A.I. Assignment 4

Pathfinding and sorting (3) - optimisation with constraints

Consider a similar setup with the previous task. The drone is placed in a known environment, described on a rectangular map of size *n x n* units, with the task to charge with energy *k* sensors. The sensors are placed in known positions, sensor *i* is at [x_i, y_i] on the map. We want to charge these sensors as effectively as possible in order to use them to survey the **maxim total area surrounding them**. The drone moves and charges the sensors until it depletes its *m* units of energy from the battery. A sensor *i* can be charged with energy e_i from the drone with a value from *0* to *5* (energy that comes from the drone's battery), meaning that for a quantity of *q* energy it can see *q* squares around if there is no wall.

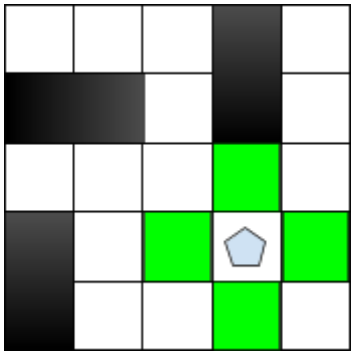

Fig. 1a: for energy $e_i=1$

we get 4 squares surveilled

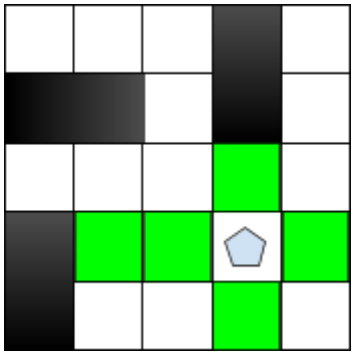

Fig. 1b: for energy $e_i=2$

we get 5 squares surveilled

Observe that in Fig. 1 for $e_i>2$ we get the same number of surveilled squares (5) so would be a waste of energy to fill it up with more than 2 units of energy.

Task

Using ACO (**and** any other suitable method), write and complete the application that will be used in order to drive the drone in solving it's task. The area is known to the drone. From each position the drone can move in one adjacent empty square.

In:

- the drone position
- the energy of the drone *m*
- the sensors positions
- the map

Out:

- the **order** to visit the sensors so with *m* energy we get the maxim total area surveilled surrounding them

Suggestion: Possible approach of the problem:

1. Determine for each sensor the number of squares that can be seen for each value from 0 to 5
2. Determine the minimum distance between each pair of sensors
3. Determine using ACO the shortest path between the sensors
4. Determine using any method the quantity of energy that is left there (careful about the energy spent and the remaining one after moving between points)

For this assignment one can get a maximum **150** points.

Extra **50** points can be earned for a solver that uses only ACO solves in one shot the steps 3 and 4 from above.

Due time:

1 week to present an almost finished version of the code

2 weeks for the final solution

IF nothing is done in the first week you will have a penalty of 10 points.

The solution can not be turned in after the 2 weeks.