HOMEWORK #4
Due: December 1 (Friday) by 5pm

Instructions:

- The assignment consists of *two* questions, worth 4 and 6 points.

- Submit your assignment *electronically* (via Email) to the address
  math2e03@math.mcmaster.ca; hardcopy submissions will not be accepted.

- It is obligatory to use the MATLAB template file available at
  http://www.math.mcmaster.ca/~bprotas/MATH2E03/template.m (see also the link in
  the "Computer Programs" section on the left); submissions non compliant with this template
  will not be accepted.

- Make sure to enter your name and student I.D. number in the appropriate section of the
  template.

- Late submissions and submissions which do not comply with these guidelines will not be
  accepted.

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1. Consider the following model of *seasonal* fishing

$$
\begin{aligned}
x_n^* &= x_{n-1} + R_1 x_{n-1}\left(1 - \frac{x_{n-1}}{K}\right) \\
x_n &= x_n^* - q_1 U x_n^*,
\end{aligned}
\tag{1}
$$

where x_n^* and x_n are the fish population in year n before and after the fishing season. Assuming
the initial value $x_0 = 0.1$ and the following values of the parameters: $K = 1.0$ (carrying capac-
ity of the environment), $R_1 = 2.0 \cdot 10^{-3}$ (increase per year of the population), $q = 8.5 \cdot 10^{-3}$
(catchability) and $U = 10$ (size of the fishing fleet)

   (a) determine the values of $\{x_n, x_n^*\}$ during the first $N = 20$ years; plot the result as a
   single line using both x_n and x_n^* (use the convention that the values x_n correspond to
   full years, i.e., $\{0, 1, \ldots, N\}$, whereas the values x_n^* correspond to "half–years", i.e.,
   $\{\frac{1}{2}, 1 + \frac{1}{2}, \ldots, N + \frac{1}{2}\}$)

   (b) repeat this calculation assuming that U is now a function of time give by $U(t) = 10(1 +
   t)$; plot this solution on the same figure as in part (a).

   (4 points)

2. You are given two companies with the following payscales

Employee	Qualification (years)	Compensation ($)
A	3	$32K$
B	5	$42K$
C	10	$50K$
D	12	$60K$

Table 1: Company A

Employee	Qualification (years)	Compensation ($)
X	2	$98K$
Y	4	$120K$
Z	9	$200K$

Table 2: Company B

Using log–log least square fits

(a) determine which of the two companies adheres more closely to the principle of formal justice (base your answer on the *average* value of the least–square error obtained in the two cases).

(b) for each company plot the data points together with the best fit functions (use linear coordinates and a single figure).

HINT —refer to `http://mathworld.wolfram.com/LeastSquaresFitting.html` for additional details regarding least square fits (specific formulas, etc.).
(6 points)