Coordinated Disaster Relief

Strategic Minds Collective
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Scenario

- A country has been affected by a major natural disaster (National Pandemic)
- Each province has their own relief organizations working to benefit their province the most
- The disaster affected each province equally
- Provinces have the choice to either focus all resources on themselves or coalesce with other provinces to benefit the country as a whole

Type of Problem

- Superadditive Coalition problem
- (Transferable vs non-transferable)
- (Characteristic vs partition)

https://www.irit.fr/~Andreas.Herzig/Org/WsSintelnet12/Slides/Elkind.pdf

https://www.cs.ubc.ca/~kevinlb/teaching/cs532l%20-%202007-8/lectures/lect23.pdf

Transferable or Nontransferable

- Transferable because they buy from the same third party contractor

Characteristic Function Game vs. Partition Function Game

- Characteristic Function Game (CFG) because gov has infinite supplies

Excludable vs Non Excludable

- Non Excludable because provinces cannot keep other provinces from buying supplies.

Rival vs. Non Rival

- Non rival because purchasing supplies does not deplete supplies for the other provinces.

Symmetry?

- Each province has a different payoff vector to start, groups of the same size have different payoffs as well

Example

Counties C, M, P (Change these names later)

- $v(\emptyset) = v(\{C\}) = v(\{M\}) = v(\{P\}) = 0$
- $v(\{C, M\}) = 500$, $v(\{C, P\}) = 500$, $v(\{M, P\}) = 0$
- $v(\{C, M, P\}) = 750$

Starting budget: C: $4, M: $3, P: $3

Benefit: w = 500 w = 750 w = 1000

Cost: p = $7 p = $9 p = $11

(250, 250, 250) core, (750, 0, 0) also core.

UNFAIR CORE

Mechanism

- The government wants to ensure a “fair” distribution
  - Could be where each county gets an equal amount of goods
  - Could be proportional, so counties that pay more get more
- They could subsidize certain provinces (within a certain budget)
  - This can be an arbitrary number
  - Capped by the sum of all the players’ budgets
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Ideas for Analyzing the Core

https://www.quora.com/How-can-I-find-the-core-or-least-core-in-a-cooperative-game

If we look at our previous game, we can reformulate the core as needing to satisfy:

$C, M, P >= 0$

$C + M >= 500, C + P >= 500, P + M >= 0$

We can investigate the boundary of the solution set to investigate the different "extreme solutions to this problem"

Government subsidizes could change the boundaries of the convex set of the core and exclude solutions that aren't "fair"

Pseudocode (Prolly getting rid of this)