

APPM 4600 — HOMEWORK # 6

1. The nonlinear system

$$\begin{cases} f(x, y) = x^2 + y^2 - 4 = 0 \\ g(x, y) = e^x + y - 1 = 0 \end{cases}$$

has two real solutions. In the last homework you used Newton's method to solve this problem with following initial guesses:

- (i) $x = 1, y = 1$
- (ii) $x = 1, y = -1$
- (iii) $x = 0, y = 0$

In this assignment, use the two quasi-Newton methods with the different initial guesses. Is the performance better or worse than of Newton's methods?

2. Consider the nonlinear system

$$\begin{aligned} x + \cos(xyz) - 1 &= 0, \\ (1 - x)^{1/4} + y + 0.05z^2 - 0.15z - 1 &= 0, \\ -x^2 - 0.1y^2 + 0.01y + z - 1 &= 0. \end{aligned}$$

Using your own codes test the following three techniques for approximating the solution to the nonlinear system to within 10^{-6} :

- Newton's method
- Steepest descent method
- First Steepest descent method with a stopping tolerance of 5×10^{-2} . Use the result of this as the initial guess for Newton's method.

Using the same initial guess, which technique converges the fastest? Try to explain the performance.