Concise representations of games

Vincent Conitzer
conitzer@cs.duke.edu

Games with many agents

- How do we represent a (say, simultaneous-move) game with n agents?
- Even with only 2 actions (pure strategies) per player, there are 2^n possible outcomes
  - Impractical to list them all
- Real-world games often have structure that allows us to describe them concisely
- E.g., complete symmetry among players
  - How would we represent such a game?
  - How many numbers (utilities) do we need to specify?
  - For more, see e.g., Brandt et al. 2009, Jiang et al. 2009
- What other structure can we make use of?

Congestion games [Rosenthal 73]

- There is a set of resources R
- Agent i's set of actions (pure strategies) A_i is a subset of 2^R, representing which subsets of resources would meet her needs
  - Note: different agents may need different resources
- There exist cost functions c_r: {1, 2, 3, …} → $\Re$ such that agent i's utility for $a = (a_i, a_{-i})$ is $-\Sigma_{r \text{ in } a_i} c_r(\#(r, a))$
  - #(r, a) is the number of agents that chose r as one of their resources