

COMP310 Multi Agent Systems

Exercises for Video Set 5 - Example Solutions

1. Explain the difference between *self-interested* agents and *benevolent* agents, and discuss how these can affect the task of designing the system.

A benevolent agent is an agent who is essentially a “good guy” and is willing to help other agents to achieve their goals. A self interested agent is only wanting to work towards their own goals, who will only do things that benefit them; they are selfish.

If all agents and the system are “owned” by the same creator, the agents are more likely to be benevolent – this also simplifies the system design, as cooperation between agents is more likely and there will be less likelihood of bad and unexpected environmental changes to take into account, when the agents are executing the agent control loop.

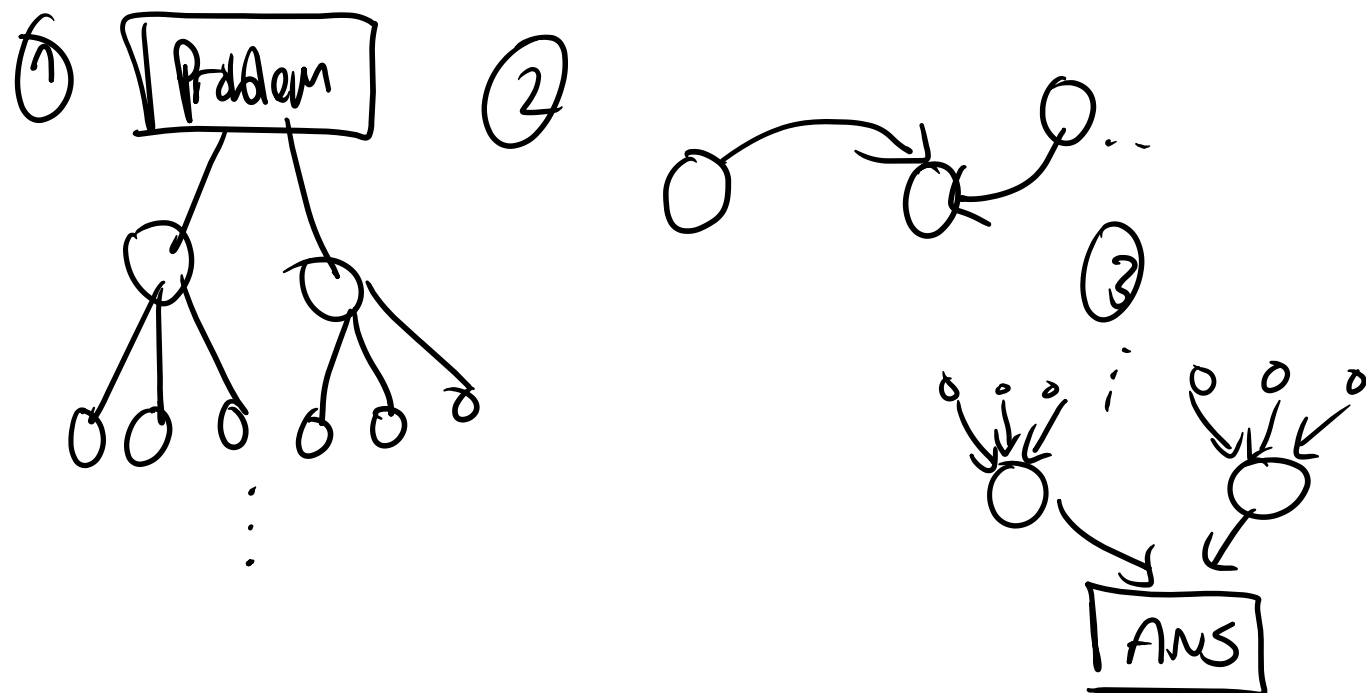
If there are self interested agents in the system, then they may be adversarial towards other agents and they may not be as cooperative. This complicates the system design, as it may become harder to develop meaningful coordination, and strategic behaviour may be required.

2. Explain the concept of *Cooperative Distributed Problem Solving*, including the different components of CDPS, and reasons why it is useful.

Cdps is the process of multiple sophisticated problem solving entities (agents) pooling their resources and working together to solve a problem. This may be because the single agent is unable to solve it by themselves (and therefore needs help), or maybe because the quality of the solution can be increased when multiple agents work on the problem.

There are three components to CDPS:

- 1) Problem decomposition- This is where the larger problem is decomposed into smaller sub-problems, and may be a recursive process. The challenge here is to know where to stop, and the granularity of the decomposed subtasks is important. The additional challenge is related to which agent(s) actually do the decomposition, and what is the best way to do this and to assign tasks.
- 2) Subproblem Solution – this is where the subproblems (from step 1) are solved, in a particular order that is set out. Agents will share information with each other at this point, in order to solve these subproblems. It may also involve further task decomposition.
- 3) Solution Synthesis – this is where the partial solutions are used to form the solution to the whole problem. As in step 1, the challenges are *how* the partial solutions are to be synthesized and also which agent is going to perform this.



3. Explain what is meant by an *action equality relationship*, and give an example.

An action equality relationship is a form of coordination relationship where the same action is performed in multiple agents' plans. This means that a single agent can perform the action, saving effort (and increasing utility) for the other agents.

An example of this is canal boats going through a set of locks. Two boats enter, and then only one captain has to fill up the lock, thereby saving the other captain some effort.

4. Explain your understanding of *coordination by social laws*.

Social laws are constraints on an agent's behaviour, which prevent particular actions within particular states. This enables agents to regulate their behaviour and to also make predictions about other agent's behaviour.

An offline design of social law coordination will hard-code these constraints in place. A scheme that allows social laws to emerge will allow agents to coordinate their behaviour based on predefined metrics, which then help to produce these constraints.