Cooperative and Adaptive Algorithms
ECE 457A
Ashwuni Kumar
20767661
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Assignment 3

Question 1.

a) Please refer to file submission. Output Best Cost: 1462.0

b) Please refer to file submission.

c) Please refer to file submission.

i) Output Best Costs: 1462.0, 1636.0, 1645.0, 1583.0, 1674.0, 1699.0, 1657.0, 1705.0, 1629.0, 1764.0

ii) Output Best Costs: 1462.0, 1471.0

iii) Output Best Costs: 1462.0

iv) Output Best Costs: 1462.0, 1462.0

v) Output Best Cost: 1517.0

The impact the initial starting point has on the best cost is very evident: we see a variety of final best costs. From part two we see that diversifying our search, increasing our tabuTenure resulted in higher costs. On the other hand in part 5 we saw that intensifying the search resulted in a lower cost. Similar to a dynamic tabuTenure, the aspiration criterium didn't appear to result in much of a change in this situation.

Question 2.

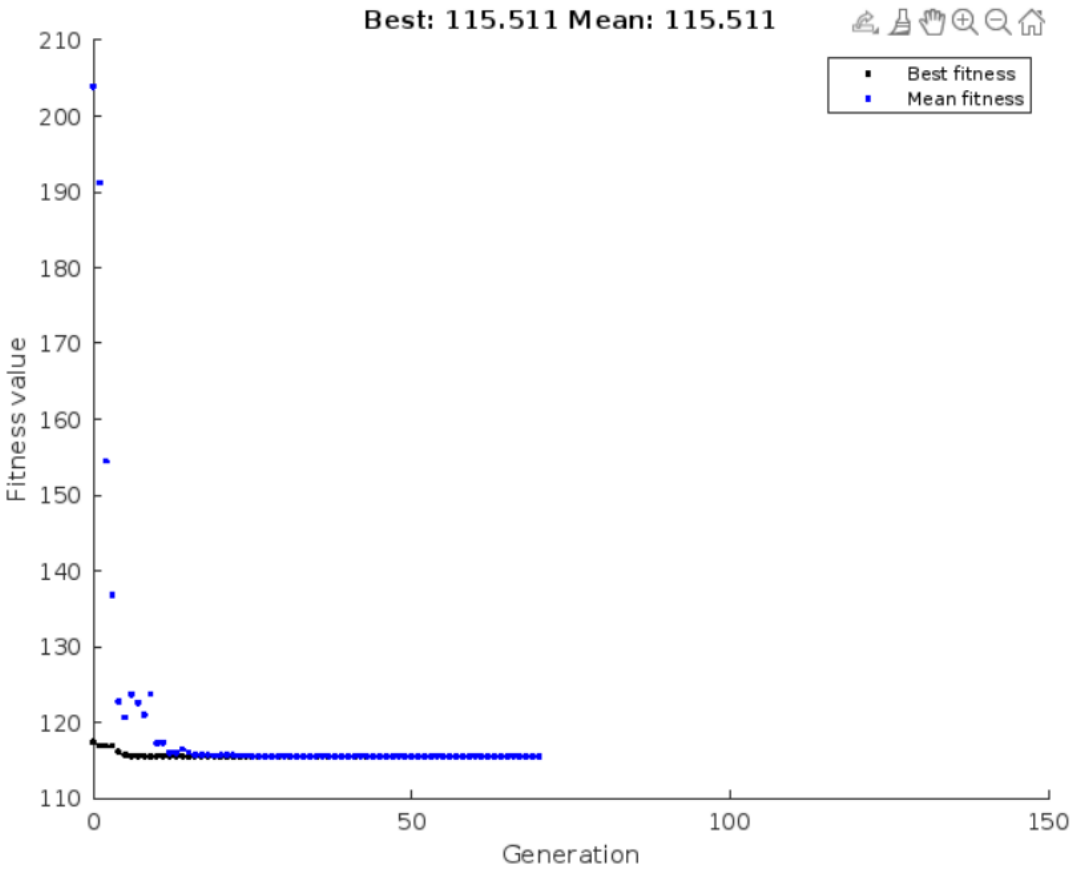
a) Optimal input values - K_p, T_i, T_d - are an array. The fitness value gets updated with the optimal value per generation. The output is an array of ISE, t_r, t_s, and M_p.

b) Please refer to file submission. Used an additive fitness function, adding ISE, t_r, t_s, and M_p together.

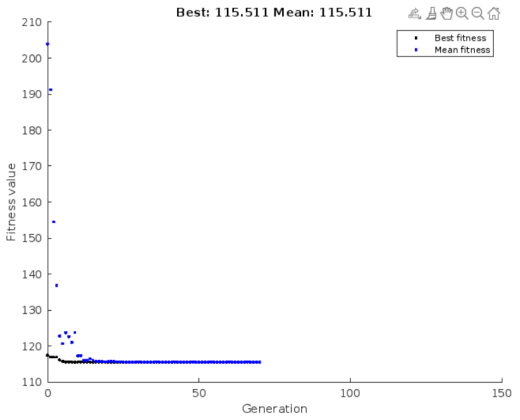
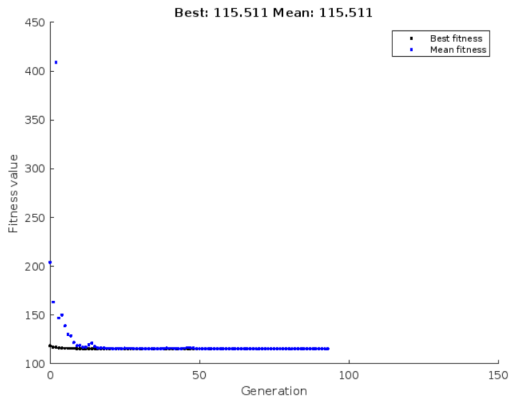
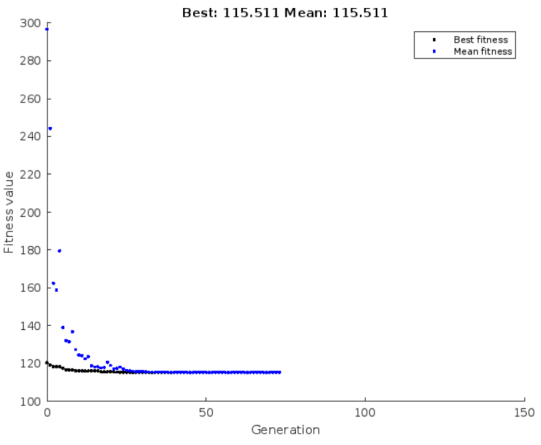
```
function fitval = fitness(data)
[a,b,c,d] = Q2_perfFCN(data);
fitval = a+b+c+d;
end
```

c) Please refer to file submission.

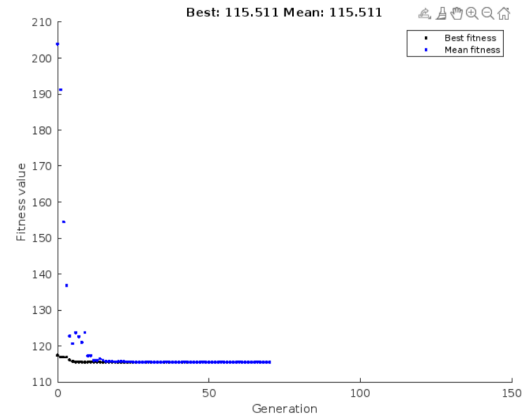
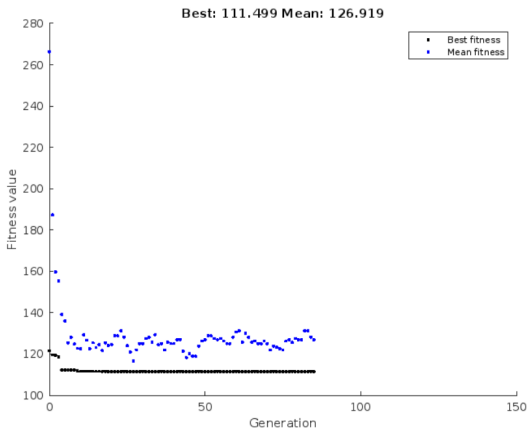
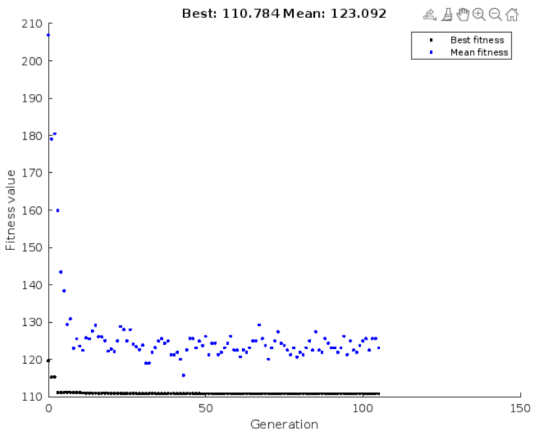
d) Please refer to file submission.



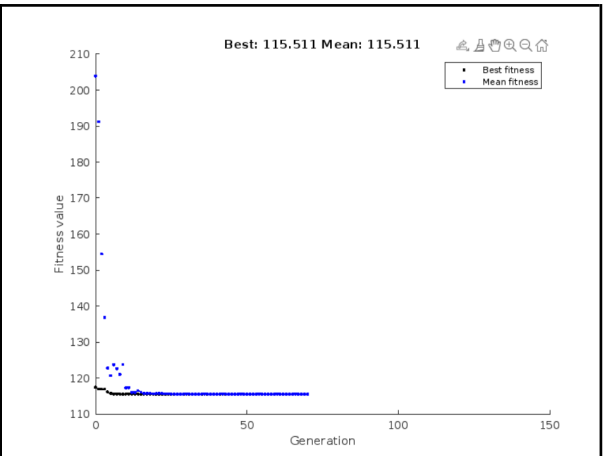
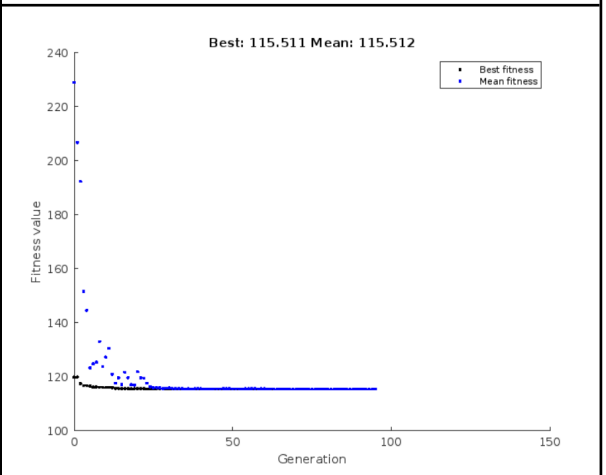
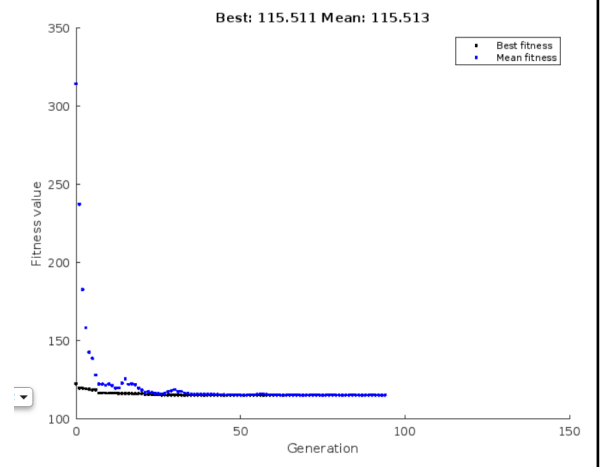
e) Ran for 150, 100, and 200 generations. As the number of generations increases, more solutions are generated and the fitness value gets better.

150 generations	
25 generations	
300 generations	

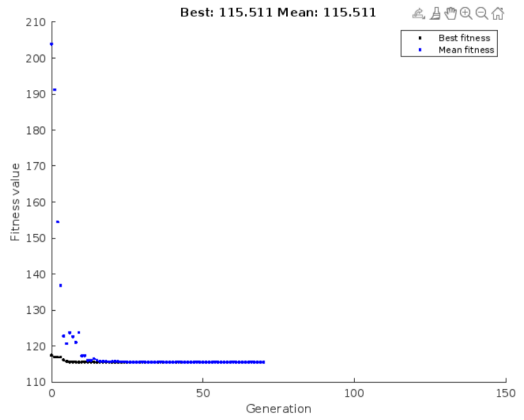
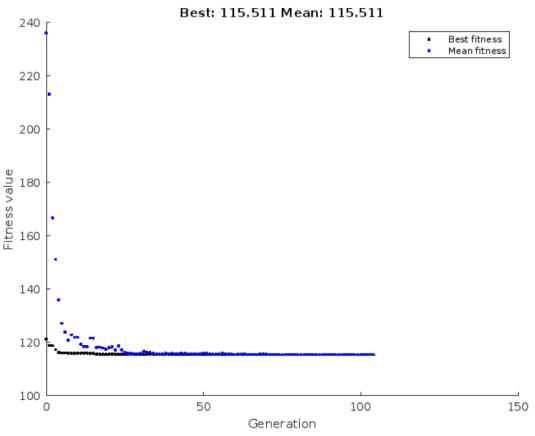
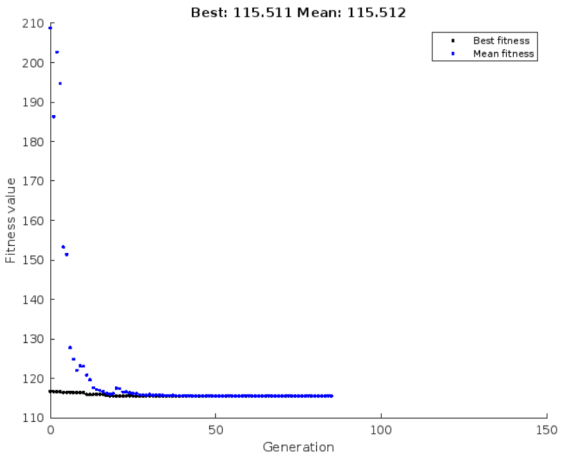
f) Ran for population size 50, 25, and 75. As the population size increases, more solutions are generated and the fitness value gets better.

50 population size	
5 population size	
150 population size	

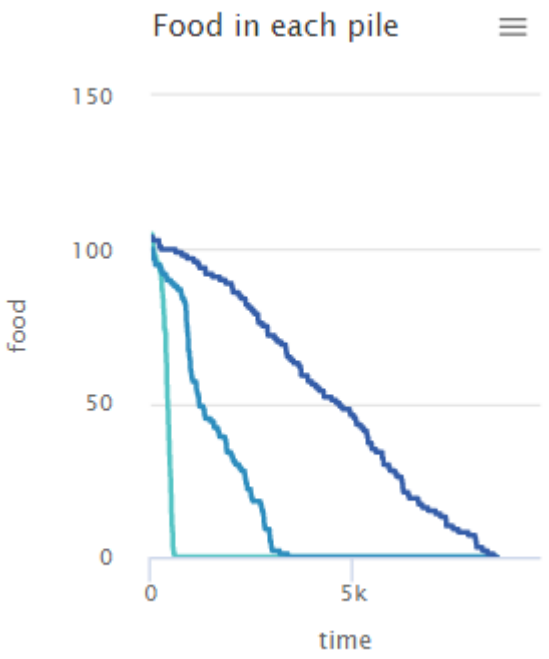
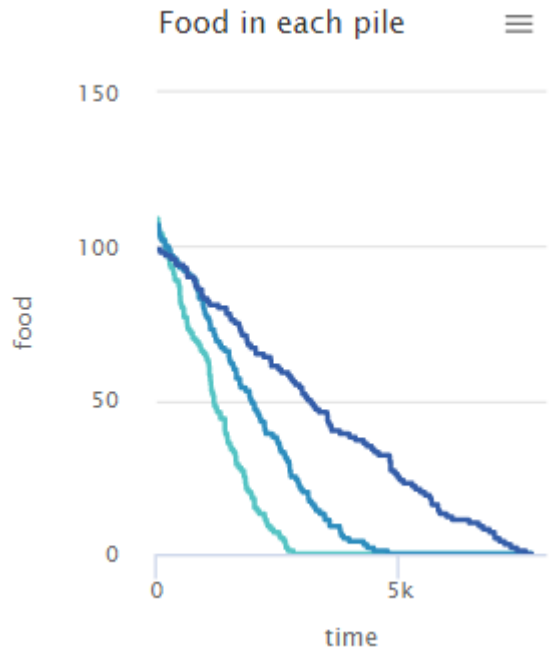
g) Run for 0.6, 0.3, and 0.9 crossover probability. As the mutation probability increases the fitness value gets worse. It appears big modifications to the parameters hinders the ability of the solution to get close and negatively affects the fitness parameter.

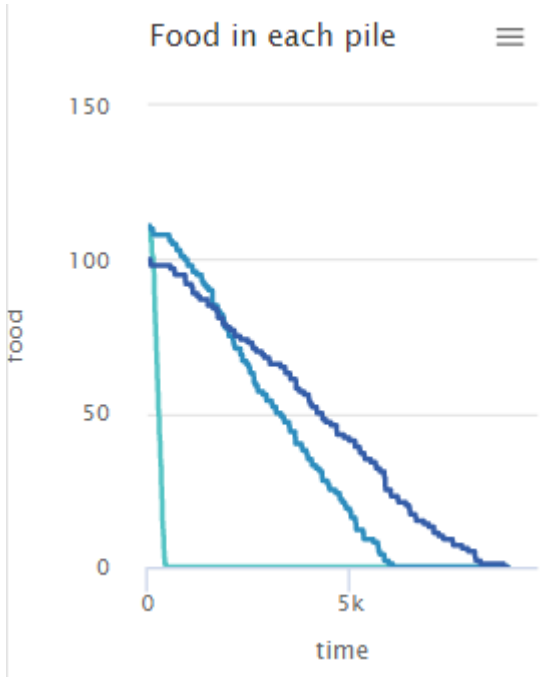
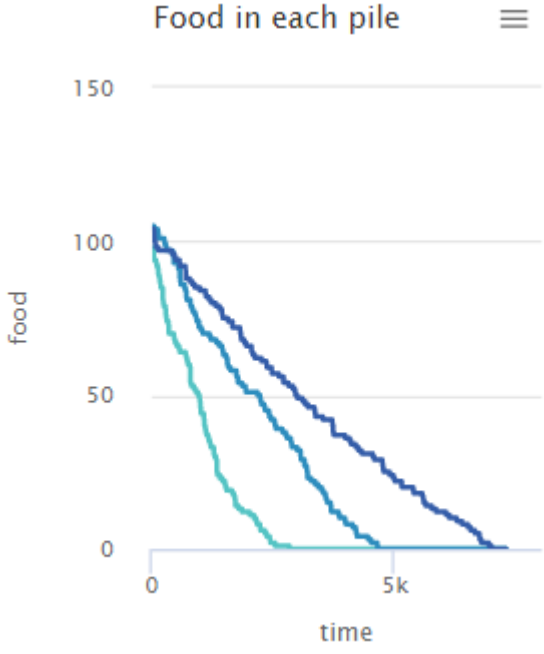
0.6 crossover probability	
0.1 crossover probability	
0.9 crossover probability	

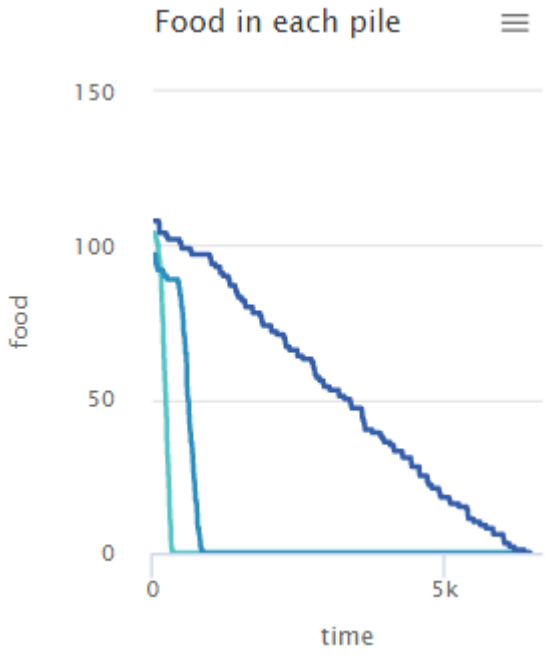
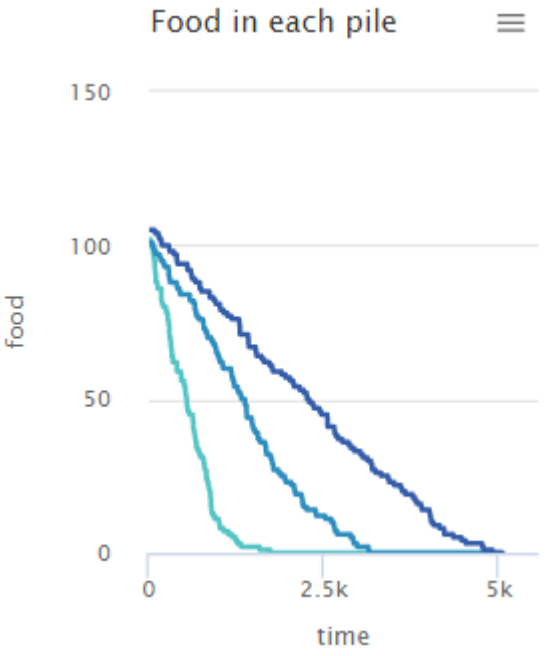
h) Run for 0.25, 0.1, and 0.4 mutation probabilities. As the mutation probability increases the fitness value gets better. It appears small modifications to one parameter keeps the solution close and allows for the fitness value to get better.

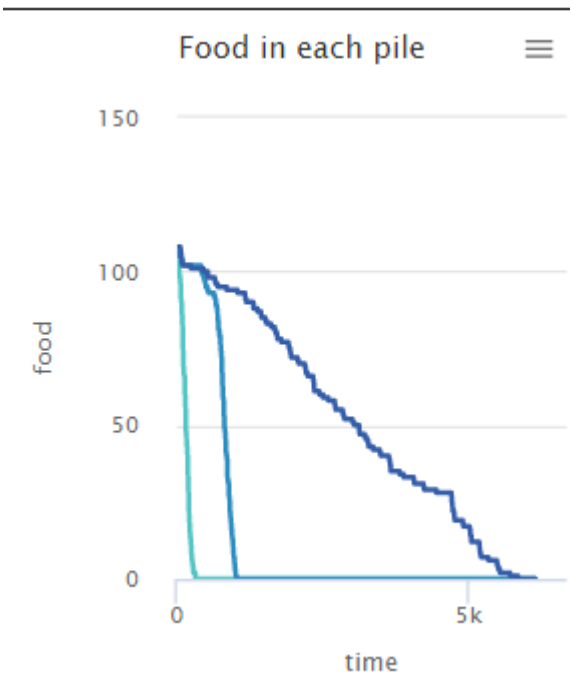
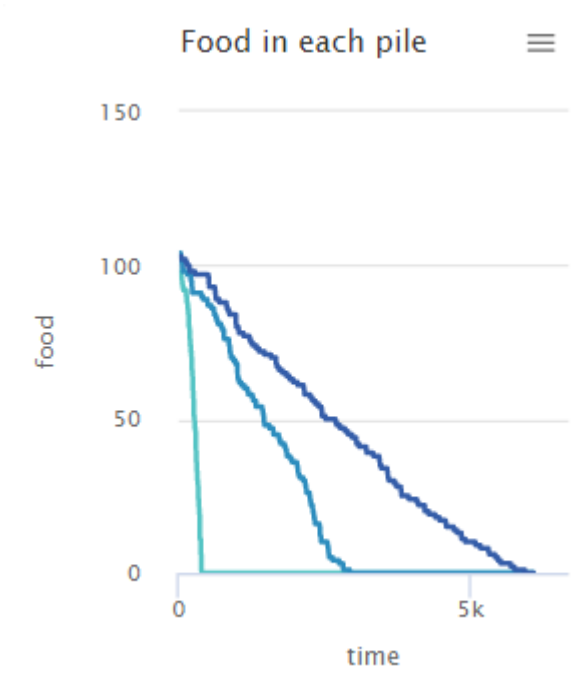
0.25 mutation probabilities	
0.1 mutation probabilities	
0.4 mutation probabilities	

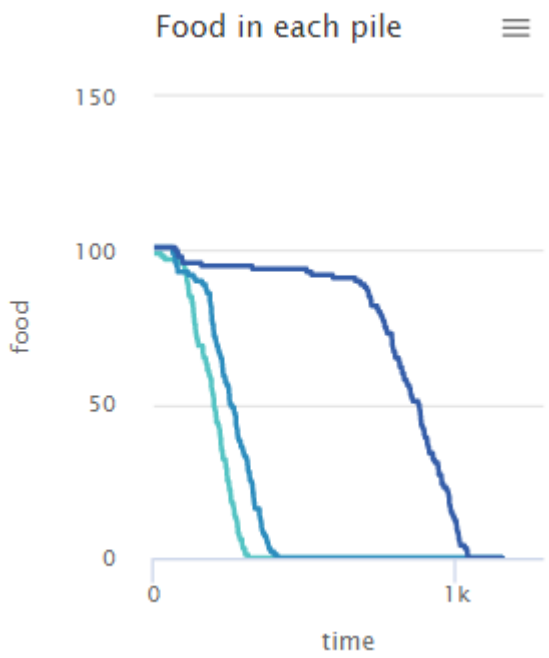
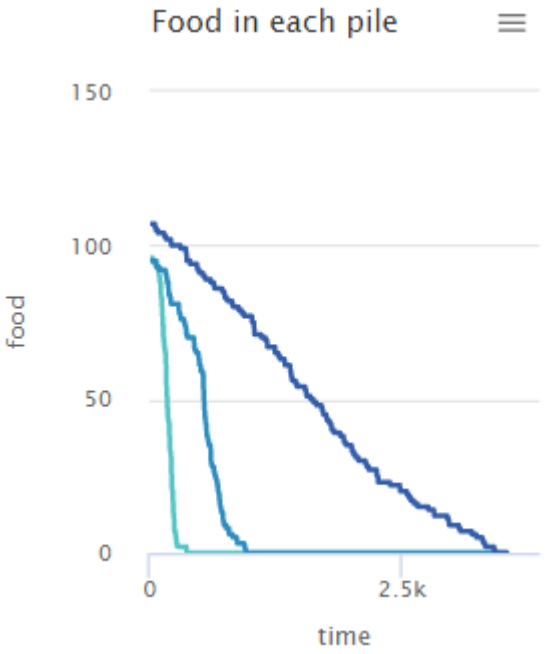
Question 3.

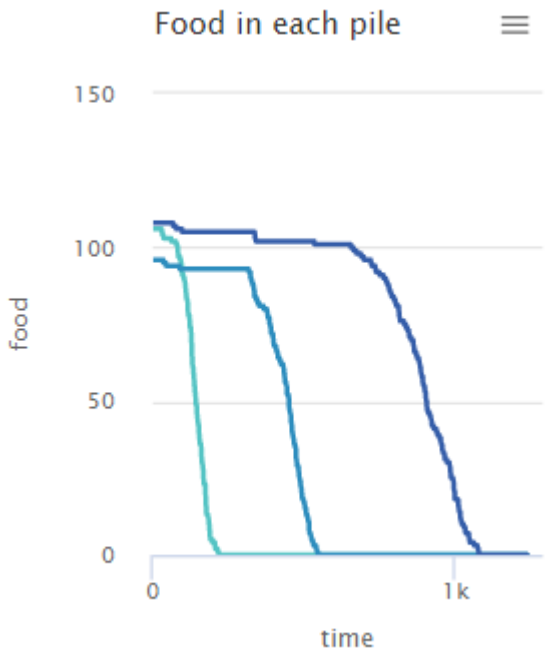
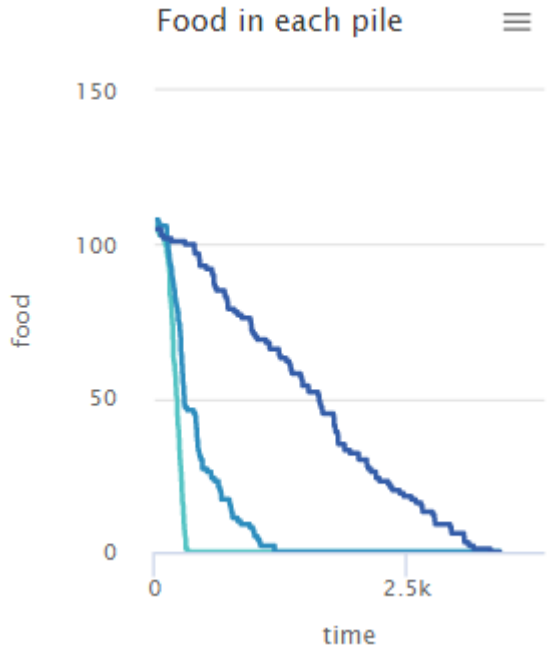
Population	Diffusion Rate	Evaporation Rate	Result
30	40	10	
30	40	20	

30	80	10	
30	80	20	

50	40	10	
50	40	20	

50	80	10	
50	80	20	

100	40	10	
100	40	20	

100	80	10	
100	80	20	

It it highly evident that the population has a great impact on the completion time. This makes sense as more ants allows for more exploration, and more phermones which in turn allows for a higher chance of finding the food and attracting other ants towards it.
We can see that the increased diffusion rate has more impact when paired with higher populations.
When comparing the effect of increasing the evaporation rate on the various instances, it is evident that increasing the evaporation rate results in the pheromone decay parameter decreasing faster and, in turn, the ant's missions taking longer. However, we also notice that

the higher evaporation rates allows for ants to find new trails faster as they are no longer influenced by the older trails.