The Multiplayer Colonel Blotto Game

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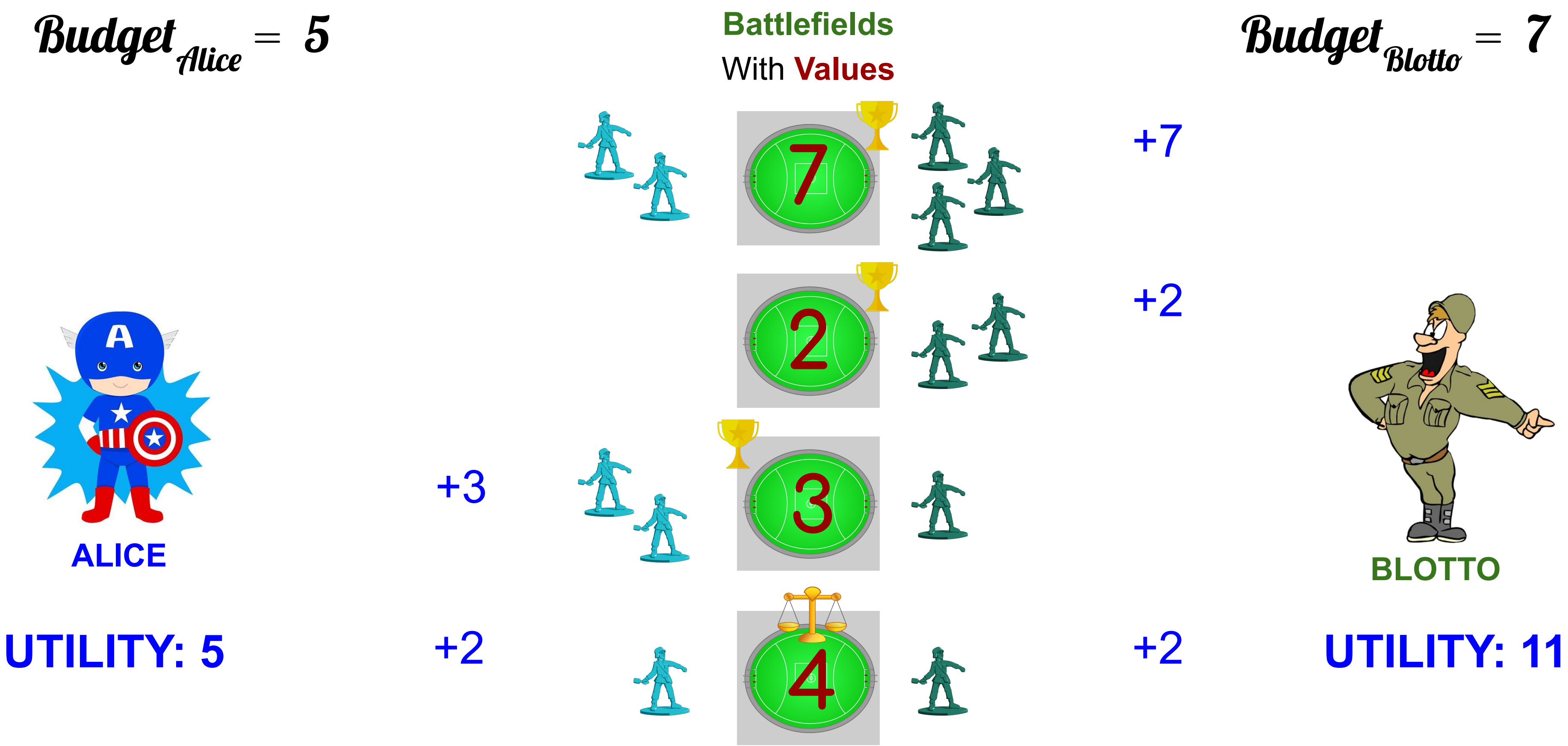
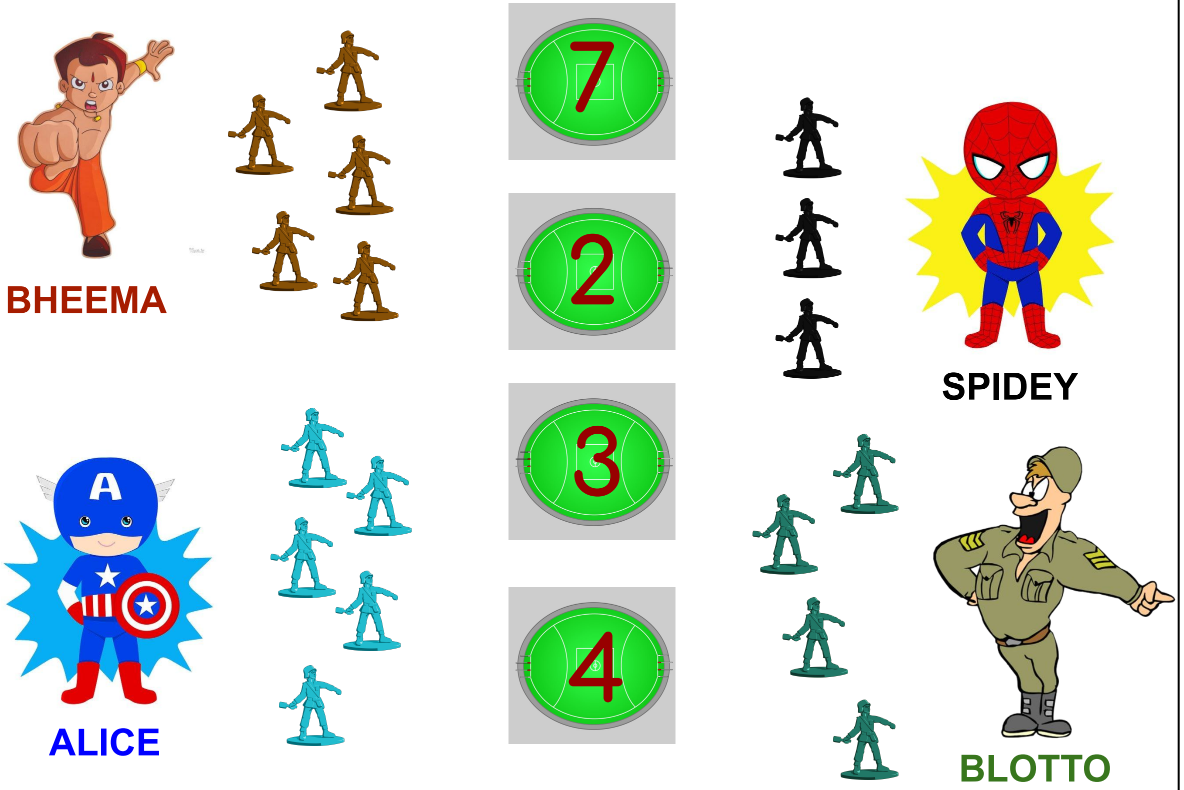


Our Contribution: Multiplayer Blotto



PLURALITY WINS!

Applications

Elections: ***k*** parties compete over ***n*** winner-take-all districts. Campaign resources need to be allocated.

R&D: ***k*** companies have the ability to use their fixed R&D budgets to research and develop ***n*** potential drugs.

Monopoly: ***k*** competing companies in the same industry want to become the dominant player in each of ***n*** new local markets.

Ads: ***k*** companies compete to advertise a substitute good to ***n*** consumers.

Ecology: ***k*** species in a habitat compete to fill ***n*** distinct ecological niches.

Main Results

Algorithm 1: for 3-player symmetric Blotto, we give an O(n) time algorithm for sampling a strategy in Nash Equilibrium. (assuming no item is worth more than ⅓ of the whole value.)

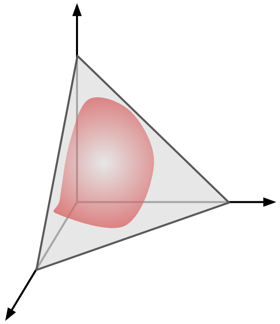
Algorithm 2: for ***k***-player symmetric Blotto, if the battlefields can be partitioned into ***k*** equal-value parts, we give an O(n) time algorithm for sampling a strategy in Nash Equilibrium.

Algorithm 3: we give an Fully Polynomial Time Approximation Scheme for sampling equilibria of Boolean Blotto games for **any** number of players.

Our Techniques

1) **Derive marginal bid distributions**:

Requirement: budget constraint holds in expectation



2) **Couple marginal bid distributions**: Requirement: budget constraint holds almost surely

3-player (Alg 1): rotate the uniform distribution on the 2-sphere in $\mathbf{R}^3$ into hyperspace; water-filling algorithm to construct the rotation

***k*-player (Alg 2)**: use properties of Dirichlet distribution

Boolean (Alg 3): greedy algorithm

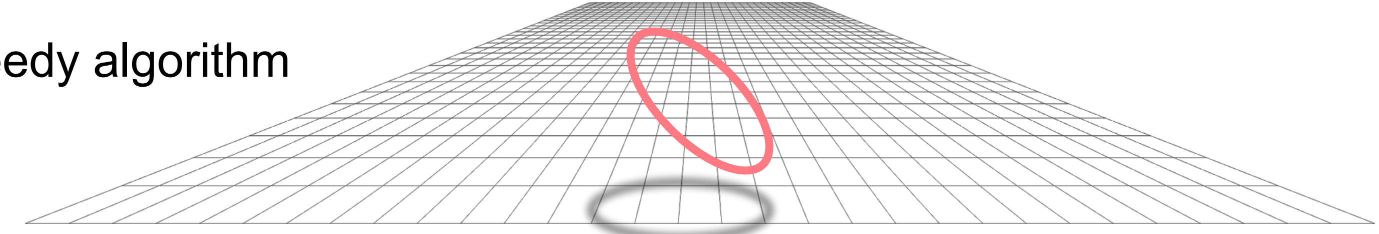


ILLUSTRATION FOR ALG 1 IN LOWER DIMENSION