
MATH 448/548 - Numerical Analysis

Homework assignment 2

Date assigned: September 24, 2009

Due date: **October 6, 2009**

- Include a cover page and a problem sheet
- Include the printout of your program(s) for completeness

PROBLEMS:

1. Using Taylor series expansion derive the error term for the following formulas:

- $f'(x) \approx \frac{1}{12h} (-f(x+2h) + 8f(x+h) - 8f(x-h) + f(x-2h))$
- $f''(x) \approx \frac{1}{h^2} (f(x) - 2f(x+h) + f(x+2h))$

2. Consider the function $f(x) = 1 + \cos(x+2)$, $x_0 = 0$. Approximate the derivative $f'(x_0)$ by computing $Df = \frac{f(x_0+h) - f(x_0-h)}{2h}$ for a sequence of decreasing values of h , i.e. $h = 10^{-n}$, $n = 1, \dots, 25$. Plot log of error against log of h and explain your observations. Make a table with the following information:

n	h	Df	$f'(0) - Df$	$(f'(0) - Df)/h$	$(f'(0) - Df)/h^2$	$(f'(0) - Df)/h^3$
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Discuss the results.

3. Apply method of undetermined coefficients to derive second order scheme for $\frac{\partial u}{\partial x}$ using three points in the following way:

$$u_x \approx c_1 u(k) + c_2 u(k+1) + c_3 u(k+2).$$