MAS: Activity 2 – Predator - Prey

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The Problem: a classic predator - prey scenario. The environment is similar to the one in Activity 1: there is a rectangular room with $m \times n$ tiles. However, as opposed to the setup in Activity 1, there are no longer any junk tiles (J) or obstacle tiles (X) in the middle of the map. Obstacle tiles still define the walls of the map.
The map contains *num_pred* predator agents and *num_prey* prey agents, knowing that $num\_pred > num\_prey$. By default there are two predator and one prey agents on the map. All agents are spawned randomly on the map, ensuring that all prey agents are at a Manhattan distance of 3 or greater from any predator agent. Furthermore, each agent of the same type (i.e. predator or prey) is at a Manhattan distance of at least 2 from another.
The purpose of the game is for the predator agents to eat all prey agents on the map. Prey agents use a reactive strategy, whereas predator agents are allowed to be cognitive, as per the following specifications.

Specifications

- the agents have four operations: *UP*, *DOWN*, *LEFT*, *RIGHT*.
- prey agents can perceive the surrounding tiles **at a Manhattan distance of 2** around their current position.
- predator agents can perceive the surrounding tiles **at a Manhattan distance of 3** around their current position.
- every agent's perception includes its current position in the map, the set of obstacle positions, the set of nearby predator agents and the set of nearby prey agents.
- two agents **can** be located in the same tile
- predator agents **are allowed to use memory**.
- prey agents are reactive - they employ a random walk strategy, trying to stay away from predators if they perceive them.
- a prey agent is considered killed in the following conditions:
  - there is at least one predator at a Manhattan distance of 1 to the prey agent
  - there are at least two predators at a Manhattan distance of 2 to the prey agent

Work **only** in the `my` package. If you need to modify anything else, discuss with the assistant.

To Do 1: Create a Java project using the provided sources and understand the content of the provided sources. See page 2 for some helpful pointers.

To Do 2: Add code to `MyEnvironment.step()` in order to generate perceptions, call `Agent.response`, and apply the returned action, for predator agents.

To Do 3: Design and implement a cognitive behavior for the predator agents, that guarantees that all prey will be killed.

To Do 4: Vary the number of predator and prey agents and explain how the increased number of agents together with your chosen strategy influences the number of steps it takes to finish the game.

Helpful pointers:

- There are separate classes for predator and prey agents: `MyPredator` and `MyPrey`
- Many helper functions are included in `AbstractHuntingEnvironment`. Pay attention to `getNearbyObstacles`, `getNearbyPredators`, `getNearbyPrey` and `removeDeadPrey`.
- `GridPosition` offers methods to find:
  - the exact position in the map (x, y) coordinates
  - whether a position is a neighbour (i.e. adjacent cell)
  - the relative orientation of a position with respect to another
- The `initialize` method in the `AbstractHuntingEnvironment` takes the following parameters: width and height of the map, number of predators, number of prey agents and a random generator. The method performs initial spawning of the agents on the map. **Use a `seed` for the random generator to test on the same initial spawning of agents.**

Cum să raportați activitatea:

- **la sfârșitul laboratorului:** trimiteți arhiva conform cu instrucțiunile de mai jos.
- **la terminarea taskurilor** aferente laboratorului (înainte de următorul laborator, altfel cu depunctare): trimiteți din nou arhiva, conform cu aceleași instrucțiuni, eventual adăugând ceva la nume.

Conținutul arhivei: numai directorul `src`, arhivat într-o arhivă cu numele `PrenumeNume_MAS-N.zip`, unde `N` este numărul laboratorului pe care l-ați rezolvat.

Cum trimiteți: trimiteți arhiva în atașament la un mesaj către adresa cs+mas@andreiolaru.ro. Dacă adresa este corectă și există atașament, veți primi un mesaj automat de confirmare.

Notă: Folosiți adresa de mai sus numai pentru a trimite activitatea de laborator. Pentru alte probleme folosiți modalitățile de contact indicate la curs.