

## Lab 15 – Templates & Standard Template Library

### Question 1

Write a program which is capable of calculating Power, Square Root, Sin, Cos and Tan of any data type. For the mathematical calculations you are allowed to use C++ 'cmath' library. Your program should consist of generic function (Function templates) for each operator. Pass the operands to desired function which returns the result after performing appropriate operation.

### Question 2

Write a class **Calculator** using templates. The template class shall allow you to perform addition, multiplication and division on integer, double, float and long data types.

### Question 3

Write a class **Vector** using templates. The template class shall provide following functionality. For detailed documentation of vector, please refer yourself to [cppreference.com](http://cppreference.com) or [cplusplus.com](http://cplusplus.com)

Member function	
<b>constructors</b>	Construct Vector
Vector ();	
Vector (int size);	
Vector (int size, const T& iv);	
Vector (const Vector <T> &);	
<b>destructor</b>	Vector destructor
~ Vector ();	
operator=	Assign content
<b>Iterators:</b>	
begin	Return pointer to beginning of data
end	Return pointer to one element beyond the end of data
<b>Capacity:</b>	
size	Return size

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Spring 2019

resize(int)	Change size
empty	Test whether Vector is empty, returns true or false
shrink_to_fit(int newsize)	Shrink to fit, drops element from the array to fit the given size
<b>Element access:</b>	
operator[]	Access element
front	Access first element
back	Access last element
<b>Modifiers:</b>	
push_back	Add element at the end
pop_back	Delete last element
swap	Swap content
clear	Clear content

### Question 4

**[Note: Please use the stl vector class for this task]**

Extend the code shown below by performing the following operations on the vector (note that more info regarding these operations can be found at <http://www.cppreference.com>). You may want to run the application each time after completing an operation to verify the content of the vector.

1. Insert 7 between the first and second element (use insert member function).
2. Replace the first element with 9 (use direct access with element index).
3. Copy the first two elements to the end of the vector (use push\_back member function and direct access with element indexes).
4. Find the first element with value 3 (use find algorithm).
5. Erase the first element with value 3 (use erase member function).
6. Find the element with the smallest value and output the value to the console (use min\_element algorithm).
7. Sort the vector (use sort algorithm).
8. Reverse the elements of the vector (use reverse algorithm).
9. Count the elements with value 9 and output the count to the console (use count algorithm).
10. Sum up the first four elements and output the result to the console (use accumulate algorithm and you may have to include < numeric >).

```
#include <iostream>
#include <vector> //vector class-template
using namespace std;
int main()
{
    vector<int> v;
    // add integers at the end of the vector
    v.push_back(2);
    v.push_back(3);
    v.push_back(4);
    v.push_back(7);
    v.push_back(5);
    // display info about v
    cout << "The size of v is: " << v.size() << "\nThe capacity of v is: " << v.capacity();
    vector<int>::const_iterator it;
    cout << "\nThe content of v is: ";
    for (it = v.begin(); it != v.end(); it++)
    {
        cout << *it << " ";
    }
    //=====
    return 0;
}
```

Note: submit **Q4main.cpp** for Question4

## Question 5

In this task you are required to implement a small address book program for your mobile using STL maps. Your address book allows users to store the data via email addresses (key), against each key you will be storing the “**Person**” object. Here each person will have able to store the first and last name, along with phone number. The STL map may be an appropriate choice for this purpose. Don’t worry about saving the address book to disk; it’s ok to lose the data when the program exits.

Note: Person.h, Person.cpp & Q5\_main.cpp for Question 5