Updated on April 3, 2022

Hints for Homework 9

1. (Low-rank approximation using SVD; image compression) Follow the demo given in Lecture 28 on Monday, March 28. Be sure to download the image file (`hubble_gray.jpg`) to the directory where your main homework live script file resides.

2. (Annuity with `fzero`)

3. (Lambert's W function) Since $y = W(x)$ if and only if $x = ye^y$, y is a root of the function $f(y) = x - ye^y$ for a given x. Once framed in this way, it is clear what to do with `fzero`.

   Note. For a given $x \in [0, 4]$, use $y_0 = (-1 + \sqrt{1 + 4x})/2$ as an initial iterate.

   Note. MATLAB actually has a built-in function for Lambert's W function; it is named `lambertw`. You may test your code against it. As always, read the documentation using `help lamberw`. You can also read the source code for this function by typing `type lambertw.m` in the Command Window!

4. (Fixed-point iteration)

   (a) Theorem 3 (Convergence of FPI) from Lecture 30 is useful.

   (b) Find a relevant example from the live script accompanying Lecture 30.

5. (Convergence of Newton's method)

   (a) Begin by carefully calculating (by hand) $f'(x)$. Then substitute it into the Newton's iterative formula

   $$x_{k+1} = x_k - \frac{f(x_k)}{f'(x_k)},$$

   and go from there.

   (b) Follow the instruction and mimic the series analysis presented in lecture.