More on Searcher Problems

Searcher problems were originally studied in graph theory in the 1970s, and recently again in computer science as an abstraction of mobile sensors which control some area, or a discrete set of locations. The model of searchers on a graph, as discussed here, is just the simplest formalization. One can refine the model by adding searcher and target speeds, viewing regions, obstacles to movement or visibility, movement and activity limits by battery capacities, communication limits, and many other real-life aspects of mobile robots. The special interest of this graph-searcher model is that we could analyze it exactly, and the technique generalizes to give bounds also on other graphs like higher-dimensional grids. A related model, for which the exact minimum number of searchers is still open, is that the searchers and the target move simultaneously, instead of alternatively, as in this model. The difficulty in analyzing simultaneous movement is that searcher and target can meet not only on a vertex, but also by simultaneously crossing the same edge in opposite directions.

The searchers (yellow) and the target (blue) move from cell to cell. They see only their current cell. Searchers catch the target if they enter the same cell.

This illustration of the searcher problem was generated by Dr. Peter Brass using POV-Ray.