Autonomous Agents 1
Assignment 1

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Implementation

The current implementation consists of the following classes:

Predator

Prey

Environment

Game

Analysis

Simulator for the environment

Avarage run time	Standard deviation
296 rounds	286.580390118

Iterative policy evaluation

Value grid in loop 32, Predator(0,0), Prey(5,5)											
Indices y\x	0	1	2	3	4	5	6	7	8	9	10
0	0.003357	0.005538	0.010435	0.018407	0.027837	0.033106	0.027837	0.018407	0.010435	0.005538	0.003357
1	0.005538	0.009923	0.020607	0.040185	0.067041	0.085283	0.067041	0.040185	0.020607	0.009923	0.005538
2	0.010435	0.020607	0.047865	0.105160	0.198928	0.280822	0.198928	0.105160	0.047865	0.020607	0.010435
3	0.018407	0.040185	0.105160	0.265391	0.591645	0.991487	0.591645	0.265391	0.105160	0.040185	0.018407
4	0.027837	0.067041	0.198928	0.591645	1.650667	3.741537	1.650667	0.591645	0.198928	0.067041	0.027837
5	0.033106	0.085283	0.280822	0.991487	3.741537	2.850622	3.741537	0.991487	0.280822	0.085283	0.033106
6	0.027837	0.067041	0.198928	0.591645	1.650667	3.741537	1.650667	0.591645	0.198928	0.067041	0.027837
7	0.018407	0.040185	0.105160	0.265391	0.591645	0.991487	0.591645	0.265391	0.105160	0.040185	0.018407
8	0.010435	0.020607	0.047865	0.105160	0.198928	0.280822	0.198928	0.105160	0.047865	0.020607	0.010435
9	0.005538	0.009923	0.020607	0.040185	0.067041	0.085283	0.067041	0.040185	0.020607	0.009923	0.005538
10	0.003357	0.005538	0.010435	0.018407	0.027837	0.033106	0.027837	0.018407	0.010435	0.005538	0.003357

Value grid in loop 32, Predator(2,3), Prey(5,4)											
Indices y\x	0	1	2	3	4	5	6	7	8	9	10
0	0.005538	0.010435	0.018407	0.027837	0.033106	0.027837	0.018407	0.010435	0.005538	0.003357	0.003357
1	0.009923	0.020607	0.040185	0.067041	0.085283	0.067041	0.040185	0.020607	0.009923	0.005538	0.005538
2	0.020607	0.047865	0.105160	0.198928	0.280822	0.198928	0.105160	0.047865	0.020607	0.010435	0.010435
3	0.040185	0.105160	0.265391	0.591645	0.991487	0.591645	0.265391	0.105160	0.040185	0.018407	0.018407
4	0.067041	0.198928	0.591645	1.650667	3.741537	1.650667	0.591645	0.198928	0.067041	0.027837	0.027837
5	0.085283	0.280822	0.991487	3.741537	2.850622	3.741537	0.991487	0.280822	0.085283	0.033106	0.033106
6	0.067041	0.198928	0.591645	1.650667	3.741537	1.650667	0.591645	0.198928	0.067041	0.027837	0.027837
7	0.040185	0.105160	0.265391	0.591645	0.991487	0.591645	0.265391	0.105160	0.040185	0.018407	0.018407
8	0.020607	0.047865	0.105160	0.198928	0.280822	0.198928	0.105160	0.047865	0.020607	0.010435	0.010435
9	0.009923	0.020607	0.040185	0.067041	0.085283	0.067041	0.040185	0.020607	0.009923	0.005538	0.005538
10	0.005538	0.010435	0.018407	0.027837	0.033106	0.027837	0.018407	0.010435	0.005538	0.003357	0.003357

Value grid in loop 32, Predator(2,10), Prey(10,0)											
Indices y\x	0	1	2	3	4	5	6	7	8	9	10
0	3.741537	1.650667	0.591645	0.198928	0.067041	0.027837	0.027837	0.067041	0.198928	0.591645	1.650667
1	0.991487	0.591645	0.265391	0.105160	0.040185	0.018407	0.018407	0.040185	0.105160	0.265391	0.591645
2	0.280822	0.198928	0.105160	0.047865	0.020607	0.010435	0.010435	0.020607	0.047865	0.105160	0.198928
3	0.085283	0.067041	0.040185	0.020607	0.009923	0.005538	0.005538	0.009923	0.020607	0.040185	0.067041
4	0.033106	0.027837	0.018407	0.010435	0.005538	0.003357	0.003357	0.005538	0.010435	0.018407	0.027837
5	0.033106	0.027837	0.018407	0.010435	0.005538	0.003357	0.003357	0.005538	0.010435	0.018407	0.027837
6	0.085283	0.067041	0.040185	0.020607	0.009923	0.005538	0.005538	0.009923	0.020607	0.040185	0.067041
7	0.280822	0.198928	0.105160	0.047865	0.020607	0.010435	0.010435	0.020607	0.047865	0.105160	0.198928
8	0.991487	0.591645	0.265391	0.105160	0.040185	0.018407	0.018407	0.040185	0.105160	0.265391	0.591645
9	3.741537	1.650667	0.591645	0.198928	0.067041	0.027837	0.027837	0.067041	0.198928	0.591645	1.650667
10	2.850622	3.741537	0.991487	0.280822	0.085283	0.033106	0.033106	0.085283	0.280822	0.991487	3.741537

Value grid in loop 32, Predator(10,10), Prey(0,0)											
Indices y\x	0	1	2	3	4	5	6	7	8	9	10
0	2.850622	3.741537	0.991487	0.280822	0.085283	0.033106	0.033106	0.085283	0.280822	0.991487	3.741537
1	3.741537	1.650667	0.591645	0.198928	0.067041	0.027837	0.027837	0.067041	0.198928	0.591645	1.650667
2	0.991487	0.591645	0.265391	0.105160	0.040185	0.018407	0.018407	0.040185	0.105160	0.265391	0.591645
3	0.280822	0.198928	0.105160	0.047865	0.020607	0.010435	0.010435	0.020607	0.047865	0.105160	0.198928
4	0.085283	0.067041	0.040185	0.020607	0.009923	0.005538	0.005538	0.009923	0.020607	0.040185	0.067041
5	0.033106	0.027837	0.018407	0.010435	0.005538	0.003357	0.003357	0.005538	0.010435	0.018407	0.027837
6	0.033106	0.027837	0.018407	0.010435	0.005538	0.003357	0.003357	0.005538	0.010435	0.018407	0.027837
7	0.085283	0.067041	0.040185	0.020607	0.009923	0.005538	0.005538	0.009923	0.020607	0.040185	0.067041
8	0.280822	0.198928	0.105160	0.047865	0.020607	0.010435	0.010435	0.020607	0.047865	0.105160	0.198928
9	0.991487	0.591645	0.265391	0.105160	0.040185	0.018407	0.018407	0.040185	0.105160	0.265391	0.591645
10	3.741537	1.650667	0.591645	0.198928	0.067041	0.027837	0.027837	0.067041	0.198928	0.591645	1.650667

Predator	Prey	Value	Discount Factor	Iterations to converge
(0, 0)	(5, 5)	0.00335	0.8	33
(2, 3)	(5, 4)	0.19892	0.8	33
(2, 10)	(10, 0)	0.19892	0.8	33
(10, 10)	(0, 0)	1.65066	0.8	33

Discount Factor	Iterations to converge
0.1	5
0.5	13
0.7	22
0.9	64

Policy iteration

Policy Iteration Grid in loop 3, discount 0.8											
Indices y\x	0	1	2	3	4	5	6	7	8	9	10
0	3.7281 ES	4.6602 ES	5.8252 ES	7.2816 ES	9.1020 ES	11.3776 S	9.1020 WS	7.2816 WS	5.8252 WS	4.6602 WS	3.7281 WS
1	4.6602 ES	5.8252 ES	7.2816 ES	9.1020 ES	11.3776 ES	14.2220 S	11.3776 WS	9.1020 WS	7.2816 WS	5.8252 WS	4.6602 WS
2	5.8252 ES	7.2816 ES	9.1020 ES	11.3776 ES	14.2220 ES	17.7776 S	14.2220 WS	11.3776 WS	9.1020 WS	7.2816 WS	5.8252 WS
3	7.2816 ES	9.1020 ES	11.3776 ES	14.2220 ES	17.7776 ES	22.2220 S	17.7776 WS	14.2220 WS	11.3776 WS	9.1020 WS	7.2816 WS
4	9.1020 ES	11.3776 ES	14.2220 ES	17.7776 ES	22.2220 ES	27.7776 S	22.2220 WS	17.7776 WS	14.2220 WS	11.3776 WS	9.1020 WS
5	11.3776 E	14.2220 E	17.7776 E	22.2220 E	27.7776 E	22.2220 WENS	27.7776 W	22.2220 W	17.7776 W	14.2220 W	11.3776 W
6	9.1020 EN	11.3776 EN	14.2220 EN	17.7776 EN	22.2220 EN	27.7776 N	22.2220 WN	17.7776 WN	14.2220 WN	11.3776 WN	9.1020 WN
7	7.2816 EN	9.1020 EN	11.3776 EN	14.2220 EN	17.7776 EN	22.2220 N	17.7776 WN	14.2220 WN	11.3776 WN	9.1020 WN	7.2816 WN
8	5.8252 EN	7.2816 EN	9.1020 EN	11.3776 EN	14.2220 EN	17.7776 N	14.2220 WN	11.3776 WN	9.1020 WN	7.2816 WN	5.8252 WN
9	4.6602 EN	5.8252 EN	7.2816 EN	9.1020 EN	11.3776 EN	14.2220 N	11.3776 WN	9.1020 WN	7.2816 WN	5.8252 WN	4.6602 WN
10	3.7281 EN	4.6602 EN	5.8252 EN	7.2816 EN	9.1020 EN	11.3776 N	9.1020 WN	7.2816 WN	5.8252 WN	4.6602 WN	3.7281 WN

Predator	Prey	Value	Discount Factor	Iterations to converge
(0, 0)	(5, 5)	0.00335	0.8	2
(2, 3)	(5, 4)	0.19892	0.8	2
(2, 10)	(10, 0)	0.19892	0.8	2
(10, 10)	(0, 0)	1.65066	0.8	2

Discount Factor	Iterations to converge
0.1	2
0.5	2
0.7	2
0.9	2

Value iteration

Prey is located at (5, 5)

Value Iteration Grid in loop 8											
Indices y\x	0	1	2	3	4	5	6	7	8	9	10
0	0.000000	0.000000	0.000027	0.000168	0.001049	0.006554	0.001049	0.000168	0.000027	0.000000	0.000000
1	0.000000	0.000027	0.000168	0.001049	0.006554	0.040960	0.006554	0.001049	0.000168	0.000027	0.000000
2	0.000027	0.000168	0.001049	0.006554	0.040960	0.256000	0.040960	0.006554	0.001049	0.000168	0.000027
3	0.000168	0.001049	0.006554	0.040960	0.256000	1.600000	0.256000	0.040960	0.006554	0.001049	0.000168
4	0.001049	0.006554	0.040960	0.256000	1.600000	10.000000	1.600000	0.256000	0.040960	0.006554	0.001049
5	0.006554	0.040960	0.256000	1.600000	10.000000	0.000000	10.000000	1.600000	0.256000	0.040960	0.006554
6	0.001049	0.006554	0.040960	0.256000	1.600000	10.000000	1.600000	0.256000	0.040960	0.006554	0.001049
7	0.000168	0.001049	0.006554	0.040960	0.256000	1.600000	0.256000	0.040960	0.006554	0.001049	0.000168
8	0.000027	0.000168	0.001049	0.006554	0.040960	0.256000	0.040960	0.006554	0.001049	0.000168	0.000027
9	0.000000	0.000027	0.000168	0.001049	0.006554	0.040960	0.006554	0.001049	0.000168	0.000027	0.000000
10	0.000000	0.000000	0.000027	0.000168	0.001049	0.006554	0.001049	0.000168	0.000027	0.000000	0.000000

Discount Factor	Iterations to converge
0.1	1
0.5	7
0.7	7
0.9	8

Smarter state-space encoding

Conclusion

Files attached

Sources