

Instructions

1. Write your answers neatly in Blue/Black ink. Make sure your answers are legible.
2. If you have to make any assumptions about unspecified things, write them clearly with justification.
3. Write the question number clearly for each answer.
4. There will be partial markings for the questions, so even if you cannot solve the entire problem be sincere with the steps.
5. Be precise.

1. Finding MSNE

(10 marks)

Use any suitable combination of the methods, the Best response function, iterative elimination of actions, and checking the characteristics of MSNE, to find **all possible MSNE** in the following game. Write a complete explanation to show why there do not exist any MSNE other than those you have listed.

	X	Y	Z
P	(4, 2)	(-1, 0)	(0, 1)
Q	(2, 10)	(4, 3)	(3, 8)
R	(3, 6)	(3, 8)	(4, 10)

2. Egalitarian vs utilitarian outcomes

(8 marks)

In the Public facility selection problem, let the set of alternatives be  $\{Hospital, Bank, School\}$  and only three agents who are asked to report their cardinal preferences to the city administration. Does there exist a cardinal preference profile of agents where an egalitarian outcome is also a utilitarian outcome? If yes, show by constructing an example and explaining why the previous statement is valid in that example.

3. Maximin vs Copeland rules

(8 marks)

*Copeland rule:* The Copeland score of a candidate depends on the number of wins in a pairwise election (with ties winning half a point), and the Copeland winner is the candidate who has the highest Copeland score.

*Maximin rule:* The Maximin rule maximizes the minimum lead against other candidates. The Maximin score of a candidate is computed as:  $Maximin\ score(a) = \min_{b \in A} |\{i : a \succ_i b\}|$ , where  $A$  is the set of candidates. The Maximin winner is the candidate with the highest Maximin score.

Both the rules guarantee *Condorcet consistency*, which means that if there exists a candidate that beats all other candidates in a pairwise election, both rules guarantee to choose that

100  
290  
200  
270  
22

DS5618(Aug-Dec 25)

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candidate as the winner.

Construct a preference profile of 4 candidates  $A = \{a, b, c, d\}$  where the winner by the Copeland rule is not the same as that by the Maximin rule. Assume both the rules follow a common tie-breaking rule:  $a \succ b \succ c \succ d$ . Explain your answer briefly.

4. Weak domination and NE

(4 marks)

Construct a game of two players to show that a weakly dominated action can be in a Pure strategy Nash Equilibrium.

END

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