

Homework 6

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AMS 209: Foundations of Scientific Computing

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The goal of this homework was to create a `Python` script that can compile and execute `Fortran` code. In addition, the python script also created a `.txt` file with the runtime parameters and managed output files to make sure they were not overwritten. Lastly, the `Python` code also grabs the `.dat` files and plots the results.

The `Fortran` code performs the Newton's method to find the roots of a specific function with the given threshold. In this case we use

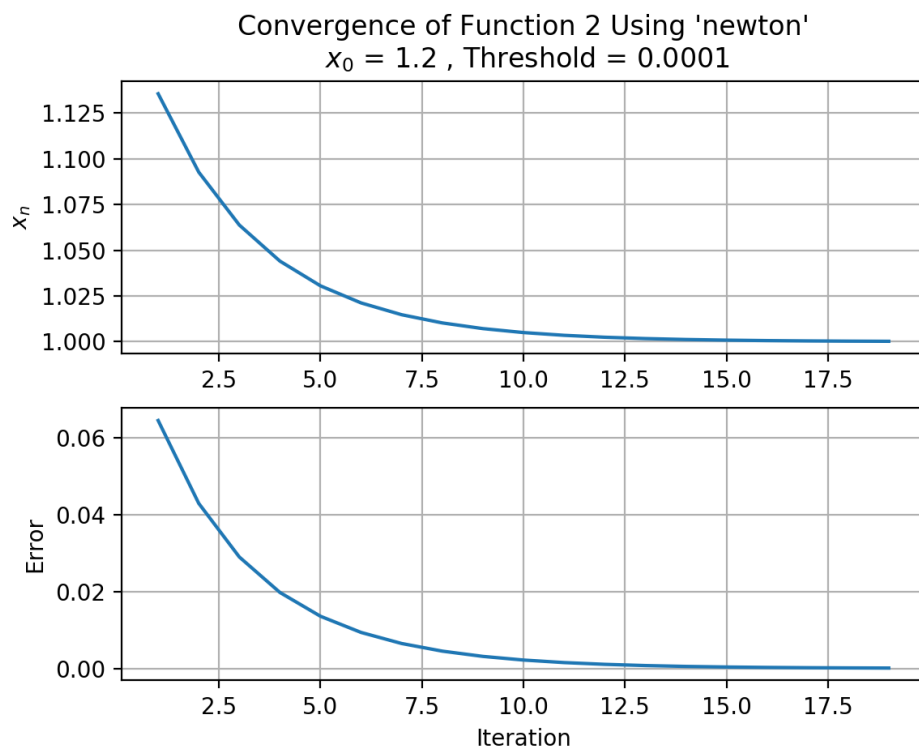
$$f(x) = (x - 1) \log_{10}(x). \quad (1)$$

The root of the problem is $x^* = 1$ then we test the code using two different initial guesses $x_0 = 1.2$ and $x_0 = 0.0001$. As can be seen in the following figures, the error for the initial guess near the root is very small. However, for the solution far away from the root begins small then shoots up and once again falls down below the threshold.

Initial Condition $x_0 = 1.2$

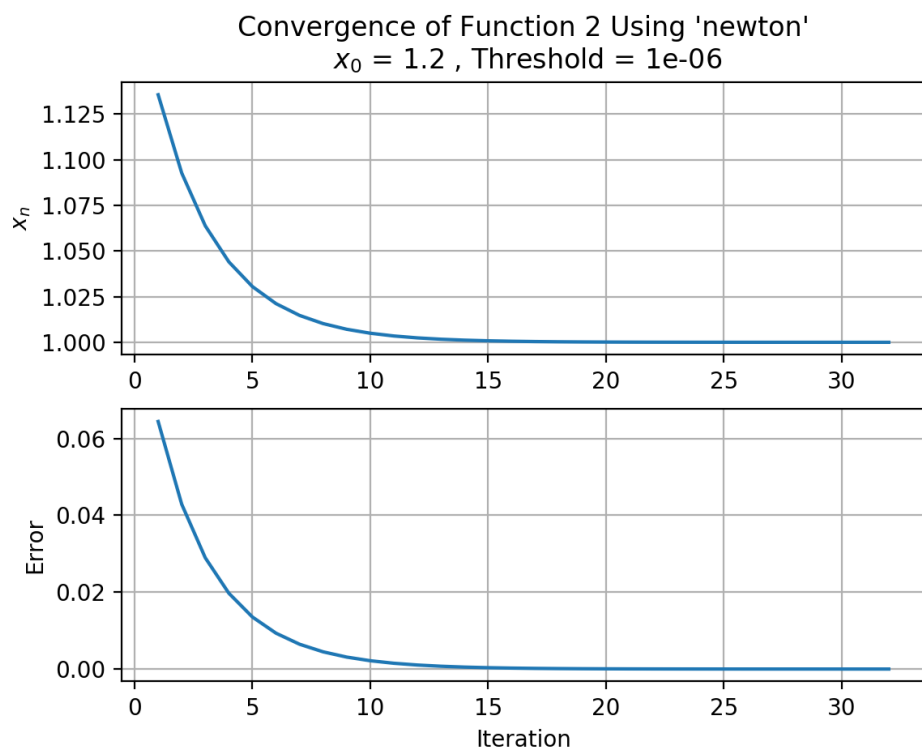
For threshold error 0.0001:

Figure 1: The target function $f(x) = (x - 1) \log_{10}(x)$.



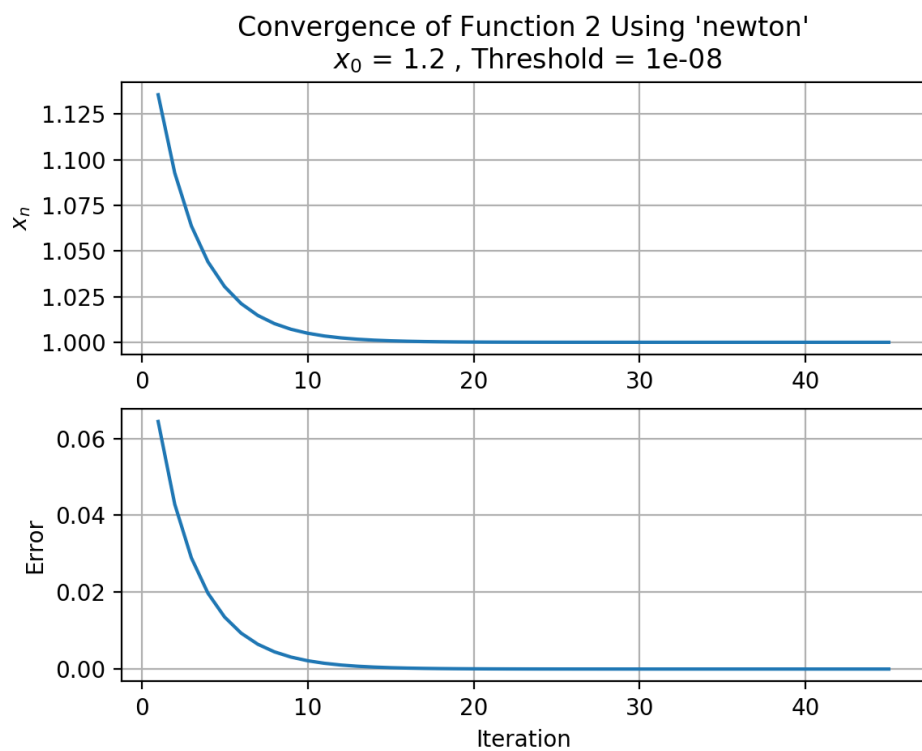
For threshold error 1.0e-6:

Figure 2: The target function $f(x) = (x - 1) \log_{10}(x)$.



For threshold error 1.0e-8:

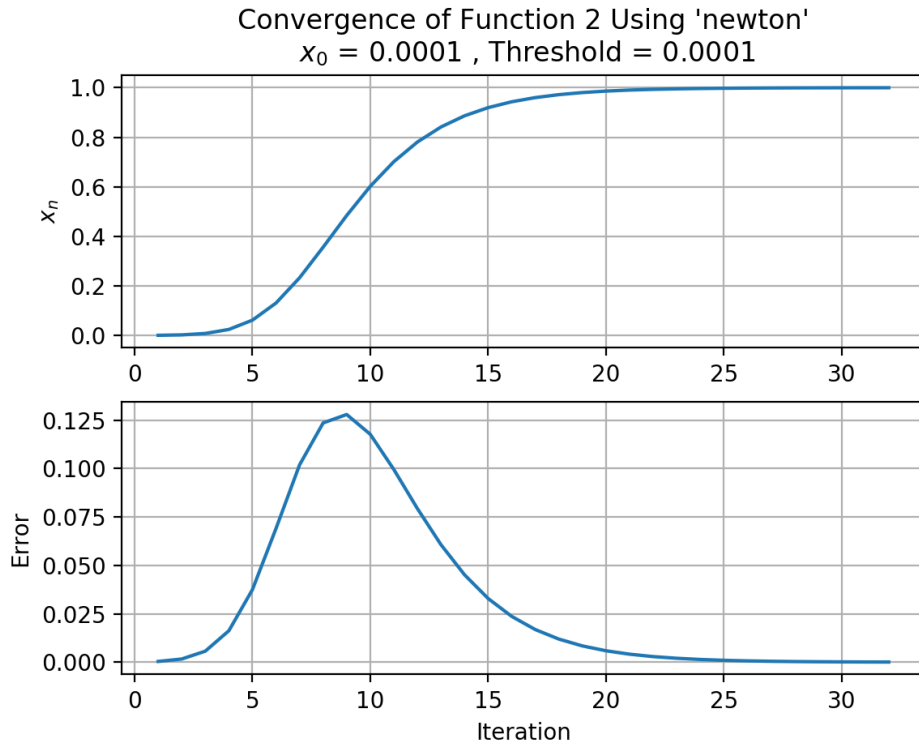
Figure 3: The target function $f(x) = (x - 1) \log_{10}(x)$.



Initial Condition $x_0 = 0.0001$

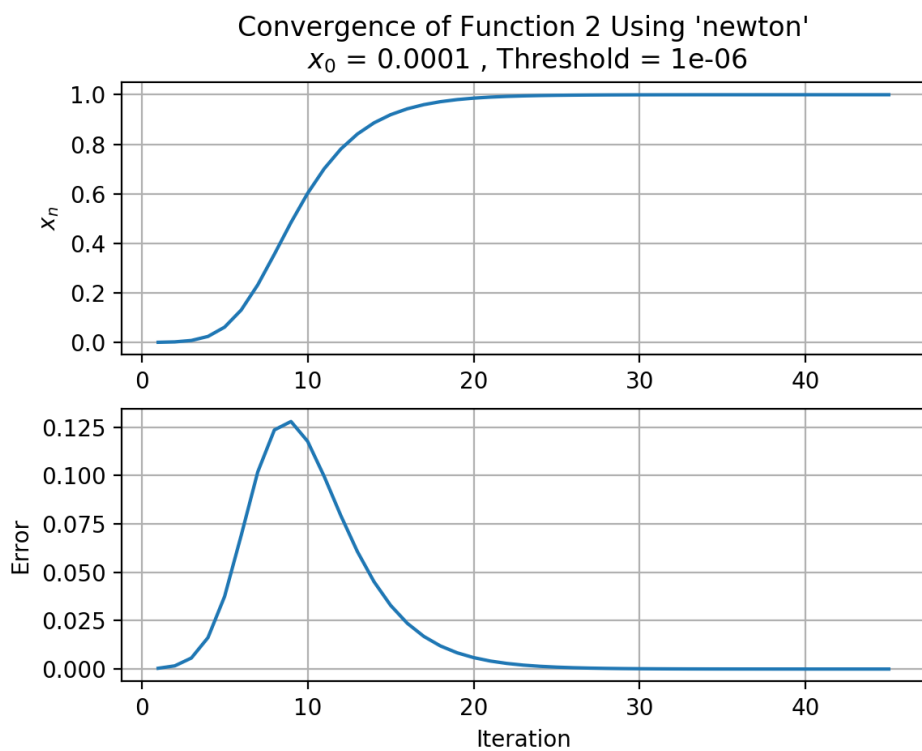
For threshold error 0.0001:

Figure 4: The target function $f(x) = (x - 1) \log_{10}(x)$.



For threshold error 1.0e-6:

Figure 5: The target function $f(x) = (x - 1) \log_{10}(x)$.



For threshold error 1.0e-8:

Figure 6: The target function $f(x) = (x - 1) \log_{10}(x)$.

