

Introduction and Disclaimer

These mock examination questions span diverse disciplines and are designed for your practice in preparation for the International Research Olympiad (IRO) 2024. Endeavor to answer them to the best of your ability, utilizing this opportunity to enhance your skills and knowledge. For additional practice, it is advisable to engage in extensive reading of various papers; such efforts will contribute to a more comprehensive and nuanced understanding of the subject matter.

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Try your best, and good luck! -International Research Olympiad 2024

Mock Examination Answer Key 5

Bolded answers are correct.

Paper 5: Statistics

Question 1

Question: What does the D-H-M model assert about flipping a coin?

- a) **51% of coins land on a side different from that on which they started.**
- **This is correct according to the D-H-M model, which asserts a slight bias based on the starting side of the coin.**
- b) 50% of coins land on the same side that they started.
- This would imply no bias, which contradicts the D-H-M model's findings.
- c) All coins have a bias towards heads due to engravings shifting coins' mass distribution.
- The model does not specify a bias towards heads; it focuses on the starting position bias.
- d) When people flip a coin, the axis of rotation changes throughout the coin's trajectory.
- The model's prediction is not about the rotation axis but about the probability of landing on the starting side.

Question 2

Question: Does this paper provide statistically significant support for the D-H-M model of coin-flipping?

a) **True.**

- **The paper's data support the D-H-M model, showing a slight bias in favor of the starting side.**

b) **False.**

- The evidence in the paper does not support this choice; the findings align with the D-H-M model's predictions.

Question 3

Question: What is a problem in the way that data was collected in this research paper?

- a) Different denominations of coins consistently produced different results.
 - The paper does not indicate that different coin denominations were a significant factor.
- b) Coin-flippers were aware that they were testing the fairness of coins.
 - Awareness of the study's purpose could introduce a psychological bias, although it's not indicated as a problem by the study.
- c) The researchers did not use a randomized controlled trial to ensure the validity of the coin flips.
 - Randomization is key in experiments to avoid biases, but the paper does not state that this was a problem in the data collection.
- d) **The researchers did not account for the influence of external factors such as air resistance or surface irregularities on the coin flips.**
 - **This could be a significant issue as such factors can affect the outcome of a coin flip, potentially skewing the results.**

Question 4

Question: How did the authors account for biases specific to certain coin-flippers in their analysis?

- a) They compared each flipper's Gaussian distribution.
 - Comparing Gaussian distributions could indicate variations in flipping styles, but it does not account for individual biases.
- b) **They used a Bayesian logistic regression model.**
 - **This statistical method allows for individual flipper biases to be modeled and accounted for in the analysis.**
- c) They used randomized samples.
 - While randomization is useful for controlling for biases, it doesn't account for individual flipper differences post-sampling.
- d) Coins were put through an automatic flipping machine to remove human bias.
 - An automatic machine removes human variance, but the question is about accounting for biases, not removing them.