Lecture-5

Wednesday, August 3, 2022 9:32 PM

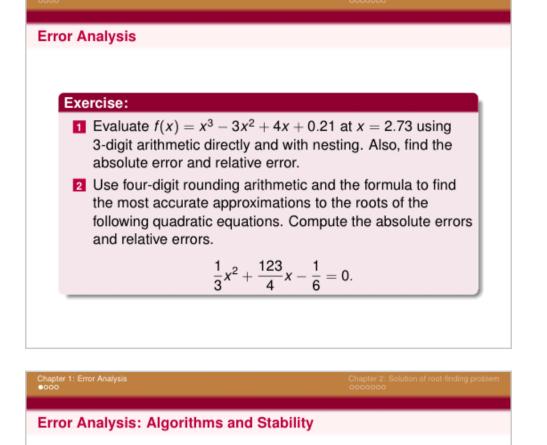


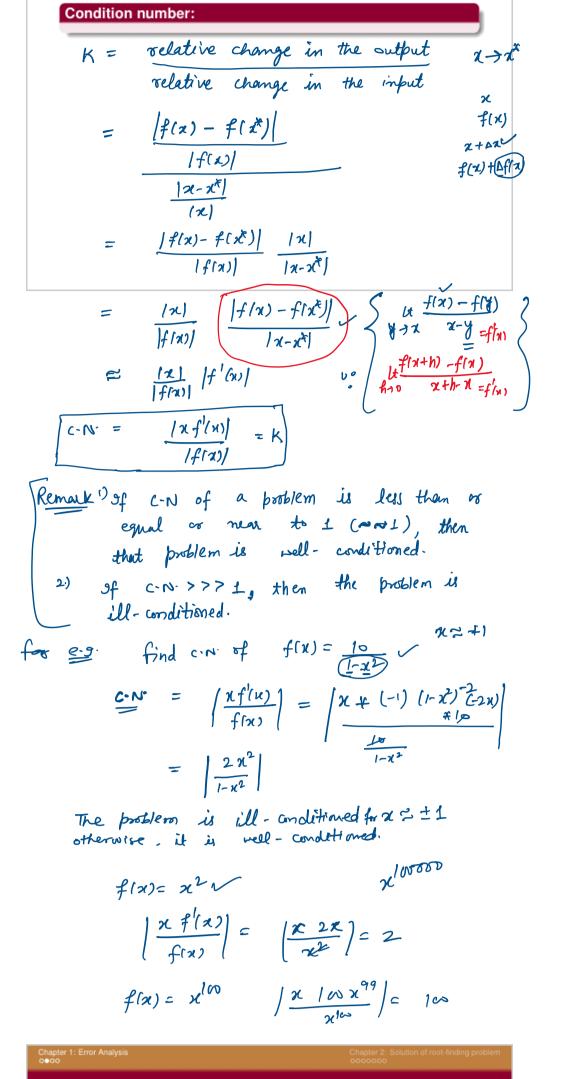
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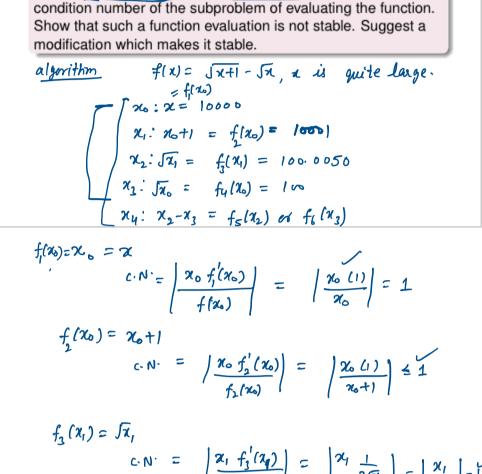
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Lecture 5: Numerical Analysis (UMA011)

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Error Analysis: Algorithms and Stability

Write an algorithm to calculate the expression

 $f(x) = \sqrt{x+1} - \sqrt{x}$ when x is quite large. By considering the

Example:

$$c.N = \begin{vmatrix} x_1 & f_3'(x_1) \\ f_3(x_1) \end{vmatrix} = \begin{vmatrix} x_1 \\ \frac{1}{2x_1} \end{vmatrix} = \begin{vmatrix} x_$$

 $a_5 = \frac{1}{2} x_4$, $c-N^2 = \frac{1}{2} \frac{x_4 + \frac{9}{2}(x_4)}{\frac{9}{2}(x_4)} = \frac{1}{2} \frac{x_4 + \frac{1}{2}x_4}{\frac{1}{2}x_4} = 1$

Write an algorithm to calculate the expression $e^x - \cos x$ when

Stable

=) The modified expression is

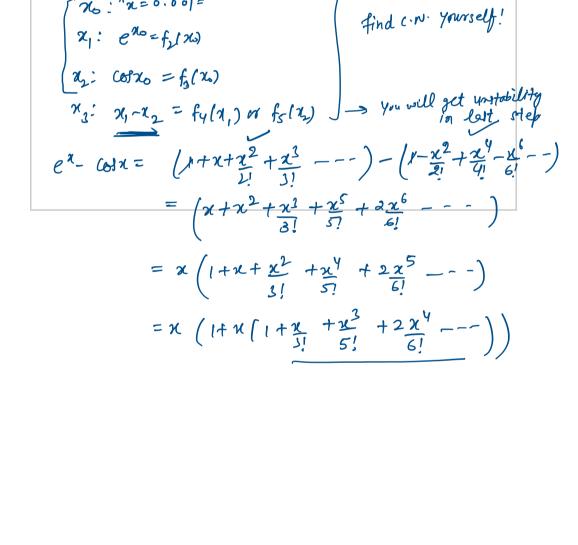
Error Analysis: Algorithms and Stability

x is near 0 and rewrite it to be stable.

Example:

Error Analysis

Exercise:



1 Compute and interpret the condition number for:

Write an algorithm to calculate the expression

Consider the stability (by calculating the condition number) of $\sqrt{x+1} - 1$ when x is near 0. Rewrite the expression to

 $f(x) = \ln(x+1) - \ln(x)$, for large values of x using six digit rounding arithmetic. By considering the condition number of the subproblem of evaluating the function, show that such a function evaluation is not stable. Also propose the modification of function evaluation so that algorithm will

(i) $f(x) = \sin(x)$ for $x = 0.51\pi$ and (ii) $f(x) = \tan(x)$ for x = 1.7.

rid it of subtractive cancellation.

become stable.

