# DF - Game theory

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| **What is the definition for zero-sum games?** | For each pair of strategies (1) X’s gains + Y’s gains = 0 (1). |
| **What is a play-safe strategy?** | A strategy that gives best guaranteed outcome regardless of what the opponent does. |
| **What is a pure strategy?** | When both players play their play-safe strategy every time **THUS** minimising potential losses for each player. |
| **What is the value of a game to a player?** | The payoff to the player if they use their best strategy.  *This best strategy may be their play-safe strategy or an optimal mixed strategy.* |
| **How can you show there is no stable solution? If so, what must be done?** | * By showing that the minimax (worst case for A) ≠ maximin (worst case for B).   + Since stable solution exists ⇔ row maximin = col minimax. * Use an optimal mixed strategy where you play each move with some probability.   *This stable solution would mean that neither player can gain by changing their play-safe strategy.* |
| **What should you make sure of when finding an optimal mixed strategy using Simplex?** | * All the entries are positive (as simplex requires all variables to be non-negative). * If they aren’t, add some constant to each entry then subtract this from the value once you’ve found it.   **This is demonstrated below:**      Perform Simplex…    You may want to find the optimal mixed strategy for the other player too. |
| **How should you set up a game theory problem involving Simplex?** | 1. Ensure the value you’re maximising is less than all the probability constants (eg, v ≤ p2 + 2p3). 2. Ensure all probabilities sum to ≤ 1 (you can add a slack variable which will then equal zero). 3. All the variables are ≥ 0 as shown.     *This is because simplex requires us to be working in the positive region of a graph.* |
| **How can you solve m x n zero-sum games?** | 1. Look for a stable solution. If none then mixed strategy. 2. Look for dominance and reduce size. 3. If m x 2 or 2 x n, sketch graphs. Otherwise use LP. |