

Ranking

– Seminar –

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- **Schedule:**

- first meeting: Wednesday, April 18, 2012, 17:45, D 436
- compact seminar?

- **How to get 4 ECTS:**

- presentation of ~ 60 minutes (english) and discussion
- seminar paper in LNCS style
- attendance on a regular and active basis

- **Web:**

- <http://www.inf.uni-konstanz.de/algo/lehre/ss12/seminar/>

- **alternatives, candidates, ...**

$$X = \{x_1, \dots, x_m\}$$

- **agents, voters, ...**

$$A = \{a_1, \dots, a_n\}$$

- **preferences, (ordinal) utilities, rankings, ...**

bijjective function $\pi_i : X \rightarrow \{1, \dots, m\}$ for $a_i \in A$
 $\pi_i(x) < \pi_i(y)$ means “ a_i strictly prefers x over y ”

- **social choice rule, voting rule, ...**

$$F : \Pi^n \rightarrow X : (\pi_1, \dots, \pi_n) \mapsto x_j$$

Social Choice: Winter Olympic Games 2014



119th IOC Session, Guatemala City, July 4, 2007:

- $X = \{ \text{PyeongChang, Sochi} \}$, $\|X\| = 2$
- $A = \{ \text{Tamás Aján, Shahid Ali, Béatrice Allen, ...} \}$, $\|A\| = 95$
- 48 IOC members: $1 = \pi_i(\text{Sochi})$, $2 = \pi_i(\text{PyeongChang})$
47 IOC members: $1 = \pi_i(\text{PyeongChang})$, $2 = \pi_i(\text{Sochi})$
- $F(\pi_1, \dots, \pi_n) = \arg \max_{x \in X} \|A_x\|$ mit $A_x = \{a_i \in A \mid \pi_i(x) = 1\}$,

$$F(\pi_1, \dots, \pi_{95}) = \text{Sochi}$$

Social Choice: Manipulation

Manipulation = strategic voting, i.e., public preference may deviate from private preference

119th IOC Session, Guatemala City, 4. Juli 2007:

- voter $a_i \in A$ having private preference $\pi_i(\text{PyeongChang}) = 1$ should vote for PyeongChang
- voter $a_i \in A$ having private preference $\pi_i(\text{Sochi}) = 1$ should vote for Sochi
- given two alternatives, truthful voting is a dominant strategy

Gibbard-Satterthwaite Theorem:

If $\|X\| \geq 3$ then each (surjective) voting system such that truthful voting is a dominant strategy for each voter is dictatorial.

Ranking by pairwise comparisons:

- 1 V. R. Merlin, D. G. Saari: Copeland Method II: Manipulation, Monotonicity, and Paradoxes. *Journal of Economic Theory*, 72(1):148–172, 1997.
- 2 J. P. Keener: The Perron-Frobenius Theorem and the Ranking of Football Teams. *SIAM Review*, 35(1):80–93, 1993.

Rank aggregation:

- 3 M. Schulze: A New Monotonic and Clone-Independent Single-Winner Election Method. *Voting Matters*, 17:9–19, 2003.
- 4 N. Alon: Ranking Tournaments. *SIAM Journal on Discrete Mathematics*, 20(1):137–142, 2006.

Rank correlation:

- 5 R. Fagin, R. Kumar, D. Sivakumar: Comparing top k lists. *SIAM Journal on Discrete Mathematics*, 17(1):134–160, 2003.

Axioms:

- 6 A. Altman, M. Tennenholtz: Axiomatic Foundations of Ranking Systems. *Journal of Artificial Intelligence Research*, 31:473-495, 2008.

Conjoint measurement:

- 7 D. Bouyssou, M. Pirlot: Conjoint Measurement Tools for MCDM. In: *Multiple Criteria Decision Analysis: State of the Art Surveys*. International Series in Operations Research & Management Science 78, II, pp. 73–112. Springer 2005.
- 8 D. Bouyssou, M. Pirlot: Conjoint Measurement Tools for MCDM. In: *Multiple Criteria Decision Analysis: State of the Art Surveys*. International Series in Operations Research & Management Science 78, II, pp. 73–112. Springer 2005.