西交利物浦大學
Xi'an Jiaotong-Liverpool University

PAPER CODE	EXAMINER	DEPARTMENT	TEL
CPT302	K.L. Man	CPT	1509

2nd SEMESTER 2021/2022 - Assessment Task II (10%)
BACHELOR DEGREE - Year 4
MULTIAGENT SYSTEMS

INSTRUCTIONS TO STUDENTS

1. **The Assessment should be done individually.**
2. **Total marks available are 100, accounting for 10% of the overall module marks.**
3. **The number in the column on the right indicates the marks for each question.**
4. **Answer all questions.**
5. **Answers should be written in English.**
6. **Relevant and clear steps should be included in your answers.**
7. **Your solutions should be submitted electronically through the Learning Mall via the submission link.**
8. **The naming of Report (in pdf) is as follows: CPT302_CW_003_StudentID.pdf (e.g., CPT302_CW_003_1712345.pdf)**

QUESTION 1. [25 MARKS]

(a) Given the Prisoner's Dilemma: Peter and Tom are collectively charged with a crime and held in separate cells with no way of meeting or communicating. They are told that: (1) if both confess, each will be jailed for X years; (2) if one confesses and the other does not, the confessor will be freed and the other will be jailed for Y years; and (3) if neither confesses, each will be jailed for Z years. Note that X, Y, Z are positive integers. Answer the following questions:

- What is the payoff matrix of the above Prisoner's Dilemma problem?
- Given that Y > X > Z. If Peter considers only his own interest, what will he do?
- Design a payoff matrix for the above Prisoner's Dilemma such that no player has a dominant strategy and justify your answer.

For the following questions, consider the payoffs for agent i and agent j that are shown in separate matrices below with positive integers a, b, c, d such that $b < a < d < c$:

Agent i	i : D	i : C
j : D	a	b
j : C	c	d

Agent j	i : D	i : C
j : D	a	c
j : C	b	d

(b) Identify with justification, if any, the pairs of the above payoff matrices that are in pure strategy Nash equilibrium.

(c) State whether any outcomes of the above payoff matrices are Pareto optimal. Justify your answer.

(d) Identify with justification, if any, the pairs of the above payoff matrices that maximizes the social welfare.

QUESTION 2. [25 MARKS]

For the following questions, consider an election with 3 candidates {Micheal, Nigel, Oliver} and the following preference table (note: A,B,C,D,E and F are positive integers):

Number of votes	A	B	C	D	E	F
1st choice	Oliver	Micheal	Nigel	Micheal	Oliver	Micheal
2nd choice	Nigel	Oliver	Oliver	Oliver	Nigel	Oliver
3rd choice	Micheal	Nigel	Micheal	Nigel	Micheal	Nigel

You are required to show the relevant steps in the exam script about how you have gotten the answers for the following questions.

(a) Justify the values on A,..,F, design an election protocol using a Plurality vote in such a way that the winners are both Oliver and Micheal.

(b) Justify the values on A,..,F, design an election protocol using a Borda count (starting with 1) in such a way that both Oliver and Micheal are NOT the winner.

(c) Given that A > C > F, A=D, B=C and E=F. Find the winner (if any) of the above election using the Method of Pairwise Comparisons.

(d) Given that A > C > F, A=D, B=C and E=F. Draw a majority graph for the above election. With the aid of the majority graph, identify which candidate(s) is/are possible winner(s).

(e) Given that F > C > A, A=D, B=C and E=F. How would the above voters' preferences have to change for Oliver to become a Condorcet winner?

QUESTION 3. [20 MARKS]

Mr. White has three wives, and he is committed to a marriage contract that specifies that they should receive 300, 200 and 100 units respectively, after his death. This implies that, given a total amount of α units left after the Mr. White's death, the three wives can only claim 300, 200, and 100, respectively, out of the α units. If after Mr.White dies, the amount of money left is not enough for this distribution, it is recommended the following:

1. If $\alpha = 100$ is available after the man dies, then each wife gets 100/3 .
2. If $\alpha = 200$ is available after the man dies, wife 1 gets 50, and the other two get 75 each.
3. If $\alpha = 300$ is available after the man dies, wife 1 gets 50, wife 2 gets 100 and wife 3 gets 150.

Model the above-mentioned game as a coalitional game. In your answers, you are required to provide a summary of the following:

- Define the characteristic function of the coalitional game.
- Highlight the important in allocating fair payoffs (to each wife) in the coalitional game (you might consider to achieve this with the use of Shapley value).

QUESTION 4. [10 MARKS]

Statement: Theoretically, second-price sealed-bid auctions have many advantages over other types of auction mechanisms (e.g. English auction and Dutch auction). However, this mechanism is not widely used.

If you think that the above statement is true, show it is true (highlighting the advantages) by means of a simple example. Otherwise, give two reasons to explain why the statement is false.

QUESTION 5. [20 MARKS]

What is meant by the "*Cooperative Distributed Problem Solving (CDPS)*"? With the aid of an example, explain how the *CDPS* works. Outline the key problems that need to be fixed in *CDPS*. In your answers, you are required to give a summary of your example and include the following information:

- Describe precisely the role and functionality of each component in your example.
- Explain how the components cooperate together and how the key problems in your example can be fixed.
- Note: if you present the example of "monitoring aircraft movements" (from Week 11 InClass Exercises) as your example, you will be awarded zero mark for Question 5.

END OF ASSESSMENT PAPER