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% DYNAQ_MAZE_SCRIPT - Implements the DynaQ Algorithm on the simple maze example found in
Chapter 9
%
% Written by:
% --
% John L. Weatherwax          2007-12-03
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% email: wax@alum.mit.edu
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% Please send comments and especially bug reports to the
% above email address.
%
%-----

close all;
clc;

% sample_discrete.m
addpath( genpath( '../.../FullBNT-1.0.4/KPMstats/' ) );

% the learning rate:
alpha = 1e-1;

% the probability of a random action (non-greedy):
epsilon = 0.1;

% the discount factor:
gamma = 0.95;
%gamma = 1.0;

% the beginning and terminal states (in matrix notation):
s_start = [ 3, 1 ];
s_end   = [ 1, 9 ];

MAX_N_STEPS=30;
%MAX_N_STEPS=1e3;
MAX_N_STEPS=1e4;
MAX_N_STEPS=1e5;
MAX_N_STEPS=1e6;
%MAX_N_STEPS=10e6;

% the number of steps to do in planning:
nPlanningSteps = 0;
nPlanningSteps = 5;
nPlanningSteps = 50;

[Q,ets,numFinishes,Model_ns,Model_nr] =
dynaQ_maze(alpha,epsilon,gamma,nPlanningSteps,@mk_ex_9_1_mz,s_start,s_end,MAX_N_STEPS);

% get our initial maze:
MZ = mk_ex_9_1_mz(0); [sideII,sideJJ] = size(MZ);

% compute the (negative) cost to go and the optimal (greedy with respect to the state-
value function) policy:
pol_pi = zeros(sideII,sideJJ); V = zeros(sideII,sideJJ);
for ii=1:sideII,
    for jj=1:sideJJ,
        sti = sub2ind( [sideII,sideJJ], ii, jj );
        [V(ii,jj),pol_pi(ii,jj)] = max( Q(sti,:) );
    end
end

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end
end

plot_mz_policy(pol_pi,MZ,s_start,s_end);
title( 'policy (1=>up,2=>down,3=>right,4=>left); start=green; stop=red' );
fn = sprintf('dynaQ_maze_policy_nE_%d',MAX_N_STEPS); saveas( gcf, fn, 'png' );

figure; imagesc( V ); colormap(flipud(jet)); colorbar;
title( 'state value function' );
fn = sprintf('dynaQ_maze_state_value_fn_nE_%d',MAX_N_STEPS); saveas( gcf, fn, 'png' );

figure; plot( 1:length(ets), ets, '-x' );
title( sprintf('timesteps to reach goal (number of Planning steps=%5d)',nPlanningSteps)
); grid on; drawnow;
fn = sprintf('dynaQ_q_learning_rate_nPS_%d',nPlanningSteps); saveas( gcf, fn, 'png' );

%close all;
clear functions;
return;
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