

Activity No. 2.1	
Hands-on Activity 2.1 Arrays, Pointers and Dynamic Memory Allocation	
Course Code: CPE010	Program: Computer Engineering
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6. Output

Screenshot	 <pre> 1  #include &lt;iostream&gt; 2  #include &lt;string.h&gt; 3 4  class Student{ 5  private: 6      std::string studentName; 7      int studentAge; 8 9  public: 10     Student(std::string newName = "John Doe", int newAge=18){ 11         studentName = move(newName); 12         studentAge = newAge; 13         std::cout &lt;&lt; "Constructor Called." &lt;&lt; std::endl; 14     }; 15 16     ~Student(){ 17         std::cout &lt;&lt; "Destructor Called." &lt;&lt; std::endl; 18     } 19 20     //Copy Constructor 21     Student(const Student &amp;copyStudent){ 22         std::cout &lt;&lt; "Copy Constructor Called" &lt;&lt; std::endl; 23         studentName = copyStudent.studentName; 24         studentAge = copyStudent.studentAge; 25     } 26 27     //Display Attributes 28     void printDetails(){ 29         std::cout &lt;&lt; this-&gt;studentName &lt;&lt; " " &lt;&lt; this-&gt;studentAge &lt;&lt; std::endl; 30     } 31 }; 32 33 int main() { 34     Student student1("Roman", 28); 35     Student student2(student1); 36     Student student3; 37     student3 = student2; 38     return 0; 39 } </pre> <p>Constructor Called. Copy Constructor Called Constructor Called. Destructor Called. Destructor Called. Destructor Called.</p>
Observation	<p>The constructor initializes an object with the input. The deconstructor removes the object from the class. The copy constructor copies the existing object in the class.</p>

Table 2-1. Initial Driver Program

## Screenshot

```

9  #include <iostream>
10 #include <string.h>
11
12
13 class Student{
14     private:
15         std::string studentName;
16         int studentAge;
17     public:
18         Student(std::string newName = "John Doe", int newAge=18){
19             studentName = move(newName);
20             studentAge = newAge;
21             std::cout << "Constructor Called." << std::endl;
22         };
23
24         ~Student(){
25             std::cout << "Destructor Called." << std::endl;
26         }
27         //Copy Constructor
28         Student(const Student &copyStudent){
29             std::cout << "Copy Constructor Called" << std::endl;
30             studentName = copyStudent.studentName;
31             studentAge = copyStudent.studentAge;
32         }
33         //Display Attributes
34         void printDetails(){
35             std::cout << this->studentName << " " << this->studentAge << std::endl;
36         }
37     };
38
39 int main() {
40     const size_t j = 5;
41     Student studentList[j] = {};
42     std::string namesList[j] = {"Carly", "Freddy", "Sam", "Zack", "Cody"};
43     int ageList[j] = {15, 16, 18, 19, 16};
44     return 0;
45 }
46
47

```

input

```

Constructor Called.
Constructor Called.
Constructor Called.
Constructor Called.
Destructor Called.
Destructor Called.
Destructor Called.
Destructor Called.

```

## Observation

The objects in the class that are constructed are deconstructed after. The constructor occurred 4 times and the destructor occurred 5 times.

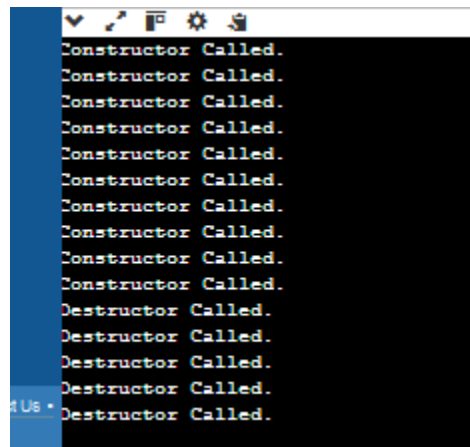
Table 2-2. Modified Driver Program with Student Lists

## Loop 1

```

8
9 #include <iostream>
10 #include <string.h>
11
12
13 class Student{
14     private:
15         std::string studentName;
16         int studentAge;
17
18     public:
19         Student(std::string newName = "John Doe", int newAge=18){
20             studentName = move(newName);
21             studentAge = newAge;
22             std::cout << "Constructor Called." << std::endl;
23         };
24
25         ~Student(){
26             std::cout << "Destructor Called." << std::endl;
27         }
28         //Copy Constructor
29         Student(const Student &copyStudent){
30             std::cout << "Copy Constructor Called" << std::endl;
31             studentName = copyStudent.studentName;
32             studentAge = copyStudent.studentAge;
33         }
34         //Display Attributes
35         void printDetails(){
36             std::cout << this->studentName << " " << this->studentAge << std::endl;
37         }
38     };
39 int main() {
40     const size_t j = 5;
41     Student studentList[j] = {};
42     std::string namesList[j] = {"Carly", "Freddy", "Sam", "Zack", "Cody"};
43     int ageList[j] = {15, 16, 18, 19, 16};
44     for(int i = 0; i < j; i++){ //Loop A
45         Student *ptr = new Student(namesList[i], ageList[i]);
46         studentList[i] = *ptr;
47     }
48     /*for(int i = 0; i < j; i++){ //Loop B
49         studentList[i].printDetails();
50     }*/
51     return 0;
52 }
53

```



```

Constructor Called.
Constructor Called.
Constructor Called.
Constructor Called.
Constructor Called.
Constructor Called.
Constructor Called.
Constructor Called.
Constructor Called.
Constructor Called.
Destructor Called.
Destructor Called.
Destructor Called.
Destructor Called.
Destructor Called.

```

## Observation

The is supposed to call the object 5 times but the operation occurred 2 times which made the constructor output to be 10. The deconstructor deleted the objects in the class.

## Loop 2

```

1  // *****
2
3  #include <iostream>
4  #include <string.h>
5
6
7  class Student{
8  private:
9      std::string studentName;
10     int studentAge;
11
12 public:
13     Student(std::string newName ="John Doe", int newAge=18){
14         studentName = move(newName);
15         studentAge = newAge;
16         std::cout << "Constructor Called." << std::endl;
17     };
18
19     ~Student(){
20         std::cout << "Destructor Called." << std::endl;
21     }
22     //Copy Constructor
23     Student(const Student &copyStudent){
24         std::cout << "Copy Constructor Called" << std::endl;
25         studentName = copyStudent.studentName;
26         studentAge = copyStudent.studentAge;
27     }
28     //Display Attributes
29     void printDetails(){
30         std::cout << this->studentName << " " << this->studentAge << std::endl;
31     }
32 };
33
34 int main() {
35     const size_t j = 5;
36     Student studentList[j] = {};
37     std::string namesList[j] = {"Carly", "Freddy", "Sam", "Zack", "Cody"};
38     int ageList[j] = {15, 16, 18, 19, 16};
39     /*for(int i = 0; i < j; i++){ //Loop A
40         Student *ptr = new Student(namesList[i], ageList[i]);
41         studentList[i] = *ptr;
42     }*/
43     for(int i = 0; i < j; i++){ //Loop B
44         studentList[i].printDetails();
45     }
46     return 0;
47 }
48
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```

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```

## Observation

The loop 2 has the same as the loop 1 but this has a print function and repeatedly print out John Doe 18.

Output	<pre> Constructor Called. Constructor Called. Constructor Called. Constructor Called. Constructor Called. Constructor Called. Carly 15 Freddy 16 Sam 18 Zack 19 Cody 16 Destructor Called. Destructor Called. Destructor Called. Destructor Called. Destructor Called. </pre>
Observation	The output is the same in both loop 1 and 2 but instead it printed the contents of the array which are the different names and ages.

Table 2-3. Final Driver Program

## 7. Supplementary Activity

ILO C: Solve programming problems using dynamic memory allocation, arrays and pointers

Jenna's Grocery List		
Apple	PHP 10	x7
Banana	PHP 10	x8
Broccoli	PHP 60	x12
Lettuce	PHP 50	x10

Jenna wants to buy the following fruits and vegetables for her daily consumption. However, she needs to distinguish between fruit and vegetable, as well as calculate the sum of prices that she has to pay in total.

Problem 1: Create a class for the fruit and the vegetable classes. Each class must have a constructor, destructor, copy constructor and copy assignment operator. They must also have all relevant attributes (such as name, price and quantity) and functions (such as calculate sum) as presented in the problem description above.

Problem 2: Create an array GroceryList in the driver code that will contain all items in Jenna's Grocery List. You must then access each saved instance and display all details about the items.

Problem 3: Create a function TotalSum that will calculate the sum of all objects listed in Jenna's Grocery List.

Problem 4: Delete the Lettuce from Jenna's GroceryList list and de-allocate the memory assigned.

```
#include <iostream>
```

```
#include <string>
```

```
using namespace std;
```

```
class Item {
public:
```

```

Item(const string& name, double price, int quantity) :
    name(name), price(price), quantity(quantity) {}

double calculateSum() const {
    return price * quantity;
}

void display() const {
    cout << name << " | PHP " << price << " | x" << quantity << endl;
}

private:
    string name;
    double price;
    int quantity;
};

int main() {
    Item* apple = new Item("Apple", 10, 7);
    Item* banana = new Item("Banana", 10, 8);
    Item* broccoli = new Item("Broccoli", 60, 12);
    Item* lettuce = new Item("Lettuce", 50, 10);

    Item* groceryList[4] = { apple, banana, broccoli, lettuce };

    cout << "Jenna's Grocery List:" << endl;
    for (int i = 0; i < 4; i++) {
        groceryList[i]->display();
    }

    double totalSum = 0;
    for (int i = 0; i < 4; i++) {
        totalSum += groceryList[i]->calculateSum();
    }
    cout<<endl;
    cout << "Total Sum: PHP " << totalSum << endl;

    delete lettuce;
    groceryList[3] = nullptr;
    cout<<endl;
    cout << "Jenna's Grocery List (After Removing Lettuce):" << endl;
    for (int i = 0; i < 4; i++) {
        if (groceryList[i] != nullptr) {
            groceryList[i]->display();
        }
    }

    delete apple;
    delete banana;
    delete broccoli;
}

```

```
return 0;  
}
```

```
Jenna's Grocery List:  
Apple | PHP 10 | x7  
Banana | PHP 10 | x8  
Broccoli | PHP 60 | x12  
Lettuce | PHP 50 | x10  
  
Total Sum: PHP 1370  
  
Jenna's Grocery List (After Removing Lettuce):  
Apple | PHP 10 | x7  
Banana | PHP 10 | x8  
Broccoli | PHP 60 | x12
```

## 8. Conclusion

In this hands-on practice, we learned how constructors initialize each object in an array, guaranteeing that they begin with defined values. When objects leave scope, destructors immediately clean up resources, preventing resource leaks from occurring. This understanding is essential for proper memory management and helps to write strong and efficient C++ code.

## 9. Assessment Rubric