



VI51: Virtual Life Simulation - Final Exam P2014

Duration: 2h.

No document nor calculator nor smart phone nor touchpad allowed.

English recommended, French accepted.

Malus of 1 point for dirty sheets.

Each part must be made on separated sheets.

Part 1: Markov Models

Question 1.1: (2 pts)

Give the mathematical formalization of the Markov models seen in lectures.

Question 1.2: (2 pts)

Particle filtering algorithms are considered to be a good solution to tackle with the computational cost issue. Explain how they work?

Exercise 1.3: (4 pts)

Consider an HMM representation of a coin tossing experiment. Assume a 3-state model corresponding to 3 different coins with the following probabilities:

	Coin 1	Coin 2	Coin 3
P(H)	0.5	0.75	0.25
P(T)	0.5	0.25	0.75

and with all state transition probabilities equal to $1/3$. (Assume initial state probabilities of $1/3$).

We observe the sequence O: HHHHTHTTT.

Question 1.3.1:

The most likely state sequence is the one for which the probability of each individual observation is maximum. Finds this sequence and gives the probability of $P(O,S)$, S being the found state sequence.

Question 1.3.2:

What Viterbi's algorithm is supposed to compute? Apply it to the observation sequence O. Compares the obtained state sequence to the one computed in the previous question.

Part 2: Simulator

Question 2.1: (1 pts)

Agents may interact together by stigmergy. What is stigmergy?

Question 2.2: (1 pts)

What is the difference between an influence and an action?

Question 2.3: (2 pts)

Considering a collection of agents that inhabit in the simulation, what are the two major methods for *executing* them inside the simulator? Give a brief explanation.

Exercise 2.4:

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

Question 2.4.1: (1 pts)

Give the list of the actions associated to each of the concepts above.

Question 2.4.2: (1 pts)

Give the names of the motion behavior(s) associated to each of the actions above.

Question 2.4.3: (2 pts)

You must provide the state machine for an artificial intelligence. What are the states to consider in this state machine?

Question 2.4.4: (4 pts)

Give the complete state machine of an artificial intelligence.