ECON 5760
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Problem Set 3

Problem 1. For this problem you are to write a script (m-file) called NR.m that is capable of implementing the Newton-Raphson method for solving a general system of equations for which $\mathbf{f}(\mathbf{x}) = \mathbf{0}$. This function should be able to take as an input a general system of equations and an initial guess of $\mathbf{x_0}$.

a. Using your function above, find the solution to the following system of equations for an arbitrary q:

$$\begin{array}{ccc}
\frac{1}{k_t^{\alpha} - k_{t+1}} & = & \frac{\alpha\beta k_{t+1}^{\alpha-1}}{k_{t+1}^{\alpha} - k_{t+2}} \\
\frac{1}{k_{t+1}^{\alpha} - k_{t+2}} & = & \frac{\alpha\beta k_{t+2}^{\alpha-1}}{k_{t+2}^{\alpha} - k_{t+3}} \\
. & = & . \\
. & = & . \\
. & = & . \\
\frac{1}{k_{t+q-2}^{\alpha} - k_{t+q-1}} & = & \frac{\alpha\beta k_{t+q-1}^{\alpha-1}}{k_{t+q-1}^{\alpha} - k_{t+q}}
\end{array}$$

Problem 2. Write a m-file called twostatesim.m that simulates a two-state Markov chain for the following transition matrix:

$$P = \begin{pmatrix} .50 & .50 \\ .04 & .96 \end{pmatrix} \tag{1}$$

Use the methodology as described in the write-up by Karl Sigman. The code should take as inputs the initial state s_0, the transition matrix P, possible values for each state $z = [1, 2]'$, and the length of the simulation T.

a. Check to see if the invariant distribution is converging to the true distribution for a large T.

b. What size T is required to get an "accurate" approximation of the invariant distribution π? How long does your code take to compute the invariant distribution for this T?

c. Now write a generalized version of your code called markovsim.m that simulates a Markov chain for an arbitrary P and $z = [z_1, z_2, ..., z_m]$. Check to see if your code is working by once again calculating the invariant distribution under Monte-Carlo simulation versus iterating on the unconditional distribution.