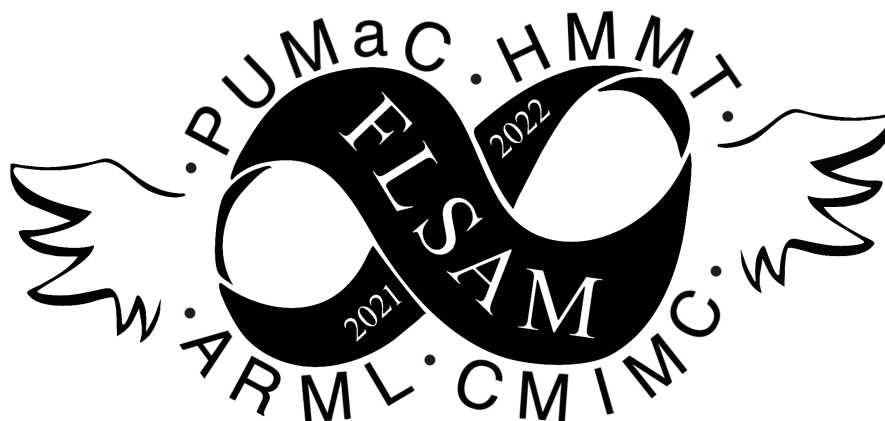


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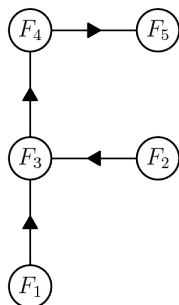


2021-2022 Introduction Meeting — September 2021

Ultra Relay

Welcome to the **FLSAM Ultra Relay**! This event consists of 25 problems separated into five different relays. Many of the problems in these relays will depend on other problems, as indicated by the network below. Problems are not all worth the same number of points; the point value for each problem can be found next to the problem.

This round is run like the HMMT Guts Round or the PUMaC Live Round. When the time begins, each team will send a member to pick up copies of the first relay. Once a team has their answers, they send a student to turn in those answers and pick up the next relay. A team **may not** go back to a previous relay after turning in answers, so allocate your time effectively.



*The label for each problem also refers to the answer of that problem. For example, F_1 denotes the answer to problem **F1**.*

*You will have **45 minutes** to complete the test. Good luck, and have fun!*

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- F1. [2] Bill is 20 years older than Jill. If Jill's age divides Bill's age, what is the sum of all the possible values of Jill's age?
- F2. [4] For positive integers a, b , find the minimum possible integer value of $\frac{a^2+b^2}{2021}$.
- F3. [5] Sharvaa gets the lengths $F_1, F_2, F_2 - F_1$, and 1, and forms a cyclic quadrilateral in that order. Aaron gets the lengths $F_2, F_1, F_2 - F_1$, and 1, and forms a cyclic quadrilateral in that order. What is the maximum difference in the areas of the cyclic quadrilaterals they form?
- F4. [6] Alex, Aaron, and Charley play ping-pong, with a 2-person team vs. a 1-person team. Aaron and Charley form a team with probability $\frac{F_3}{10}$. If Aaron's team wins with probability $\frac{6}{7}$ per round and Charley always gets $\frac{13}{14}$ of the points for his team, find the expected number of rounds for Charley to get to 69 points. Each round gives 1 point to the winning team.
- F5. [8] Alex and Charley have a pile of k rocks, where k is a positive integer. They divide the pile of rocks into two smaller piles, and they each take one of the piles. They agree to each choose two rocks from their pile. Find the sum of all possible values of k given that there are $\frac{F_4}{14}$ more ways that Alex can choose his two rocks than Charley can.