Assignment #7

MACS 30000, Dr. Evans
Due Monday, Nov. 26 at 11:30am

1. **Unit Testing in Python (3 points).** Read Chapter 7 "Unit Testing" from Humpherys and Jarvis (2018, Ch. 7). This is a chapter from an open access set of labs that accompany a great applied math textbook Humpherys et al. (2017). Do Problems 1, 2, and 3 from this Chapter. Submit your code and a description of your answers.

2. **Test driven development (3 points).** Test driven development is a paradigm that helps ensure that submitted code satisfies certain requirements. Pretend that you are my research assistant. I want you to write a Python function that has the following properties, and it must pass the following test. Write this function. Copy this test file into the folder where your function resides and make sure that all tests pass. Submit your function and the testing output showing that it passed.

   (a) In the theory of the firm in economics, the interest rate in a given period r_t in equilibrium is a function of the aggregate capital stock K_t, aggregate labor L_t, and parameters of the model α (capital share of income), Z (total factor productivity), and δ (depreciation rate).

   $$r_t = \alpha Z \left(\frac{L_t}{K_t}\right)^{1-\alpha} - \delta \quad \forall t$$

   (b) A python script that contains only functions is called a "module". Write a Python module entitled `get_r.py`. Inside that module, define a function `get_r()` that takes as inputs K, L, α, Z, and δ and returns the corresponding interest rate. Furthermore, this function must work for values of $\alpha, \delta \in (0,1)$ and $K, L, Z > 0$. Furthermore, if K and L are both scalars, this function should return a scalar interest rate. And if K and L are both vectors, this function should return a corresponding vector of interest rates.

```
def get_r(K, L, alpha, Z, delta):
    '''
    This function generates the interest rate or vector of interest rates
    '''
    # Put your function stuff here

    return r
```

   (c) Put the file `test_r.py` in the same folder as the module you created in part (b). Use the `py.test --cov` command from the `pytest` package to test whether your function does what it is supposed to. Edit your function until it passes all the tests. Report your `pytest` test results.

3. **Watts (2014) (4 points).** Read Watts (2014). This paper focuses on the importance of having a model, making assumptions explicit, causal inference, and prediction. In a one-to-two-page written response, answer the following questions.

    (a) When initially introduced in the 1960s, rational choice theory imposed a framework of theoretical assumptions that fit with or "rationalized" observed behavior. What were some of the criticisms of this approach?

    (b) What is the main pitfall that Watts sees in using commonsense theories of action? [Hint: A good explanation of the answer is in the last half of the section entitled, "Theorizing by Mental Simulation".] The answer to this question precedes its decomposition into three parts in the Section, "Three Problems with Rationalizable Action as Causal Explanation."

    (c) What is Watts' proposed solution to the issues with rational choice modeling and causal explanation?

    (d) Although this paper does a good job or relating causality to prediction, I don't like its disdain for theory that specifically outlines the assumptions and mechanisms of process being modeled. Write a short addendum to the paper about how theoretical models—with their necessary simplifications and their specific assumptions about mechanisms—could benefit causal inference and prediction.

References

Humpherys, Jeffrey and Tyler J. Jarvis, "Labs for Foundations of Applied Mathematics: Python Essentials," creative commons, open access 2018.

_ , _ , and Emily J. Evans, *Foundations of Applied Mathematics: Mathematical Analysis*, Vol. 1, SIAM: Society for Industrial and Applied Mathematics, 2017.

Watts, Duncan J., "Common Sense and Sociological Explanations," *American Journal of Sociology*, September 2014, *120* (2), 313–351.