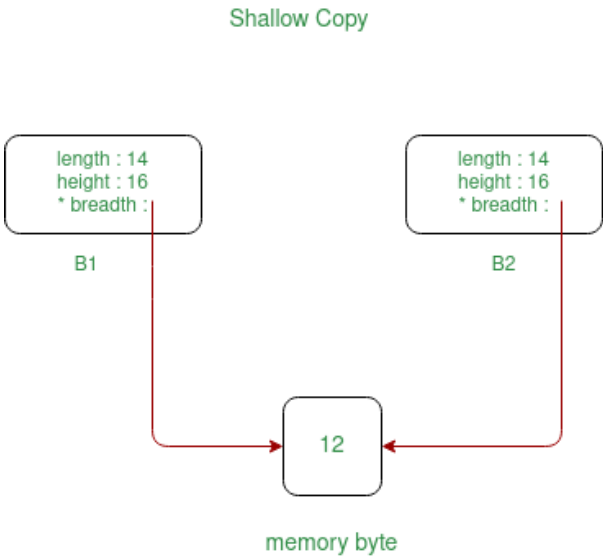
Depending upon the resources like dynamic memory held by the object, either we need to perform Shallow Copy or Deep Copy in order to create a replica of the object. In general, if the variables of an object have been dynamically allocated, then it is required to do a Deep Copy in order to create a copy of the object.

Shallow Copy:

In shallow copy, an object is created by simply copying the data of all variables of the original object. This works well if none of the variables of the object are defined in the heap section of memory . If some variables are dynamically allocated memory from heap section, then the copied object variable will also reference the same memory location.
This will create ambiguity and run-time errors, dangling pointer. Since both objects will reference to the same memory location, then change made by one will reflect those change in another object as well. Since we wanted to create a replica of the object, this purpose will not be filled by Shallow copy.
Note: C++ compiler implicitly creates a copy constructor and overloads assignment operator in order to perform shallow copy at compile time.



Shallow Copy of object if some variables are defined in heap memory, then:



Below is the implementation of the above approach:

C++

```
// C++ program for the above approach
#include <iostream>
using namespace std;

// Box Class
class box {
private:
    int length;
    int breadth;
    int height;
```

```
public:
    // Function that sets the dimensions
    void set_dimensions(int length1, int breadth1,
                        int height1)
    {
        length = length1;
        breadth = breadth1;
        height = height1;
    }

    // Function to display the dimensions
    // of the Box object
    void show_data()
    {
        cout << " Length = " << length
             << "\n Breadth = " << breadth
             << "\n Height = " << height
             << endl;
    }
};

// Driver Code
int main()
{
    // Object of class Box
    box B1, B3;

    // Set dimensions of Box B1
    B1.set_dimensions(14, 12, 16);
    B1.show_data();

    // When copying the data of object
    // at the time of initialization
    // then copy is made through
    // COPY CONSTRUCTOR
    box B2 = B1;
    B2.show_data();

    // When copying the data of object
    // after initialization then the
    // copy is done through DEFAULT
    // ASSIGNMENT OPERATOR
    B3 = B1;
    B3.show_data();

    return 0;
}
```

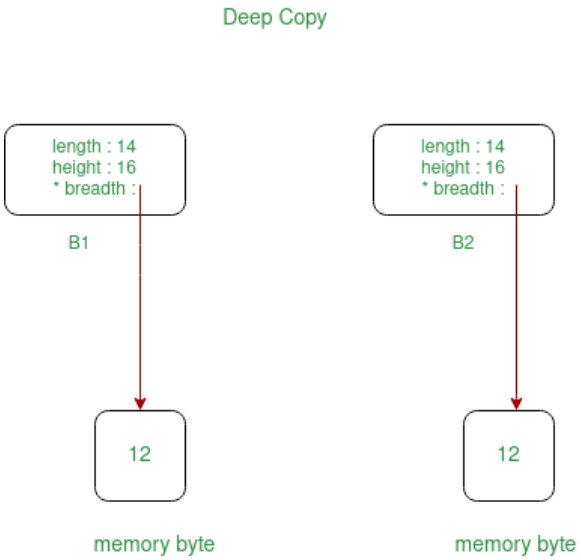
Output:

```
 Length = 14
```

```
Breadth = 12
Height = 16
Length = 14
Breadth = 12
Height = 16
Length = 14
Breadth = 12
Height = 16
```

Deep Copy:

In Deep copy, an object is created by copying data of all variables, and it also allocates similar memory resources with the same value to the object. In order to perform Deep copy, we need to explicitly define the copy constructor and assign dynamic memory as well, if required. Also, it is required to dynamically allocate memory to the variables in the other constructors, as well.



Below is the implementation of the above approach:

C++

```
// C++ program to implement the
// deep copy
#include <iostream>
using namespace std;

// Box Class
class box {
```

```
private:
    int length;
    int* breadth;
    int height;

public:
    // Constructor
    box()
    {
        breadth = new int;
    }

    // Function to set the dimensions
    // of the Box
    void set_dimension(int len, int brea,
                       int heig)
    {
        length = len;
        *breadth = brea;
        height = heig;
    }

    // Function to show the dimensions
    // of the Box
    void show_data()
    {
        cout << " Length = " << length
             << "\n Breadth = " << *breadth
             << "\n Height = " << height
             << endl;
    }

    // Parameterized Constructors for
    // for implementing deep copy
    box(box& sample)
    {
        length = sample.length;
        breadth = new int;
        *breadth = *(sample.breadth);
        height = sample.height;
    }

    // Destructors
    ~box()
    {
        delete breadth;
    }
};

// Driver Code
int main()
{
```

```
    // Object of class first
    box first;

    // Set the dimensions
    first.set_dimension(12, 14, 16);

    // Display the dimensions
    first.show_data();

    // When the data will be copied then
    // all the resources will also get
    // allocated to the new object
    box second = first;

    // Display the dimensions
    second.show_data();

    return 0;
}
```

Output:

```
Length = 12
 Breadth = 14
 Height = 16
 Length = 12
 Breadth = 14
 Height = 16
```

Let us see the differences in a tabular form -:

	Shallow Copy	Deep copy
1.	When we create a copy of object by copying data of all member variables as it is, then it is called shallow copy	When we create an object by copying data of another object along with the values of memory resources that reside outside the object, then it is called a deep copy
2.	A shallow copy of an object copies all of the member field values.	Deep copy is performed by implementing our own copy constructor.

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