PS04

Irina —1—

$$u(c,l) = \frac{c^{1-\sigma}}{1-\sigma} - \chi \frac{l^{1+\eta}}{1+\eta}$$

$l_t \in [0,1]$
$\delta = 0.05$
$\alpha = 1/3$
$z = 1$
$\sigma = 2$
$\eta = 1$

NM algorithm is a direct search which starts @ initial guess & iteratively searches for optimum by evaluating fn @ nearby points.

Q1.) a) Direct over (k', l). I used global optimization using Nelder-Mead from "Optim" package. NM doesn't need derivatives. Code is attached but I cannot fix error in line 77 (related to "optimize"). ~~I also used interpolation "interp" for Value fn.~~

b) direct over single (k'). I used solutions from PS02, "interp", NM from "Optim". Analytical solution for l used:

$$\beta^t l_t^\eta \chi = \mu_t w_t$$ replace

as problem in Optim is min, so I used negative utility "-u" to make it max.

$$\beta^t l_t^\eta \chi = w_t \beta^t c_t^{-\sigma}$$

$$l_t^\eta = \frac{w_t c_t^{-\sigma}}{\chi}$$

$$w_t^* = (1-\alpha) z k_t^\alpha l_t^{-\alpha}$$

no closed form for l_t?

initial guess = 0.80 k_{ss} was assumed in a code.

$$l_t^\eta = \frac{(1-\alpha) z k_t^\alpha l_t^{-\alpha} c_t^{-\sigma}}{\chi}$$

I tried to solve analytically for c. Can express c in terms of k, k'? after substitution of l into c — not possible to get closed form ~~[illegible]~~

$$l_t^* = \left(\frac{c_t^{-\sigma} k_t^\alpha z (1-\alpha)}{\chi}\right)^{\frac{1}{\alpha+\eta}}$$

Substitute for c_t into l_t^* & solve for l_t^*

Analytical expression for consumption

$$c_t = z k_t^\alpha l_t^{1-\alpha} + (1-\delta) k_t - k_{t+1},$$ ~~[illegible]~~

Code is attached. Plots are not attached as there is an error to be fixed. I assumed $l = l_{ss}$ & used "Brent" optimizer

fo given

① using FOCs from PS 02:

$$\ell^* = \left[\frac{c^{-\alpha} \cdot k^{\alpha} \cdot (1-\alpha)}{X}\right]^{\frac{1}{\alpha+\eta}}$$

$$r^* = \alpha z k^{\alpha-1} \cdot \ell^{1-\alpha}$$

$$w^* = z(1-\alpha) k^{\alpha} \ell^{-\alpha}$$

$$\ell_t = \left[\frac{c^{-\alpha} \cdot w}{X}\right]^{1/\eta}$$

(Euler eq.)

$$c_t^{-\sigma} = \beta c_{t+1}^{-\sigma} [(1-\delta) + r_{t+1}]$$

$$c_t^{-\sigma} - \beta c_{t+1}^{-\sigma} [(1-\delta) + r_{t+1}] = 0$$

I tried to use ~~[illegible]~~ ~~N-M~~ "NLsolver" algorithm using ~~[illegible]~~ "NLsolver" package. Cannot attach plots @ this step due to error (still working on it).

Q2) capital ↓ to 80% of steady state. I attempted to write code (attached).

Q4.) "Tiktak" is a global optimization algorithm which is claimed to be robust & efficient. It is local search algorithm starting @ initial point & iterates refining solution by moving to a new point in search space if it has a better obj. fn. value. It combines random and deterministic steps & periodically restarting from new initial point to ensure it is not stuck @ local min. Overall, it is heuristic type so it is useful in multidimensional spaces.

~~b) I attempted to write the basic Controlled Random Search algorithm from Appendix A. This method generates new trial points in search space according to some rules.~~
I followed the algorithm from the paper.

b), c) d) e). I used Griewank fn, with n=2 and n=5. and Rastrigin fn with n=2, n=5. There is an error in one line (86) which I don't know how to fix. Because of this error I cannot ~~[illegible]~~ complete the code execution to see final results. It is the same error (I highlighted it in the code).