Problem Set #7

ECON 815, Prof. Jason DeBacker
Due Thursday, November 21, 1:15 p.m.

This problem set will have you specify and solve a dynamic optimization problem using dynamic programming techniques. There are two parts to this assignment, the second of which builds on the first. The full assignment is due on Thursday, November 21, *but you should plan to run your model specification by me (Part A) no later than 5pm on Tuesday, November 12.*

Part A

Write down a dynamic economic model that is relevant to a question of interest to you. Please use a discrete time model. The model can have an infinite or finite horizon. You should specify the choices over this time horizon of some economic agent (e.g., an individual, household, firm, or social planner).

Your model description should include a specification of the economic environment (elements of this are outlined below) and provide the Bellman equation that represents the dynamic optimization problem. You should clearly note the state variable(s) and control variable(s). Finally, please show the first order necessary condition(s) of the model that characterize the model solution (or, if this is a discrete choice problem, show the cut-off rule(s) that characterize the model solution).

Specification of the environment (underlying stuff of the economy):

1. Population of agents
    - Who are we modeling?- individuals, households, firms, etc.
2. Preferences
    - Utility function (individuals/households)
    - Profit function (firms)
    - Social welfare function (social planner)
    - Rate of time preference
3. Productive technology
    - How do we produce output?
    - What's feasible?
4. Information technology
    - Who knows what?
    - When do they know it?
5. Enforcement technology
    - How are property rights enforced?
6. Matching technology
    - How do people meet?

Part B

Now that you've specified an economic model, you will use dynamic programming techniques to solve the model. If you need to make some assumptions not stated in the economic model in order to solve it on the computer, please specify those. You may choose your solution technique (e.g., policy function iteration, value function iteration).

To show your model solution, please plot your value function as a function of the state variable (or one of the state variables) and plot at least one of your policy functions as a function of the state variable (or one of the state variables).

Deliverables

You will submit your problem set by pushing the files to your GitHub repository that you created from forking the repository for this class. You will place all files for the problem set in the path `/CompEcon_Fall2019/ProblemSets/ProblemSet7/`. These files will include:

1. Two `*.py` scripts. One of these should be a module that contains nothing but function definitions of functions used in your model. Call this `functions.py`. The second will be called `execute.py` and will declare the model parameters and call the functions necessary to solve the model, and then plot the model output (the value and policy function plots outlined above).

2. A pdf compiled from TeX that includes the model description from Part A and then a section with the model figures from Part B along with a description of those figures. Please name your pdf "ProblemSet7_LastName.pdf".