Mini-Project 5:
Monster Diagnosis (Spring 2021):
CS7637

Josh Adams
Jadams334@gatech.edu

***Abstract*—For Mini-Project 5 we are given the challenge to produce an agent which looks at a given monsters current state and produces an expected combination of diseases which would explain the monsters state.**

1 HOW DOES YOUR AGENT WORK?

My agent works in two relatively simple stages. The first stage is to reduce the possible answer space as much as possible. This works by iterating over all of the values for the diseases and compares it to the monster's state. It determines required diseases. To determine if a disease is a required disease or not a simple calculation is performed by looking at the value of monsters' vitamin and the diseases value. If it is possible to reach the monsters' value without using that specific disease, then that specific disease is not a required one. It does this for each of the 26 vitamins. A quick example is if the monster's vitamin A were a + (plus) and there exists 5 diseases with values [0,0,-,-+] then this means the last disease is required because there is no combination of 0's and –'s which would equate to a +. This is checked for just + and – values of the monster.

If required diseases exist, they are used in the second stage to try and figure out the solution to the problem. During the second stage, the agent creates combinations of all required diseases and remaining diseases. For example, if disease 5 was a required disease, the agent would not check any combinations which do not contain disease 5. The agent then compares the values associated with the various combinations to the monster's state. Once a value is reached which solves the problem it is returned. It is also guaranteed to be the smallest combination of explanatory diseases for the monster's state.

2 HOW WELL DOES YOUR AGENT PERFORM?

Overall, my agent performs well and is able to get all questions correct in gradescope.

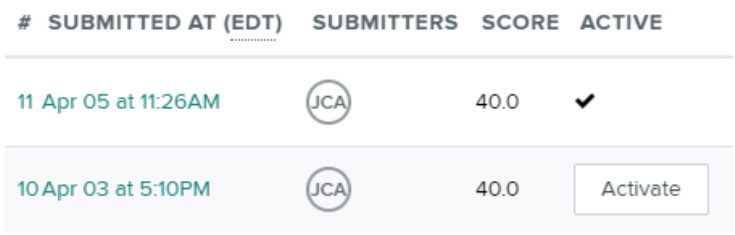

Figure 1 — Performance of agent.

Figure 1 shows two example submissions to gradescope. Currently, my agent does not struggle on any particular case. While I was developing the agent, I did come across many cases that it struggled with. Those issues would produce states which were computationally intractable. I was able to overcome a majority of these issues with a single change. This change happened because I made a post to Ed Discussion and asked what the correct answer would have been. I then traced my agents processing to find where my agent threw away the correct result. I found that my agent was not comparing the combined disease values with the monster's current state correctly. I made the appropriate changes, and my agent was then able to solve all problems correctly.

3 HOW EFFICIENT IS YOUR AGENT?

My agent's efficiency is less than ideal. My agent works by combining many diseases and calculating their values, then compares that result to the monster's state. When dealing with these smaller problems the runtimes are very manageable and able to solve any of the problems' I have come across in less than a second. I would expect the average efficiency to be $O(N^{N*\log(N)})$ the reason is that my agent will reduce the possible answer space effectively when possible but still must process most diseases and associated vitamin values. In the worst cases the efficiency would fall to $O(N^N)$, which is terrible. The way it would reach this situation is if the disease solution is one of the last ones processed. My agent would try every single combination before reaching that resulting disease. This also assumes the worst condition where the agent is not able to reduce the answer space. As the number of which are passed to the agent increase, the efficiency of the agent does suffer.

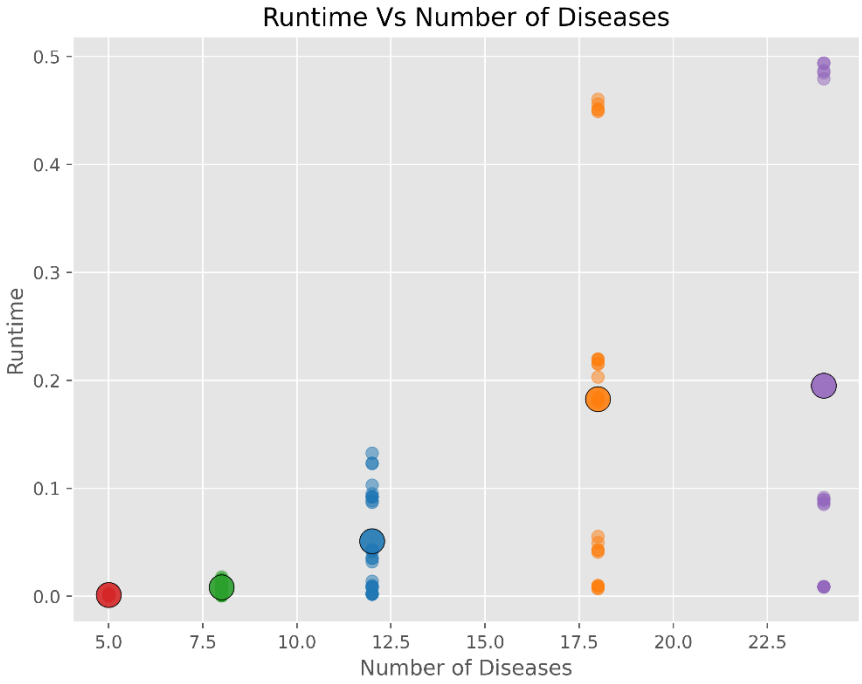

Figure 2 — Runtimes compared as number of diseases increase.

Figure 2 shows the runtimes for different problems and different number of diseases. The large markers above each number of diseases indicates the average of the results. The smaller markers are the individual results which are used to calculate the average. These results were from problems my agent encountered on gradescope, which varied in number of diseases passed to the agent from 5 to 24.

4 DOES YOUR AGENT FO ANYTHING PARTICULARLY CLEVER?

In my opinion, my agent does not do anything particularly clever to solve a problem. But it could be considered clever to initially reduce the problem space. The increase does not occur often but when it does it can reduce the number of computations does by n, where n is the number of diseases found during this initial evaluation. It works by comparing the values of each vitamin for each disease and the monster's vitamin. If the monster has a + (plus) and there exists only a single + in a column of vitamins, then the solution must at least contain that disease. Same goes for – (minus), if there exists only a single - in a column, then that disease must be part of the solution.

5 HOW DOES YOUR AGENT COMPARE TO A HUMAN?

When comparing my agent to a human there are three main aspects which can be compared. The speed and accuracy of the results as well as methodology. When it comes to speed, the agent is orders of magnitude faster than a human would be. That difference gets larger as the complexity of the monster and the number of diseases increase. When comparing accuracy, I have no doubt some human would be able to optimally solve any problem given.

When it comes to methodology, I would say that the agent does perform similarly as a human would. My agent starts by comparing the various diseases to the monster's current state and if that is a solution it is returned. Progressively trying strategic combinations until ultimately reaching a solution.