VI51 : Virtual Life Simulation
Final Exam
Springer 2010

2h, Neither paper nor electronical document is allowed
English recommended, French accepted
Notation ratio in VI51: 50%

Each part may be written on a separate sheet

PART 1 : Environment and Motion Models (9 points)

Question 1:

Explain the principle and the main advantage of the influence/reaction approach.

Question 2:

You want to write an environment model for a 3D real-time strategy game based on virtual simulation principles.
What is(are) the best data-structure(s) to represent this environment model. Explain your choices.

Question 3:

You want to write the behaviour(s) for shooter-game artificial intelligences. These artificial players has the goal to kill the human player as fast as possible. The available shooter game concepts are : armor, munition, 1 type of gun, and life.

1. Select a technique to code the artificial intelligence behaviour. Why have you selected it ?
2. Provide, the algorithm, statechart, or graph which permits to describe the behaviour.

PART 2 : Markov Model (4 points)

Question 1:

On which markov model Viterbi algorithm can be applied? What is its purpose? What are the difference with the forward algorithm?

Question 2:

A person is living in an environment where he can be exposed to a sting of insect involving several diseases. This person can be into 3 different states: (I) immunized, (S) sick, (N) neither immunized nor sick. From one month to another, his state can change following these rules:

- Being (I): 0.9 to stay (I), 0.1 to go to (N)
- Being (N): 0.5 to stay (N), 0.5 to go to (S)
- Being (S): 0.2 to stay (S), 0.8 to go to (I)

Draw the Markov chain graph of this situation and give the transition matrix.

Compute the state probability for this person after 3 month, 6 month, 1 year, 2 years for each possible initial state.

PART 3 : Learning Algorithms (5 points)

Question 1:

a) Define a supervised learning problem. Give a graphical example.
b) Define an unsupervised learning problem. Give a graphical example.

Question 2:

An agent has to find as fast as possible the exit of a maze, represented as a grid composed of mxn cells. A cell can be void, or an obstacle or the exit can be in it. Whenever the agent chooses one of the four cardinal directions (east, west, north or south):

- it reaches the maze cell in that direction with a probability of 0.8,
- it reaches the maze cell at its left with a probability of 0.1
- it reaches the maze cell at its right with a probability of 0.1.

a) Define as precisely as possible the MDP representing the maze.
b) Which of the algorithms seen in class can be applied the most successfully to compute the policy of the agent ? Why ?