Notes on CS70 Discussion Solutions CrowdSourcing Model

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1 Background

Gireeja wrote a paper creating/defining a model for Crowd Sourcing. The CS70 Discussion Solutions is a situation that closely matches the model.

2 Questions

What is it about the situation that caused it to match a crowdsourcing model? (What criterion defined it as a crowdsourcing problem?)
How can we improve the contest so it better fits the goal of the manager? If we change 1 parameter, what will happen? Let's tweak parameters in controlled experiments (changing 1 variable at a time) and see how and by how much parameters affect the outcomes of the contest. Then, let's design the ideal contest for admin and discussion solutions. Let's also observe how students react to different contests to determine how they are learning and what learning styles best suit them.

2.1 How can we do this?

We create a model that mathematizes the utility the manager gets and explore parameters to increase that utility.

2.2 Hypothesis

- All pay auction: students must bid attempted solutions regardless if they get the reward (extra credit) or not
- TRUE discussion solutions are never posted online, only student solutions

3 Description

Players: Students
Incentive: Extra Credit (Is prize value relatively unknown to students? They don't know HOW much extra credit they get until they bid and win for the first time.)
Manager: Professor, GSIs, Readers = admin
Incentive/Goal for Manager: Get the right discussion solutions and get maximum number of students to learn by participating *with effort.* A third possible goal is to differentiate who the strongest players are.

Cost of prize to manager: Virtually nothing if we consider grade inflation to be minimal, thus Utility = value of function f($\overrightarrow{x}$).

3.1 Motivations to bid

1. Participation grade
2. Need of extra credit
3. Internal incentive
   (a) Wanted the practice so why not post for a chance at reward
   (b) Enjoy doing problems
   (c) Want attention from readers/GSIs (weak/maybe nonexistent)

3.2 Costs

- TIME! HIGH cost because of need to LaTeX or equivalent
  1. Almost all students submitted LaTeX versions instead of scanned in solutions. This is because if you're selected you must submit LaTeX solutions, so why not submit LaTeX from the get-go?
  2. LaTeX solutions are perceived as more professional and thus more likely to be selected for reward
- It needs to be 100% complete and correct, which could be a deterrent. Students feel they can't meet the threshold.
- Other classes compete for attention
- Low reward. Most students would rather study for tests with large impact. The word "extra" makes the prize feel unnecessary, and many students are so overworked they only focus on what's necessary to pass classes. Students who are already acing the course and have leftover time feel no *need* for "extra" credit. Some students are irrational and value video games/reddit/short term pleasures over extra credit, because they fail to see/appreciate the value of extra credit.

4 Comparison

4.1 Differences with Gireeja's model

1. Players do NOT know each other's strengths
   - However, based on their grades, they know relatively where they are in the class
   - Since it's Berkeley/maybe people in general, many players assume they are "bad" compared to everyone else (assumption??)
2. In model, there was a Nash equilibrium where only 2 players bid. Players 3 through n of less strength bid 0 with probability 1. In the current setting 3 people get extra credit, so there should be 3 to 4 players who bid.

4.2 Connection to Gireeja's paper

The task is a combination of a selective task and market creation. It's selective because there's a "right" answer to solutions. Even if students post different ways of approaching the problem, there's still a "correct end goal." It's market creation because the managers want as many people to participate as possible with effort, so the more students that participate the better.

For selective task, $U_task = max(x_1, x_2, \dots x_n) - A$

$$\mathbb{E}[U_task] = \frac{A}{6}\left(\frac{3c_2 + c_1}{c_2^2}\right) - A$$

This expected utility is positive iff $\frac{3c_2 - c_1}{6c_2^2} - 1 > 0$
If $c_2 \gg c_1$ then $c_2 < \frac{1}{2}$
If $3c_2 - c_1 = \epsilon$ is small (low difference) then $c_2^2 < \frac{\epsilon}{6}$ ensures positive utility
This is based on $c_1 < c_2$

For market creation, $f(\overrightarrow{x}) = \alpha n + \beta$
Manager utility doesn't depend on utility of players at all

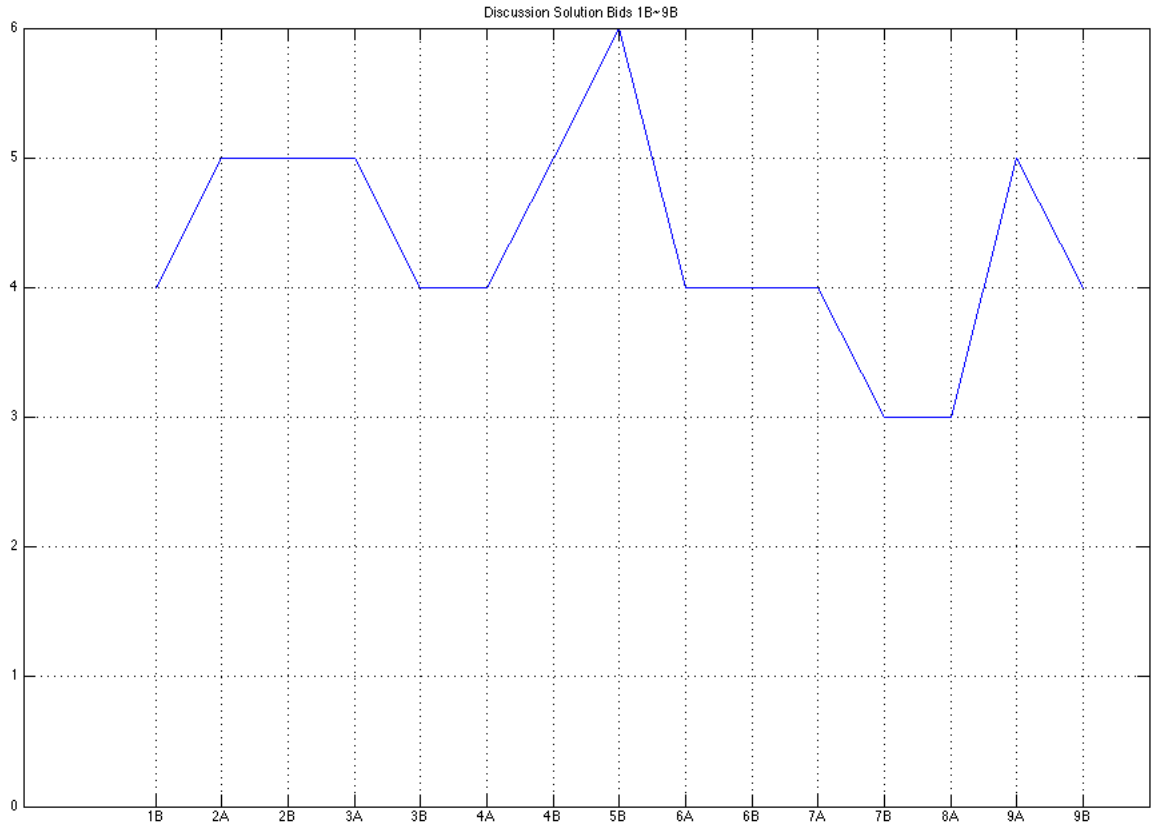
4.3 What this means

If the managers gave everyone extra credit simply for participating, everyone would only put in the minimal bid. This is why the manager wants participation *with effort.* The manager wants to challenge everyone.

Since there are elements of both selective task and market creation in the Discussion Solutions situation, we need to decide which one is weighted more and/or how to combine the two to create a model for this scenario.

5 Data

Discussion	# of bids	Players
1B	4 bids	Hansong Zhang, Kevin Chen, Daniel Suryakusuma, Andrew Luo
2A	5 bids	Viraj Mahesh, Lingtian Cheng, Hansong Zhang, Hongling Lu, Arnav Dugar
2B	5 bids	Lingtian Cheng, Hongling Lu, Melanie Cebula, Myra Haqqi, Arnav Dugar
3A	5 bids	Hongling Lu, Viraj Mahesh, Brian Chu, Myra Haqqi, Arnav Dugar
3B	4 bids	Chris Dock, Hansong Zhang, Hongling Lu, Myra Haqqi
4A	4 bids	Kevin Mawhorter, Hongling Lu, Melanie Cebula, Cong Chen
4B	5 bids	Arnav Dugar, Anurag Ajay, Myra Haqqi, Hongling Lu, Lingtian Cheng
5A	0 bids	Midterm so no solution thread posted
5B	6 bids	Hongling Lu, Arnav Dugar, Aditya Challa, Anurag Ajay, Myra Haqqi, Alex Yang
6A	4 bids	Arnav Dugar, Hongling Lu, Myra Haqqi, Aditya Challa
6B	4 bids	Aditya Challa, Myra Haqqi, Anurag Ajay, Arnav Dugar
7A	4 bids	Aditya Challa, Jong Yun Lee, Myra Haqqi, Max Kanwal
7B	3 bids	Aditya Challa, Max Kanwal, Myra Haqqi
8A	3 bids	Myra Haqqi, Aditya Challa, Liuxiao Zhang
8B	0 bids	Midterm so no solution thread posted
9A	5 bids	Albert Lin, Derek Ahmed, Aditya Challa, Myra Haqqi, Max Kanwal
9B	4 bids	Derek Ahmed, Albert Lin, Aditya Challa, Myra Haqqi



Average bids per contest: $4\frac{1}{3}$

Player	# of bids	Bid dates
Aditya Challa	8	5B, 6A, 6B, 7A, 7B, 8A, 9A, 9B
Albert Lin	2	9A, 9B
Alex Yang	1	5B
Andrew Luo	1	1B
Anurag Ajay	3	4B, 5B, 6B
Arnav Dugar	7	2A, 2B, 3A, 4B, 5B, 6A, 6B
Brian Chu	1	3A
Chris Dock	1	3B
Cong Chen	1	4A
Daniel Suryakusuma	1	1B
Derek Ahmed	2	9A, 9B
Hansong Zhang	3	1B, 2A, 3B
Hongling Lu	8	2A, 2B, 3A, 3B, 4A, 4B, 5B, 6A
Jong Yun Lee	1	7A
Kevin Chen	1	1B
Kevin Mawhorter	1	4A
Lingtian Cheng	3	2A, 2B, 4B
Liuxiao Zhang	1	8A
Max Kanwal	3	7A, 7B, 9A
Melanie Cebula	2	2B, 4A
Myra Haqqi	12	2B, 3A, 3B, 4B, 5B, 6A, 6B, 7A, 7B, 8A, 9A, 9B
Viraj Mahesh	2	2A, 3A

Average bids per player: 2.9545
After removing the 4 outliers: 1.667
Total bid opportunities (contests): 15
Fraction: $\frac{1}{5} = 0.2$
Total players: 22
Returning players > 1 instance: 12 = only a little over half!

5.1 Interesting observations

1. There were no anons. This means people were proud of their work and/or considered themselves strongest players in the class.

2. People corrected each other. Most corrections were done by peers. This means most people weren't afraid of their corrections helping their competitors. Either they're confident their solutions are better and they will also be selected (there is a window of 3 after all) or they don't care because getting the right solution is what matters.

3. People post close to the deadline. More data needs to be collected. As the deadline nears, people see that other people haven't posted and are incentivized. They feel there is a greater chance they will be selected. Bids are a deterrence, lack of bids increases **expected value** which is somehow dependent on time (We should determine what/how correlation).

4. There were only 3 4 bids from strong players. Strong bids deterred weak bids. At most 6 bids.

5. Weak players couldn't afford to bid because the cost was too great.

6. As numbers were relatively stable, whether there was an upcoming midterm or a midterm just passed didn't affect number of bids. This could be a negligible effect due to the strength of the bidding players.

7. Exactly 3 players from 2A also participated in 2B. Maybe those 3 players got payoff?

6 Moving Forward

1. Take data from HW solutions (everyone has ALREADY bid) to contrast with Discussion Solutions

2. Flesh out these notes further, check if Questions/Hypothesis are good to explore or if we should explore something else

3. Where in strength do the players lie? Does it match up that they are the strongest players?