Tutorial 8

Katja Mankinen

October 4, 2018

Aim

After this tutorial, you

- know how to use `for` and `while` loops
- can store data in vectors
- can use pointers
- have gathered much knowledge for your final project!

You should preferably finish all the exercises today. **You can start doing the exercises immediately, at your own pace.** If you have some problems or questions, just ask help!

1. Leap years

Years that are evenly divisible by 400 or are evenly divisible by 4 but not by 100 are called leap years, such as 2016 and 1860. In leap years, February has 29 days and the other months have either 30 or 31 days.

Write a C++ program that accepts the year as user input, determines whether the year is a leap year or a common year, and displays a message telling whether the entered year is a leap year or not. Compile and run your code, and make sure the output is as expected.

```
g++ -o leapyears leapyears.cxx
./leapyears
```

Example output:

```
Enter a year: 1961
It is not a leap year!

Enter a year: 2020
It is a leap year!
```

You can test your algorithm with the following leap years: 2356, 1896, 2028, 2204, 1812, ...

2. Warm up with pointers

Write a following program, compile it, and make sure you understand all the outputs!

```cpp
#include <iostream>

using namespace std;
```

```cpp
int main(){
  int a = 5, b = 10;
  int *p1;
  int *p2;
  p1 = &a;
  cout << "p1 = &a: " << p1 << " = " << &a <<endl;
  p2 = &b;
  cout << "p2 = &b: " << p2 << " = " << &b<<endl;
  *p1 = 10;
  cout << "*p1 = a: " << *p1 << " = " << a << endl;
  p1 = p2;
  cout << "p1 = p2: " << p1 << " = " << p2 <<endl;
  *p1 = 20;
  cout << "\n*p1 " << *p1  << "\np1 " << p1 << endl;
  cout << "\np2 " << p2  << "\n*p2 " << *p2 << endl;
  cout << "\na " << a  << "\nb " << b << endl;
  cout << "\n&a " << &a << "\n&b " << &b << endl;
}
```

3.   Passing by value and reference

There are 3 ways to pass arguments to a function:

- call-by-value

- call-by-reference with a pointer argument

- call-by-reference with a reference argument

   Your next task is to finish my incomplete program. Some of its functionalities are not working yet. Copy the code below, and add the missing parts!

```cpp
#include <iostream>

void increaseAgeByRef(int &myAge){
  //I want to increase my age by 1}

void increaseAgeByPtr(int *myAge){
  //I want to increase my age by 1}

void increaseAge(int myAge){
  //I want to increase my age by 1}

int main()
{
   int myAge = 30;
   std::cout << myAge << std::endl;
   increaseAge(myAge); // Call increaseAge() to increase my age by 1
   std::cout << myAge << std::endl; //is this working?
   // call different functions here and print the output
```

```
    // check if the address of myAge the same in increaseAgeByRef(),
     increaseAgeByPtr() and increaseAge() as it is in main()
    return 0;
}
```

4. Vectors and strings with famous scientists

Your next exercise is to make a list of famous scientists. Name of each scientist will be represented by a `string` stored in a `vector`.

Birthday	Name	Occupation
1815-12-10	Ada Lovelace	mathematician and world's first computer programmer
1878-11-07	Lisa Meitner	physicist, worked on radioactivity and nuclear physics
1912-05-31	Chien-Shiung Wu	physicist, worked on nuclear physics
1914-11-09	Hedy Lamarr	inventor and actress, a pioneer in the field of wireless communications
1928-07-23	Vera Rubin	astronomer, pioneered work on galaxy rotation curves
1941-06-07	Cecilia Jarlskog	theoretical physicist, working mainly on elementary particle physics
1943-07-15	Jocelyn Bell Burnell	astrophysicist, discovered the first radio pulsars
1960-10-29	Fabiola Gianotti	particle physicist, CERN Director-General

Create a C++ program that does the following:

1. Create an empty vector of type `string`. Print it.

2. Append the first four names (Lovelace, Meitner, Wu, Lamarr) to the list. Print it.

3. Remove the last name from the vector. Print it.

4. Append the name "Rubin" to the vector. Print it.

5. Replace the name "Meitner" with "Jarlskog". Print the vector.

6. Append the names "BellBurnell" and "Gianotti" to the vector. Print it.

7. Finally, how many names do you have in your list?

Is any of the mentioned famous scientists born in a leap year?

Hint: You can always find help from Google, Stack Overflow and for example `http://www.cplusplus.com/reference/algorithm/replace/`