ECON 5760
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Problem Set 1

**Problem 1**. For this problem you are to write a script (m-file) that does up to a 3rd order Taylor approximation of the function $f(x) = x^2$.

a. Let $\bar{x} = 0$ and $h \in (-1, 1)$. Using as the taylorapprox.m script as a guide, replicate the results for the new function above. How "good" is the linear approximation away from $\bar{x} = 0$? What explains the linear function's performance? How does it compare to a 2nd and 3rd order approximation?

b. How long did the loop take to complete across all values for $h$? Now vectorize the code so that the loop acros all $h$ is no longer needed. How much faster is the vectorization versus the loop? Call this script taylorapproxvec.m.

**Problem 2**. Write a function called lip.m that approximates a function $f(x)$ using linear interpolation. The inputs should be two values $x_1$ and $x_2$ along with the two corresponding values $f(x_1)$ and $f(x_2)$ for which the function is defined. In addition to this, the function should also take as an input the value of $x$ which the function is to be approximated at and the output should be the approximate value for $f(x)$, $\hat{f}(x)$.

a. Use this code to estimate the value of $f(x) = ln(x)$ at the point $x = 1$ with the neighboring points being $x_1 = .80$ and $x_2 = 1.2$. How close is the approximate value to the true value? What happens to the quality of the approximation as you choose points closer to the point of approximation $x = 1$?

b. We often want to evalute the function on a range of values for $x$ instead of a single point. Write a vectorized version of your code called liploop.m that does this using a loop over the range of values for $x$.

c. Now write a function accomplishes the same task as in part b but does not use loops. Call this file lipvec.m.