Assigned: 5.04.2016 Due: 23 May 2016	KRR Written Assignment PROJECT - A Multi-Agent System

Multi-agent Mars Explorer

Consider a variant of the Mars Explorer scenario that was presented by L Steels.
There is a team of exploring/search agents on Mars having as goals to explore the planet, to collect samples of precious rock, and to carry the samples at a base ship.

The location of the samples is not known in advance. No map of the area is available and the agents have insufficient space to store one. Moreover, agents are limited in the amount of sample they can carry at a given time.

The base ship broadcasts radio signal which weakens with distance. Thus, an agent knows how to return to the base and how far away it is from it.
There is no direct communication between the agents or between an agent and the base ship.
An agent has a limited set of sensors:

- a sensor for detecting precious rock, operating at close range
- a sensor notifying the agent if an another agent or an obstacle is near by
- a sensor that detects if the agent is at the base ship
- a sensor that detects that it is full (the storing capacity has been exhausted, in this case the agent has to go to base and unload)

The agents can do the following:

- Can move on the planet in search for samples or returning to base
- Can avoid obstacles and other agents
- Are able to gather precious rock, once the rock is found
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- Unload rock when at base

Part I:

a) Propose, describe and implement a reactive agent model to solve the problem having as goal a collaborative best solution measured in terms of amount of rock collected versus time.
An interface where the agents movements can be observed is required.
b) How is the efficiency of the system impacted by the number of agents? Can more agents collect more samples?
c) Is there a limit in the number of agents from which there is no evident increase in efficiency? Support your answers by performing experiments.

Part II: We introduce in the system a second kind of agents, carrier agents, which are agents capable of collecting the samples discovered and dug by the search agents, and carry them to the base. The capacity of carrier agents is unlimited.
The carrier agents are cognitive agents able to exchange messages with the base and with search agents (search agents are to be modified accordingly), move to a specific location following the signal sent by search agents, and draw a map of the territory if necessary.

a) Propose, describe and implement a cognitive agent model of carrier agents, which, together with the search agents, solve the problem having as goal a collaborative best solution measured in terms of amount of rock collected versus time.
An interface where the movements of both types of agents can be observed is required.

You should also define the messages and associated protocol between the carrier agents and the ship, and between the carrier agents and the search agents. Keep in mind that the search agents are reactive agents, therefore their capabilities of message exchange and protocol should be kept at a minimum.

b) What is the optimal ratio of search agents versus carrier agents?

Part III: Describe your design decision, your implementation and the obtained results in a report having the following structure:

- Introduction and problem presentation
- Design decisions and implementation solutions for Part I. Indicate each design decision, each restriction (if any) or hypothesis you have used. Describe the representation of the environment.
- Design decisions and implementation solutions for Part II. Indicate each design decision, each restriction (if any) or hypothesis you have used.
- Reports and interpretations of results for both Part I and Part II
- Proposals for improvements

You can implement the system in Java, C, C++, Jade, Lisp, Scheme or Prolog. You must indicate in your report the language and the platform used.

You must upload in Moodle an archive with the code to solve the problem and instructions on how to run the code, the document containing Part III, which must also include obtained results. Each student will be asked questions about the design decisions, obtained results and code.

You should not copy code from books, Web sites, colleagues. The solution must be yours!