Econ 525a Fall 2014 Yale University Prof. Tony Smith

## PROBLEM SET #4

This problem set is due on October 10. You should submit copies of your code along with a brief description, perhaps in the form of graphs or tables, of your findings. You can use any programming language to complete the problems, but Fortran 90 will run a lot faster than Matlab!

- 1. Compute a cubic spline approximation to the function that you maximized in the last problem on Problem Set #3, i.e.,  $f(x) = \log(x) x$ , on a grid of 25 evenly-spaced points on the interval [0.5, 1.5]. Create a graph showing the difference between the actual function and its approximation on this interval.
- 2. This problem repeats the first problem on Problem Set #3 but does not restrict bond holdings to lie on a discrete grid. Instead, the optimal bond choice must simply lie in the half-open interval  $[\underline{b}, (b + \epsilon)/q)$ .
  - (a) On the last problem set you computed two value functions,  $v(b, \epsilon_{\ell})$  and  $v(b, \epsilon_{h})$ , on a grid of 200 points for bond holdings b. Use 50 of these grid points, spread across the entire interval [-6, 6], to compute a cubic spline approximation to each function.
  - (b) Now compute the optimal bond choice at each of the 100 points on the grid (i.e., 50 values for bond holdings times 2 values for ε), approximating the value function on the right-hand side of the Bellman equation using the pair of cubic splines that you computed in part (a). Use your answers to update the value function at each of the grid points. Continue iterating until convergence within a reasonable tolerance. Graph the two value functions and the two decision rules (one for each value of ε).
  - (c) Use the decision rules that you computed in part (b) to generate a long simulation (at least 10,000 time periods) for the bond holdings of a typical agent over his lifetime. (Use linear interpolation to obtain optimal decisions off the grid.)
  - (d) Use the simulated time series from part (c) to compute average bond holdings over the course of an agent's lifetime. Is it close (enough) to zero?