Spring 2021 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: AMPM
Solved by: 19 out of 19 teams
First Solve: 2 minutes (Scooby Snacks)

This was definitively the easiest problem in the set. Most teams solved this in between 10 minutes and 30 minutes. Three teams solved it after the 30 minute mark, with one team taking 10 submissions and another team solving it at the 63 minute mark. (More than likely that team was looking at other problems.) There are just two categories of special cases to consider, so more than likely, multiple submissions were due to oversights of what happens with these four input cases: 11 AM, 11 PM, 12 AM or 12 PM.

Problem B: Banana Tree
Solved by: 13 out of 19 teams
First Solve: 33 minutes (Thin Mints)

This was a tree question, very similar to an exercise from Computer Science I (COP 3502). I expected this to be the third easiest question, and based on the number of solves, it was. There weren't any fundamentally special cases to consider and the typical recursive code naturally solve the problem without too much tinkering. This was illustrated in the fact that all the teams that solved the problem correctly did so in either 1 or 2 submissions. This is the type of problem, that on paper, most students solve on the Foundation Exam. The difference here is getting all the actual nuances to work in code.

Problem C: Cantaloupe
Solved by: 7 out of 19 teams
First Solve: 43 minutes (Snickerdoodle)

Though no problem was a "stopper" in the set, this problem, along with Hopping Bunny, had the fewest solves. The key was to use a binary search. Snickerdoodle saw this quickly but most teams which solved it did so in the latter part of the contest. Care must be taken with the low and high bounds as well as the simulation when checking to see if a particular gap is possible. Only one team had a submission to the problem that didn't ultimately end up solving it. What's neat is that two teams solved this problem in the last 15 minutes, which is great!

Problem D: Dinner
Solved by: 11 out of 19 teams
First Solve: 17 minutes (Ginger Snap)

It's possible that Ginger Snap threw other teams off by solving this problem very quickly. Since the network flow code can be copied and pasted, and the ensuing graph isn't too complicated, if one knows to apply network flow, this problem can be solved very quickly. It's likely that this early solve threw some teams off (if it's solved so quickly the technique must be very easy…) But eventually about half of the teams were able to recognize the problem pattern and correctly set up the graph and solve the problem.

This problem had an issue with the data which was caught by a student after the contest. A few of the input cases had two different friends with the same name, which was not allowed by the input specification. After the contest was over, the data was fixed and each team with incorrect submissions was rejudged, resulting in two teams earning an extra problem: Cookies++ and Nutter Butter.

Problem E: Expanded Excel
Solved by: 18 out of 19 teams
First Solve: 14 minutes (Scooby Snacks)

This was definitively the second easiest question in the set, but teams were quite slow to recognize it. Even though Scooby Snacks solved the problem in 14 minutes, at the 45 minute mark there were only 2 solves total, which is well below what I was expecting with three students working in parallel. There are a couple reading details to keep straight, but largely, this problem just required Introduction to C type programming skills. Perhaps the most difficult part is realizing that one must maintain the width of every column, since each column may have a different width. Also, it's important not to count columns past the maximum column (depending on how defaults are handled for column width). The bounds were made so that longs weren't necessary (I intentionally didn't want that to trip up students.)

Problem F: Food Truck
Solved by: 8 out of 19 teams
First Solve: 22 minutes (Cookies++)

This problem is a traditional Computer Science I problem of a simulation using a priority queue. Cookies++ was very quick to jump on this problem and solve it. Surprisingly no other team solved it in the first hour. In theory, this was meant to be the third easiest problem, barely harder than Expanded Excel. But, it seems that simulations, for whatever reason, are difficult for students. This is the type of code that is more likely to be written in industry than some of the other contest type topics, so it's important for students to review how to formulate code that is simulating some process and how to set up the structure of code to account for the various actions in the simulation.

Problem G: Golden Kite
Solved by: 13 out of 19 teams
First Solve: 24 minutes (Thin Mints)

I was most shocked by how well students did on this question. I thought that this was definitively the hardest question on the exam because it mixed both geometry with brute force, but the class proved me very wrong, as this was the third easiest question based on number of solves. This makes me happy because most students shy away from both geometry and brute force, so it was great to see so many teams nail this question!

Problem H: Hopping Bunny
Solved by: 7 out of 19 teams
First Solve: 57 minutes (Scooby Snacks, Ginger Snap)

Along with Cantaloupe, this turned out to be the hardest problem in the set. It's a standard dynamic programming problem and even though the concept gets covered well in Computer Science II, most students still have trouble implementing solutions to new problems that use the technique. This is definitely an area where the class as a whole could study in preparation for technical interviews.

Contest Summary

Most teams quickly realized that AMPM was the easiest question and a vast majority of teams solved that problem within the first 30 minutes of the contest. From that point in time, the teams branched out, working on different problems. In fact, 6 of the 8 problems were solved by at least one team only 33 minutes into the contest (AMPM, Banana Tree, Dinner, Excel, Food Truck, and Golden Kite). This proves that there wasn't a clear "second easiest problem" and that most of the problems in the contest were approachable. In this way, the contest was written at an appropriate level for the audience. Which problems teams solved second and third indicated their preferences, in terms of topics.

As expected, towards the end of the first hour, the two strongest teams throughout the class, Scooby Snacks and Ginger Snap were vying for the top position. By the 1:18 mark, both teams had 6 problems solved, with Cookies++ in third place with 5 problems solved. The teams in fourth and fifth place with 4 problems solved were Thin Mints and S'mores. From there, the teams were equally spread with 1, 2 or 3 problems solved.

At the 1:45 mark, Ginger Snap solved the Expanded Excel problem (arguably the second easiest), taking the lead with 7 questions. Also, by this time, several teams moved up to solve 4 problems, including Insomnia Cookies, Snickerdoodle, Sewing Kit Cookies and Langues De Chat. Shortly thereafter, at the 1:48 mark was the first time all 19 teams had at least 2 problems. At the 2 hour mark, Scooby Snacks solved Food Truck, the only problem not solved by Ginger Snap at the time to go into the last hour with 1 problem left. Interestingly enough after solving this problem, Scooby Snacks was only 2 penalty points behind Ginger Snap! (In a real contest where penalty points matter, this would make for an extremely exciting finish.) At the same time, Thin Mints solved Cantaloupe to be the only team at the 2 hour mark with exactly 6 problems solved. Seven teams had 4 problems solved, two teams had 3 problems solved and six teams had two problems solved at the two hour mark.

At the 2:11 mark, Ginger Snap solved Food Truck, after 3 submissions to be the first team to finish the set! Eight minutes later, Scooby Snacks followed finally solving Dinner with their fourth submission. They finished 30 penalty points behind Ginger Snap in the final standings.

As the contest neared its end, at the 2:50 mark, Oreo solved Expanded Excel after 12 submissions to guarantee that all 19 teams would solve at least 3 problems. Heading into the last 10 minutes, Thin Mints had 7 problems solved, followed by Cookies++, S'mores, Snickerdoodle and Sewing Kit Cookies at 6. With 8 minutes to spare, Thin Mints solved Dinner on their second attempt, to be the third team to complete the set of problems! The contest ended with the last correct submission being Alfajores's submission to Cantaloupe, which they solved after 8 submissions. The distribution of teams and problems solved is as follows:

Problems Solved	Number of Teams
8	3
7	1
6	4
5	4
4	3
3	5

After the contest completed, a student found an error in the judge data for Dinner (where some cases used the same name for two different friends). After this error was rectified and all submissions rejudged, two more teams were credited with solving Dinner with the corresponding credit changed.