# Agent-Based Systems Tutorial Exercises

Semester 2, 2016/17 session

### Week 2 tutorial

**T1** Refine the definition of your application scenario, identifying who is designing the application, who will use it in what kind of context of use, how it will be deployed and maintained. Where you need to make decisions between different alternatives, discuss suitable options and provide reasoned arguments for your final choices.

**T2** Define the main components of your system:

(a) What are the agents, and who do they represent?

(b) Are they simulating behaviour or solving a computational problem?

(c) What core functionality has to be designed to achieve the desired behaviour?

(d) What is the environment they operate in, and what are its properties?

**T3** Define the level of autonomy of the agents you design with respect to human stakeholders, other agents, and the environment.

**T4** Sketch the design of a small fragment of your system using the models of abstract architectures we have discussed.

### Week 3 tutorial

**T5** Discuss how you would go about designing the individual agents in your system. How many different types of agents will there be? What information do you need to flesh out their design, and how could you obtain it?

**T6** Outline an example reasoning and decision-making situation an agent in your system might have to deal with. Describe what information they could perceive, what actions they could take, and what factors they should consider to make that decision. What informational or algorithmic problems need to be solved for such reasoning and decision making to be implemented in an artificial agent?

**T7** Using logical notation, specify a small number of rules that could be used to represent the knowledge the agent has, such that inference over these rules would enable it to make action decisions, assuming that the agent was designed using a deductive reasoning architecture.

**T8** Define some beliefs, desires, and intentions your agents might have if they were designed using a BDI architecture. Give concrete examples of

- a belief revision that might occur in this system,
- a rule for adopting a specific intention,
- a plan that could be used to achieve an intention, and
- a possible intention reconsideration heuristic.

## Week 4 tutorial

**T09** Discuss the use of different types of agent architectures for your system, and explain which one(s) you would prefer to use, providing appropriate justifications. If there are several types of agents in your system, you may have to distinguish between different architectures for each of them.

**T10** Sketch the design of suitable communication mechanisms for the agents in your system, specifying

- what the elements of an appropriate domain ontology would be for your domain,
- what kinds of speech acts you would need,
- which types of protocols these would be embedded in, and
- how you would integrate these communication mechanisms with your general agent designs.

**T11** Pick an agent in your application and contrast a reactive versus a deliberative design for this type of agent. How easy or hard would it be, in the case of your specific agent, to combine both types of architectures in an implementation?

**T12** Formally define the semantics of a specific speech act you might want to use in your system. What assumptions would you have to make to ensure it is used and intepreted appropriately by the agents in your system?

## Week 5 tutorial

**T13** Out of the coordination methods discussed in the lectures, what would be the most relevant ones for your system? For one of these methods and their use in your system, flesh out how this could be implemented, identifying key processes, interactions, and results, and describing how this would fit into the broader design of your system.

**T14** Choose an exemplary interaction from your system and model it formally as a normal-form game using suitable strategy sets and utilities. Discuss whether this is a suitable way of modelling part of your system in terms of either deriving appropriate solutions to guide agent behaviour, facilitating further design and implementation, or better understanding the system.

**T15** Pick a key interaction situation among agents in your system. If it is cooperative, model it, as precisely as you can, using the different stages of the teamwork-based model of coordination. If it is competitive, discuss how opponent modelling might be used to enable your agents to reason about each other, and how they could use such reasoning to guide their behaviour.

**T16** This week, you will submit a preliminary version of your coursework for feedback purposes. Write a paragraph describing what specific feedback you would like to obtain for this, and email it to the course lecturer.

### Week 6 tutorial

**T17** You should have received feedback on your intermediate submission. Read it carefully and write down any comments you have on the feedback, or questions you may have.

**T18** Exchange your submission and the feedback with your neighbour, and attempt to answer their queries. Discuss your observations with your neighbour.

**T19** Pick a part of your system where either a social choice or a coalition formation method could be applied, and attempt to formalise it using the models introduced for these methods in the lectures. The former can be used in any situation where an agreed decision needs to be made, the latter in any situation where agents have to collaborate in some way.

**T20** Critically evaluate how suitable the use of each of these two methods is for your application. You may consider the complexity of running the mechanism, the suitability and importance of the solution guarantees the provide in your system, and compare to other methods that you might find more suitable.

### Week 7 tutorial

**T21** In the lectures, we have discussed five methods for multiagent decision making: voting, coalition formation, auctions, bargaining, and argumentation. Based on reasoned arguments, discuss which two of them would be most suitable for use in your system.

**T22** For each of the two methods you have selected, specify how you would use it specifically in your system, giving a concrete example that maps their formal models to your application domain.

**T23** Over the course of previous tutorials and this tutorial, you have selected agent architectures, coordination mechanisms, and multiagent decision mechanisms for your system. Outline a high-level overall design of the system that integrates all these elements.

**T24** Exchange your description with your neighbour. Try to identify gaps in their design, and formulate at least three questions for them to clarify points that may be unclear?

### Week 8 tutorial

**T25** Give a three-minute oral presentation about your system, following the structure of the coursework questions.

**T26** During presentations by other students, write down any feedback for them you have to help them improve their solution, and pass it on to them at the end of the presentation.

**T27** Write a paragraph specifying what feedback you would like to obtain on your final coursework submission, and email it to the course lecturer.