Aspect Capital Internship Puzzle

Overview

You're given data from a series of relay races involving 15 runners, each with a hidden but fixed ability level. A relay team consists of three runners. Your challenge is to identify the best individual runner - the one with the highest underlying ability - using only the finishing order of the relay teams.

Puzzle Setup

Runner Format

- There are 15 runners, each with a fixed ability score $\mu_i \in \mathbb{R}$ for runner $i = 1, \ldots, 15$.
- These scores represent each runner's average performance. Higher values mean better runners.
- The scores are centered, meaning: $\sum_{i=1}^{15} \mu_i = 0$.
- In each race, a runner's actual performance is sampled (independently) from a normal distribution: $X_i \sim \mathcal{N}(\mu_i, 1.0)$
- This reflects natural variability in performance.

Race Format

- Races are run in teams of 3 runners.
- A team's score is the sum of its runners' sampled performances.
- Teams are ranked from best to worst based on their total score.
- No ties occur.

Example

An example race from the dataset involved three teams,

```
"race_1": {
  "1": [5, 14, 15],
  "2": [1, 10,  8],
  "3": [11, 9, 2]
}
```

This means

- Team [5, 14, 15] finished 1st
- Team [1, 10, 8] finished 2nd
- Team [11, 9, 2] finished 3rd

The Dataset

You'll receive a file called "race_results.json" containing 2500 race results. Each race lists the teams and their finishing order. The number of teams per race may vary.

Your Task

Your task is to estimate

- $\mu^* = \max_i \mu_i$ - the highest ability score
- Along with the index $i^* = \operatorname{argmax}_i \mu_i$ of the runner who has this score

Submission Format

Please submit your estimate of μ^* rounded to 2 decimal places along with the index i^* of the runner that you believe has this score, in the answer field on the application form.

Example = "i_star = 6 and mu_star = 3.51"