# Faculty of Computer Science
# CS 3113
# Fall 2003

Assignment # 6 **Due:** 8:30 am, November 28, 2003

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1. Consider the function:

$$f(x) = \ln(\frac{1}{1+x^2})$$

   (a) Find the exact value of the derivative $f'(1)$

   (b) Estimate $f'(1)$ using a centered difference with $h_1 = 0.1$. What is the percent error?

   (c) Estimate $f'(1)$ using a centered difference with $h_2 = 0.05$. What is the percent error?

   (d) Estimate $f'(1)$ using Richardson extrapolation with $h_1 = 0.1$ and $h_2 = 0.05$. What is the percent error?

2. Use the `diff(y)` command in MATLAB and compute the finite difference approximation to the first derivative at each $x$-value in the table below, excluding the two end points. Use a finite difference approximation that is second-order correct, that is with a truncation error of $O(\Delta x^2)$.

| $x$ | 0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $y$ | 1.4 | 2.1 | 3.3 | 4.7 | 7.1 | 6.4 | 8.8 | 7.2 | 8.9 | 10.7 | 9.8 |

3. Numerical Methods with MATLAB , Chapter 11, exercises 4,5

4. Determine the distance travelled for the following data:

| $t$ | 1 | 2 | 3.25 | 4.5 | 6 | 7 | 8 | 8.5 | 9.3 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| $v$ | 5 | 6 | 5.5 | 7 | 8.5 | 8 | 6 | 7 | 7 | 5 |

   (a) Use the trapezoidal rule, and

   (b) use regression analysis to fit the data to second and third order polynomials. Compute the distance by integrating these polynomials analytically, using the MATLAB function `polyint`.