CompSci 190: Pivots, Joins & Probability

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Pivot

- Cross-classifies according to two categorical variables
- Produces a grid of counts or aggregated values
- Two required arguments:
  - First: variable that forms column labels of grid
  - Second: variable that forms row labels of grid
- Two optional arguments (include both or neither)
  - **`values`**='column_label_to_aggregate'
  - **`collect`**=function_with_which_to_aggregate

(Demo)

Joining Two Tables

Keep all rows in the table that have a match ...

```
drinks.join('Cafe', discounts, 'Location')
```

... for the value in this column ...

... somewhere in this other table's ...

... column that contains matching values.

drinks

Drink	Cafe	Price
Milk Tea	Tea One	4
Espresso	Nefeli	2
Latte	Nefeli	3
Espresso	Abe's	2

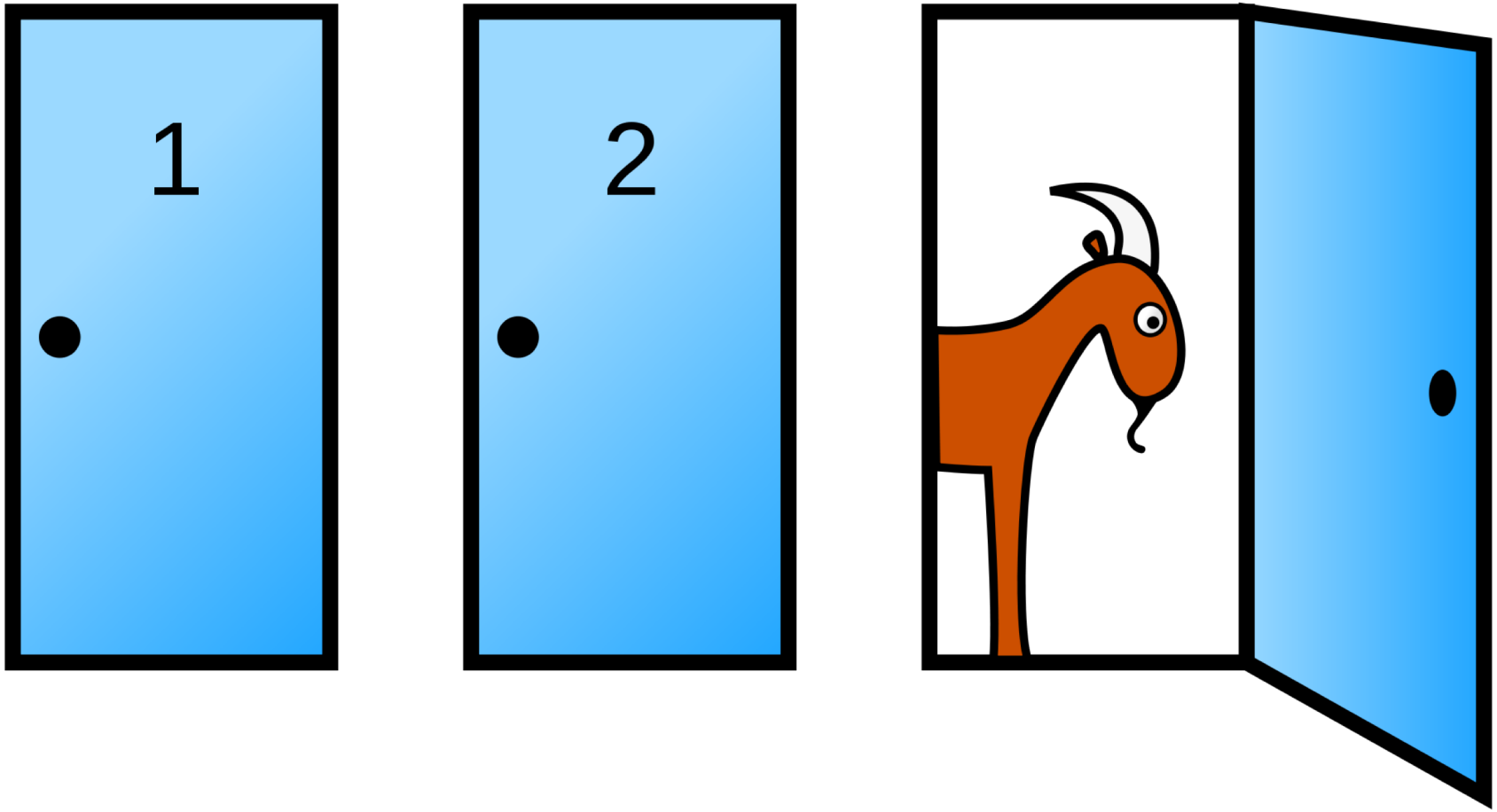
discounts

Coupon	Location
25%	Tea One
50%	Nefeli
5%	Tea One

The joined column is sorted automatically

Cafe	Drink	Price	Coupon
Nefeli	Espresso	2	50%
Nefeli	Latte	3	50%
Tea One	Milk Tea	4	25%
Tea One	Milk Tea	4	5%

Monty Hall Problem



Random Selection

`np.random.choice`

- Selects at random
- with replacement
- from an array
- a specified number of times

```
np.random.choice(some_array, sample_size)
```

Discussion Question

```
d = np.arange(6) + 1
```

What results from evaluating the following 2 expressions? Are they the same? Do they describe the same process?

```
np.random.choice(d, 1000) + np.random.choice(d, 1000)
```

```
2 * np.random.choice(d, 1000)
```

Probability

- Lowest value: 0
  - Chance of event that is impossible
- Highest value: 1 (or 100%)
  - Chance of event that is certain

- If an event has chance 70%, then the chance that it doesn't happen is
  - 100% - 70% = 30%
  - 1 - 0.7 = 0.3

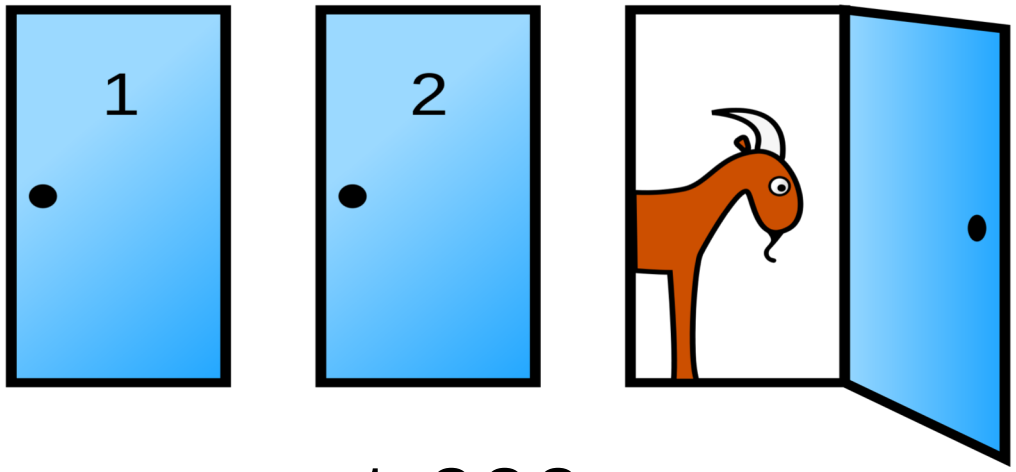
(Demo)

Equally Likely Outcomes

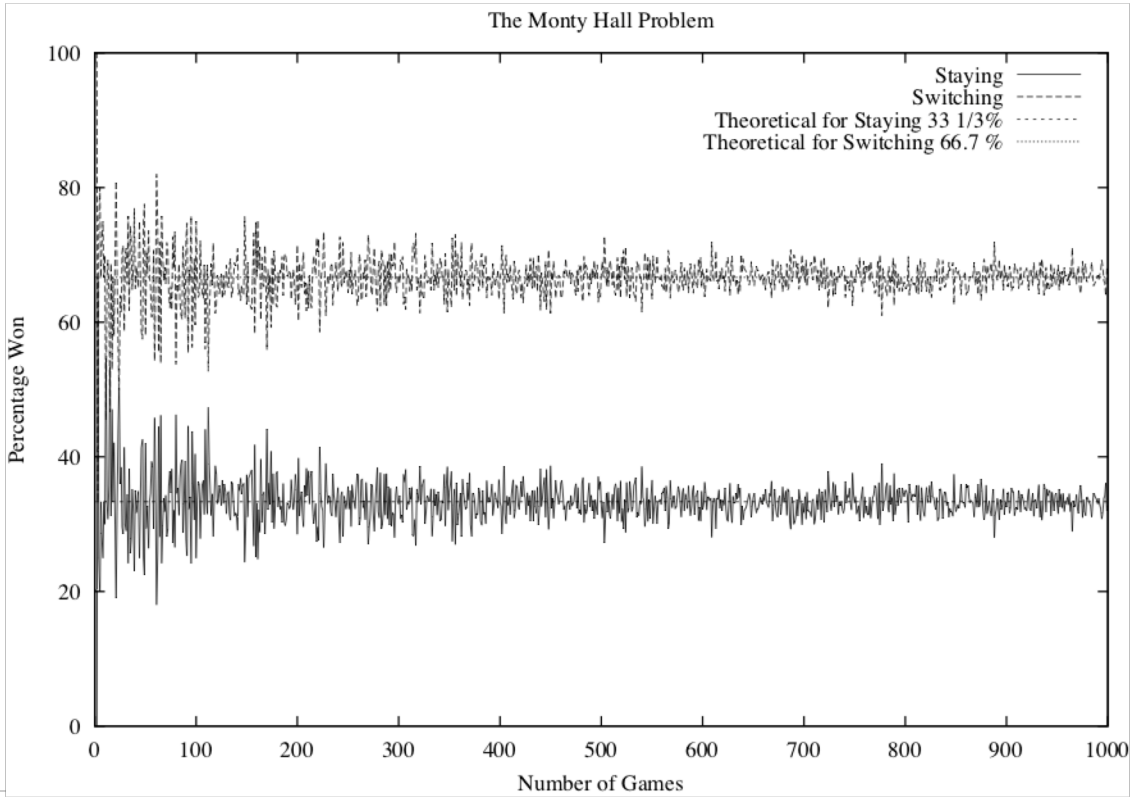
Assuming all outcomes are equally likely, the chance of an event A is:

$$P(A) = \frac{\text{number of outcomes that make A happen}}{\text{total number of outcomes}}$$

Simulating Monty Hall



x 1,000



Multiplication Rule

Chance that two events *A* and *B* both happen

= P(*A* happens) x P(*B* happens given that *A* has happened)

- The answer is *less than or equal to* each of the two chances being multiplied
- The more conditions you have to satisfy, the less likely you are to satisfy them all

Addition Rule

If event *A* can happen in *exactly one* of two ways, then

$$P(A) = P(\text{first way}) + P(\text{second way})$$

- The answer is *greater than or equal to* the chance of each individual way

Example: At Least One Head

- In 3 tosses:
  - Any outcome *except* TTT
  - P(TTT) = (½) x (½) x (½) = ⅛
  - P(at least one head) = 1 - P(TTT) = ⅞ = 87.5%

- In 10 tosses:
  - 1 - (½)**10
  - 99.9%

http://bit.ly/FoDS-s19-0214

Test 1

- Topics
  - Causality
  - Python
    - Data (names, values & types)
    - Expressions (numbers, strings, arrays, & tables)
    - Functions
  - Probability
  - Visualization
    - Charts & Histograms

- Do the review questions. Post questions to Piazza!
- Bring 2 sheets of notes