ASU CSE 691 Homework 4

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Problem 1.3. Consider the spiders and flies problem of Example 1.6.5 with two differences: the five flies stay still (rather than moving randomly), and there are only two spiders, both of which start at the fourth square from the right at the top row of the grid of Fig. 1.6.10. The base policy is to move each spider one square towards its nearest fly, with distance measured by the Manhattan metric, and with preference given to a horizontal direction over a vertical direction in case of a tie. Apply the multiagent rollout algorithm of Section 1.6.5, and compare its performance with the one of the ordinary rollout algorithm, and with the one of the base policy. This problem is also discussed in Section 2.9.

Github link: `https://github.com/sak-18/ASU-691-Spiders-Flies` (Contains animated videos for the three scenarios and code)

Let the cost of the base heuristic be $J_\mu(x)$ and multiagent rollout cost be $J_{\tilde{\mu}}(x)$. It is always the case that $J_{\tilde{\mu}}(x) \leq J_\mu(x)$. We can observe the same from the simulation of spiders and flies problem. The intial setup of the board is as follows.

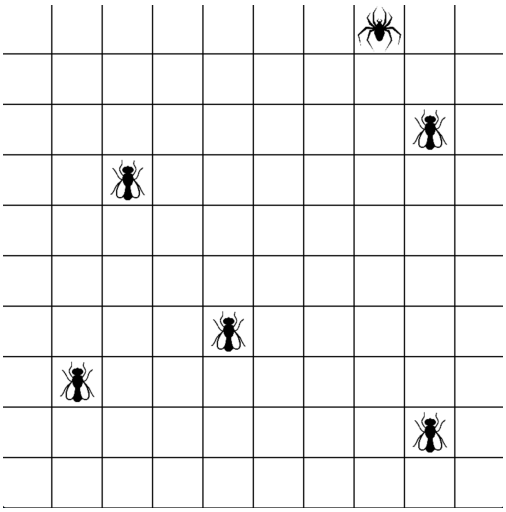

Figure 1: Initial Configuration of the board. Five stationary flies and two spiders (at the same location initially).

With the base heuristic of moving each spider to it's nearest fly the cost of the simulation is 50. The cost of simulation with 1-step lookahead with both single and multiagent rollout is 32. Refer to the video links/Github repo for each of the simulation. The difference with multiagent rollout is that the control space complexity is reduced at the cost of increasing stage complexity. With the simulations we notice that none of these solutions are optimal, as the spiders oscillate in the same cells occasionally. To improve the solution, one must increase the lookahead which could be a future extension of the problem.

Cost Approximation Method	**Cost**
Base Heuristic	50
1-step lookahead with rollout	32
1-step lookahead with multi-agent rollout	32