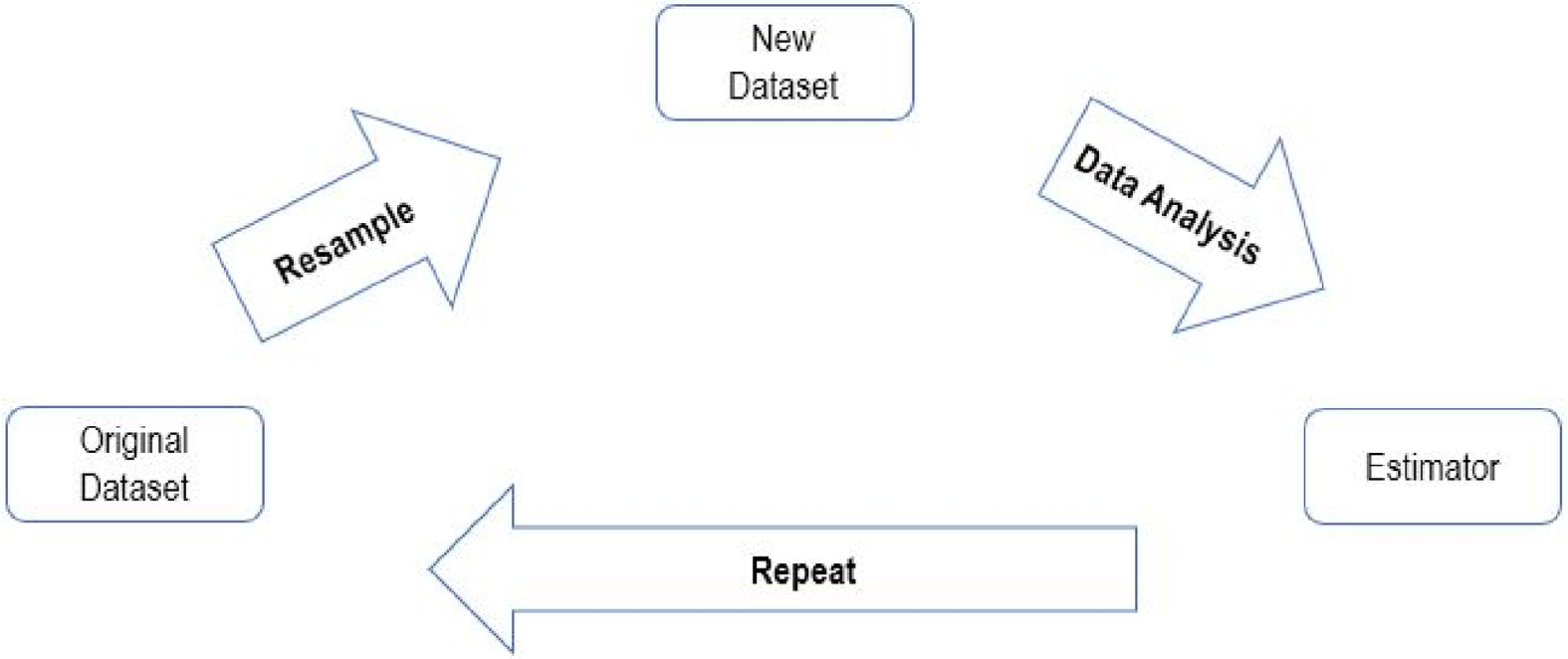
STATISTICAL SIMULATION IN PYTHON

Introduction to resampling methods

Resampling workflow



Why resample?

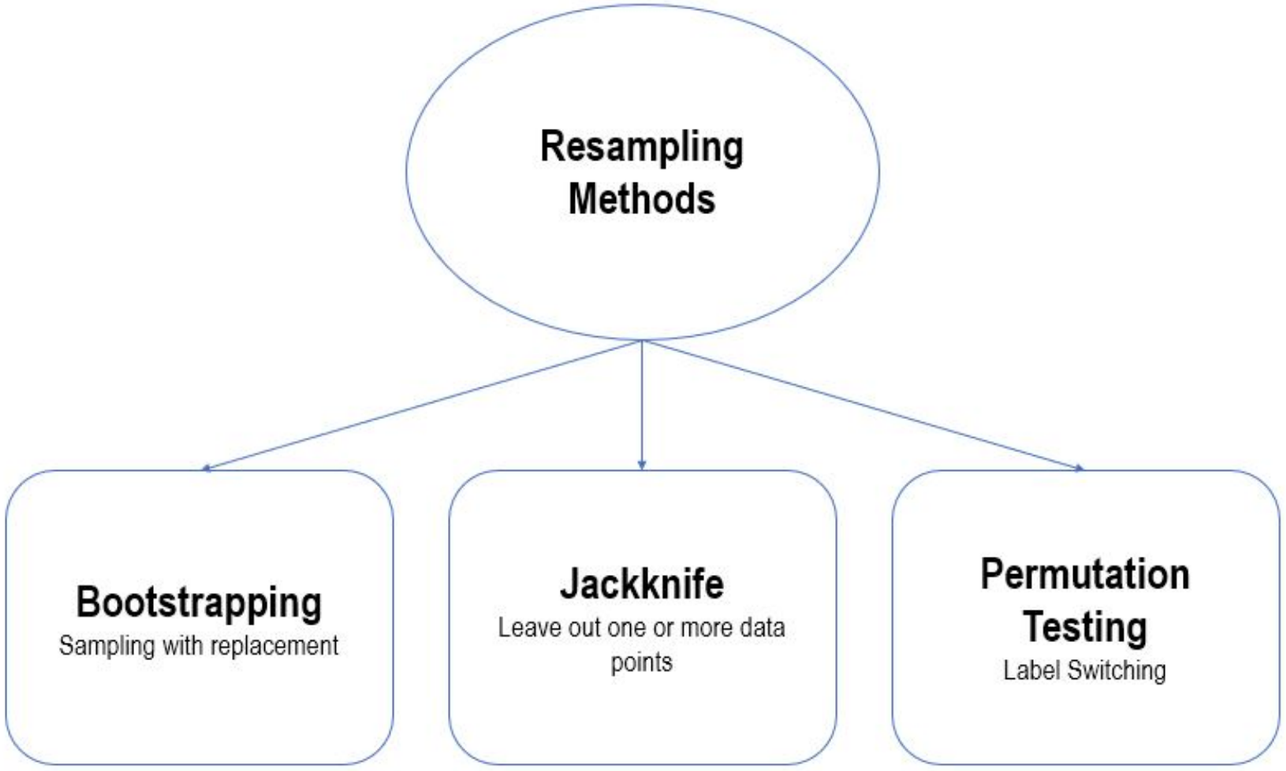
Advantages

- Simple implementation procedure.
- Applicable to complex estimators.
- No strict assumptions.

Drawbacks

- Computationally expensive.

Types of resampling methods



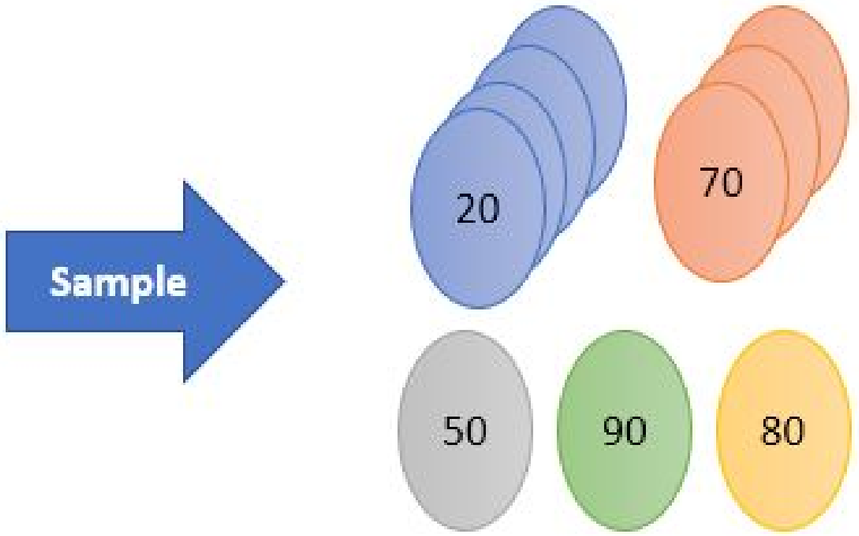
STATISTICAL SIMULATION IN PYTHON

Let's practice!

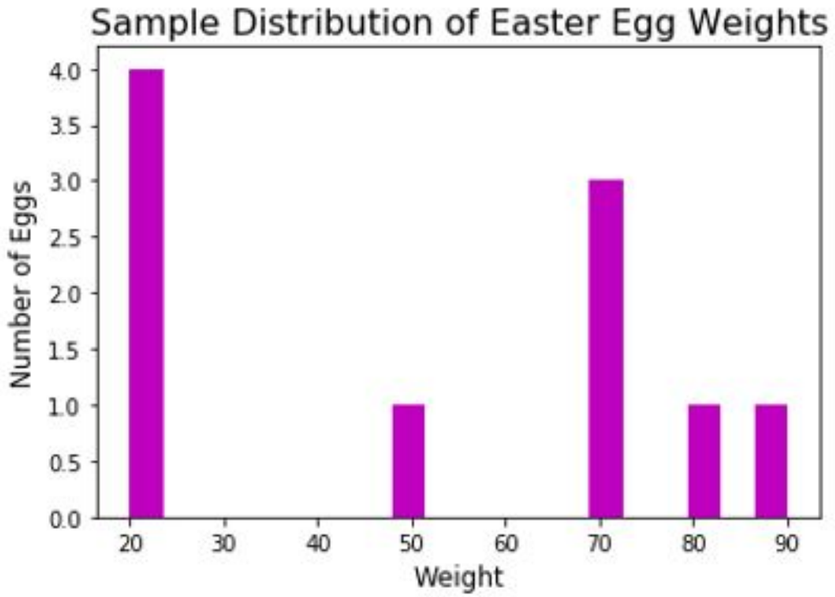
STATISTICAL SIMULATION IN PYTHON

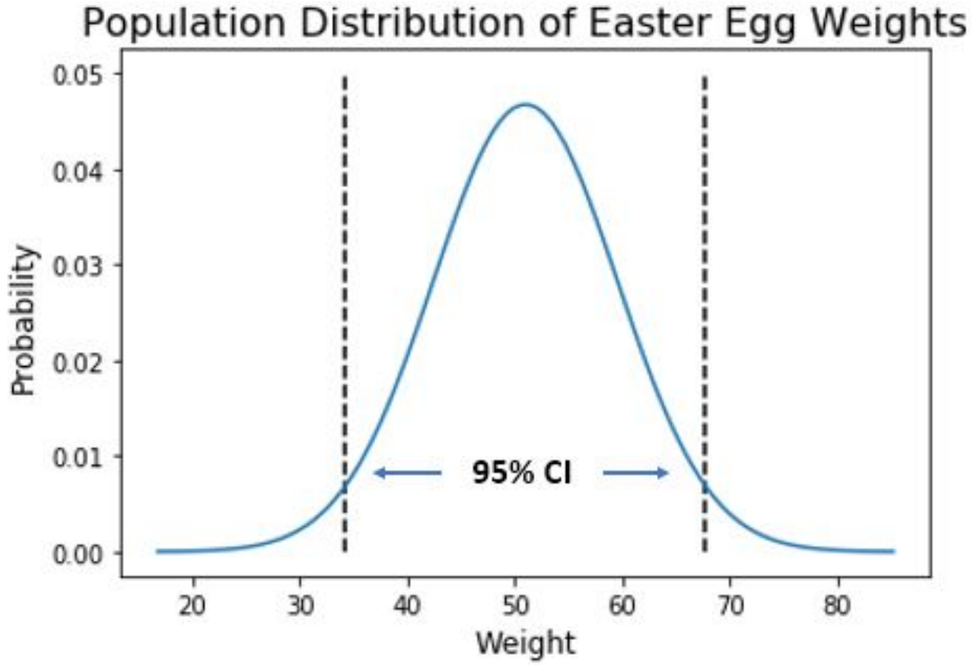
Bootstrapping

Easter eggs

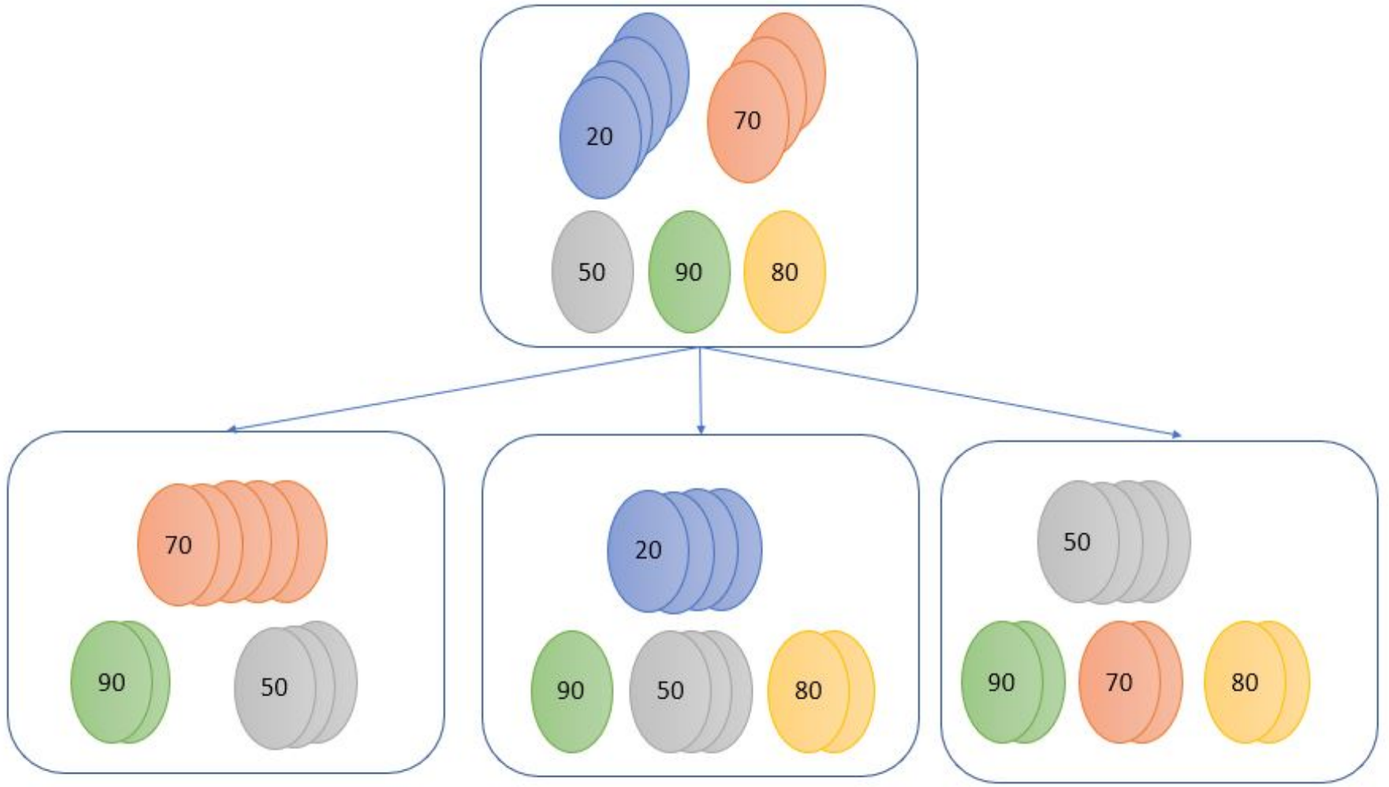


Easter eggs

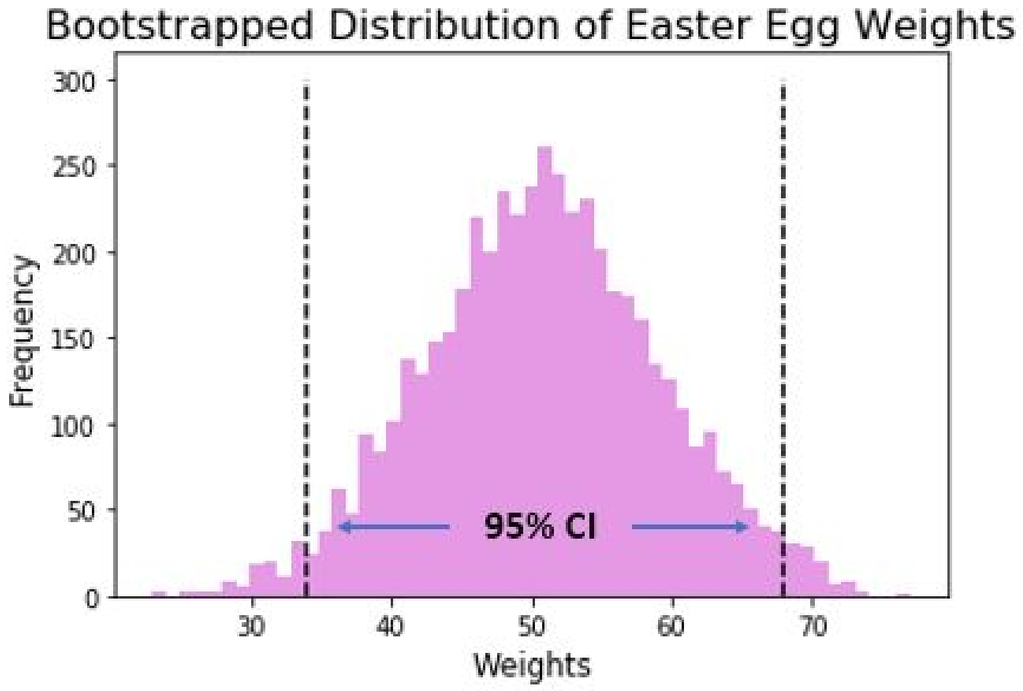

Sample Distribution of Easter Egg Weights
Number of Eggs
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
20
30
40
50
60
70
80
90
Weight


Population Distribution of Easter Egg Weights
Probability
0.00
0.01
0.02
0.03
0.04
0.05
95% CI
20
30
40
50
60
70
80
Weight

Bootstrapping Easter eggs



Bootstrapped distribution



Bootstrap - Good to know

- Run at least 5-10k iterations.
- Expect an approximate answer.
- Consider bias correction.

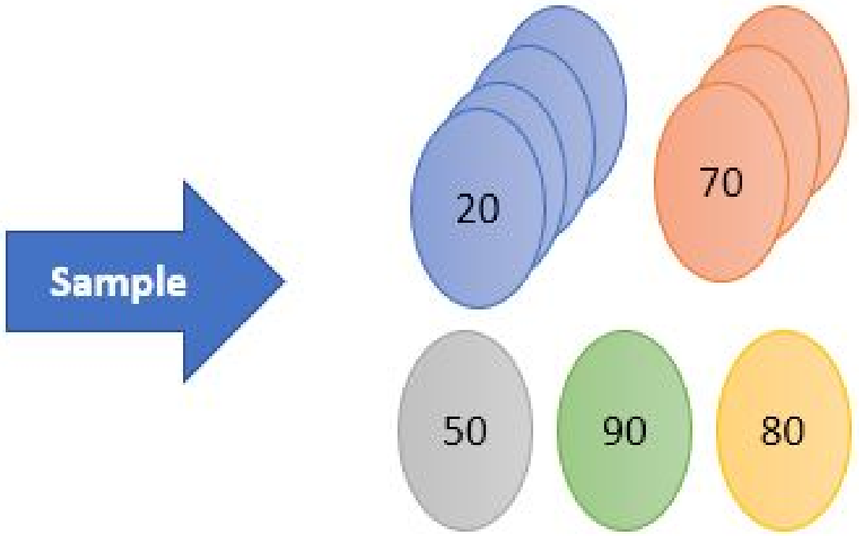
STATISTICAL SIMULATION IN PYTHON

Let's practice!

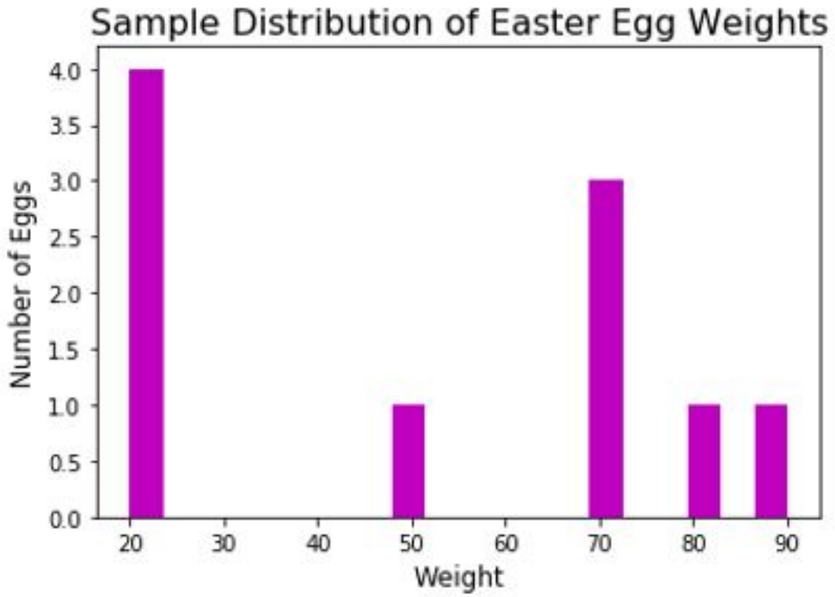
STATISTICAL SIMULATION IN PYTHON

Jackknife resampling

Easter eggs



Easter eggs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70
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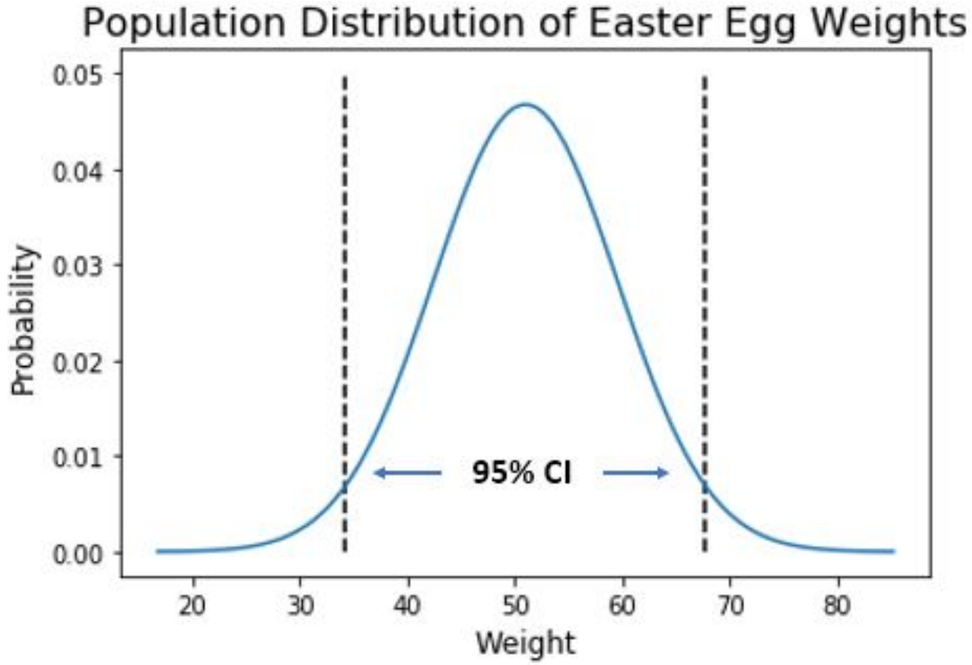
90
Weight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95% CI
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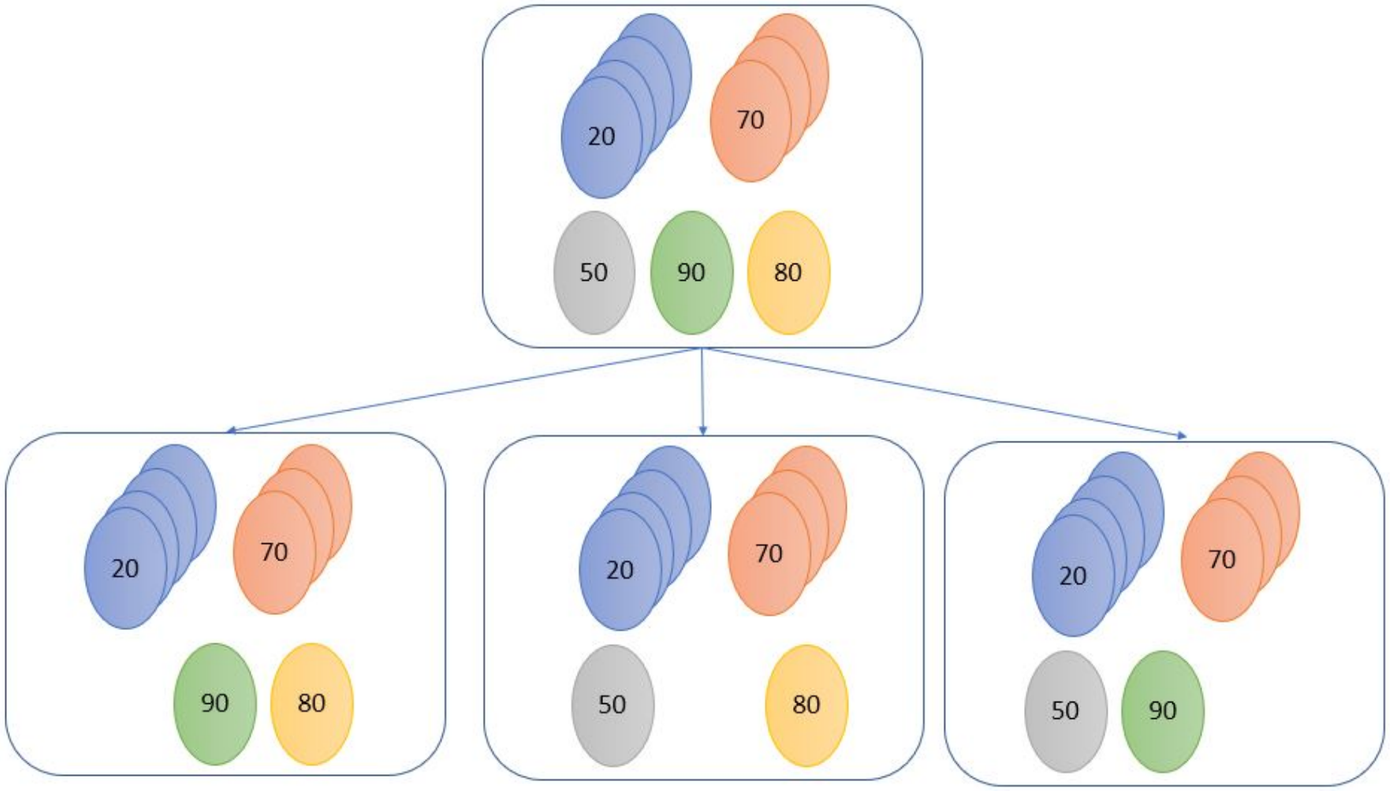
Weight

Jackknifing Easter eggs



Jackknife estimate

Jackknife Estimate

$$\hat{\theta}_{jackknife} = \frac{1}{n}\Sigma_{i=1}^{n}\hat{\theta}_i$$

$\hat{\theta}_{jackknife}$: Jackknife Estimate, $\hat{\theta}_i$: Estimate for each Jackknife Sample

Variance of Jackknife Estimate

$$Var(\hat{\theta}_{jackknife}) = \frac{n-1}{n}\Sigma(\hat{\theta}_i - \hat{\theta}_{jackknife})^2$$

$\hat{\theta}_{jackknife}$: Jackknife Estimate $\hat{\theta}_i$: Estimate for each Jackknife Sample

Jackknife vs Bootstrap

Jackknife

- Mean Weight = 51g
- 95% CI = [33.36g, 68.64g]

Bootstrap

- Mean Weight = 50.8g
- 95% CI = [35g, 67.03g]

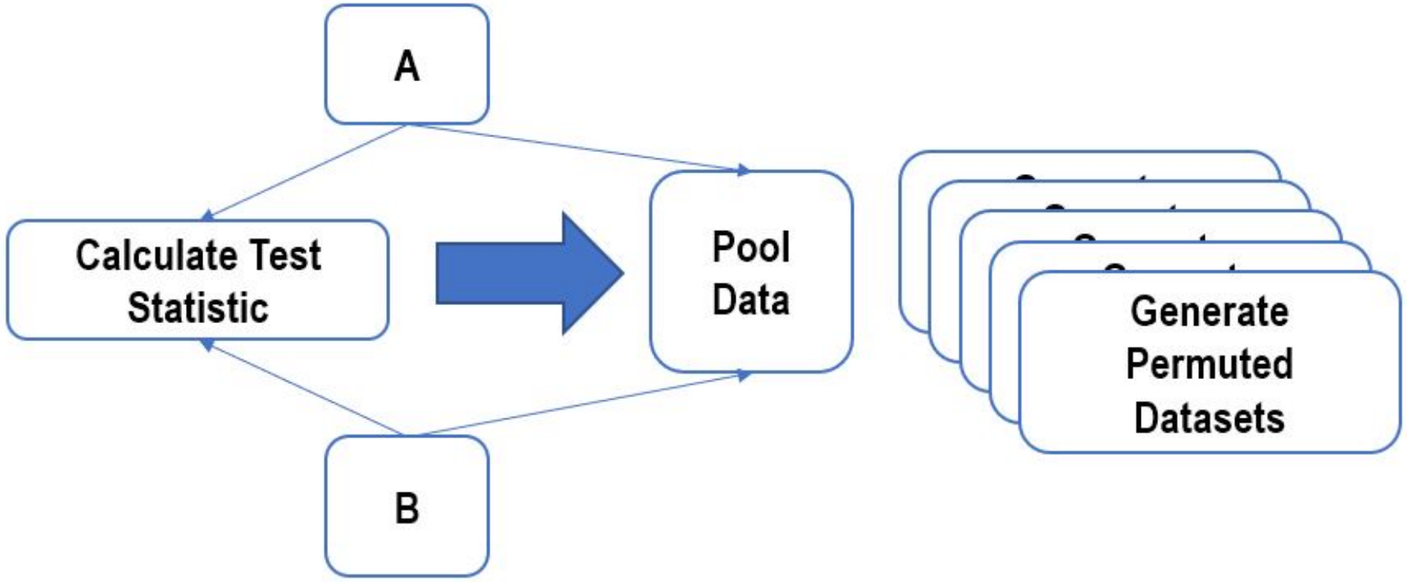
STATISTICAL SIMULATION IN PYTHON

Let's practice!

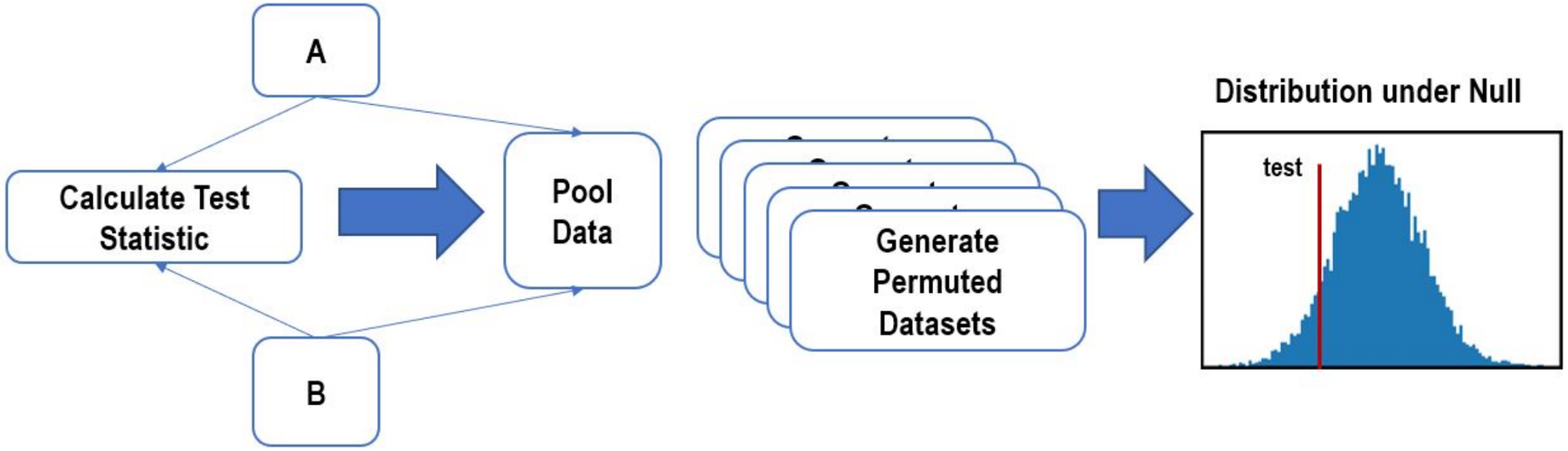
STATISTICAL SIMULATION IN PYTHON

Permutation testing

Steps involved



Steps involved



Discussion

ADVANTAGES

- Very flexible
- No strict assumptions
- Widely applicable

DRAWBACKS

- Computationally Expensive
- Custom coding required

Donation website

STATISTICAL SIMULATION IN PYTHON

Let's practice!