Guan-Wun Hao

Mona Prakash

Vote To Go On The Best

Aim: Plan The BEST Vacation!

Step 1: Collect votes from all of you to gather information about individual preferences

Step 2: Analyze votes and pick cities that maximize utilities

Assumptions:

1. All of us travel together
2. No negative votes


London


Prague


Berlin


Paris


Zurich


Venice

Quadratic Voting

- Set of alternatives
- Budget of some number of coins to spend
- Allocate coins to reveal preferences
- N coins spent on an alternative, buys you $\sqrt{N}$ votes for that alternative
  - An additional vote is more expensive than the previous vote, for the same alternative.
- Incorporates true intensity of preferences

Quadratic Voting Example

Voting for or against construction of a bridge

- Total value to you = $1000
- Every vote sways the decision in your favor by 1%
  - Value from an additional vote = 1% of $1000 =$10

	Total Cost	Marginal Cost	Additional Benefit
Buy 1 Vote	$1	$1	$10
Buy 2 Votes	$4	$(4-1)=$3	$10
Buy 3 Votes	$9	$(9-4)=$5	$10
Buy 4 Votes	$16	$(16-9)=$7	$10
Buy 5 Votes	$25	$(25-16)=$9	$10
Buy 6 Votes	$36	$(36-25)=$11	$10

Quadratic Voting

- 6 alternatives
- 100 coins to spend

City	Coins Spent	Votes Casted
London:	10	3.16
Paris:	10	3.16
Prague:	16	4.00
Berlin:	4	2.00
Zurich:	5	2.24
Venice:	5	2.24

Coin Budget Left To Spend: 50

Submit

Quadratic Voting

	Alt1	Alt2	Alt3	Alt4
Vote 1:				
# of coins spent	25	25	49	1
Corresponding votes	5	5	7	1
Vote 2:				
# of coins spent	9	16	36	39
Corresponding votes	3	4	6	6.245

Optimal Outcome: Pick Alt2 and Alt3, giving a total utility of 22

Further Questions: Collusion? Efficiency? Fairness?

Proportional Approval Voting (PAV)

- **Idea**
- **Maximization**
  - get_city{ i in voters, j in cities }
  - Does this voter get at least j cities?
  - If we pick top k cities
  - sum{ i in voters, j in 1..k } 1/j*get_city[i,j]
- **Constraint**
  - The cities this voter gets are at most the ones visited and also he approves of.
  - If a voter gets 2 cities, then he must get at least 1 city.
  - The number of city visited is at most k cities

Proportional Approval Voting (PAV)

Does the voter “like” the city?

	London	Paris	Zurich	Venice
Voter1	1	0	1	1
Voter2	0	1	0	0
Voter3	1	1	0	1

Proportional Approval Voting (PAV)

- If we pick 3 cities…
- The optimal choice would be
  - London
  - Paris
  - Venice

Proportional Approval Voting (PAV)

- Let’s make the problem more interesting!!
- If there is a time budget and a matrix of distance constraints
  - Visit as many cities as possible under the constraint

Proportional Approval Voting (PAV)

- Time Budget: 6
- Distance Constraint

	London	Paris	Zurich	Venice
London	-	1	3	4
Paris	1	-	2	3
Zurich	3	2	-	1
Venice	4	3	1	-

Proportional Approval Voting (PAV)

- The optimal choice would be
  - London
  - Paris
  - Zurich
- The optimal tour is
  - We depart from RDU
  - Starting the tour and leaving Europe at London
  - London -> Zurich -> Paris -> London

We will send out a survey to collect your votes by the end of the week, PLEASE fill it out as soon as you can.

Your participation is integral to our success! We really appreciate your help :)