Solving Normal-Form Games

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Previously ... on multi-agent systems (tutorials and lectures).

1. Formal definition of a game $\mathcal{G} = (\mathcal{N}, \mathcal{A}, u)$
   - $\mathcal{N}$ – a set of players
   - $\mathcal{A}$ – a set of actions
   - u – outcome for each combination of actions
2. Pure and mixed strategies
3. Nash equilibrium, computation
4. other equilibria

Task 1: Prove the following corollary.

Corollary

Let $s \in \mathcal{S}$ be a Nash equilibrium and $a_i, a_i' \in \mathcal{A}_i$ are actions from the support of s_i. Now, $u_i(a_i, s_{-i}) = u_i(a_i', s_{-i})$.

Task 2: Construct an LP for the following zero-sum normal-form game (the row player is maximizing the utility, the column player is minimizing).

	L	**M**	**R**
U	3	4	-1
C	1	2	0
D	0	-1	1

Task 3: A *mixed-integer linear program (MILP)* is a linear program that includes integer variables. Formulate the problem of computing a NE in a general-sum game as a MILP.

Task 4: Either construct the following game or show that such a game cannot exist: Find a game with 2 actions (pure strategies) for each player such that 1) there are exactly 2 pure Nash equilibria and 2) there is no fully mixed NE (that randomizes over more than 1 pure strategy for a player).

Task 5: Either prove the following statement or give a counterexample: Every convex combination of two different NE is a Correlated equilibrium.

Task 6: Find a Correlated equilibrium that is not a convex combination of NE.