

Central themes and questions in TEK5010 MAS 2023

Theme 0: General concepts in multiagent systems

Game theory topics:

Theme 1: Non-cooperative game theory

Theme 2: Voting

Theme 3: Cooperative game theory

Theme 4: Auctions

Theme 5: Bargaining

Theme 6: Arguing

Swarm intelligence topics:

Theme 7: Classical swarm intelligence

Theme 8: Response threshold

Theme 9: Swarm robotics 1

Theme 10: Swarm robotics 2

Theme 0: General concepts in multiagent systems

Question 1: Could you describe an agent?

Question 2: What is a multiagent system?

Question 3: What do we mean by emergence in SI?

Question 4: What is stigmergy?

Theme 1: Non-cooperative game theory

Question 1: Could you classify the different types of game theory?

Question 2: Explain what we mean by self-interested agents

Question 3: How do we model utility?

- a) Name a few properties of the preference orderings
- b) Discuss the relation between utility and money

Question 4: What do we mean by strategic interaction?

Question 5: Could you name a few solution concepts for solving a 2x2 game on strategic form?

Question 6: Could you explain the Prisoner's Dilemma?

- a) Why is it a dilemma?
- b) Name a few important real-world PDs

Question 7: How does repeating the PD game affect the outcome?

Question 8: What do we mean by competitive games and zero-sum games?

Theme 2: Voting

Question 1: Explain what we mean by social choice theory

Question 2: Explain Plurality voting, its strengths and weaknesses

Question 3: Explain Simple majority voting, its strengths and weaknesses

Question 4: Explain Sequential majority election, its strengths and weaknesses

Question 5: Explain the Borda count

Question 6: Explain the majority graph

a) What is a possible winner?

b) What is a Condorcet winner?

Question 7: Explain the Slater rule

Question 8: Explain dictatorship

Question 9: What does Arrow's theorem say?

Question 10: What is Condorcet's paradox?

Question 11: What do we mean by tactical voting and strategic manipulation?

Question 12: Could you give an interpretation of the Gibbard-Satterthwaite theorem?

Question 13: Why could the Second-order Copeland be an advantageous election scheme in terms of strategic manipulation?

Theme 3: Cooperative game theory

Question 1: Classify the different types of game theory

Question 2: Explain what we mean by cooperative game theory, especially in relation to non-cooperative game theory

Question 3: Describe and explain the formal description of a cooperative game

Question 4: What is the core?

Question 5: In relation to cooperative games, what is the Shapley value?

Question 6: Explain marginal contribution net

Question 7: Explain the induced subgraph

Question 8: What are simple games?

Question 9: What are weighted voting games?

Question 10: What is coalitional structure formation?

Theme 4: Auctions

Question 1: What are auctions?

- a) In what way are auctions thought to be efficient?
- b) What two main types of auctions are there?

Question 2: Explain the English auction and motivate optimal strategy

Question 3: Explain the Dutch auction

Question 4: Explain the first-price, sealed-bid auction and motivate optimal strategy

Question 5: Explain the Vickrey auction and motivate optimal strategy

Question 6: What is winner's curse?

Question 7: What do we mean by combinatorial auctions?

- a) How do we solve this combinatorial problem?
- b) How do we represent complex bids?

Question 8: Explain the VCG-mechanism

Theme 5: Bargaining

Question 1: Explain what we mean by bargaining

Question 2: What is the conflict deal?

Question 3: Explain the alternating offer bargaining model, assuming some simplifying assumptions.

Question 4: Explain the ultimatum game

- a) What is the Nash equilibrium in one-shot ultimatum?
- b) What is the Nash equilibrium in two-shot ultimatum?
- c) What is the Nash equilibrium in unlimited round ultimatum?

Question 5: What happens when the players get impatient in the ultimatum game?

- a) What is the Nash equilibrium in impatient one-shot ultimatum?
- b) What is the Nash equilibrium in impatient two-shot ultimatum?
- c) What is the Nash equilibrium in impatient unlimited round ultimatum?

Question 6: Explain the negotiation decision function as shown in the figure 15.3

Question 7: Explain the bargaining for task allocation in relation to figure 15.4

- a) Describe the monotonic concession protocol
- b) Describe the Zeuthen strategy

Question 8: What is the basis for many-to-many negotiations of exchanging already endowed goods?

Theme 6: Arguing

Question 1: What is arguing?

Question 2: What different modes of arguing exist?

Question 3: What types of argumentation system exist?

Question 4: Could you explain a Dung style argumentation system?

Question 5: Which arguments to accept in a Dung style argumentation system?

Question 6: Which arguments to choose if multiple preferred extensions?

Question 7: Could you describe deductive argumentation?

a) What is a rebuttal and an undercut?

Theme 7: Classical swarm intelligence

Question 1: Explain the binary bridge experiment

Question 2: Explain the Ant Colony Optimization metaheuristic algorithm

a) What type of problems are ACO especially applicable to? Could you name one?

Question 3: Explain the pheromone update rule in AS

Question 4: Explain the transition rule (the probability of going to node j) in AS

Question 5: Explain the Canonical Particle Swarm Optimization metaheuristic algorithm

a) What type of problems are PSO especially applicable to?

Question 6: What is taxis?

a) Could you explain how taxis could be an inspiration for swarm robotics?

Question 7: What is Artificial Potential Field?

Theme 8: Response threshold

Question 1: Could you explain the inspiration behind response thresholds in task allocation?

Question 2: How do we model response thresholds in task allocation?

Question 3: Could you describe and explain the stimulus dynamics (assuming one task)?

Question 4: Could you describe and explain the transition probabilities (assuming one task)?

Question 5: How would you alter this transition dynamics (continuous-time) to allow for more than one task?

Question 6: How would you alter this transition dynamics (continuous-time) to account for specialization through learning?

Theme 9: Swarm robotics 1

Question 1: What is swarm robotics?

Question 2: Could you characterize swarm performance as a function of robots?

a) What processes affect performance in the inference region?

b) Could you model this general swarm performance using the USL?

Question 3: Could you explain swarm modelling as a series of mappings?

Question 4: When is it appropriate to use rate equations for modelling swarm dynamics?

Question 5: Could you explain the Langevin equation?

Question 6: Could you explain the Fokker-Planck equation?

Theme 10: Swarm robotics 2

Question 1: Could you explain the voter model for decision-making in a swarm system?

Question 2: Could you explain the majority rule?

Question 3: Could you explain how urn models function?

Question 4: Could you explain the Hegselmann and Krause decision-making model?

Question 5: We want to find the warmest, lightest or most radioactive spot in a search area. Could you name a few types of models for solving this problem?

Question 6: Could you sketch the Beeclust algorithm?

Question 7: Could you explain the Langevin equation in relation to the Beeclust algorithm?

Question 8: Could you explain the Fokker-Planck equation in relation to the Beeclust algorithm?