Fairness in Long-Term Participatory Budgeting

Normative requirements for participatory budgeting processes spanning several years

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Model and Fairness Theory

Instance
Sequence of budgeting problems

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Solution
Sequence of feasible budget allocations

Welfare Measures for type t at round k

Satisfaction

$$\frac{1}{|t|}\sum_{i\in t}\sum_{j\le k} c(A_j(i)\cap\pi_j)$$

Relative satisfaction

$$\frac{1}{|t|}\sum_{i\in t}\sum_{j\le k}\frac{c(A_j(i)\cap\pi_j)}{c(A_j(i))}$$

Share

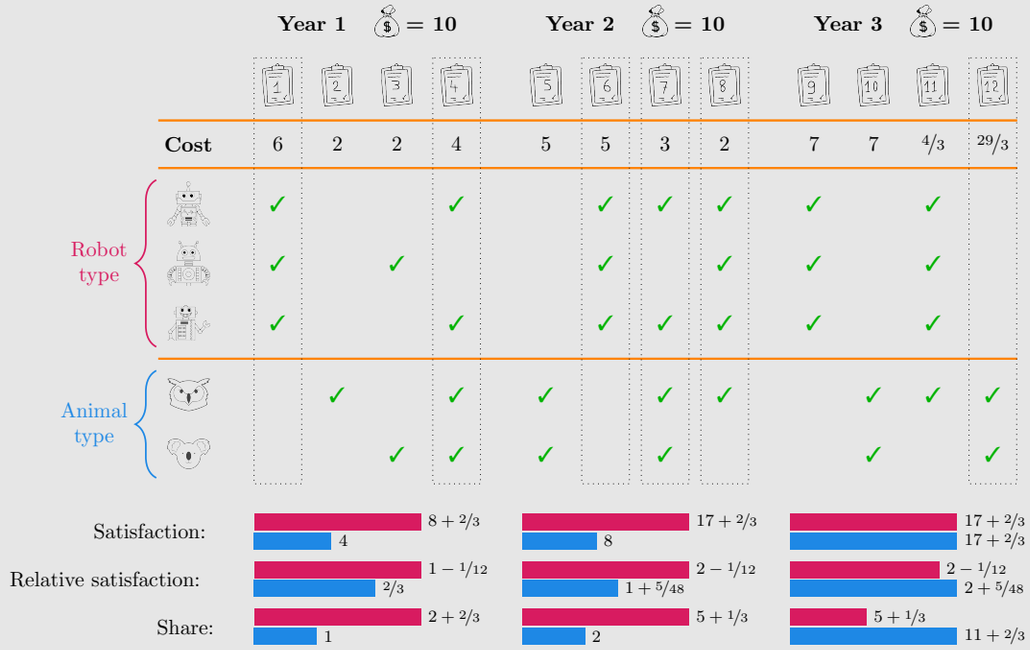
$$\frac{1}{|t|}\sum_{i\in t}\sum_{j\le k}\sum_{p\in\pi_j}\frac{c(p)}{|\{i' \mid p\in A_j(i')\}|}$$

Fairness Criteria for a given solution and a welfare measure F

Equal-F
All types should enjoy the same welfare for specific rounds

F-Gini-optimal
The distribution of welfare among the types should be Gini-optimal.

Convergence to equal-F
If the instance were infinite, the solution should converge towards equal-F



Results

Achieving equal-F at round k

Satisfaction: ✗
Relative Satisfaction: ✗
Share: ✗
NP-complete

Picking a Gini-opti. solution at round k

Satisfaction: ✓
Relative Satisfaction: ✓
Share: ✓
co-NP-complete

Coverging towards equal-F

Satisfaction: ✓($n \le 3$)
Rel. Satisfaction: ✓($t \le 2$)
Share: ✓($n \le 3$)