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Project 3

CS475 Spring 2019 Ecampus

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Professor Bailey

I ran my code on my personal MacBook Air. I compiled with GCC 8.3.0

Own-Choice Quantity

The dynamic I added to the environment simulation was wolves. This seemed simple but functional enough. The wolves eat graindeer and die out when there is not enough to eat and they have to find suboptimal food sources causing the pack as a whole to grow smaller. The relevant code for this is:

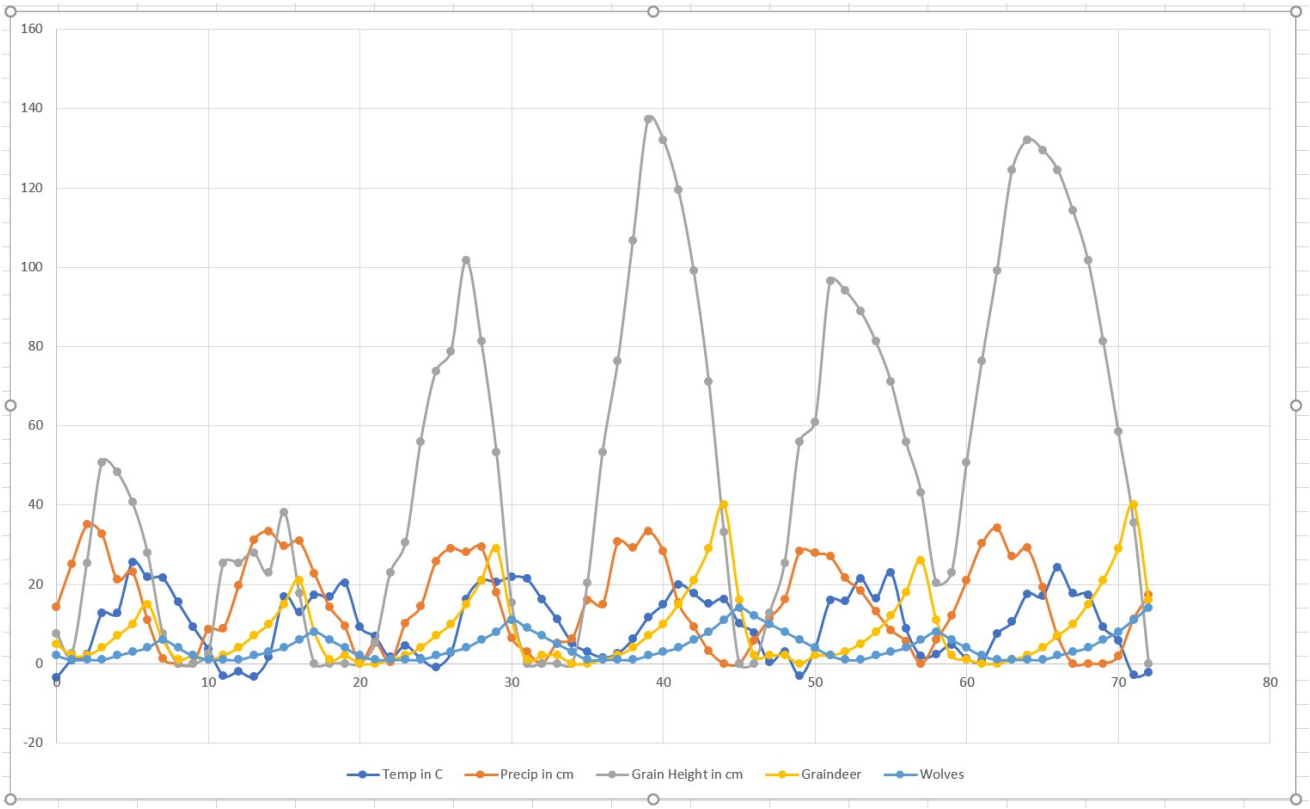
```
int NextNumWolves = NowNumWolves + NowNumWolves/4 + 1;

if(NextNumWolves*2 > NowNumDeer){
   NextNumWolves = NowNumWolves - 2;
}

if(NextNumWolves < 1){
   NextNumWolves = 1;
}
```

The first table and graph I show are in centimeters and Celsius, the graph does not show the the interactions between graindeer and wolves well. The commentary section contains additional tables and graphs to show the interactions properly for my data. These first ones were included for comparison with project document graphs primarily.

Table

	Temp in C	Precip in cm	Grain Height in cm	Graindeer	Wolves
0	-3.592722222	14.241272	7.62	5	2
1	0.844777778	25.149302	2.54	2	1
2	2.321666667	34.970974	25.4	2	1
3	12.70138889	32.656526	50.8	4	1
4	12.65488889	21.250656	48.26	7	2
5	25.53961111	23.125176	40.64	10	3
6	21.74727778	11.079988	27.94	15	4
7	21.56066667	1.276858	7.62	6	6
8	15.49411111	0	0	1	4
9	9.331555556	0	0	2	2
10	3.679944444	8.611108	2.54	1	1
11	-3.021388889	8.90778	25.4	2	1
12	-2.093666667	19.607276	25.4	4	1
13	-3.309166667	31.09087	27.94	7	2
14	1.712055556	33.44037	22.86	10	3
15	16.79211111	29.625544	38.1	15	4
16	12.89683333	30.859984	17.78	21	6
17	17.36311111	22.811232	0	8	8
18	16.77933333	14.350238	0	1	6
19	20.40561111	9.39927	0	2	4
20	9.358055556	0.51689	0	0	2
21	6.789388889	5.304536	5.08	0	1
22	1.596277778	0.35687	22.86	1	1
23	4.535055556	10.18032	30.48	2	1
24	1.274944444	14.375384	55.88	4	1
25	-0.842944444	25.698704	73.66	7	2
26	2.657111111	29.101288	78.74	10	3
27	16.16794444	28.095448	101.6	15	4
28	20.95155556	29.353764	81.28	21	6
29	20.58961111	17.853914	53.34	29	8
30	21.87522222	6.462014	15.24	11	11
31	21.31355556	2.99847	0	1	9
32	16.277	0	0	2	7
33	11.12222222	5.10159	0	2	5
34	5.224111111	6.300978	0	0	3
35	2.991777778	15.980664	20.32	0	1
36	1.55	14.853666	53.34	1	1
37	2.552777778	30.661356	76.2	2	1
38	6.213833333	29.135578	106.68	4	1
39	11.56038889	33.383982	137.16	7	2
40	14.96855556	28.31465	132.08	10	3
41	19.97266667	15.290038	119.38	15	4
42	17.66488889	9.360916	99.06	21	6
43	15.02122222	3.21437	71.12	29	8
44	16.29288889	0	33.02	40	11
45	10.18233333	0	0	16	14
46	7.658222222	5.813552	0	2	12
47	0.388722222	11.3919	12.7	2	10
48	2.980055556	16.130778	25.4	2	8
49	-3.0125	28.353258	55.88	0	6
50	3.767666667	27.859482	60.96	2	4
51	15.87961111	27.062684	96.52	2	2
52	15.73694444	21.552662	93.98	3	1
53	21.37238889	18.340324	88.9	5	1
54	16.46522222	13.180822	81.28	8	2
55	22.96733333	8.457438	71.12	12	3
56	8.832833333	5.576824	55.88	18	4
57	1.8795	0	43.18	26	6
58	2.398555556	5.899658	20.32	11	8
59	4.702444444	12.089384	22.86	2	6
60	1.273388889	20.962112	50.8	1	4
61	0.610444444	30.22981	76.2	0	2
62	7.461666667	34.20364	99.06	0	1
63	10.46588889	27.00401	124.46	1	1
64	17.54355556	29.13126	132.08	2	1
65	16.9735	19.329654	129.54	4	1
66	24.21161111	6.867652	124.46	7	2
67	17.63033333	0	114.3	10	3
68	17.35261111	0	101.6	15	4
69	9.187888889	0	81.28	21	6
70	5.712388889	1.85039	58.42	29	8
71	-2.840777778	11.219942	35.56	40	11
72	-2.3305	17.233646	0	16	14

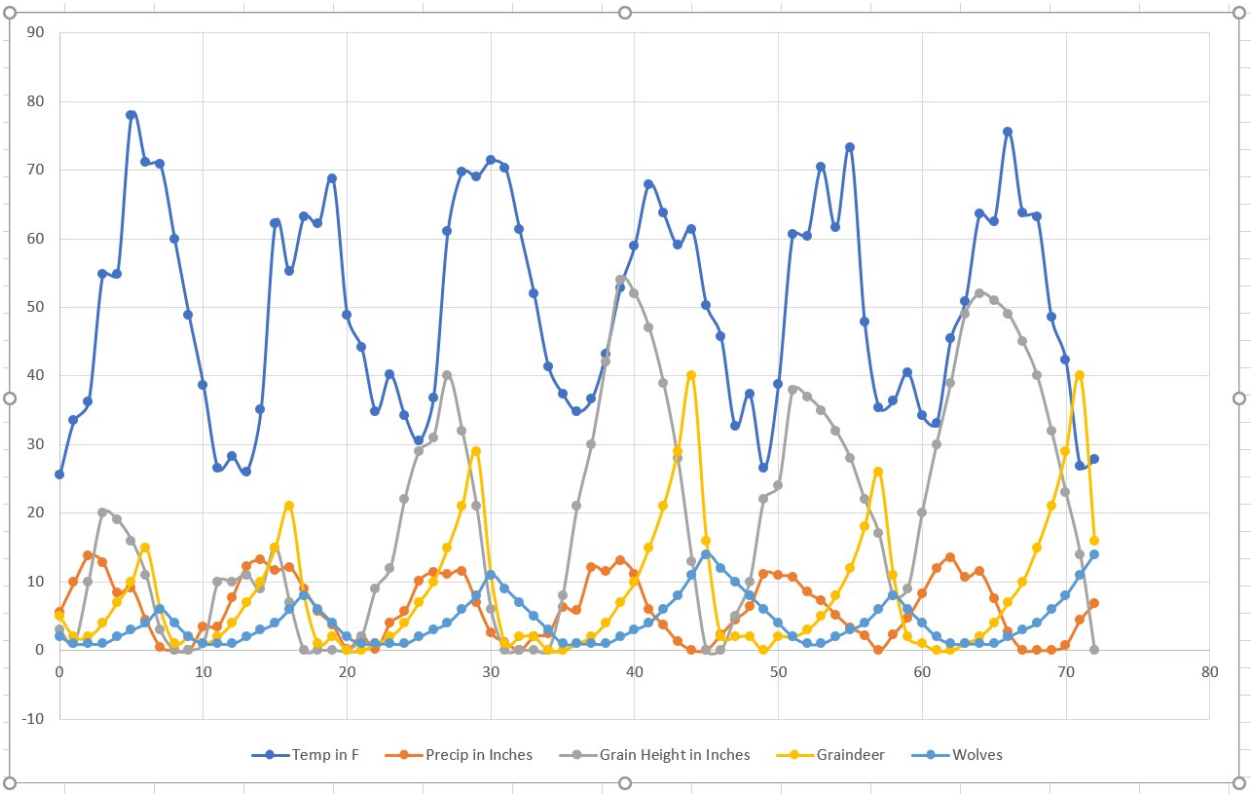
Graph



Commentary with Supplemental Tables and Graphs

The fact the agent I picked for my simulation was wolves meant there was inherently going to be fewer wolves. The way I programed things meant there was always some deer and wolves but overall compared to not having wolves in the simulation there were fewer deer. This lead to there being much larger amounts of grain such as can been seen above in comparison with the graphs on the project webpage. The way I had deer reproduce and die though meant that the grain height was affected dramatically in short periods. This could simulate deer coming through from other areas and sticking around. The wolves overall die more slowly but consistently enough to see the interactions in the graphs below. When values are kept in English units the ‘waves’ of deer, grain and wolves show how weather will cause grain to grow, then deer will spawn, the grain will peak and dip back down, the wolves will rise up to eat deer as long as there are enough deer to sustain them, but then the grain is gone, deer die out quickly, wolves steadily decline, and then the cycle repeats. This cycle does so 6 times in the spawn of the simulation.

This graph shows the interactions.



This table is the data for the graph and what is produced repeatedly by my code. The randomness is static in that the same seed is used every time because of the way I have it coded right now. I liked doing it this way because you can be certain of the effects of your agent.

	Temp in F	Precip in Inches	Grain Height in Inches	Graindeer	Wolves
0	25.5331	5.6068	3	5	2
1	33.5206	9.9013	1	2	1
2	36.179	13.7681	10	2	1
3	54.8625	12.8569	20	4	1
4	54.7788	8.3664	19	7	2
5	77.9713	9.1044	16	10	3
6	71.1451	4.3622	11	15	4
7	70.8092	0.5027	3	6	6
8	59.8894	0	0	1	4
9	48.7968	0	0	2	2
10	38.6239	3.3902	1	1	1
11	26.5615	3.507	10	2	1
12	28.2314	7.7194	10	4	1
13	26.0435	12.2405	11	7	2
14	35.0817	13.1655	9	10	3
15	62.2258	11.6636	15	15	4
16	55.2143	12.1496	7	21	6
17	63.2536	8.9808	0	8	8
18	62.2028	5.6497	0	1	6
19	68.7301	3.7005	0	2	4
20	48.8445	0.2035	0	0	2
21	44.2209	2.0884	2	0	1
22	34.8733	0.1405	9	1	1
23	40.1631	4.008	12	2	1
24	34.2949	5.6596	22	4	1
25	30.4827	10.1176	29	7	2
26	36.7828	11.4572	31	10	3
27	61.1023	11.0612	40	15	4
28	69.7128	11.5566	32	21	6
29	69.0613	7.0291	21	29	8
30	71.3754	2.5441	6	11	11
31	70.3644	1.1805	0	1	9
32	61.2986	0	0	2	7
33	52.02	2.0085	0	2	5
34	41.4034	2.4807	0	0	3
35	37.3852	6.2916	8	0	1
36	34.79	5.8479	21	1	1
37	36.595	12.0714	30	2	1
38	43.1849	11.4707	42	4	1
39	52.8087	13.1433	54	7	2
40	58.9434	11.1475	52	10	3
41	67.9508	6.0197	47	15	4
42	63.7968	3.6854	39	21	6
43	59.0382	1.2655	28	29	8
44	61.3272	0	13	40	11
45	50.3282	0	0	16	14
46	45.7848	2.2888	0	2	12
47	32.6997	4.485	5	2	10
48	37.3641	6.3507	10	2	8
49	26.5775	11.1627	22	0	6
50	38.7818	10.9683	24	2	4
51	60.5833	10.6546	38	2	2
52	60.3265	8.4853	37	3	1
53	70.4703	7.2206	35	5	1
54	61.6374	5.1893	32	8	2
55	73.3412	3.3297	28	12	3
56	47.8991	2.1956	22	18	4
57	35.3831	0	17	26	6
58	36.3174	2.3227	8	11	8
59	40.4644	4.7596	9	2	6
60	34.2921	8.2528	20	1	4
61	33.0988	11.9015	30	0	2
62	45.431	13.466	39	0	1
63	50.8386	10.6315	49	1	1
64	63.5784	11.469	52	2	1
65	62.5523	7.6101	51	4	1
66	75.5809	2.7038	49	7	2
67	63.7346	0	45	10	3
68	63.2347	0	40	15	4
69	48.5382	0	32	21	6
70	42.2823	0.7285	23	29	8
71	26.8866	4.4173	14	40	11
72	27.8051	6.7849	0	16	14