Spring 2023 COP 4516 Team Final Contest Summary (by Arup Guha)

The first part of the summary will be a problem by problem analysis of how teams did in the contest and some observations about the problems. The second part will be an analysis of the teams and how they did. Here is the first, by problem:

Problem A: Connect the Dots
Solved by: 0 out of 17 teams

Unfortunately, no one solved this problem in contest. Chances are, that although teams knew how to do the problem, the implementation in time proved to be too difficult.

Problem B: USACO grade
Solved by: 17 out of 17 teams
First Solve: 5 minutes (Banana Peppers, Buffalo Chicken)

This was very clearly the easiest problem in the set. All teams solved this problem within the first 30 minutes of contest, and only one team needed more than 1 submission. This was exactly what was intended; the hope was that all teams would get off to a good start with this problem to help build momentum.

Problem C: Grow Tree Grow
Solved by: 8 out of 17 teams
First Solve: 43 minutes (Ricotta)

Ricotta discovered this problem, solving it at the 43 minute mark, a good deal before any other team solved the problem. As the contest wore on, more teams discovered the problem, with 4 teams solving the problem in the second hour, and three more teams in the final hour.

Problem D: Counting Oranges in Orange County
Solved by: 5 out of 17 teams
First Solve: 71 minutes (Pickle)

This was supposed to be one of the hardest problems in the set, but Team Pickle solved it in barely 20 minutes after their previous correct solve. Later in the second hour, 32 minutes later, one other team, Cheese, solved the problem. Then, after 25 submissions, Team Ham solved Oranges at the 2:38 mark. Then, within the last ten minutes of the contest, as a pleasant surprise to many, both Buffalo Chicken and Ricotta solve the problem. For Ricotta, this moved them into second place.

Problem E: Order Statistics
Solved by: 14 out of 17 teams
First Solve: 36 minutes (Gorgonzola)

This problem was definitely the third easiest problem in the set, after USACO Grade and Senior Design, both of which were solved by all teams. Gorgonzola uncovered the problem at the 36 minute mark, then 6 other teams were able to solve it in the first hour, followed by another 4 teams solving the problem in the second hour. With 4 minutes left in the contest, Smoked Ham solved the problem, on their 17^{th} submission, rounding out the 14 total solves on the problem.

Problem F: Scientist
Solved by: 0 out of 17 teams

Only one team, Gorgonzola, attempted this problem, but their attempt had a flawed greedy approach. It's possible other teams saw the network flow solution but chose not to try the problem due to implementation difficulties.

Problem G: Senior Design
Solved by: 17 out of 17 teams
First Solve: 18 minutes (Ricotta)

Team Ricotta exposed this as the second easiest problem in the set at the 18 minute mark. Many teams followed their lead solving the problem in the first hour and all teams at least had an attempt in by the end of the first hour. In the second hour, all but one team fixed their error (not using long appropriately) so that 16 teams solved the problem by the two hour mark. Then, finally, at the 2:25 mark, Buffalo Chicken became the last team to solve the problem, fixing their int long problem.

Problem H: Subway Surfers
Solved by: 1 out of 17 teams
First Solve: 80 minutes (Asiago)

The first correct submission utilized memorization, moving forwards, exactly like Lior's solution. A little surprisingly, no other team solved this problem in contest. It's possible that due to the fact that the logic dealing with a single row is atypical compared to most DP problems. Getting this solve early on paved the way for Asiago to earn third place.

Contest Summary

The contest started out quickly, with all teams recognizing that USACO Grade was the easiest question. Banana Peppers and Buffalo Chicken started the scoring, getting the problem at the 5 minute mark. All of the other 15 teams followed, as all 17 teams had the problem solved in the first half hour.

The second unique problem solved was Senior Design by team Ricotta at the 18 minute mark. Once they uncovered this problem, several other teams followed suit. By the end of the first hour, 11 of 17 teams had solved Senior Design with all the other 6 teams making submissions on the problem. More than likely, the culprit with most of the incorrect submissions was the necessity of using longs, since the maximum numerator could be $10^5 \times 10^5 = 10^{10}$, since each of the 10^5 could be as large as 10^5.

The first correct submission to Order Statistics came at the 36 minute mark by team Gorgonzola, and seven minutes later, team Ricotta became the first to solve the Grow Tree Grow problem. At the end of the first hour, four teams managed to solve three problems, with a majority of teams with two problems and two teams stuck at one problem. Thus, at this juncture, most teams were looking to either fix their solution to Senior Design or write a solution to Order Statistics.

Close to the start of the second hour, at the 1:07 mark, Gorgonzola solved Grow Tree Grow, jumping into the lead with four problems solved, representing a superset of problems solved by all the teams. There is a clear divide between the difficulty of the first four problems and the second four problems, so at this point a couple key questions remain: how many teams will be able to solve all four easier problems, and what sort of progress will teams make on the more challenging half of the set?

In a shocking turn of events, Team Pickle solved Counting Oranges, on their first attempt, at the 1:11 minute mark. In the judges estimation, this might have been the hardest problem in the set! Although this didn't pull them into the lead (they jumped to second place behind Gorgonzola), having solved a hard problem gives them an advantage, since they have an easier problem, Grow Tree Grow, left to solve.

Then, just nine minutes later, at the 1:20 mark, Team Asiago correctly solved Subway Surfers. Surprisingly, this team had only 1 problem at the 1:19 mark, and solved BOTH Senior Design and Subway Surfers at the 1:20 mark. As the second hour progressed, nearly all of the teams discovered their error on Senior Design with 16 out of 17 teams solving the problem before the end of the second hour. In addition, quite a few more teams solved the Order Statistics problem (total of 11 teams). After that, Grow Tree Grow as the next most solved problem at the two hour mark, with 5 solves. One other notable solve was Oranges by Team Cheese at the 1:43 mark. With one hour left in the contest, Pickle was in the lead with five problems, with four teams on their heels with four problems, followed by 7 teams with three problems and 5 teams with two problems.

The beginning of the last hour seemed to be the wall that teams hit. Right after the 2:02 mark, only 2 problems were solved until the 2:25 mark: Asiago solving Grow Tree Grow at 2:17 and Buffalo Chicken finally conquering Senior Design at the 2:25 mark, meaning that all 17 teams solved Senior Design! At the 2:38 mark, Team Ham finally solved Counting Oranges, after 25

submissions, proving that if you don’t succeed at first, try, try again! Then, at the 2:46 mark, a major change in the leaderboard occurred. Team Asiago, the only team to have solved the Subway Surfers problem, finally solved Order Statistics, with their first submission, pulling into second place, right behind Team Pickle.

The fireworks weren’t over. Only 7 minutes later, Team Ricotta solved their fifth problem, Counting Oranges, to pull them into second place, pushing Asiago to third place and Gorgonzola to fourth place. This was the last change to the top of the scoreboard, with Asiago finishing in third place, Ricotta in second place and Pickle as the 2023 COP 4516 Team Final Contest Champions! It was nice to see all three top teams distinguish themselves by solving 5 problems each (rest of the field had 4 or fewer). This meant that each solved one of the four hard problems, in addition to cleaning up all four of the easier problems.