Computational Mathematics

Exercises Set: 1 (deadline Dec 16/2011)

1. Find the root to the following equations:

(a) $e^x - 2\cos(x) = 0$, $x \in (-2,0)$
(b) $x^2 + \sin(x) + e^x - 2 = 0$, $x \in (0,1)$

using the methods of *bisection*, *linear interpolation* and *Newton-Raphson*. Compare the three methods by computing the number of iterations needed to achieve accuracy of 10^{-8}.

2. Find the root to the following equation, using the $x=g(x)$ method (carefully select the x=g(x) format that converges) and Aitken's acceleration formula:

$$e^x - 2x^2 = 0 \ , \ x \in (-2,0)$$

3. Solve the following system of equation, using the Newton-Raphson method. Check the convergence of the method by computing the number of iterations needed, for an accuracy between 10^{-3} and 10^{-9}. Present the results in a graph and comment on it.

$$2e^x - y = 0$$
$$xy - e^x = 0$$

4. Find the solution of the linear system **Ax=B**, using (a) *Gauss-Jordan* (with pivoting), and (b) *L-U decomposition*.

$$A = \begin{pmatrix} -0.002 & 4.000 & 4.000 \\ -2.000 & 2.906 & -5.387 \\ 3.000 & -4.031 & -3.112 \end{pmatrix} \quad B = \begin{pmatrix} 7.998 \\ -4.481 \\ -4.415 \end{pmatrix}$$