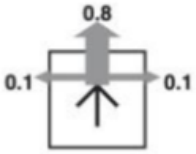
1. Value Iterations

3	0	0	+1	-1
2	0		0	0
1	START	0	0	0
	1	2	3	4

$R(3,3) = +1$
$R(4,3) = -1$
Otherwise,
$R(s) = -0.05$

$\gamma = 0.9$



Iteration 1:

3	-0.05	0.67	+1	-1
2	-0.05		0.67	-0.05
1	-0.05	-0.05	-0.05	-0.05
	1	2	3	4

Iteration 2:

3	0.4234	0.7906	+1	-1
2	-0.095		0.7258	0.3379
1	-0.095	-0.095	0.4234	-0.095
	1	2	3	4

Iteration 3:

3	0.548788	0.812308	+1	-1
2	0.237748		0.765733	0.374026
1	-0.1355	0.237748	0.455476	0.276709
	1	2	3	4

Iteration 4:

3	0.60565	0.81621544	+1	-1
2	0.387922		0.77257831	0.43623157
1	0.13038088	0.32073736	0.54762889	0.33650887
	1	2	3	4

Iteration 1

- $U_1(3, 2) = U_1(2, 3) = -0.05 + 0.9(0.8(1) + 0.1(0) + 0.1(0)) = 0.67$
- Everything else $= -0.05 + 0.9(0.8(0) + 0.1(0) + 0.1(0)) = -0.05$

Iteration 2

- $U_2(3, 1) = U_2(1, 3) = -0.05 + 0.9(0.8(0.67) + 0.1(-0.05) + 0.1(-0.05)) = 0.4234$
- $U_2(3, 2) = -0.05 + 0.9(0.8(1) + 0.1(0.67) + 0.1(-0.05)) = 0.7258$
- $U_2(4, 2) = -0.05 + 0.9(0.8(1) + 0.1(-1) + 0.1(-0.05)) = 0.3379$
- $U_2(2, 3) = -0.05 + 0.9(0.8(1) + 0.1(0.67) + 0.1(0.67)) = 0.7906$
- Everything else $= -0.05 + 0.9(0.8(-0.05) + 0.1(-0.05) + 0.1(-0.05)) = -0.095$

Iteration 3

- $U_3(1, 1) = -0.05 + 0.9(0.8(-0.095) + 0.1(-0.095) + 0.1(-0.095)) = -0.1355$
- $U_3(2, 1) = U_3(1, 2) = -0.05 + 0.9(0.8(0.4234) + 0.1(-0.095) + 0.1(-0.095)) = 0.237748$
- $U_3(3, 1) = -0.05 + 0.9(0.8(0.7258) + 0.1(-0.095) + 0.1(-0.095)) = 0.455476$
- $U_3(4, 1) = -0.05 + 0.9(0.8(0.4234) + 0.1(0.3379) + 0.1(-0.095)) = 0.276709$
- $U_3(3, 2) = -0.05 + 0.9(0.8(1) + 0.1(0.7258) + 0.1(0.3379)) = 0.765733$
- $U_3(4, 2) = -0.05 + 0.9(0.8(0.7258) + 0.1(-1) + 0.1(-0.095)) = 0.374026$
- $U_3(1, 3) = -0.05 + 0.9(0.8(0.7906) + 0.1(0.4234) + 0.1(-0.095)) = 0.548788$
- $U_3(2, 3) = -0.05 + 0.9(0.8(1) + 0.1(0.7906) + 0.1(0.7906)) = 0.812308$

Iteration 4

- $U_4(1, 1) = -0.05 + 0.9(0.8(0.237748) + 0.1(-0.1355) + 0.1(0.237748)) = 0.13038088$
- $U_4(2, 1) = -0.05 + 0.9(0.8(0.455476) + 0.1(0.237748) + 0.1(0.237748)) = 0.32073736$
- $U_4(3, 1) = -0.05 + 0.9(0.8(0.765733) + 0.1(0.237748) + 0.1(0.276709)) = 0.54762889$
- $U_4(4, 1) = -0.05 + 0.9(0.8(0.455476) + 0.1(0.276709) + 0.1(0.374026)) = 0.33650887$
- $U_4(1, 2) = -0.05 + 0.9(0.8(0.548788) + 0.1(0.237748) + 0.1(0.237748)) = 0.387922$
- $U_4(3, 2) = -0.05 + 0.9(0.8(1) + 0.1(0.765733) + 0.1(0.374026)) = 0.77257831$
- $U_4(3, 3) = -0.05 + 0.9(0.8(0.765733) + 0.1(-1) + 0.1(0.276709)) = 0.43623157$
- $U_4(1, 3) = -0.05 + 0.9(0.8(0.812308) + 0.1(0.548788) + 0.1(0.237748)) = 0.60565$
- $U_4(2, 3) = -0.05 + 0.9(0.8(1) + 0.1(0.812308) + 0.1(0.812308)) = 0.81621544$

2. Perceptron Wining and Winning

a. Minimum # of Misclassifications: 39
   Iteration #: 1000

b. A set of weights is separable if that set perfectly predicts the entire training set. After 1000 iterations, the weights failed to predict 39 out of the 179 examples. As a bonus, I checked for 10000 iterations as well and found that only 11 examples failed in that case. It might be possible for the weights to converge eventually, but in the amount of time given, the data set ended up not being separable.

c. With standardized attribute values:
   i. Minimum # of Misclassifications: 0
      Iteration #: 6

   ii. Clearly, the algorithm performed *much* better with the standardized set, as the data ended up being separable after only a mere 6 iterations.