Econ 525a (first half)
Fall 2012
Yale University
Prof. Tony Smith

## PROBLEM SET #1

*Answers to this problem set are due by the beginning of lecture on Wednesday, September 19. You should submit copies of your code along with a brief description, perhaps in the form of graphs or tables, of your findings. Please submit this documentation by email to:* `tony.smith@yale.edu`.

1. (a) Write a program (in a language of your choosing) to solve the neoclassical growth model using value iteration on a discrete grid (this is the method that we discussed in lecture on September 10). Let the production function take the form $f(k) = Ak^{\alpha} + (1-\delta)k$, where $A > 0$, $0 < \alpha < 1$, and $0 \leq \delta \leq 1$. Let the utility (or felicity) function be $U(c) = \log(c)$. Center your grid at the steady-state capital stock $\bar{k}$, as defined by $f'(\bar{k}) = \beta^{-1}$. Start with a small number (say, 11) of equally-spaced grid points, and then increase this number to, say, 101. Obtain numerical results both for the case of full depreciation ($\delta = 1$) and for the case of less-than-full depreciation ($\delta < 1$). For $\delta = 1$, compare your numerical findings to the analytical (closed-form) solutions for the value function and the decision rule.

   (b) Investigate the extent to which Howard's policy improvement algorithm increases the speed of convergence of the value function.

2. Use one-sided finite differences to compute an approximation to the first derivative of $g(p) \equiv 0.5p^{-0.5} + 0.5p^{-0.2}$ at $p = 1.5$. Let the increment $\epsilon$ in the finite differences range across all the values in the set $\{10^{-1}, 10^{-2}, \ldots, 10^{-10}\}$. For which value of $\epsilon$ is the approximate first derivative the most accurate?

3. Repeat the third problem using two-sided finite differences to approximate the first derivative.