**Heredity Probability Simulator**

This Python program simulates the heredity patterns of a trait passed down through a family over generations. It calculates the probabilities of family members having a specific gene and the associated trait based on their parents' genetic information.

**Description**

The simulator models the inheritance of a gene that can cause a particular trait. It takes into account the unconditional probabilities for having zero, one, or two copies of the gene and the probabilities of expressing a trait given the number of gene copies. The program also accounts for gene mutation, which can alter the inheritance pattern.

**Features**

- Load gene and trait data from a CSV file.

- Calculate joint probability distributions for gene and trait presence in a family.

- Update and normalize probabilities for each family member.

- Utilize a Monte Carlo simulation to estimate probabilities.

**Usage**

To run the heredity simulation, you need to provide a CSV file containing the family data. The CSV should have columns for `name`, `mother`, `father`, and `trait`. The `trait` column should contain `0` or `1` if the trait presence is known, or be blank if unknown.

**bash**

python heredity.py data.csv

**Dependencies**

Python 3.x

CSV module (included in standard Python library)

itertools module (included in standard Python library)

sys module (included in standard Python library)

**Data Format**

Name, mother, father, trait

Alice,,,

Bob, Alice, Charles, True

Charles,,,

**Contributing**

If you’d like to contribute to this project, please fork the repository and use a feature branch. Pull requests are warmly welcomed.

**Licensing**

Remember to replace "heredity.py" and "data.csv" with the actual filenames if they are different. The `README.md` file should be placed in the root directory of your repository. When you push this to GitHub, the platform will automatically display the contents of the `README.md` file as the homepage of the repository.