Mathematical Logic & Dirichlet's Principle

Introductory Package

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Albion Online Intellectual Club

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Introduction

Tutor Introduction

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Добро пожаловать! Welcome! This introductory package will give you a head start with tasks to challenge your thinking and recommended readings to deepen your understanding. I look forward to meeting you for the first session soon.

Quote: *"There is no branch of mathematics, however abstract, which may not some day be applied to phenomena of the real world." - Nikolai Lobachevsky*

Tasks

Task 1 - Truth-tellers and Liars

You are on an island where there are two types of people:

- **Truth-tellers**, who always tell the truth.
- **Liars**, who always lie.

You meet three islanders, and you know that **at least one of them is a truth-teller**. You ask each of them:

"How many truth-tellers are among you three?"

Their responses are:

- Person 1: **"One."**
- Person 2: **"Two."**
- Person 3: **"Three."**

Question: How many truth-tellers are there, and how do you know?

You have n pairs of socks, each a different color, in a drawer. Without looking, what is the minimum number of socks you must take out to guarantee that you have at least one matching pair of socks?

Task 3 - Number Theory (Divisibility)

You are given 100 distinct integers. Prove that you can find at least two integers in the set whose difference is divisible by 99.

Supplementary Reading

Recommended Reading Material

The following links contain useful information that will help you prepare for the first session.

- Dirichlet's Principle
- Conditional Probability
- Bayes' Theorem
- Intro to Combinatorics