IA51: AI for Games and Vir. Env., Intermediate Exam P2016

Duration: 2h00.
Paper documents are allowed. No electronic device allowed.
English recommended, French accepted.

Part 1: Questions (5 points)

Question 1.1:

In the definition of the concept of "Agent", four major characteristics are defined. **Provide at least two of these characteristics, and briefly explain them.**

Question 1.2:

Consider two agents, which want to act on the same object at exactly the same simulation time. **What is the module of the simulator, which is managing these simultaneous actions? Brielfy explain the basics of the model for managing the simultaneous actions.**

Question 1.3:

What is(are) the difference(s) between the "Seeking" kinematic behavior and the "Seeking" steering behavior, according to Reynold?

Question 1.4:

Let a simulator is composed of software modules (environment, agent, user interface, etc.) **What is(are) the module(s) of the simulator managing the state variables of the agent bodies? What is(are) the module(s) of the simulator influencing the agent bodies?**

Part 2: Environment Model

The goal of this part is to define a continuous environment that represents a forest. It may contain objects (trees, rocks, etc.)

Question 2.1: Environment Model (5 points)

Write the UML class diagram for the environment and its internal data structure. You should select the best data structure for supporting the continuous space of the environment. You should detail the following elements in the class diagram:

- the different types of environment objects;
- the data structure that contains the environment objects;
- the relationship with the agents.

Question 2.2: Perception Function Prototype (1 points)

Let the function `computePerception`, which computes the collection of perceived objects for each agent. **What is the prototype of this function?**

Question 2.3: Perception Algorithm (6 points)

Write the perception algorithm that corresponds to the content of the function `computePerception`, and following the UML class diagram that is proposed in the first question of this part. You could write it with pseudo-code, or the SARL language.

Part 3: Fleeing Motion Algorithm (3 points)

Let the agent A. The goal of this part of the exam is to provide the algorithm for the "fleeing" **steering behaviour** related to A. This behavior permits to A to flee a position in the environment, as fast as possible. The inputs of the algorithm are:

- p_A is the current position of A (position x_A, y_A);
- $\vec{v}_A$ is the current velocity vector of A (not a unit vector, vector with its length in m/s);
- S_A is the maximal speed capability of the agent A (in m/s);
- A_A is the maximal linear acceleration capability of the agent A (in m/s^2);
- T is the point to reach (position x_T, y_T).

The output of the algorithm is the linear motion vector $\vec{m} = (m_x, m_y)$ that has its length in m/s^2.
m/s means "speed in meters per second", and m/s^2 means "acceleration in meters per square second."

Provide "fleeing" steering behaviour algorithm. You could write it with pseudo-code, or the SARL language.