AI6125: MULTI-AGENT SYSTEM

Assignment #2
Technical Questions

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

NANYANG TECHNOLOGICAL UNIVERSITY

1. (a) The question ‘aren’t agents just expert systems by another name?’ refers to the relationship between agents and expert systems. Describe what an expert system is. List TWO main differences between agents and expert systems.

(7 marks)

(b) Five trends in the history of computing have led the emergence of the field of multiagent systems. One of the trends is *intelligence*. Explain with an example what *intelligence* means.

(4 marks)

(c) Utility functions can be used as a method for telling agents what to do without telling them how to do it. Give two types of utility functions and discuss the challenges faced when designing such functions.

(10 marks)

(d) Two most common types of tasks are *achievement tasks* and *maintenance tasks*. Explain what these two types of tasks are.

(4 marks)

2. You are preparing to go for a bike ride and are trying to decide whether to use your thin road tires or your thicker, knobbier tires. The advantage of the thin road tires is that you can ride much faster. But, you know from previous experience that your road tires are more likely to go flat during a ride. There is a 40% chance your road tires will go flat but only a 10% chance that the thicker tires will go flat. Because of the risk of a flat, you also have to decide whether or not to bring your tools along on the ride (a pump, tire levers and a puncture kit). These tools will weigh you down.

The utilities of different cases are given in Table Q2 below.

Table Q2

Which tire to use	Whether tire goes flat	Whether to bring tools	Utility
Road tire	Yes	Yes	50
Thicker tire	Yes	Yes	40
Road tire	No	Yes	75
Thicker tire	No	Yes	65
Road tire	Yes	No	0
Thicker tire	Yes	No	0
Road tire	No	No	100
Thicker tire	No	No	75

(a) What are the three types of nodes in a decision network for this problem? Draw the decision network.

(10 marks)

(b) What is the optimal decision? What is the expected utility of the optimal decision? Show clearly the detailed steps of deriving your answers.

(15 marks)

3. (a) When building a team of fighter jet agents for fighting with another team of fighter jet agents, what are the additional issues we have to consider compared with designing a single fighter jet agent?

(10 marks)

(b) Briefly describe the five stages included in the CONTRACT NET protocol.

(5 marks)

(c) Anyone who wishes to register a new vehicle in Singapore must first obtain a Certificate of Entitlement (COE). COEs are bid through the COE Open Bidding System. The number of successful bidders is limited by the COEs available for each particular COE category. Each successful bidder pays the price of the highest unsuccessful bid. Assume that each bidder wants only one COE. Is the biding mechanism truthful? Explain why.

(10 marks)

4. Consider the two payoff matrices A and B in Table Q4a and Table Q4b respectively. The first number in each entry is the payoff received by the row player *i*; while the second number is the payoff received by the column player *j*.

Payoff matrix A:

Table Q4a

	***j* defect**	***j* cooperate**
***i* defect**	**(7, 7)**	**(6, 7)**
***i* cooperate**	**(7, 7)**	**(7, 8)**

Payoff matrix B:

Table Q4b

	***j* defect**	***j* cooperate**
***i* defect**	**(2, 3)**	**(3, 3)**
***i* cooperate**	**(1, 5)**	**(4, 2)**

(a) Identify which strategy pairs (if any) in these two payoff matrices are in dominant strategy equilibrium. 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)

Deadline

Submit the assignment as either a PDF or Microsoft Word file with the file name "AI6125-Assignment-2-YOUR NAME" via the submission link at NTULearn.

The due date of the assignment is: **Sunday, April 4, 2021, 11:59:59PM**

Note that **THREE (3)** marks will be deducted for the delay submission of each calendar day.