In the name of God

ADVANCED METHODS ON COMPUTATIONAL PHYSICS

Quiz 2

(Date Due: 1399/02/16, From 13:00 until 14:00 o'clock)

NOTE: Your answer accompanying your codes and plots must be compressed into a single zip file and sent to "goodarzipooyan@gmail.com" and cc to movahedsadegh@yahoo.com before 14:00 o'clock.

1. Mean field model for Pandemi: In order to examine an epidemic of disease that has spread across a large region, an approach is called mean field model, is used. Suppose that the number of population is N. In the SIR model (*Susceptible S*, *Infected I*, and *Removed R* (due to either recovery or death)) dynamics is given by

$$S + I \rightarrow I + I$$

$$I \rightarrow R$$

Accordingly, the coupled differential equations are as follows:

$$\frac{dI}{dt} = \frac{b}{N} SI - kI$$

$$\frac{dS}{dt} = -\frac{b}{N} SI$$

$$\frac{dR}{dt} = kI$$

with infectious contact rate b and removal rate k. The total population is satisfied in $N = S + I + R$.

A : Suppose that $N = 101$ and at $t = 0$, $I = 1$, $S = 100$, $b = 2$, $k = 0.05$. Compute $S(t)$, $I(t)$ and $R(t)$, numerically. Suppose that $t_{final} = 500$.

B : Using the *Susceptible.txt*, *Infected.txt* and *Recovered.txt*, and by comparison your numerical results with corresponding data, determine the best fit values for $b \in [0, 2]$ and $k \in [0, 1]$.

Good luck, Movahed