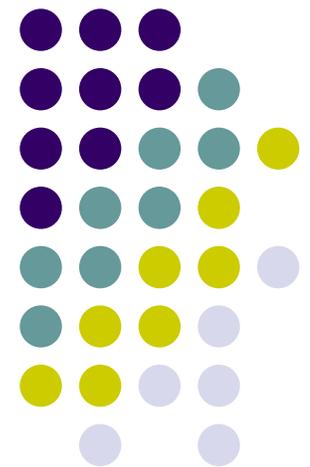


Preference Elicitation

Jaesuk Ahn





Why it is difficult?

- Preference Elicitation: simply ranking a set of objects



AHP (Analytic Hierarchy Process)

- (Example) Three alternatives and three criterion.
- Using pairwise comparison per each criterion

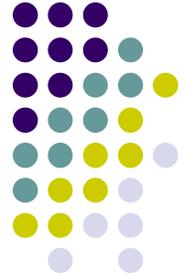
Criterion 1	Alternative 1	Alternative 2	Alternative 3
Alternative 1	1	1/3	2
Alternative 2	3	1	4
Alternative 3	1/2	1/4	1

- Normalize each column

Criterion 1	Alternative 1	Alternative 2	Alternative 3
Alternative 1	0.222	0.211	0.286
Alternative 2	0.667	0.632	0.571
Alternative 3	0.111	0.158	0.143

- Average over the columns

Criterion 1	Average
Alternative 1	0.239
Alternative 2	0.623
Alternative 3	0.137



AHP (Analytic Hierarchy Process)

Criterion	C1	C2	C3	Final
Alternative	0.653	0.291	0.056	
Alt 1	0.239	0.233	0.674	0.261
Alt 2	0.623	0.055	0.101	0.428
Alt 3	0.137	0.713	0.226	0.311

- Solve multi-criteria decision problems



From agent's perspective

- Agents must compute or gather information to determine their values of the items in the auction.
 - It is difficult.
-
- What can help agents to do this kind of task in the auction?



From agent's perspective

- Agents must compute or gather information to determine their values of the items in the auction.
- It is difficult.

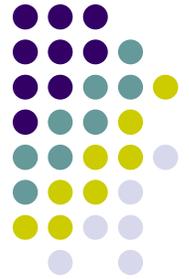
Determining one's valuation for any given package can be hard

Huge number of possible packages to evaluate

Determining one's valuation for any single item against package bidding

- What can help agents to do this kind of task in the auction?

Good estimation of other agents' valuations



Auction design

- Which auction types are best to aid agents' valuation problem in the auction with possible package bidding?
 - Sealed Bid auction? Vickery auction?
Problems? Possible Improvement?
 - Ascending auction (English Auction)?

Multi-round Ascending Auction



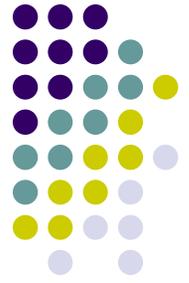
- (Price Discovery) Chance to refine their bid, therefore, auction design allowed participants to bid effectively without exact information about their valuation.
- (Multi-Round Auction) It allows bidders to see the price of all items during the auction. Price-feedback guides bidders to the part of the allocation space on which they are likely to be most competitive, given current bids from other bidders

Ascending Multi-round combinatorial auction



- Information about Provisional Winner (bidding price) is available (price discovery and package refinement)
- Possible coalition among small bidder to avoid threshold problem (auction helps valuation for the small bidder)
 - Goliath placed bid of \$126 on the 4 items. Dave want needs to have only on the these items and can afford to bid up to \$25.
 - Since the end of round, Dave can see price information regarding Goliath. Even though we don't know what's next bid from Goliath, auction mechanism can give Dave an idea of minimum bidding amount for him and his partnering to beat Goliath's current winning bid. (no explicit communication is allowed, though)

Staged (multi-round) second-price bid Auction



- Bidder 1: v_1 [2, 7]
- Bidder 2: $v_2 = 8$
- Bidder 3: $v_3 = [11, 15]$

- Bidder can refine its lower(LB) and upper(UB) bound on value until 1) $LB > \text{ask price}$ or 2) $UB < \text{ask price}$. Bidder bid its LB in the case 1), and leave the auction in the case 2)