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% 14.06 Recitation March 5 2004
% Example Matlab Code

% Starting hints:
% 1) Open MATLAB and selction from the menu select: File=>New=>M File.
% The M-file is where you will write your program. Save it in an
% appropriate place
% 2) make sure that "current directory" is set to the folder in which your m-file is
saved
% 3) To run a program simply use the "save and run" button in the m-file
% window
% 4) The output of the program will show in the command window of Matlab
% 5) You can type commands (eg plot commands) direct in the command window
% to operate on variables that are in MATLAB's memory from the last
% program that ran.
% TO STOP A RUNNING PROGRAMMING (if it is taking too long or is not
% coverging) simnply use "cntrl" and "C" at once.

% _____________________________________________________________________

% This is a simple program to solve a deterministic dynamic programming problem
% The value function is V(Wt) = max {ln(c) + beta*V(Wt+1)} where
% the evolution of wealth occurs according to Wt+1=(1+r)Wt-c+y
% The agent receives a constant income y each period

%To begin with I need to declare paramater values for r beta y and epsilon

clear all;  % clears all variables from memory

y = 1;
r = 0.1;
beta = 1/1.1;
epsilon = 0.2;   % this is the convergence criterion

% Now to set the size of the interval over which we discretize the problem

wmin = -10;  % Sets the minimum value of the grid for W - THINK ABOUT THIS VALUE
wmax = 40;   % Sets the maximum value of the grid for W
grid = 0.1; % Sets the fineness of the grid - smaller leads to more accuracy
             % BUT comes at the cost of make the program slow

W = [wmin:grid:wmax]';

nom = length(W);  % Finds the length of this vector

% The W matrix defines the possible values that we let the state variable take on
% It will remain unchanged throughout the program.

V = zeros(nom,1);

% This V matrix is our starting guess for the value function.

P = zeros(nom,1);

% This sets up the policy rule - it will be update as we go

k=1;

while k > epsilon;

    k   %Note that I am allowing this to be printed (by dropping the ";") so we can
see the convergence

G = zeros(nom,1);
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 i = 1;

 while i < nom + 1
      M = zeros(nom, 1);
      x = W(i,1);
      j = 1;
        while j < nom + 1;
           M(j,1) = log( max(x*(1+r) + y - W(j,1),0.0000000000000000001) ) +
beta*V(j,1);
           j=j+1;
       end

    % We now find the optimal choice and put the associate value into the new guess
at the value function G

    G(i,1) = max(M);

    % Now to find the location of the maximizing choice of W

    e = 1;
    while G(i,1) > M(e,1);
        e = e + 1;
    end

    % Here the policy finction P is the optinal level of wealth to leave over
    % for the future - could covert to consumption through the budget
    % constraint.

    P(i,1)=W(e,1);

    i=i+1;

end

% Now we see if the new value function G is far away from the previous
% guess - if the normed difference is less than 0.1 then

k = norm(V-G);

V=G;

end

% Now we have have converged, I print the "policy function" and the expected value
function

[P V]

% To plot these (against the correct x-axis ie W):
% plot(W,P)
% plot(W,V)
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