Introduction to Game Theory (Spring-21)	Due on: **5 pm, 13th Feb 2021**
Instructor: *Sujit Prakash Gujar*	Posted on: 2nd Feb 2021

Theory Assignment-1

1 Questions

1. Consider the game with the payoff matrix as given in Table 1. Does it have a dominant strategy equilibrium? Do the players have pure minimax strategies? If yes, what are they? Explain.

	B1	**B2**
A1	-1,1	0,0
A2	3,-3	2,-2
A3	4,-4	-1,1

Table 1: **Pay-off Matrix**

2. Prove that every dominant strategy equilibrium of a two-player zero-sum game is a saddle point of the matrix.

3. For a general strategic form game $\Gamma = \langle N, (S_i)_{i \in N}, (u_i)_{i \in N} \rangle$, prove the following

$$U_i(\sigma_i, \sigma_{-i}) = \Sigma_{s_i \in S_i} \sigma_i(s_i) U_i(s_i, \sigma_i)$$

where $\sigma_i(s_i)$ is the probability with which player i plays strategy s_i, given its mixed strategy σ_i. And $U_i(\sigma_i, \sigma_{-i})$ is the expected utility of player i when it plays s_i while other players play the mixed strategy σ_{-i}.

4. Recall the Robot game (refer, the first lecture slides). Formulate this as a strategic form game along with their utilities in matrix form representation. Does it have any Pure Strategy Nash Equilibrium (PSNE)? If yes, why? Otherwise, prove it.

5. Find out a Mixed Strategy Nash Equilibrium (MSNE) for the game with the payoff matrix given as follows.

	B1	**B2**
A1	5,3	3,4
A2	4,5	4,3

Table 2: **Pay-off Matrix**

2 Submission Instructions

Submit a scanned copy of handwritten answers in a single PDF named $< rollnumber >$.pdf.