Econ 126: Computational Macroeconomics
Winter 2019: Jenkins

Final Exam: Version A Key

1. (a) An AR(1) process is stable if a one-time shock to ϵ_{t+1} does not cause the process to tend toward infinity in absolute value.

   (b) $|\rho| < 1$ or $-1 < \rho < 1$

   (c) i. Process #1. The processes smoothly returns to 0.

   ii. Process #3. The processes oscillates between positive and negative values, but smoothly returns to 0 in absolute value.

   iii. Process #2. The processes oscillates between positive and negative values and tends toward infinity in absolute value.

2. (a) The maximization problem in terms of only K_1:

$$\max_{K_1} \log\left[(1-\delta)K_0 - K_1\right] + \beta \log(K_1) \tag{1}$$

   (b) The first-order condition with respect to K_1:

$$\frac{1}{(1-\delta)K_0 - K_1} = \frac{\beta}{K_1} \tag{2}$$

   (c) The solutions for K_1 and C_1:

$$K_1 = \frac{\beta(1-\delta)}{1+\beta} K_0 \tag{3}$$

   and:

$$C_0 = \frac{1-\delta}{1+\beta} K_0 \tag{4}$$

   (d) As δ increases, C_0 decreases. The Euler equation implies that the household wants to smooth consumption. A higher depreciation rate reduces future consumption and so the household smooths its consumption by reducing current consumption.

3. (a) In period 5, the TFP shock increases output by about 1.5%, increases labor by about 1%, increases consumption by about 02%, and increases investment by about 6%. Capital doesn't change in period 5.

(b) The TFP shock creates a temporary increase in the marginal product of labor which means that the household gets earns more per unit of labor at the margin. Since the household is compensated at a higher rate for supplying labor, it does so.

(c) After period 5, output descends toward the steady state. Labor and investment also descend starting in period 6, but they both overshoot the steady state and for a short time are below their initial values before returning to 0. Consumption rises for several periods before falling back toward the steady state because investment falls faster than output. The capital stock begins rising in period 6 and peaks just after period 10 before descending back toward the steady state.

4. (a) A marginal increase in K_{t+1} reduces current utility in period t by the marginal utility of consumption: $1/C_t$. Furthermore, a marginal increase in K_{t+1} increases the resources available for future consumption by $\alpha A_{t+1} K_{t+1}^{\alpha-1} L_{t+1}^{1-\alpha} + 1 - \delta$ and utility increases by that quantity times the marginal utility of future consumption $1/C_{t+1}$. This is all discounted back to period t by β.

(b) Summers means that during periods of economic contraction, it seems that markets allocate resources less efficiently or effectively. For example, rising unemployment represents a breakdown in the exchange mechanism because unemployed people are willing to work at the prevailing wages, but employers are not willing to hire them.

5. (a) RBC and NK models are both based on models of representative households that solve intertemporal utility maximization problems and therefore both models have Euler equations.

(b) The RBC approach presumes no link between nominal and real quantities and attributes all macroeconomic fluctuations to TFP shocks. The NK approach takes seriously the link between real and nominal quantities with the new-Keynesian Phillips curve that specifies an upward-sloping relationship between inflation and output.