Assignment 5

This assignment will be graded out 30 points possible. Your final assignment average, which is weighted 30% of your final average, will equal the average of all of your assignment grades. I encourage you to work independently, since these assignments are designed to help you prepare for the exam and final project. If you have any questions, please see me or the TA for help. This problem set is due on **Friday, November 3 at the beginning of class**. Please email your MATLAB code to the TA and submit any written portion to him in class.

1. Suppose the economy is initially in a steady-state where the unemployment rate is 0.04, so that the employment rate is 0.96. Now suppose that a sudden shift towards automation in the economy introduced a new Markov transition matrix:

$$P = \begin{bmatrix} 0.30 & 0.70 \\ 0.05 & 0.95 \end{bmatrix}, \tag{1}$$

   where the top row corresponds to unemployment today, the bottom row corresponds to employment today, the first column corresponds to unemployment in the next period, and finally, the second column corresponds to employment in the next period. Plot the sequence of unemployment rates over time, as it converges to the new stationary distribution, starting from the initial unemployment rate. What is the new steady-state unemployment rate?

2. Continue thinking about the Markov transition matrix from the previous problem. Suppose the unemployment benefit replacement ratio is 30%. Accordingly, let $z_u = 0.3$ in the unemployed state, let $z_e = 1$ in the employed state, and continue assuming that $w = 1$. Letting $\beta = 0.96$, $R = 1.04$, and the contemporaneous utility function $u(c) = log(c)$, solve the following Bellman's equation:

$$V(a, z_i) = \max_{a'} u(c) + \beta E_{z'|z_i}[V(a', z')] \tag{2}$$

$$\text{s.t. } c = wz_i + Ra - a' \quad \forall\, i \in \{u, e\}. \tag{3}$$

   Solve for the optimal savings function, and plot $a'(a, z_u)$, $a'(a, z_e)$, and a 45° line all on the same figure. Compare your graph to the graph on p. 957 of Mark Huggett's 1993 *Journal of Monetary Economics* paper "The risk-free rate in heterogeneous-agent incomplete-insurance economies." (No need to write anything, just FYI.)

3. Solve for aggregate savings in the previous question. Now suppose that the unemployment benefit replacement ratio fell to 15%, so that $z_u = 0.15$ and $z_e = 1$. Calculate the percentage change in savings from the decline in z_u.

Hints:

1. If your agent optimization problem is not converging, try tightening the tolerances on the optimization routine using *optimset*.
2. You may want to cluster asset grid points closer to the origin. To do this, consider using *logspace* instead of *linspace*. Notice that you can just apply your original bounds by the transformation $log(bound)/log(10)$.
3. When solving for the distribution, in order to solve for the location of the grid points bounding the savings choice, use the function *find* with the correct inputs. Make sure you understand the function before using it.
4. Test, test, test your code at each step of the way and create a modular framework!!! Take time to think about your code's architecture before starting. Create a set of functions that delivers each piece of information that you will need for each part.