1. Choose True/False for the following statements. $1 \times 5 = 5$

   (a) Consider three strategies s_i, s_i', and s_i'' of a player i. Also, i) s_i weakly dominates s_i' and ii) s_i' weakly dominates s_i'' then it is possible that s_i'' weakly dominates s_i.

   (b) A player with m number of strategies has either 0 or 1 number of strongly dominant strategy.

   (c) A PSNE is always a dominant strategy equilibrium.

   (d) At Pure Strategy Nash Equilibrium (PSNE), a player may not find optimal payoff.

   (e) A player does not have any benefit of unilaterally moving to some other strategy from her PSNE strategy.

2. Consider the following instance of the Prisoner's Dilemma problem.

		Player-2	
		C	NC
Player-1	C	$(-x, -x)$	$(-x, -3)$
	NC	$(-3, -x)$	$(-6, -6)$

   Find the value of x for which

   i) The profile (C, C) is a strongly dominant strategy equilibrium. 1

   ii) The profile (C, C) is a weakly dominant strategy equilibrium, but not a strongly dominant strategy equilibrium 2

3. Find the PSNE, maxmin values and maxmin strategies for the following game.

		Player-2		
		X	Y	Z
Player-1	A	(6, 6)	(8, 20)	(0, 8)
	B	(10, 0)	(5, 5)	(2, 8)
	C	(8, 0)	(20, 0)	(4, 4)

   Answer the following for the above game:

   i) Find the PSNE. 2

   ii) Find the maxmin value (or values). 1

   iii) Find the maxmin strategy (or strategies). 1

See next page

4. In First Bid Auction, there is no strongly dominant strategy for any player. Give reason. 2

5. Compute PSNE for the two person game with $S_1 = \{0, 1\}$ and $S_2 = \{3, 4\}$ with the following utility functions: 2

$$u_1(x, y) = -u_2(x, y) \ = \mid x - y \mid \quad \forall (x, y) \in \{0, 1\} \times \{3, 4\}$$

6. Consider a game with n players. The mapping $b_i : S_{-i} \mapsto 2^{S_i}$ is the best response conrrespondence for player i. If $b_i(s_{-i}) \neq \emptyset \ \ \forall s_{-i} \in S_{-i}$, there may not exist a PSNE of the game. Give reason. 2

7. In auction-based multi-robot routing discussed in the class, suppose the team objective of n robots is

$$\min_{\mathcal{A}} f(g(r_1, \mathcal{A}_1), \ldots, g(r_n, A_n))$$

where f and g are the performance meansures of the team and individual robot respectively, $\mathcal{A} = \{A_1, \ldots, A_n\}$ is a partition of the set of targets. Let $(S_1, \ldots, S_n)$ be the current allocation of targets to the robots. Now, if an unallocated target t appears, what bid value should robot r bid on target t ? Give the general mathematical expression only. 2