MATH 337

Games, Networks, and IP

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Course website: http://www.mast.queensu.ca/~math337/index.shtml
Group project

- Title page
- Abstract (250 words)
- Intro
- Methods
- Results
- Discussion
- References

Max 4 pages.
Standard margins/format
Font types same as proposal
Finite-sum games

Ex. Payoff for ABC:

<table>
<thead>
<tr>
<th>ABC</th>
<th>Western</th>
<th>Soap opera</th>
<th>Big Bang Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soap Opera</td>
<td>35</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Big Bang Theory</td>
<td>45</td>
<td>58</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>14</td>
<td>70</td>
</tr>
</tbody>
</table>

Payoff for NBC = 100 - x
Pure & Mixed Strategies

Pure: A complete characterization of how a player (rationally) plays a game

Mixed: Assignment of probabilities to each strategy (probability distribution over all possible strategies).
The Betting Game

Info:

- Player 1 draws a card from a deck (hiding it from player 2).
- Player 1 either decides to:
  - a) pass (discarding card & paying player 2 $1) or
  - b) bet.
- Player 2 (upon a bet) can
  - fold (paying $1 to player 1) or
  - Call (Player 1 reveals the card)
    - $2 is paid to player 1 for a high card (10, J, Q, K, A)
    - $2 is played to player 2 for a low card (2-9)
## Dominating strategies

Payoff matrix:

$$
\begin{bmatrix}
-1 & -1 \\
\frac{8}{13} & \frac{3}{13} \\
\frac{2}{13} & \frac{3}{13} \\
\frac{6}{13} & +1
\end{bmatrix}
$$

Idea: cross out strats that are inferior
Continuous game

Constraint set (feasible region)

- $K_i$ closed convex set of $\mathbb{R}^n$

Payoff function

- $U_i: K \rightarrow \mathbb{R}$

$i^{th}$ player selects $x_i \in K_i$ s.t.

- $U_i(x_1, \ldots, x_{i-1}, x_i, x_{i+1}, \ldots, x_m)$ is a max
Games, MP, VI

\[
\min f(x) \iff \langle \nabla f(x^*), x - x^* \rangle \geq 0 \\
\text{s. t. } x \in \mathbb{K} \forall x \in \mathbb{K}
\]

If \( x^* \) is a nash eqb then

\[
\langle F(x^*), x - x^* \rangle \geq 0
\]

For \( F(x^*) = \langle -\nabla_{x_1} U_1(x), \ldots - \nabla_{x_m} U_m(x) \rangle \)