

Dear Adam,

I have a few questions about the ant challenge. The problem itself is very interesting but I am very confused about the objectives.

“Your objective is to gather enough food for the ant colony and bring it back to the mound in as few turns as possible.”

In the first place, I am not pretty sure that what you mean by “enough”. From my observation, the map is randomly generated and the food is distributed at random as well. For each tile with food on it, the quantity is also graphically differentiated by the size. My question is:

If the objective “enough” is quantitized by a fixed number, it does not mean anything since the overall amount of food may be far below this fixed number. If it is measured by a number in percentile, i.e., the objective is to collect 90% of the food, it will make much more sense. Can I make the assumption like this before I go into the implementation?

The next question is about the load capacity of which an ant can carry? What should be a reasonable value for me to use? If every ant is strong enough to carry the heaviest piece of food, then there is no need to go collect the food at the same place. Is it valid to assume that each ant can only carry one unit of food?

The third question comes from the path finding. I guess this stage is pretty much like exploring the unknown area. Since we have 3 ants to begin with, this process seemingly can be concurrently executed. I doubt that do we need to make the assumption that what each ant has discovered is instantaneously available to any other ants? It is like playing Warcraft game, we send several scouts out and the dark territory is cleared immediately once this area has been explored.

Actually I am very confused about the information exchange between two ants when they happen to be on the same tile. Is this the only way to exchange for the partial information of the map? In the path finding stage, if this is the case which resembles the real world situation, it is quite possible to have duplicated scout area since an ant may not know about the region where the other ants explored if this ant never gets a chance to talk to other scout ants. If we assume during the map exploration stage, the map information is immediately shared by all others, then the life becomes much easier and in the send()/receive() function, only food information and real food pieces can be exchanged. I checked into the requirements and found out that no static variables are allowed. Does this mean every ant has partial information of the whole world unless he meets every other ant?

If we assume every ant can only move up/down/left/right, the distance seems to be measured in Manhattan distance (\mathcal{L}_1 -norm distance), then in order to get the food collection job done within a minimum time-span/turns, there might be multiple optimal paths since we only care about how many tiles an ant can move horizontally and vertically and sum these two numbers up afterwards. Once the topology information is unveiled, any shortest path (Dijkstra, A^*) algorithm can be used but it seems to be more complex than this since we have multiple ants and the number of ants keeps increasing by one every 10 turns. The exact optimization problem formulation might be intractable and only some heuristic algorithms can be applied.

I really appreciate all the help and clarifications I can get from you and I look forward to hearing back from you soon.

Best regards,
Zhirong (Larry)