Data Structures

STL Set & Map

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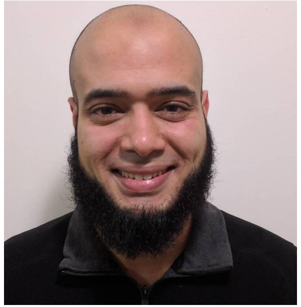
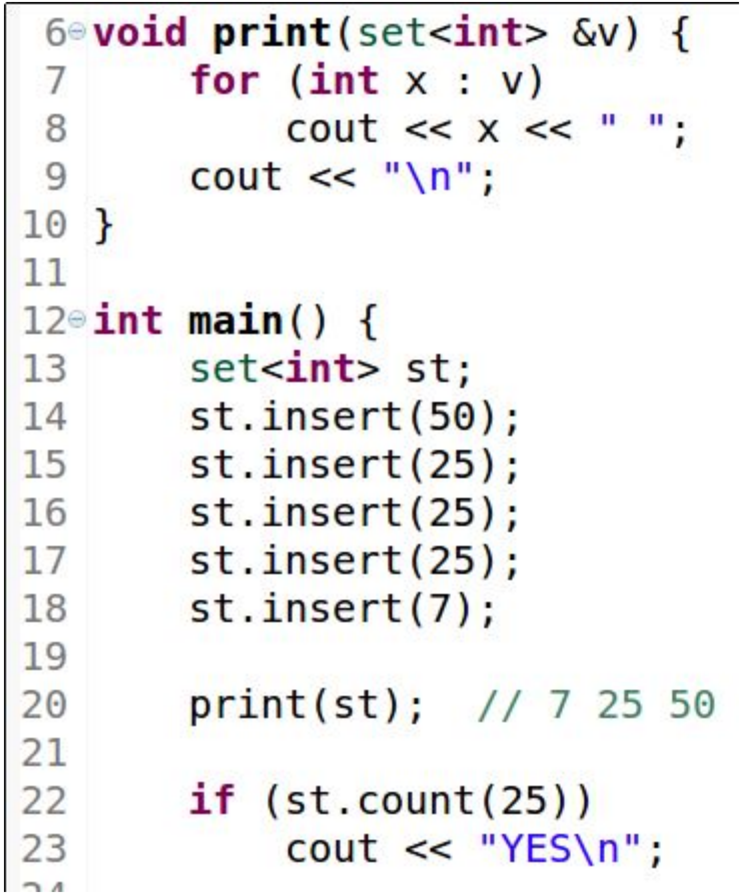


Set

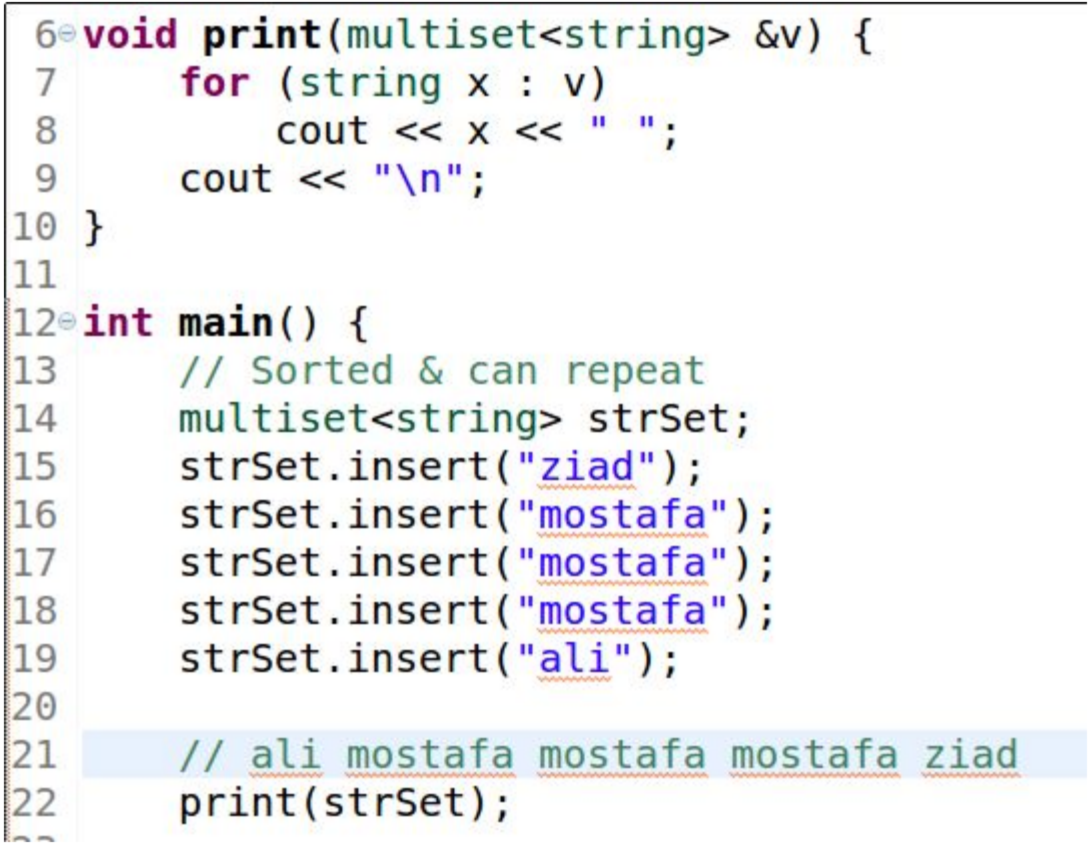
- Set is internally a self-balancing BST
    - Type: red-black tree
- Values will be printed sorted
- No duplicates
- We can search, lower_bound and many other operations



```cpp
void print(set<int> &v) {
    for (int x : v)
        cout << x << " ";
    cout << "\n";
}

int main() {
    set<int> st;
    st.insert(50);
    st.insert(25);
    st.insert(25);
    st.insert(25);
    st.insert(7);

    print(st);  // 7 25 50

    if (st.count(25))
        cout << "YES\n";
```

Multiset

- Multiset allows values to be duplicates

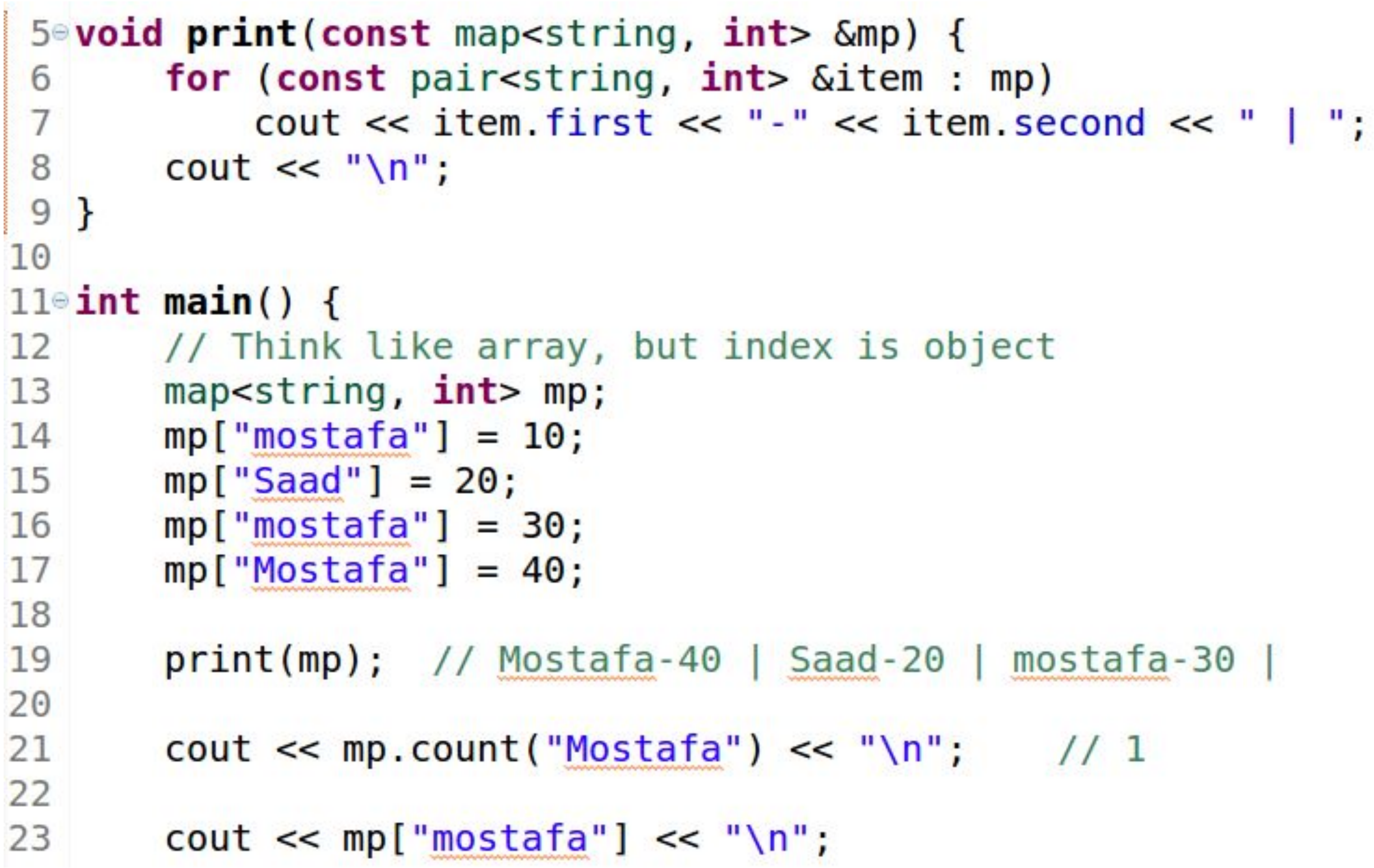


```
void print(multiset<string> &v) {
    for (string x : v)
        cout << x << " ";
    cout << "\n";
}

int main() {
    // Sorted & can repeat
    multiset<string> strSet;
    strSet.insert("ziad");
    strSet.insert("mostafa");
    strSet.insert("mostafa");
    strSet.insert("mostafa");
    strSet.insert("ali");

    // ali mostafa mostafa mostafa ziad
    print(strSet);
```

Map

- Map and Multimap are also balanced trees
- In map, we have with each key a value
- Tree is balanced based on keys
- You can retrieve the value of a key
- C++ provides this retrieval as [] access
- We can use it with iterators, but let’s keep things simple

Map



```cpp
void print(const map<string, int> &mp) {
    for (const pair<string, int> &item : mp)
        cout << item.first << "-" << item.second << " | ";
    cout << "\n";
}

int main() {
    // Think like array, but index is object
    map<string, int> mp;
    mp["mostafa"] = 10;
    mp["Saad"] = 20;
    mp["mostafa"] = 30;
    mp["Mostafa"] = 40;

    print(mp);  // Mostafa-40 | Saad-20 | mostafa-30 |

    cout << mp.count("Mostafa") << "\n";    // 1

    cout << mp["mostafa"] << "\n";
```

"Acquire knowledge and impart it to the people."

"Seek knowledge from the Cradle to the Grave."