

# CPSC 567: Foundations of Multi-Agent Systems

## Questions to prepare yourself for the Final

- Name 3 areas related to Multi-Agent Systems in Computer Science.
- Name 3 areas related to Multi-Agent Systems outside of Computer Science.
- Provide the general definition of agent we used in this course.
- Give two examples of more strict definitions proposed in the literature.
- What is the difference between  $g_{Ag}$  and  $f_{Ag}$  and what general problem in MAS is based on this difference?
- What is the action language of an agent?
- Give an example of an unfair agent (with regard to our formal definitions).
- Name 5 paradigms used for modeling agents.
- Given a particular modeling paradigm:
  - discuss the pros and cons of this paradigm
  - and given a description of an agent to model, produce a model according to the paradigm
- Given a task we want to fulfill with an agent model, provide the modelling paradigms best suited for the task.
- Provide the general definition of an agent in a MAS used in this course.
- Provide the general definition of a MAS used in this course.
- Using our definitions, what is the behavior of an agent in a MAS?
- Using our definitions, what is the interaction of agents in a MAS?
- Name 4 dimensions that can be used for describing a MAS.
- Given two MAS as descriptions using the dimensions for describing MAS provided by two different persons, can you provide an objective comparison of these two systems? Justify your answer!
- What is an organization?
- Given a textual description of an organization, provide a description of it using our definition.
- Given a description of an organization and an agent in this organization is given some information, what other agents will end up with this information (according to the organization structure)?
- Define Cooperative Problem Solving!
- What is wrong with the following definition of Cooperative Problem Solving?
  - a) Definition, creation and distribution of subtasks decomposing the given task
  - b) Working on (or solving of) the subtasks by the assigned agents
  - c) Synthesis of the achieved resultsa)-c) repeated until a satisfying solution to the given task is found.
- Name the two basic principles how computers communicate with each other.
- A multicast is a communication of one agent with  $n$  out of  $m$  agents. How can a multicast be realized in a MAS using shared memory? What problems are occurring, if we need multicast for several different groups of  $n$  agents out of the total of  $m$ ?
- What are the problems of communication using shared memory?
- What are the problems of communication by message passing?

- Name 6 general cooperation concepts.
- Given a task for a MAS and a particular cooperation concept, provide a realization of the task using the cooperation concept.
- Given a general cooperation concept, name the advantages of this concept.
- Given a general cooperation concept, name the disadvantages/problems of it.
- For cooperation by making selected information available to others, provide a scenario in which it cannot be used (and explain why it cannot be used).
- If we want to use voting as cooperation concept and use as decision scheme that an alternative requires absolute majority to be selected, how many votes do we have to do?
- Describe the procedure of a particular auction type.
- Why is an English Auction not a good auction to be used for distributing resources between agents?
- Provide an example MAS based on the contract-net protocol that shows that the contract-net protocol does not guarantee to produce globally optimal job assignments to agents.
- Given a MAS based on the FA/C approach, conflict resolution strategies of the agents and a conflict situation, what will be the compromise the MAS will reach?
- Given an organization utilizing Craig's extension of blackboards, how many communications are necessary in this organization for a message from one specific agent to reach another specific agent?
- Name 4 general problems we have to face in competitive environments!
- What is the rationality assumption?
- Given a payoff matrix, what are the Nash Equilibria of this matrix?
- Given a payoff matrix, what would be the optimal solution (i.e. the optimal behavior by the agents) for society?
- Given an environment in which several agents are acting and an abuse of the current environment, suggest minimal changes to the environment to prevent this particular abuse (while keeping indicated properties of the current environment).
- Provide an example for a cheating opportunity in the delivery men scenario.
- What did Rosenschein and Zlotkin propose to make cheating in the delivery men scenario useless?
- What is semi-cooperative search?
- What agents are involved in a stakeholder search?
- Who provides the scheme for a stakeholder search?
- What is a stakeholder agent given from the chair agent?
- Name 3 tasks that the tactics of a stakeholder agent have to define.
- What is the basic idea of coalitions?
- What are the basic problems to solve with regard to coalitions?
- Given an advanced operation on coalitions (in a graphical format), describe how this operation can be achieved using only the primitive operations (also graphically).
- What are the basic possibilities for controlling a coalition?
- What are the components of Langley's basic learning model?
- Using Langley's basic learning model, characterize an on-line learning agent.
- Name 4 different learn methodologies.
- Name the two ways how a teacher can interact with a pupil with regard to feedback.
- What is the credit assignment problem in learning behavior for one agent?
- What is abduction?

- What are the possible goals for learning in MAS?
- Describe the most appropriate agent architecture for using reinforcement learning.
- Describe the steps in the basic cycle of the DFG algorithm (on a high-level).
- Why does the calculation of a bid in the DFG algorithm include a random factor?
- When modifying the evaluation of an organization in the DFG algorithm, what is the effect of having a  $* E_i^j > R^{\text{extern}}$ ?
- When forming a new organization in the DFG algorithm out of two organizations  $U_i$  and  $U_j$  (with evaluations  $E_i^m$  and  $E_j^m$  for situation  $S_m$ ), the evaluation of the new organization is set to some predefined base value. What is the problem with setting the evaluation of the new organisation to  $E_i^m + E_j^m$ ?
- What are the steps in the main loop of an evolutionary algorithm?
- What is a Pursuit Game?
- Name 4 aspects that can be varied in Pursuit Games to produce different variants.
- How does a situation in OLEMAS look like?
- What is an individual in the off-line version of OLEMAS?
- How does OLEMAS define the fitness of an individual?
- How is the special action “learn” realized in OLEMAS?
- What is the best way in OLEMAS to get a model of another agent?
- What does OLEMAS do, if it replaces an agent in a successful team by another agent that is very different (from the old agent)?
- How does the crossover in OLEMAS with a seed strategy work?
- What types of agents are used in MARS?
- Name 3 status variables of a situation of a shipping company agent in MARS.
- Name 4 elements of  $\text{Act}_{\text{own}}$  of a truck in MARS.
- Who can a truck in MARS communicate with?
- What is the difference between the contract-net protocol and the extended contract-net protocol in MARS?
- How can a truck that cannot fit in another job into its tour, nevertheless participate in simulated trading in MARS?
- Name 4 elements of a user’s personal information space.
- What types of agents are used in ILTIS?
- Name 3 actions in  $\text{Act}_{C_0}$  of the BB control agent in ILTIS.
- What is a work slip in ILTIS?
- What problem with regard to processing agents does ILTIS have?
- Answer questions about the ARES assignment.