School Of Mechanical & Manufacturing Engineering, NUST

Department of Mechanical Engineering

CS-114 - Fundamentals of Programming

Lab Report # 10

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Vectors and Object Oriented Programming

Objectives:

The objectives of this lab are:

- Learn about Vectors
- Learn about Object Oriented Programming

Tasks:

Task 1:

Iterate Through Vector Using Iterators and print all pushed elements. Next you need to push integer 5 and remove element at that position.

Code:

```
#include <iostream>
#include <vector>
using namespace std;
int main()
{

    vector<int> v;

    v.push_back(1); v.push_back(3); v.push_back(5);
    v.push_back(7); v.push_back(9); v.push_back(11);

    cout<<"The elements of the Vector are : "<<endl;
    for (vector<int>::iterator it = v.begin(); it != v.end(); it++)
    {
        cout << *it <<" ";
    }
    cout<<endl;

    v.push_back(5);
    cout<<"The elements after adding 5 are : "<<endl;
    for (vector<int>::iterator it = v.begin(); it != v.end(); it++)
    {
        cout << *it <<" ";
    }
    cout<<endl;

    cout<<"The vector after removing integer at position 5 is : "<<endl;
     v.erase(v.begin()+4);
     for (vector<int>::iterator it = v.begin(); it != v.end(); ++it)
     {
         cout << *it <<" ";
     }
     return 0;
}
```

Output:

```
The elements of the Vector are :
1 3 5 7 9 11
The elements after adding 5 are :
1 3 5 7 9 11 5
The vector after removing integer at position 5 is :
1 3 5 7 11 5
--------------------------------
Process exited after 0.08391 seconds with return value 0
Press any key to continue . . .
```

Task 2:

Write a complete C++ program that uses 2 vectors, 1 for names (string) and 1 for grades (int)

a. Ask the user for the number of name/grade pairs that will be entered.
b. Display the mean of the grades.
c. Display the median of the grades.
d. Display the mode of the grades.
e. Display the names of the students with the mode as their grade.

Code:

```cpp
#include <iostream>
#include <vector>
using namespace std;
int main()
{
    vector<string> names;
    vector<int> marks;
    int students;

    cout<<"Enter the total number of students: "<<endl;
    cin>>students;

    for(int i=0; i<students; i++)
    {
        string name;
        int mark;
        cout<<"Student Name: ";
        cin>>name;
        cout<<"Student Marks: ";
        cin>>mark;

        while(mark > 100 || mark < 0)
        {
            cout<<"Invalid marks! Enter a valid value: ";
            cin>>mark;
        }
        names.push_back(name);
```

```
28          marks.push_back(mark);
29      }
30
31      float mean;
32      int sum=0;
33      for(vector<int>::iterator i = marks.begin(); i !=marks.end(); i++)
34      {
35          sum += *i;
36      }
37      mean = static_cast<float>(sum) / students;
38      cout<<"The Mean is: "<<mean<<endl;
39
40      float median;
41      for (int i = 0; i < students - 1; i++) {
42          for (int j = 0; j < students - i - 1; j++) {
43              if (marks[j] > marks[j + 1]) {
44                  swap(marks[j], marks[j + 1]);
45                  swap(names[j], names[j +1 ]);
46              }
47          }
48      }
49
50      if(students % 2 == 0)
51      {
52          median = (marks[students/2 -1] + marks[students/2]) / 2;
53      }
54      if(students % 2 != 0)
55      {
56          median = marks [students / 2 ];
57      }
58      cout<<"The Median is : "<<median<<endl;
59
60      int mode = -1,  modefrequency = 0, currentfrequency = 1;
61      for(int i=0; i<students; i++)
62      {
63          if(marks[i] ==  marks[i+1])
64          {
65              currentfrequency += 1;
66          }
67          else
68          {
69              currentfrequency = 1;
70          }
71          if(currentfrequency > modefrequency)
72          {
73              mode = marks[i];
74              modefrequency = currentfrequency;
75          }
76      }
77      if(modefrequency >= 2)
78      {
79          cout<<"The Mode is : "<<mode<<endl;
80
```

```
81          cout<<"The students with mode as their marks are : ";
82          for(int i=0; i<students; i++)
83          {
84              if(marks[i] == mode)
85              {
86                  cout<<names[i]<<",";
87              }
88          }
89      }
90      else
91      {
92          cout<<"As no value is repeated, mode does not exist.";
93      }
94      return 0;
95  }
```

Output:

```
Enter the total number of students:
4
Student Name: Ayesha
Student Marks: 70
Student Name: Rabia
Student Marks: 80
Student Name: Nayab
Student Marks: 90
Student Name: Rehma
Student Marks: 95
The Mean is: 83.75
The Median is : 85
As no value is repeated, mode does not exist.
--------------------------------
Process exited after 17.94 seconds with return value 0
Press any key to continue . . .
```

Task 3:

Write a program to print the area and perimeter of a triangle having sides of 3 m, 4 m and 5 m by creating a class named 'Triangle' with a function to print the area and perimeter.

Code:

```cpp
#include <iostream>
using namespace std;
class Triangle
{
    private:
    double L1,L2,L3;
    public:
        Triangle(double s1,double s2, double s3):L1(s1),L2(s2),L3(s3){  }
        void PrintArea(){
            double Area = (L2*L1)/2;
            cout<<"The area of triangle is : "<<Area<<endl;

        }
        void PrintPerimeter(){
            double peri = L1+L2+L3;
            cout<<"The perimeter of triangle is : "<<peri<<endl;
        }
};

int main()
{
    Triangle T1 (3,4,5);
    T1.PrintArea();
    T1.PrintPerimeter();
}
```

Output:

```
The area of triangle is : 6
The perimeter of triangle is : 12

--------------------------------
Process exited after 0.07208 seconds with return value 0
Press any key to continue . . .
```

Task 4:

Write a structure to store the names, salary, and hours of work per day of 10 employees in a company. Write a program to increase the salary depending on the number of hours of work per day as follows and then print the name of all the employees along with their final salaries.

Hours of work per day	8	10	>=12
Increase in Salary	$50	$100	$150

Code:

```cpp
#include <iostream>
#include <string>
using namespace std;
struct Employee {
    string name;
    double salary;
    int hoursofwork;
};

void increaseSalary(Employee &employee) {
    if (employee.hoursofwork >= 12) {
        employee.salary += 150;
    }
    else if (employee.hoursofwork >= 10) {
        employee.salary += 100;
    }
    else if (employee.hoursofwork >= 8) {
        employee.salary += 50;
    }
}

int main() {
    int numEmployees = 10;
    Employee employees[numEmployees];
    for (int i = 0; i < numEmployees; ++i) {
        cout << "Enter details for Employee " << i + 1 << ":\n";
        cout << "Name: ";
```

```
28          cin >> employees[i].name;
29          cout << "Salary: $";
30          cin >> employees[i].salary;
31          cout << "Hours of work per day: ";
32          cin >> employees[i].hoursofwork;
33          cout << endl;
34          increaseSalary(employees[i]);
35      }
36
37      cout << "Employee Details with Final Salaries:\n";
38      for (int i = 0; i < numEmployees; ++i) {
39          cout << "Name: " << employees[i].name << ", Final Salary: $" << employees[i].salary << endl;
40      }
41
42      return 0;
43  }
```

Output:

```
Enter details for Employee 1:
Name: Ayesha
Salary: $300
Hours of work per day: 8

Enter details for Employee 2:
Name: Rabia
Salary: $400
Hours of work per day: 9

Enter details for Employee 3:
Name: Nayab
Salary: $500
Hours of work per day: 10

Enter details for Employee 4:
Name: Rehma
Salary: $200
Hours of work per day: 5

Enter details for Employee 5:
Name: Ali
Salary: $650
Hours of work per day: 12

Enter details for Employee 6:
Name: Ujala
Salary: $350
Hours of work per day: 8
```

```
Enter details for Employee 7:
Name: Hannan
Salary: $700
Hours of work per day: 4

Enter details for Employee 8:
Name: Maryam
Salary: $800
Hours of work per day: 12

Enter details for Employee 9:
Name: Zaheer
Salary: $1000
Hours of work per day: 10

Enter details for Employee 10:
Name: Nasira
Salary: $1200
Hours of work per day: 11

Employee Details with Final Salaries:
Name: Ayesha, Final Salary: $350
Name: Rabia, Final Salary: $450
Name: Nayab, Final Salary: $600
Name: Rehma, Final Salary: $200
Name: Ali, Final Salary: $800
Name: Ujala, Final Salary: $400
Name: Hannan, Final Salary: $700
Name: Maryam, Final Salary: $950
Name: Zaheer, Final Salary: $1100
Name: Nasira, Final Salary: $1300
```