Python Probability Practice

**Python Probability Introduction**

**Simulating Coin Flips**

Video + ipynb

**Probability Quiz**

In this quiz, you will simulate coin flips and die rolls to compute proportions for the following outcomes.

1. Two fair coin flips produce exactly two heads
2. Three fair coin flips produce exactly one head
3. Three biased coin flips with P(H) = 0.6 produce exactly one head
4. A die rolls an even number
5. Two dice roll a double

Then, you'll compare these proportions with probabilities in the quizzes below.

When simulating coin flips, use 0 to represent heads and 1 to represent tails. When simulating die rolls, use the correct integers to match the numbers on the sides of a standard 6 sided die.

**QUESTION 1 OF 2**

Use the proportions you observed in your simulation data in order to guess the probabilities of the following outcomes.

**OUTCOME**

**PROBABILITY**

Two fair coin flips produce exactly two heads 0.25

Three fair coin flips produce exactly one head 0.375

Three biased coin flips with P(H) = 0.6 produce exactly one head 0.288

A die rolls an even number 0.5

Two dice roll a double 0.167

**QUESTION 2 OF 2**

Compute the probabilities of each of the five outcomes above mathematically. Do these match the proportions you found in your simulated data?

Yes

**Binomial Distributions Quiz**

In this quiz, you will simulate coin flips using np.random.binomial compute proportions for the following outcomes.

1. A fair coin flip produces heads
2. Five fair coin flips produce exactly one head
3. Ten fair coin flips produce exactly four heads
4. Five biased coin flips with P(H) = 0.8 produce exactly five heads
5. Ten biased coin flips with P(H) = 0.15 produce three or more heads

Then, you'll compare these proportions with probabilities in the quizzes below.

**Binomial Distributions¶**

Use NumPy to create simulations and compute proportions for the following outcomes. The first one is done for you.

**QUESTION 1 OF 2**

Used the proportions you observed in your simulation data in order to guess the probabilities of the following outcomes.

**OUTCOME- PROBABILITY**

A fair coin flip produces heads 0.5

Five fair coin flips produce exactly one head 0.156

Ten fair coin flips produce exactly four heads 0.205

Five biased coin flips with P(H) = 0.8 produce exactly five heads 0.328

Ten biased coin flips with P(H) = 0.15 produce three or more heads 0.180

**QUESTION 2 OF 2**

Compute the probabilities of each of the five outcomes above mathematically. Do these line up with the proportions you found in your simulated data?

Yes

**Cancer Test Results**

**QUESTION 1 OF 2**

Match the correct answer for each of the following questions.

**QUESTION**

**ANSWER**

How many patients are there in total?

2914

How many patients have cancer?

306

How many patients do not have cancer?

2608

What proportion of patients have cancer?

0.105

What proportion of patients don't have cancer?

0.895

Correct

**QUESTION 2 OF 2**

Match the correct answer for each of the following questions.

**QUESTION**

**ANSWER**

What proportion of patients with cancer test positive?

0.905

What proportion of patients with cancer test negative?

0.095

What proportion of patients without cancer test positive?

0.204

What proportion of patients without cancer test negative?

0.796

Correct

**Conditional Probability & Bayes Rule Quiz**

In the previous section, you found the following proportions from the cancer results dataset.

1. Patients with cancer: **0.105**
2. Patients without cancer: **0.895**
3. Patients with cancer who tested positive: **0.905**
4. Patients with cancer who tested negative: **0.095**
5. Patients without cancer who tested positive: **0.204**
6. Patients without cancer who tested negative: **0.796**

Based on the above proportions observed in the data, we can assume the following probabilities.

|  |  |
| --- | --- |
| Probability | Meaning |
| **P(cancer) = 0.105** | Probability a patient has cancer |
| **P(~cancer) = 0.895** | Probability a patient does not have cancer |
| **P(positive|cancer) = 0.905** | Probability a patient with cancer tests positive |
| **P(negative|cancer) = 0.095** | Probability a patient with cancer tests negative |
| **P(positive|~cancer) = 0.204** | Probability a patient without cancer tests positive |
| **P(negative|~cancer) = 0.796** | Probability a patient without cancer tests negative |

**Quiz Questions**

Use the probabilities given above and Bayes rule to compute the following probabilities.

1. Probability a patient who tested positive has cancer, or P(cancer|positive)
2. Probability a patient who tested positive doesn't have cancer, or P(~cancer|positive)
3. Probability a patient who tested negative has cancer, or P(cancer|negative)
4. Probability a patient who tested negative doesn't have cancer, or P(~cancer|negative)

Then, use the Jupyter notebook to compare them to true proportions in the dataset.

Example:

P(C) = 0.105 P(-C) = 0.895

P(Pos|C) = 0.905 P(Neg|C) = 0.095

P(Neg|-C) = 0.204 P(Pos|-C) = 0.796

**QUESTION 1 OF 2**

Using the probabilities above and Bayes rule, compute the following probabilities.

0.674

0.236

0.389

**PROBABILITY**

**VALUE**

P(cancer|positive)

0.342

P(~cancer|positive)

0.658

P(cancer|negative)

0.014

P(~cancer|negative)

0.986

**QUESTION 2 OF 2**

Do these proportions line up with the probabilities you computed earlier?

Yes

Great! If you did your computations correctly, the proportions and probabilities should match pretty closely!

**CONTINUE**

**Python Probability Conclusion**