

NANYANG TECHNOLOGICAL UNIVERSITY
SEMESTER 2 EXAMINATION 2018-2019
CE4046/CZ4046 – INTELLIGENT AGENTS

Apr/May 2019

Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 4 pages.
2. Answer **ALL** questions.
3. This is a closed-book examination.
4. All questions carry equal marks.

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1. (a) The question ‘Isn’t a multi-agent system just a distributed/concurrent system?’ is an objection to the multi-agent system filed. Provide TWO arguments against this objection.
(6 marks)
 - (b) One of the properties that an intelligent agent needs to have is “*social*”. What does this property mean? Which of the five trends in the history of computing has made this property possible?
(6 marks)
 - (c) Agents are different from objects. List FOUR main differences between agents and objects.
(8 marks)
 - (d) What is the main difference between a *purely reactive agent* and a *state-based agent*? Describe a scenario where a state-based agent is beneficial.
(5 marks)

2. A robot can decide whether or not to go to get coffee for its owner. The robot is clumsy, and there is a probability of 0.4 that it will drop the coffee. The robot has sensors to know when it has dropped the coffee. It also has the option to clean up the floor. The utilities of different cases are given in Table Q2 below.

Table Q2

Whether to get coffee	Whether to drop coffee	Whether to clean up	Utility
No	No	No	0
No	No	Yes	20
Yes	No	No	100
Yes	No	Yes	-50
Yes	Yes	No	-100
Yes	Yes	Yes	-50

- (a) What are the three types of nodes in a decision network for this problem? Draw the decision network.
(10 marks)
- (b) If the robot gets coffee and drops it, should it clean up? If the robot gets coffee but does not drop it, should it clean up? If the robot does not get coffee, should it clean up?
(6 marks)
- (c) Should the robot go to get coffee for its owner? Show clearly all the steps of calculation.
(9 marks)
3. (a) The popular online strategy game StarCraft has emerged as an important benchmark for AI. StarCraft is a complicated strategy game that requires players to consider hundreds of options at any given moment, to make strategic choices with payoffs a long way down the road, and to operate in a fast-changing environment with imperfect information. Each player starts with a number of worker units, which gather basic resources to build more units and structures and create new technologies. List and briefly explain a few key ideas in multi-agent systems which can be used to build a successful agent to play StarCraft.
(6 marks)

Note: Question No. 3 continues on Page 3

- (b) In the classic Contract Net protocol, contracts have traditionally been binding. In the leveled commitment Contract Net protocol, the level of commitment is set by decommitting penalties. To be freed from the contract, an agent simply pays its penalty to the other contract party(ies). Explain the potential benefit of using such leveled commitment Contract Net protocol. (5 marks)
- (c) Explain why the first price auction is not truthful. (5 marks)
- (d) Explain the difference between core and Shapley value. (5 marks)
- (e) Explain manipulation in voting. (4 marks)
4. Consider the two payoff matrices 1 and 2 in Table Q4a and Table Q4b respectively. The first number in each entry is the payoff received by the row player A; while the second number is the payoff received by the column player B.

Payoff matrix 1:

Table Q4a

	B: left	B: right
A: up	(-1, 0)	(2, 1)
A: down	(0, 2)	(1, -1)

Payoff matrix 2:

Table Q4b

	B: left	B: right
A: up	(2, -2)	(-1, -1)
A: down	(1, 1)	(-1, 0)

Note: Question No. 4 continues on Page 4

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- (a) Identify the dominant strategies (if any) of each player in these two payoff matrices. Briefly explain your answer.
(5 marks)
- (b) Identify which strategy pairs (if any) in these two payoff matrices are in Nash equilibrium. Briefly explain your answer.
(8 marks)
- (c) Identify which outcomes in these two payoff matrices are Pareto optimal. Briefly explain your answer.
(7 marks)
- (d) Identify which outcomes in these two payoff matrices maximize social welfare. Briefly explain your answer.
(5 marks)

END OF PAPER

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Please read the following instructions carefully:

- 1. Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**
2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.
3. Please write your Matriculation Number on the front of the answer book.
4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.