University of Colorado
Department of Computer Science

Numerical Computation CSCI 3656

Spring 2016

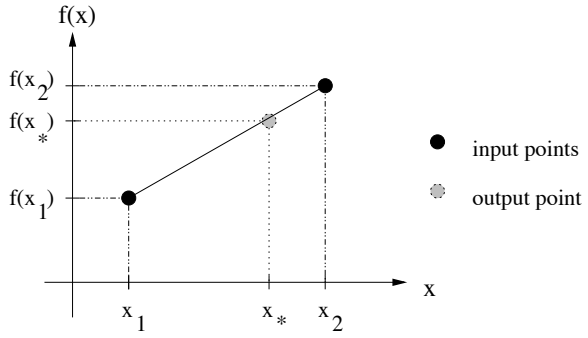
Problem Set 6

Issued: 23 February 2016

Due: 1 March 2016

1. In your favorite programming language, implement a program that:

   - takes as input two points — $(x_1, f(x_1))$ and $(x_2, f(x_2))$ — and another x value x_* that is between x_1 and x_2, and
   - computes $f(x_*)$ using simple linear interpolation, as shown in the picture below:



   (a) *[5 pts]* Dig around on the web and find some interesting **decadal** census data (e.g., of India, of your home city, of stray dogs in London, ...) that covers at least the last 50 years and preferably the last century. Turn in a plot of your data and a link to the webpage where you found it. Don't forget to label your axes.

   (b) *[15 pts]* Use your interpolation code to estimate the value of your chosen quantity halfway through the most recent decade. (That is, say you know the population of Cleveland in 2000 and 2010. What was that population in 2005?) If you have access to yearly data, compare your interpolated result to the true population.

2. *[10 pts]* The same idea can be applied in order to *extrapolate*: that is, to find a value for $f(x_*)$ if x_* is *not* between x_1 and x_2. Using the same data and the same code as in problem 1, estimate the size of your chosen population in 2050. This will require making an intelligent choice about what two points to feed your program, and perhaps removing any "between" error checks that you may have incorporated.

3. *[10 pts]* Use the Lagrangian interpolating polynomial approach to fit a parabola to the last three points in your data.

   Use that polynomial to estimate the size of your population halfway through the last decade. Compare that to the value that you got in problem 1. Which of the two interpolated values is better, do you think? Would that depend on the shape of the data?