This part of the assignment is due by the 9/12.

In general always write your name and date of creation as comments in the files and try to be "user friendly" when you write the code:

- **Add comments on the code to remember yourself and the other what the code does**
- **Manage the possible errors in the input given by the user**

The 70% of this assignment consists in completing part 1) (a,b and c, e)

1. Define a class that includes the cauchy function and members to calculate the integral of the function and sample random points on it.
   a. Define the function, with a constructor that takes as argument the extremes of the linear dominion where the function is defined and a string. These 3 things should initialize private member of the class.
   b. Define a private member function that is the cauchy function: f(x)= $\frac{1}{\pi(1+x^2)}$
   c. Define a public member function of the class that evaluates the integral of the function, on the range stored as private members. The integral can be calculated as I= R*($\frac{\sum_i^N f(xi)}{N}$) where x_i are random points extracted from the range and R is the length of the range. The integral should be 0.874 if you use -5,5 as extremes of the range.
   d. Add a member function that sample random numbers from the Cauchy distribution. To sample random number from a not-uniform distribution you can use the Metropolis algorithm.
      i. Generate a random number (x) on the range where the function is defined, sampled from a uniform function. This will be the first number you generated (x_1=x)
      ii. Iterative:
         1. Generate a random number y from the uniform distribution
         2. Compute A= $min(\frac{f(y)}{f(xt)}, 1)$, where f is the function and x_t is the previous number extracted
         3. Accept y with probability A.
         4. If you accepted y x_{t+1}= y otherwise x_{t+1}=x_t
         5. Write x_{t+1} on a file, called as the string that you passed as argument to the constructor

   e. Write a separate file where you have your main
      i. Build an object of your new class
      ii. Call the function that calculates the integral (you could pass as only argument of the function the number of points)
      iii. Call the metropolis algorithm member function(you could pass as only argument of the function the number of points). This should create a file
      iv. You can include in your main file cauchy_test.h: #include "cauchy_test.h" and compile also adding cauchy_test.cc to the g++ list, then call in your main CreateHistogramFile(outputfile,low,high), where outputfile is the file created in point 3 and low and high are the

ranges given to the constructor. This will create a file called input_plotting.csv that you can open with excel/gnuplot to check if you generated points according to a Cauchy distribution