Probability and Statistics

Part-5

MA2103 - 2023

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More Sampling

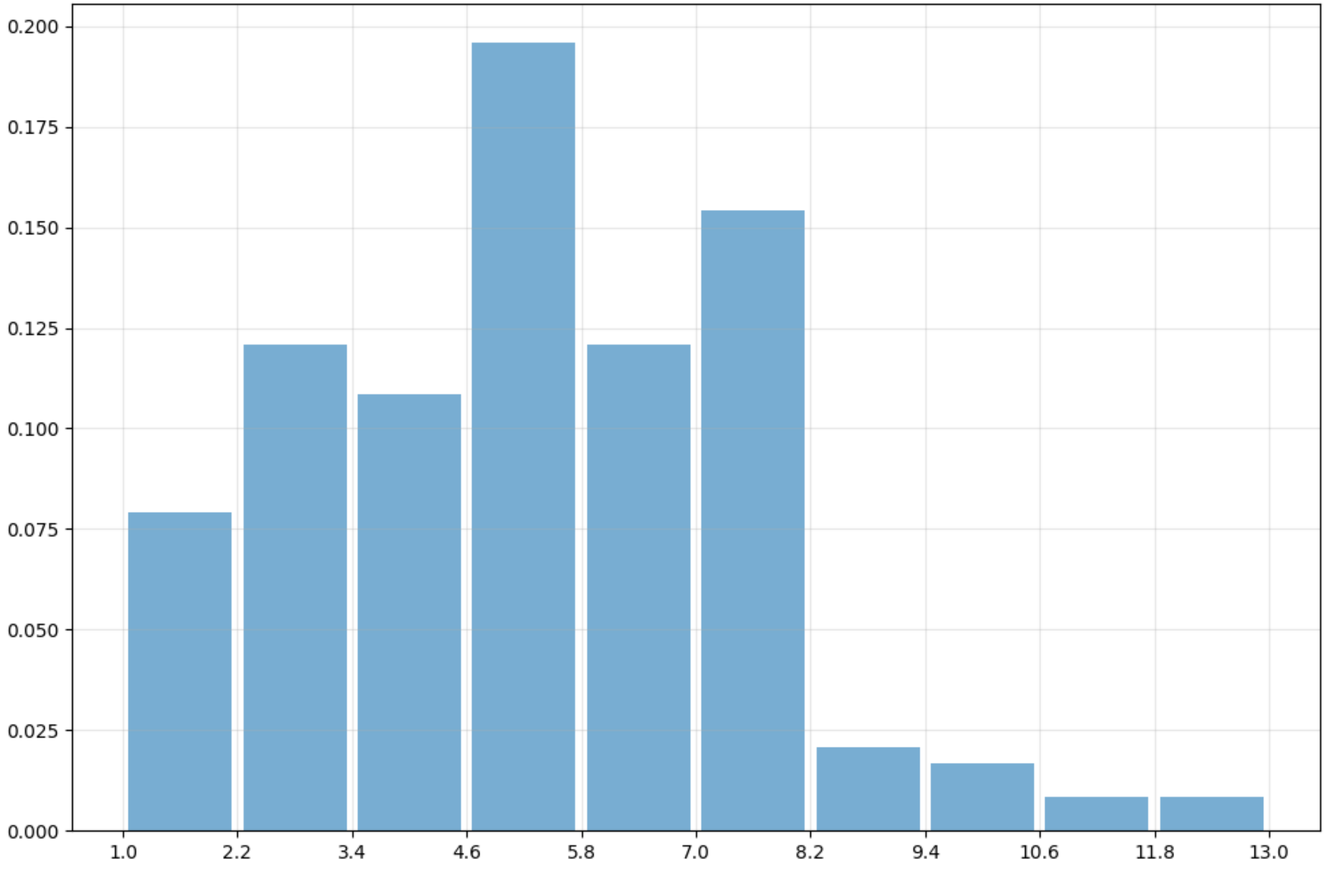
More on the uniform random sampling!

Let’s look at a statistical measurement.

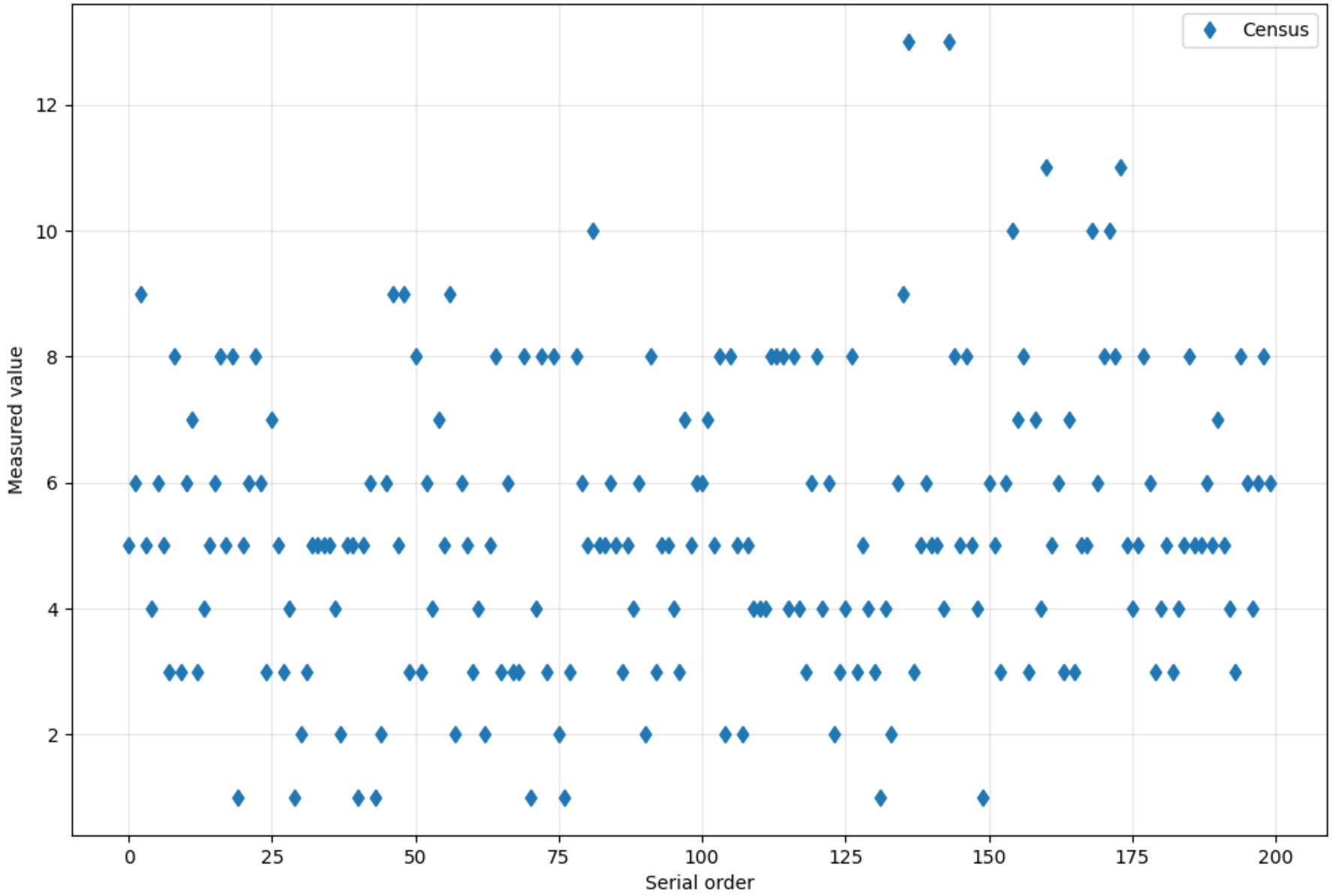
A two hundred sample gave following distribution

This distribution is called Poisson distribution!

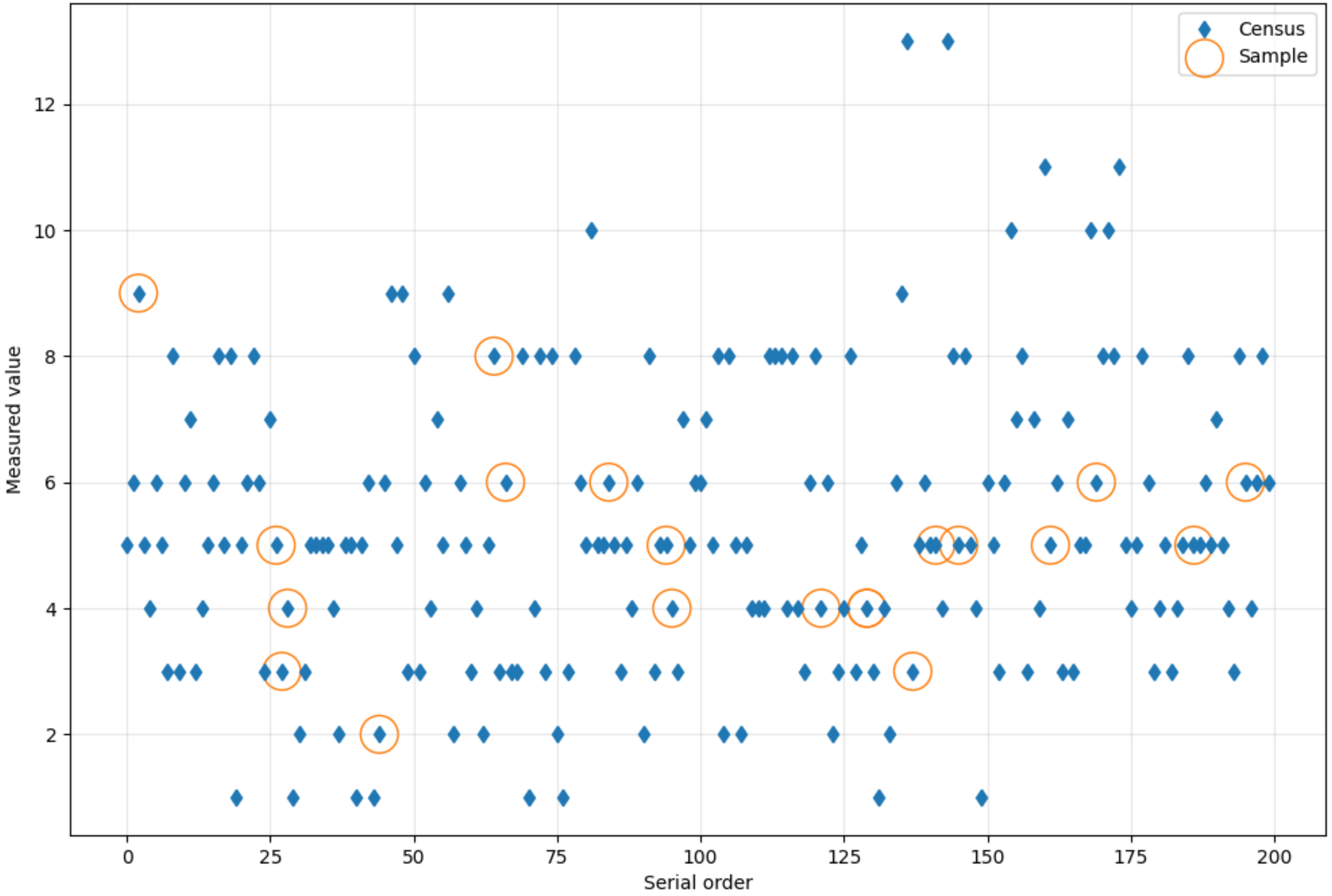
Let’s collect 20 samples with uniform random distribution and look at it’s distribution



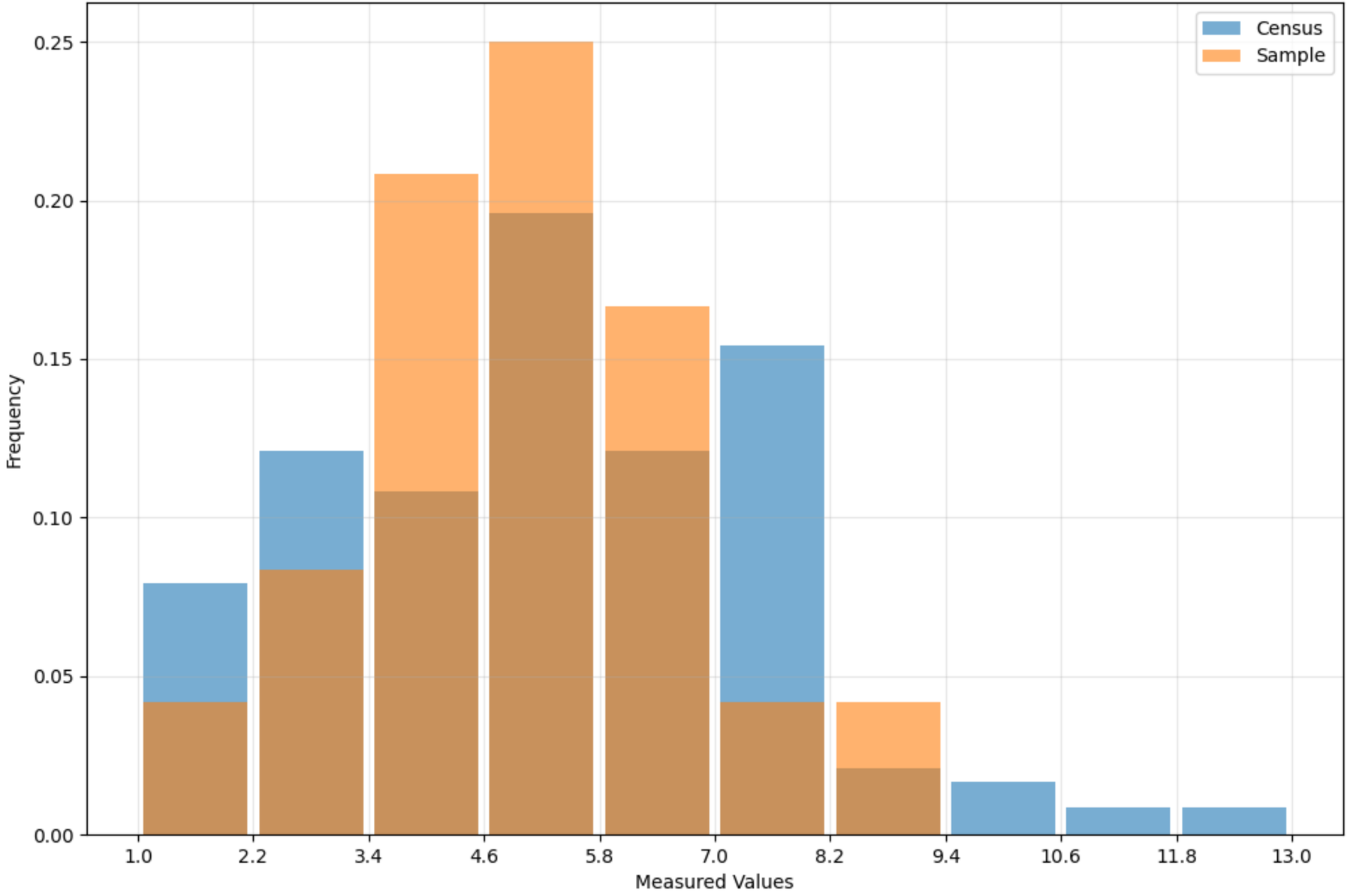
With 20 Samples



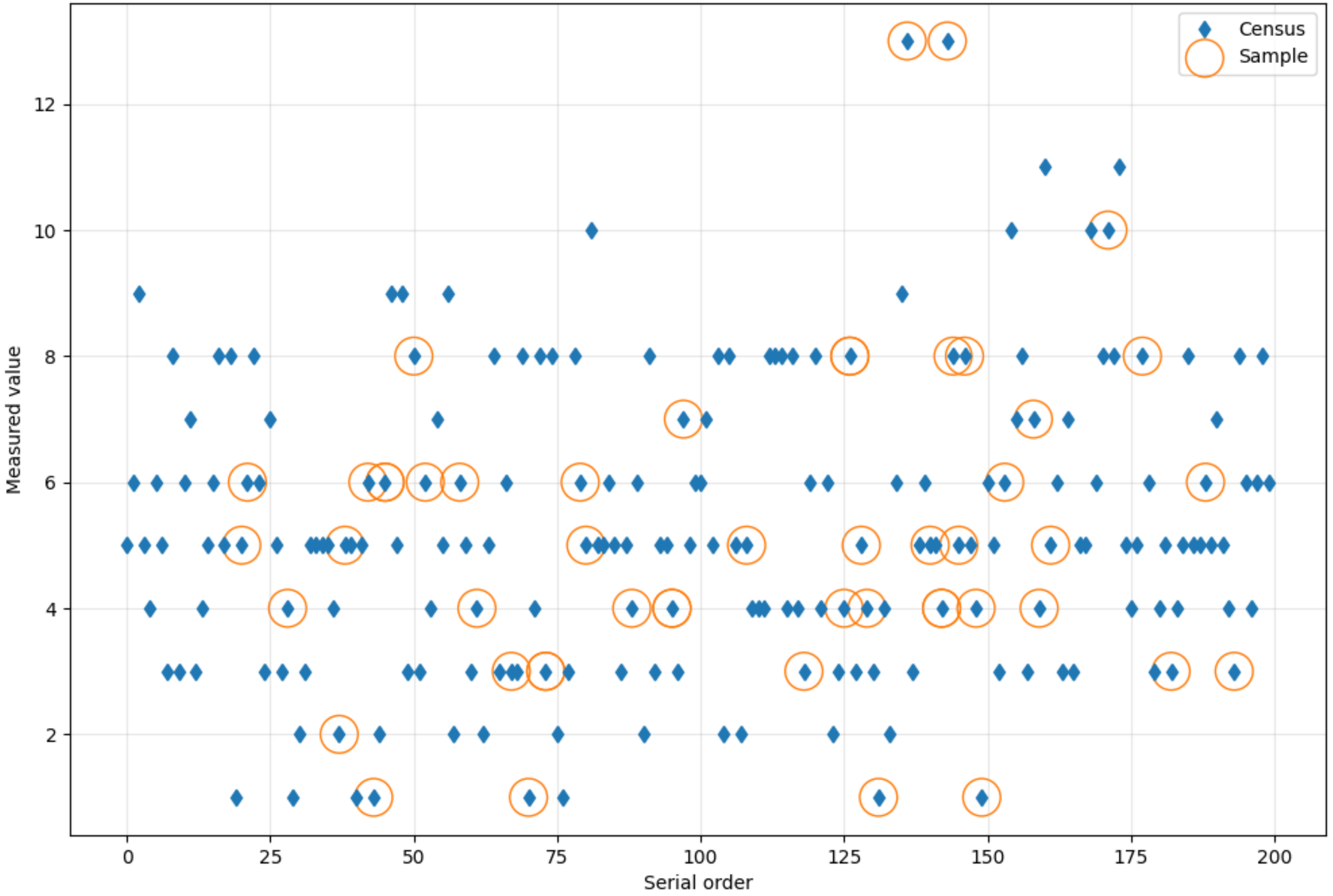
With 20 Samples



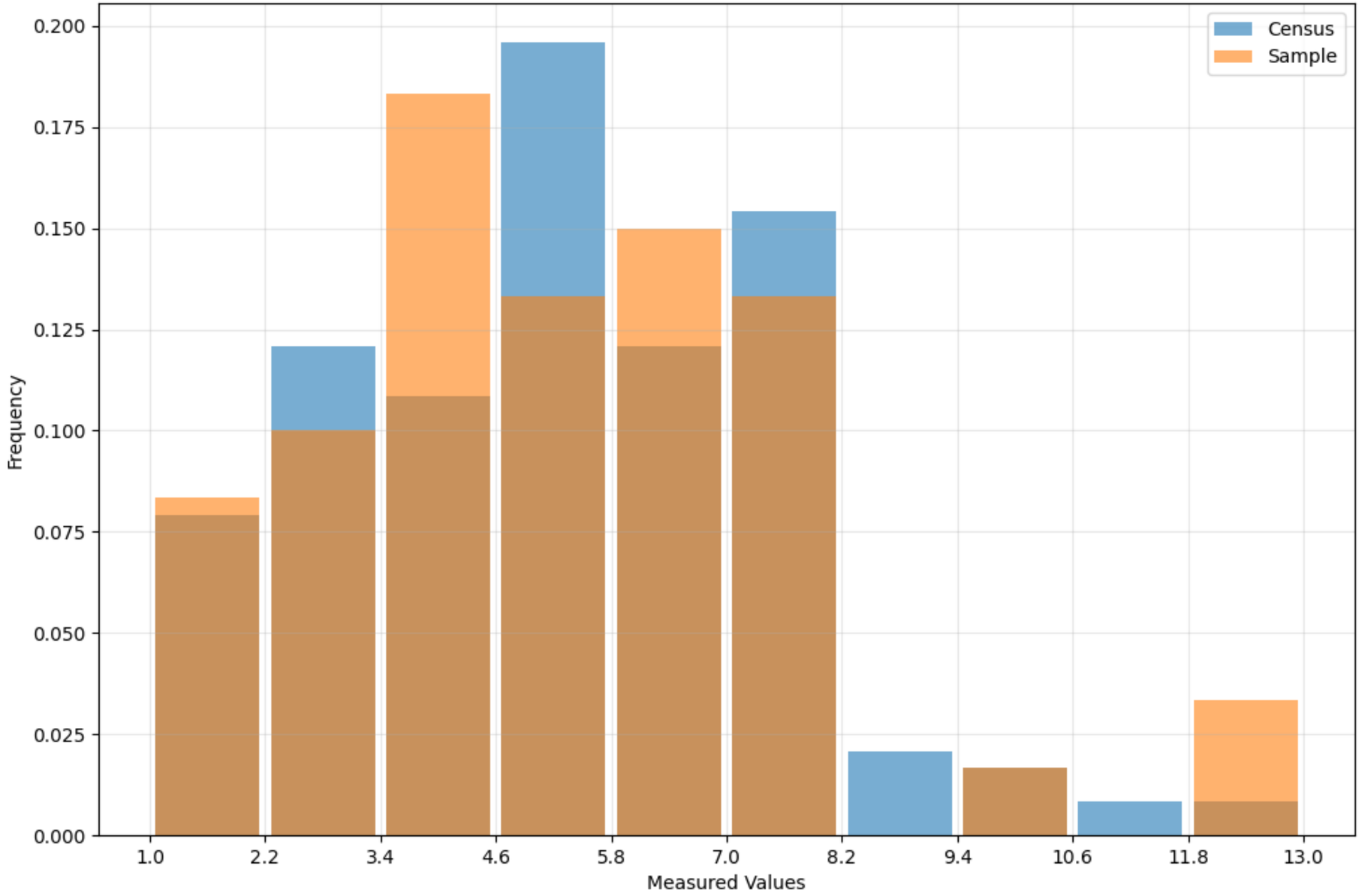
With 20 Samples



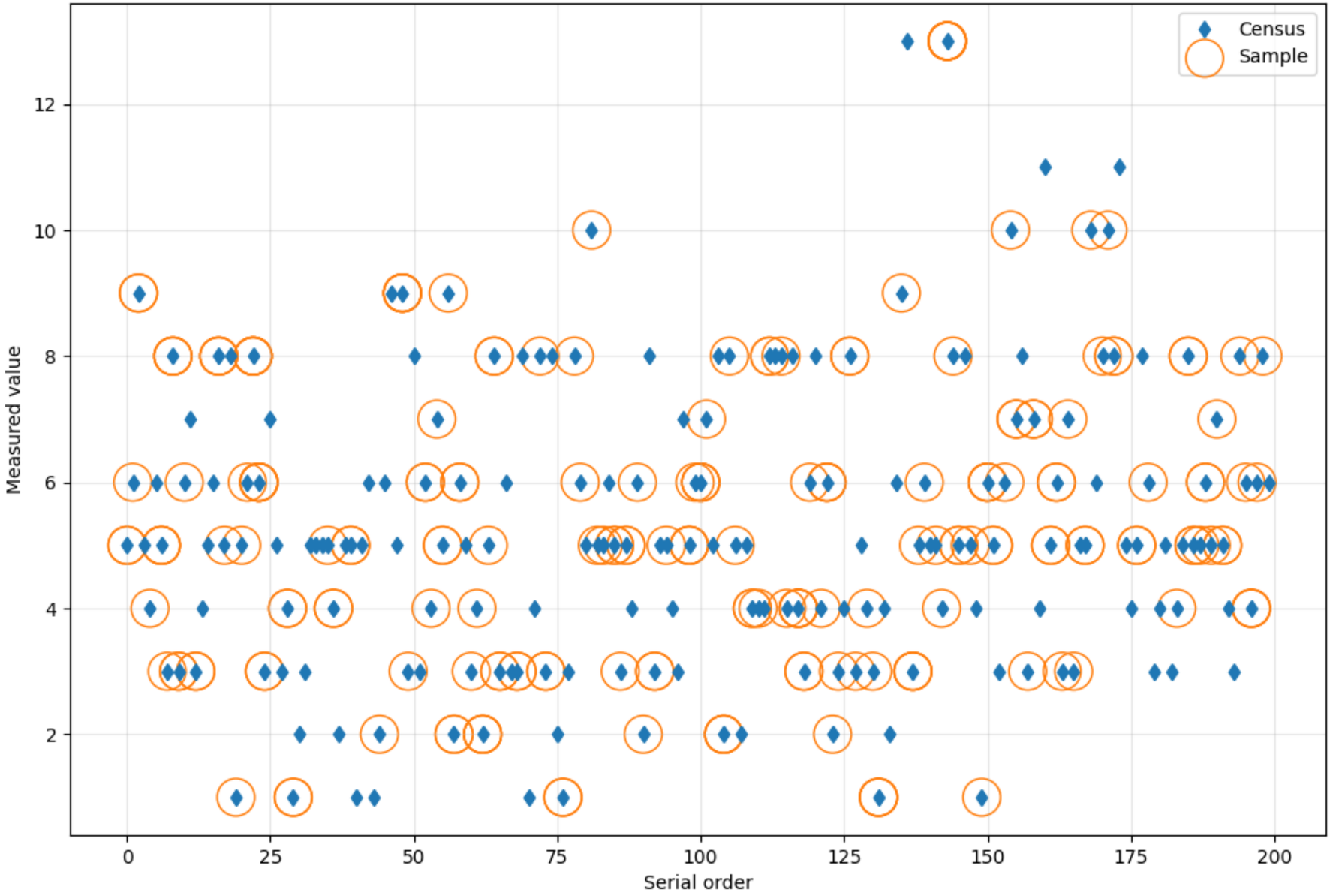
With 50 Samples



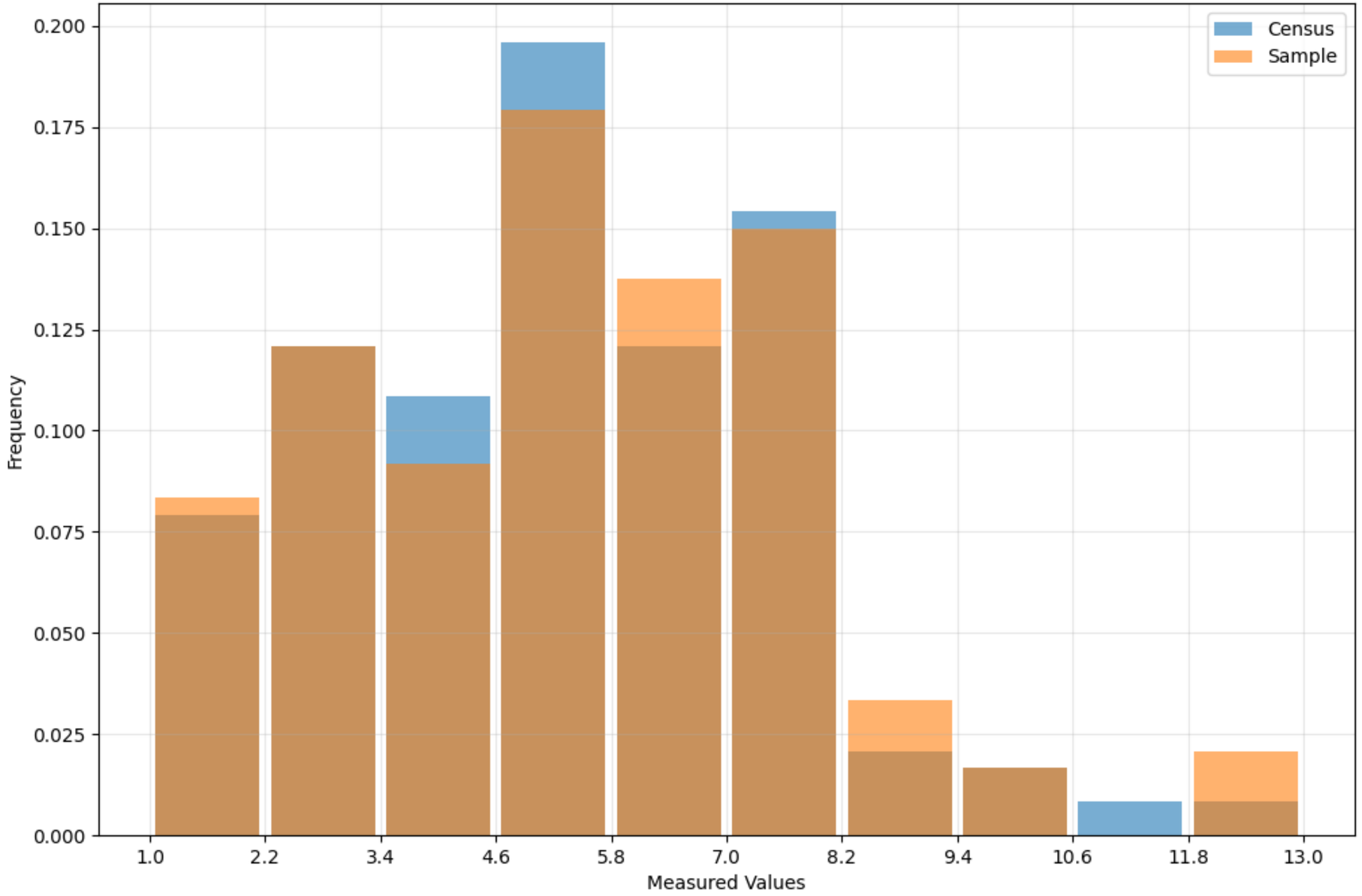
With 50 Samples



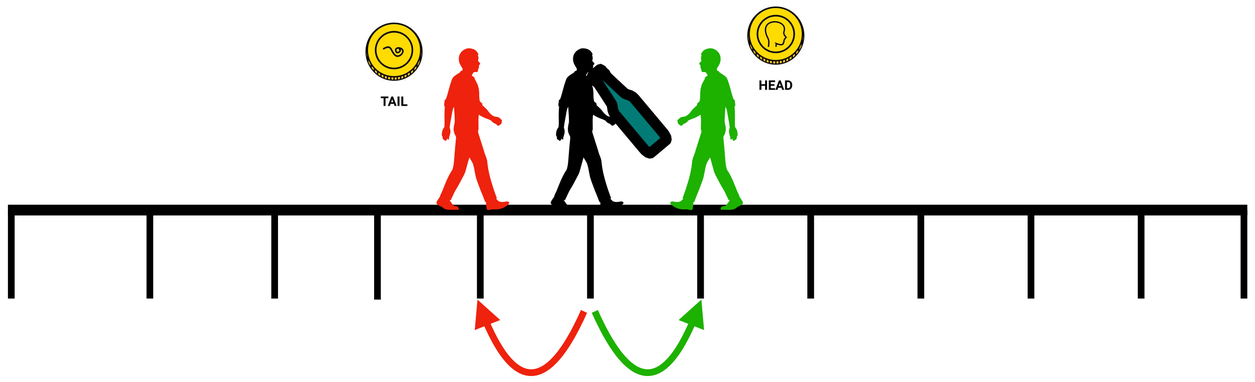
With 200 Samples



With 200 Samples



Random Walk



1 step backward 1 step forward

Flip a coin!

Heads → Move one step forward

Tails → Move one step backward

Let's say we have a biased coin! p the probability of getting heads and $(1-p)$ is the probability of finding tails

p could be 0.5 for a fair coin

Question is to find out how far does the person reach after N steps?

After First toss

The possibilities are {H}, {T}

There is probability of p person at one step forward
and probability of $1-p$ person at one step backward

After two tosses

The possibilities are {H,H}, {H,T}, {T,H}, {T,T}

There is probability of $2p(1-p)$ person at starting point {H,T}, {T,H}

probability of p^2 person at two step backward {H,H}

probability of $(1-p)^2$ person at two step backward {T,T}

A brief look at coin toss

For a biased coin, p the probability of getting heads

What is probability of getting R heads in N toss is

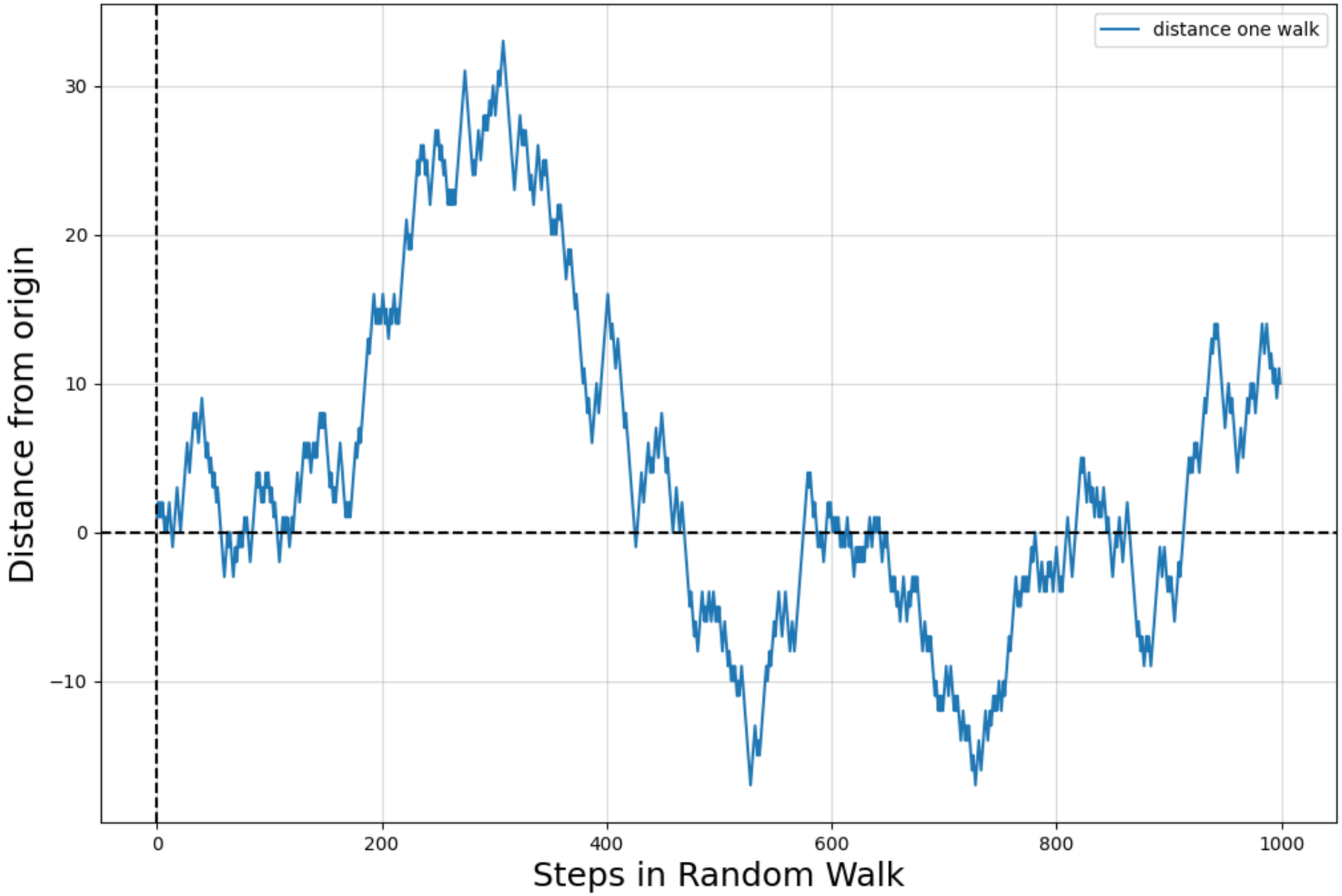
$$p^R(1-p)^{N-R}$$

After three tosses

The possibilities are {H,H,H}, {H,H,T}, {H,T,H}, {H,T,T}

2F 1F 1F 1B

Result from single walk



Average of 1000 simulations!

Summary

- ➡In random walk mean of distance travelled is zero
- ➡variance of distance travelled go as $\sqrt{N}$ where N is number of steps
- ➡In diffusion the distance travelled by the particle is proportional to $\sqrt{T}$ where T is time.
- ➡Random walk can be used for stochastic sample, one can talk a sample at each step
- ➡The Random walk do not keep memory, each test depends on only one previous step. Such sequences are called ergodic sequence/ process
- ➡It can be extended to multidimensional space