MÄLARDALENS HÖGSKOLA
ESKILSTUNA VÄSTERÅS

Laboratory report No. 2

Sara Lenman, Magnus Östgren

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Instructors: Milica Rančić, Fredrik Jansson
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Problem 1

Problem 1 – Description

Find the points in wich the function $f(x) = 12 - 26x + 20x^2 - 7x^3 - 12e^{x-2} + 14xe^{x-2}$ intersects with the x-axis on the interval $[0,\ 3]$.

1. Plot the function and choose approximate guesses for the values of x.
2. Using the Newton-Raphson method find the values of x.
3. For each root also wright
   1. The sequence of iterations
   2. The absolute error.
   3. The absolute relative error ratio and $|E_{i+1}|/|E_i|^{\ 2}$ that converges to a nonzero limit.

Problem 1 – Solution and Results

1.
   By studying the function the approximate points of interest, where the function intersects with the x axis, are x=0.8 and x=1.9.
   The Newton-Raphson method gives the approximations 0.857142857154355 and 1.999959308631318 after 100 iterations.
   Graph of function in picture 1.

2. Using matlab the sequence of iterations, absolute error and relative error are presented in the output, shown in appendix A.

Problem 2

Problem 2 – Description

1. Which of the roots converges in a quadratic matter also compute the asymptotic error constant A.
2. If a root does not show quadratic convergence then explain why the the theorem on quadratic convergence is not applicable.
3. If the root does not show quadratic convergence then does it obey linear convergence. Explain why.

Problem 2 – Solution and Results

Picture 2 and picture 3 show that the relative error converges linearly for the first root and quadratically for the second root, because picture 2 is of the linear relative error for both roots and only the graph for the first root converges, in picture 3 that is of the quadratic relative error only the graph for the second root converges. The asymptotic error constant is 6130102.022975 for the second root, because it is the same as the relative error ratio.

The first root is not quadratically convergent because A is not constant for that root when R = 2, see Definition 3 (Mathews 2004 page 75).

The error does obey linear convergence, because it does give a constant A for R = 1 in Definition 3 (Mathews 2004 page 75).