Numerical Methods 2023
Instructor: Cezar Santos

Problem Set 1

Deadline: Jan 31, 2023
Instructions: you must send a zipped folder with your codes, named lastname_code_ps1.zip (e.g. santos_code_ps1.zip). You must also send a PDF file with information about your solution, named lastname_answers_ps1.pdf (e.g. santos_answers_ps1.pdf).

For this problem set, you will work with the following AR(1) stochastic process:

$$z_t = \rho z_{t-1} + \epsilon_t,$$

with $\epsilon_t \sim N(0, \sigma^2)$. Suppose, for now that $\rho = 0.95$ and $\sigma = 0.007$, the calibration in Cooley & Prescott (1995).

Questions

Note: For this problem set, you must solve the questions below in two different programming languages.

1. Discretize the process using the Tauchen (1986) method. Use 9 points.
2. Discretize the process using the Rouwenhorst method. Use 9 points.
3. Simulate the continuous process for 10000 periods. Do the same for the discretized processes (remember to use the same realizations for the shock for all simulations). Compare the paths of each process (graphs are useful here). If they're not very close, use more points.
4. Estimate the AR(1) processes based on simulated data, both for Tauchen and Rouwenhorst. How close are they from the real data generating process? If they're not very close, use more points.
5. Redo the questions above with $\rho = 0.99$.

References

[1] Cooley, T. and E. Prescott. 1995. "Economic Growth and Business Cycles," in Cooley (ed.) Frontiers of Business Cycle Research.

[2] Tauchen, G. 1986. "Finite state markov-chain approximations to univariate and vector autoregressions," Economics Letters.