OOP

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Assignment no. 6

Title: Personal information system using sorting & searching for STL & vector container.

Problem statement:

Write a C++ program using STL for sorting and searching user defined records such as person's (name, DOB, mobileno. etc). using vector container.

Prerequisites: OOP basics, STL, vector container.

Objectives: To learn the concept of STL, searching, sorting & vector container.

Theory:

The standard Template Library (STL) is a set of C++ template classes to provide common programming data structures & functions such as lists, stacks, arrays, etc.

It is a library of container classes, algorithms, and iterators.

It is a generalized library & so, its components are parameterized.

A working knowledge of template classes is a prerequisite for working with STL.

STL has four components
- Algorithms
- containers
- functions
- Iterators

① Algorithms:
- searching
- sorting
- Important STL Algorithms
- useful array algorithms
- partition operations
- Numeric

② Containers
- containers or container classes store objects & data. There are in total seven standard "first class" container classes & three container adaptor classes & only seven header files that provide access to this container or container adaptors.

* sequence containers:
implement data structures which can be accessed in a sequential manner.
- vector
- list
- deque
- arrays
- forward_list (introduced in c++11)

* Container adaptors :
provide a different interface for sequential containers.
  - queue
  - priority_queue
  - stack

* Associative containers :-
implement sorted data structures that can be quickly searched (O(log n) complexity).
  - set
  - multiset
  - map
  - multimap

* Unordered Associative Containers :-
implement unordered data structures that can be quickly searched.
  - unordered_set
  - unordered_multiset
  - unordered_map
  - unordered_multimap

③ Functions :
- The STL includes classes that overload the function call operator. Instances of such classes are called functions objects or functors.
functors allow the working of associated function to be customized with the help of parameters to be

passed.

(4) Iterators:
- As name suggests, iterators are used for working upon a sequence of values. They are the major feature that allows generality in STL.

* Utility Library:
- Defined in header <utility>
- pair

Sorting:

It is one of the most basic functions applied to data. It means arranging the data in a particular fashion, which can be increasing or decreasing. There is a built in function in C++ STL by the name of sort(). This function internally uses Intro sort. In more details it is implemented using hybrid of quicksort, heap sort & insertion sort.

By default, it uses Quicksort but if Quicksort is doing unfair partitioning & taking more than nlogn time, it switches to heapsort & when the array size becomes really small, it switches to Insertion sort.

The prototype for sort is:
sort (start address, end address)

Searching:
startadress = the address of 1st element of array
end adress: adress of next contagious location of the last element of the array.
So actually sort() in the range of [staradd, endadress]

// sorting:

```
# include <iostream>
# include <algorithm>
using namespace std;

void show (int a[])
{ for (int i=0 ; i<10 ; i++)
    cout << a[i];
}
int main()
{ int a[10] = {1, 5, 8, 9, 6, 7, 3, 4, 2, 0};
  Cout<<" the array before sorting :" ;
    show(a);
  Cout << Sort (a, a+10);
  Cout<<" The array after sorting is " ;
    show(a);
}
```

op :-
The array before sorting : 1 5 8 9 6 7 3 4 2 0
The array after sorting : 0 1 2 3 4 5 6 7 8 9

Searching (binary)

It is a widely used algorithms for searching that requires array to be sorted before search is applied.
The main idea behind this algo is to keep dividing the array in half until element is found or all elements are exhausted.

The prototype for binary search is :
binary search (startad, endad, valuetofind)

where,
startad = the address of first element of array.
endad = the address of last element of array.
value to find : the target value which we have to search for.

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Algorithm:

1. Start
2. Give a header file to use 'vector'
3. create vector 'item record'
4. Initialize variables to store item code, item name, quantity & cost.
5. Using iterators store as many records you want to store using predefined functions push-back().
6. Using predefined function sort(), sort the data stored according to user requirements.
7. Using predefined functions, search() the element from the vector the user wants to check.
8. display & call the functions using a menu.
9. end.

Input: personal info such as name, DOB, mobileno.

Output:

* menu *

1. Insert
2. Display
3. search
4. sort
5. Delete
6. Exit.

Output:

Enter your Choice : 1
Enter Item name : Bat
Enter Item Quantity : 2
Enter ~~Item~~ item cost : 50
Enter Item code : 1

Conclusion:-

Hence, we have successfully studied the concept of STL (Standard template library) & how it makes many data structures easy. It briefs about the predefined functions of STL & their uses ~~use~~ such as a search() & sort().