# CSCC51H

## Assignment 1

Jan. 16, 2012 — Scarborough Campus — **Due:** Jan. 30, 2012

1. (a) Use the Newton form of the interpolating polynomial to determine the degree 4 interpolating polynomial, $p_4(x)$, corresponding to the data given in the following table:

| $x$ | 0.0 | 0.1 | 0.3 | 0.6 | 1.0 |
|---|---|---|---|---|---|
| $f(x)$ | -6.10000 | -5.99483 | -5.75014 | -5.27788 | -4.38172 |

   (b) Add the data point $f(1.1) = -3.99583$ to the table and construct the interpolating polynomial of degree five, $p_5(x)$ and plot the difference, $p_5(x) - p_4(x)$ for $x \in [0.0, 1.1]$. Note that this difference can be interpreted as an estimate of the error in using $p_4(x)$ to represent the underlying function $f(x)$.

2. Inverse Interpolation:
In 'inverse interpolation', one is given a number $\bar{y}$ and wishes to find the point $\bar{x}$ such that $f(\bar{x}) = \bar{y}$, where $f(x)$ is a function specified in tabular form. If $f(x)$ is known to be continuous and strictly monotone increasing (or decreasing), this problem can be 'solved' by considering the given table, $[x_i, f(x_i)]_{i=1}^N$, to be a table, $[g(y_i), y_i]_{i=1}^N$ for the inverse function, $g(y) = f^{-1}(y) = x$. One can then determine an approximation to $\bar{x}$ using a polynomial approximation, $q(y)$, to $g(y)$ and setting $\bar{x} = q(\bar{y})$.

   (a) Why is it necessary that $f(x)$ be monotone?

   (b) In Matlab use this idea and the Table from 2a to determine an approximation to $\bar{x}$, such that $f(\bar{x}) = -5.30$.

   (c) Using the additional data value given in 2b estimate the error you would expect in this approximation.