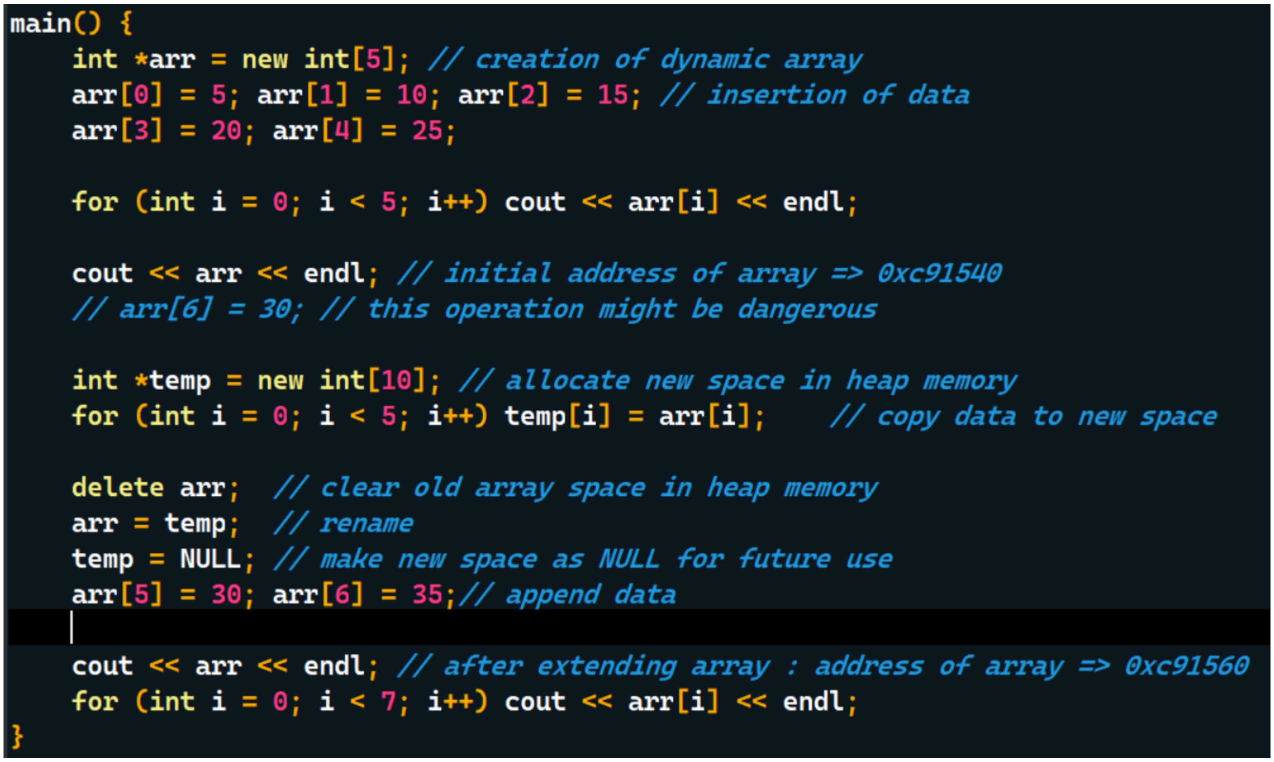
Summary

Sessions (12-01-2023)

- **Steps for extend dynamic array** :
  1) Allocate new heap memory space.
  2) Copy all elements / data which is in array to new allocated memory space.
  3) Clear array means deallocate.
  4) Rename the new space with an array.

- Copying data from one array to another is a costly operation. It need more time ie. n. But for allocating new space for an array we need constant time and for appending new data at last here also we need constant time. Therefore for appending operation in an array, time complexity is O(n+1+1) ~ O(n) for worst case.

- Example of extending dynamic array :

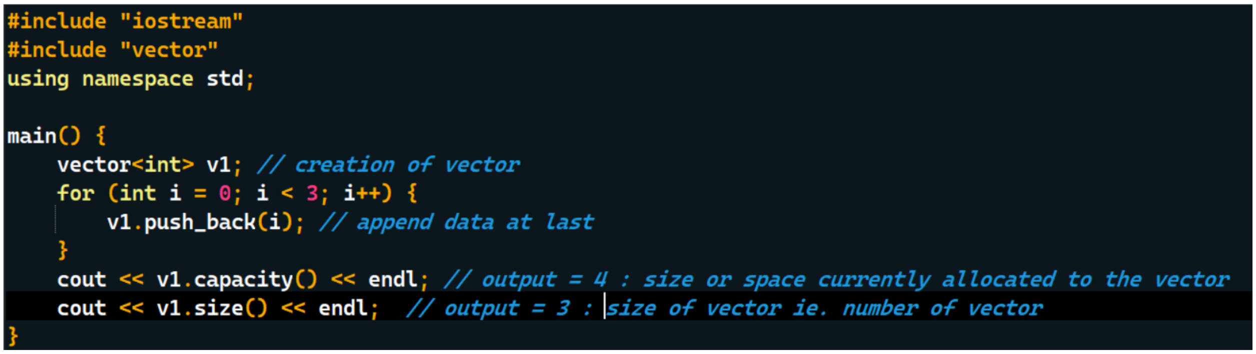


```
main() {
    int *arr = new int[5]; // creation of dynamic array
    arr[0] = 5; arr[1] = 10; arr[2] = 15; // insertion of data
    arr[3] = 20; arr[4] = 25;

    for (int i = 0; i < 5; i++) cout << arr[i] << endl;

    cout << arr << endl; // initial address of array => 0xc91540
    // arr[6] = 30; // this operation might be dangerous

    int *temp = new int[10]; // allocate new space in heap memory
    for (int i = 0; i < 5; i++) temp[i] = arr[i];    // copy data to new space

    delete arr;  // clear old array space in heap memory
    arr = temp;  // rename
    temp = NULL; // make new space as NULL for future use
    arr[5] = 30; arr[6] = 35;// append data

    cout << arr << endl; // after extending array : address of array => 0xc91560
    for (int i = 0; i < 7; i++) cout << arr[i] << endl;
}
```

- Like above, extend operation we can do remove operation, insert element between array element operation using code from scratch. For this we as a developer write lots of code.

- Instead of writing lots of code, some communities from c++ create code in a program file and the program file is known as a library. And in c++ they create template classes to provide common programming data structures and functions such as lists, stacks, arrays, etc. This is known as **STL(Standard Template Library)**.

- If we want to use pre-created data structures from STL then we have to import / include some kind of library and for a dynamic array they give a **vector**.



```
#include "iostream"
#include "vector"
using namespace std;

main() {
    vector<int> v1; // creation of vector
    for (int i = 0; i < 3; i++) {
        v1.push_back(i); // append data at last
    }
    cout << v1.capacity() << endl; // output = 4 : size or space currently allocated to the vector
    cout << v1.size() << endl;  // output = 3 : size of vector ie. number of vector
}
```