04 Sampling Distribution

David Gerard
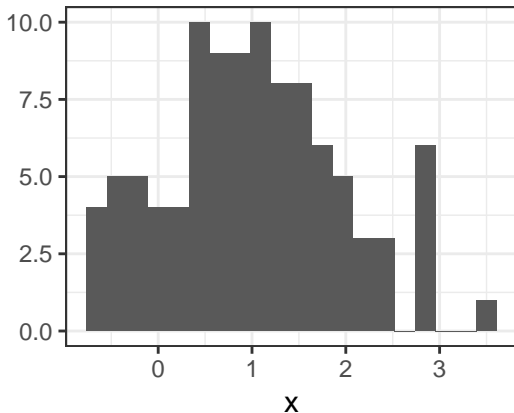
2018-12-07

Learning Objectives

We will demonstrate the concept of a sampling distribution.

Population

Suppose the population consists of 100 twins with the following histogram of differences

Sample

But we only observe one sample of 15 and calculated it's mean
2.164, *0.6218*, *0.239*, *0.04213*, *-0.1908*, *-0.6102*, *1.281*, *1.148*, *1.308*,
0.493, *1.323*, *0.8509*, *0.342*, *-0.4145* and *1.334*

avearge = 0.662.

Another Sample

But we could have collected another sample *-0.1171*, *0.5381*, *0.5779*, *0.4359*, *0.8156*, *0.3671*, *1.512*, *-0.04462*, *1.431*, *0.5352*, *0.9644*, *0.9007*, *2.118*, *1.323* and *1.281*
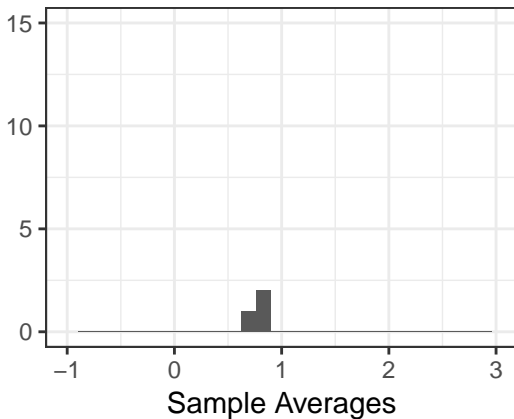
average $= 0.8425$.

Sampling Distribution

What if collect many samples and collect the corresponding sample averages in a histogram? This would be the sampling distribution of the sample average.

Keep collecting samples

0.7365, 1.712, 1.481, -0.3896, -0.4145, 0.5413, -0.2855, 1.887, 1.572, 0.7429, 2.761, 0.239, 0.02393, -0.1908 and *1.011*
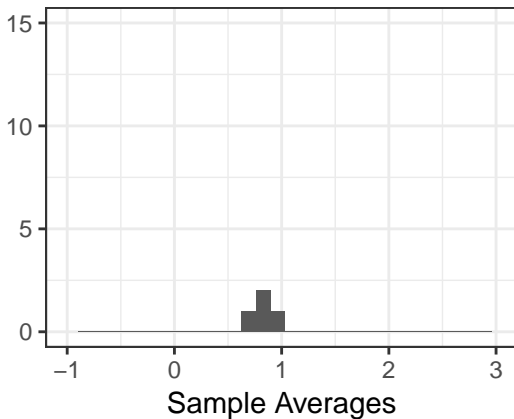
average $= 0.7619$.

Sample Averages

Keep collecting samples

0.3671, *-0.5545*, *2.496*, *0.8156*, *0.5413*, *0.7365*, *0.2961*, *-0.4197*, *2.761*, *0.5749*, *0.5381*, *1.423*, *1.091*, *2.884* and *1.475*

average $= 1.0017$.

Keep collecting samples

1.985, *-0.2855*, *-0.6102*, *0.1168*, *1.431*, *0.2961*, *0.9644*, *1.148*, *0.6889*, *0.5329*, *1.019*, *0.916*, *0.9096*, *1.091* and *1.512*

average $= 0.781$.
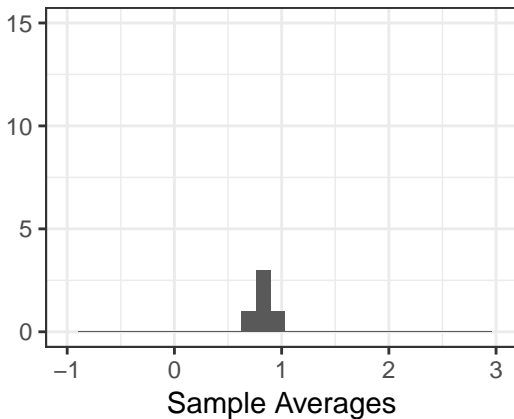
Keep collecting samples

0.0759, *-0.2365*, *-0.2097*, *1.423*, *0.4641*, *0.7429*, *0.7878*, *0.9855*, *2.884*, *0.5381*, *0.3671*, *-0.1908*, *0.239*, *0.5329* and *1.759*
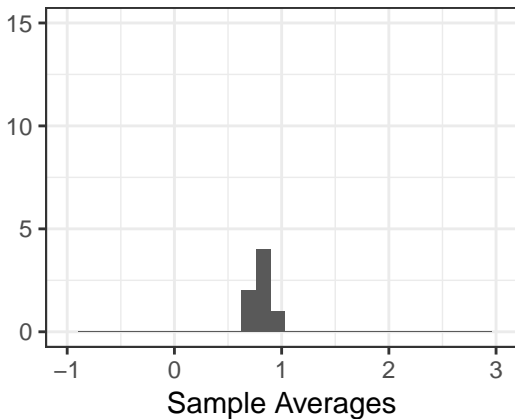
average $= 0.6775$.
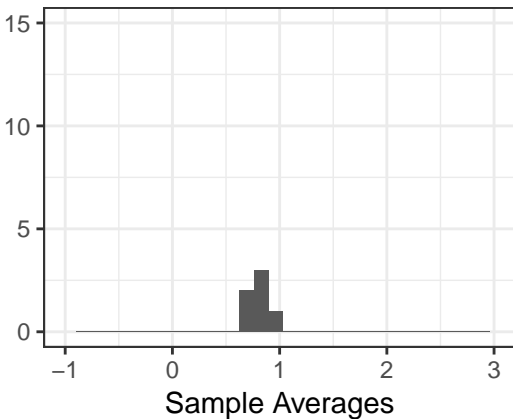
Keep collecting samples

0.7627, 2.166, -0.6172, -0.4292, -0.04462, -0.2365, 0.9855, -0.1171,
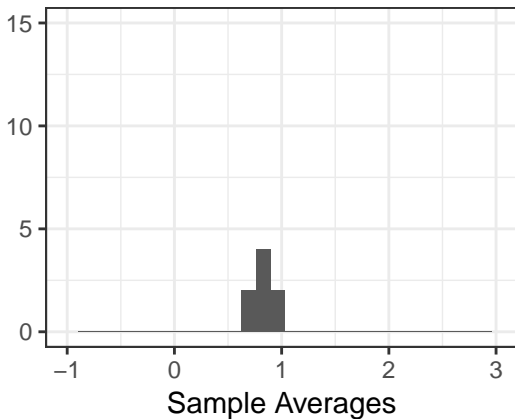*0.5749, 1.832, 0.5779, 1.23, 1.767, 1.334* and *2.118*

average $= 0.7936$.

Keep collecting samples

0.8364, 1.818, 2.166, 2.509, 0.5749, 0.7051, 1.573, 0.9855, -0.2365, 1.309, 0.1168, 0.6889, 0.7878, 0.7429 and *0.6507*
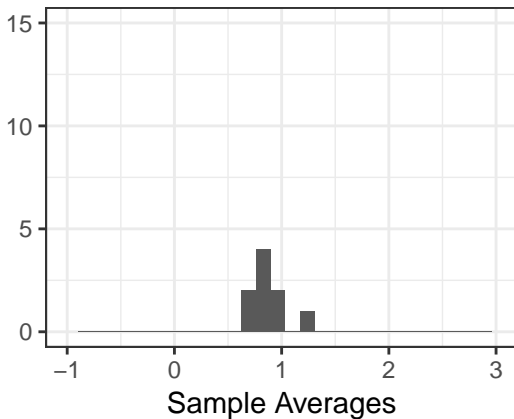
average $= 1.0152$.

Keep collecting samples

0.7878, 0.4641, 1.475, -0.3896, 1.49, 3.542, 1.769, 2.794, -0.4197, 1.887, 0.04213, 0.5329, 1.323, 2.496 and *1.573*
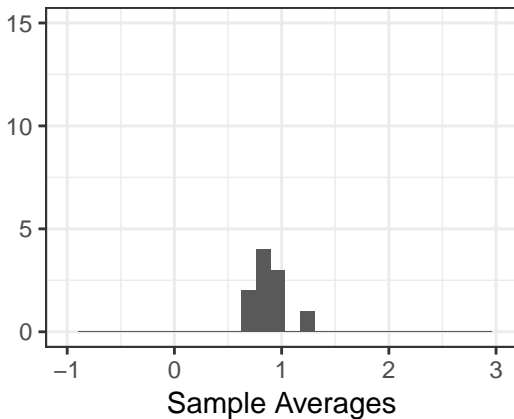
average $= 1.2911$.

Keep collecting samples

0.9007, 1.491, 0.4641, -0.2855, 0.5329, 1.281, 1.572, 1.818, 0.5352, 0.2961, 0.6218, 0.5381, 0.5413, 2.118 and *1.334*
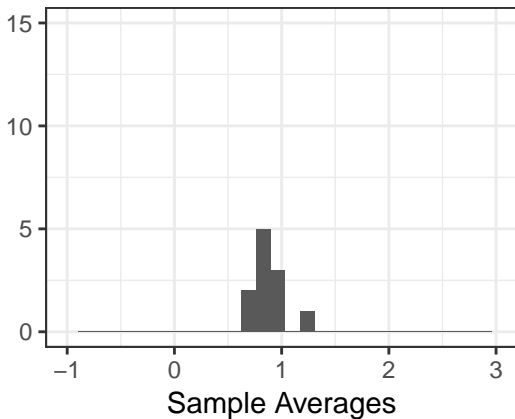
average $= 0.9172$.

Keep collecting samples

*1.091, 0.5413, 1.481, 1.512, 0.3132, 0.7365, -0.04462, 1.019,
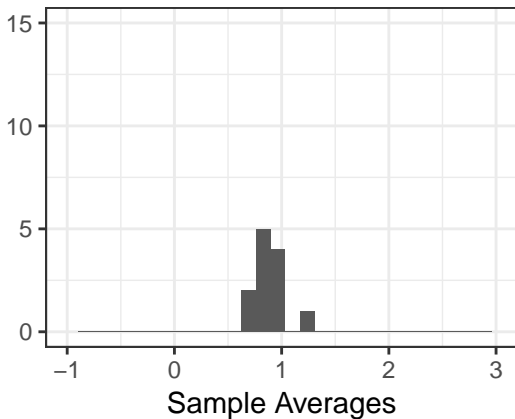0.5779, 1.49, -0.1908, 1.887, 0.8509, 1.491* and *0.2961*

average $= 0.8701$.

Keep collecting samples

0.2961, *1.512*, *0.04213*, *1.019*, *1.818*, *0.6507*, *0.5749*, *0.5413*, *1.712*, *1.036*, *-0.1908*, *1.983*, *1.475*, *-0.2097* and *1.431*
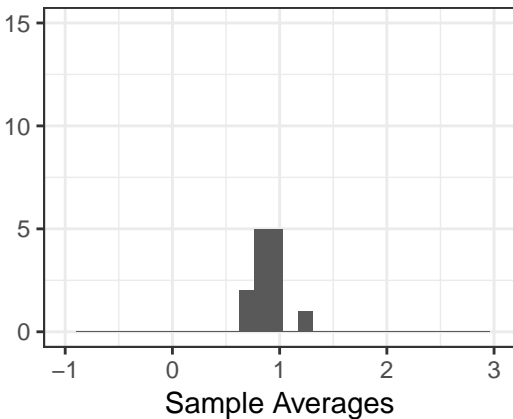
average $= 0.9127$.

Keep collecting samples

1.309, 0.239, 1.767, 0.0759, 2.884, 1.091, 0.7429, 0.7878, 1.759,
1.983, -0.6102, -0.4145, 2.761, -0.2365 and *0.9855*

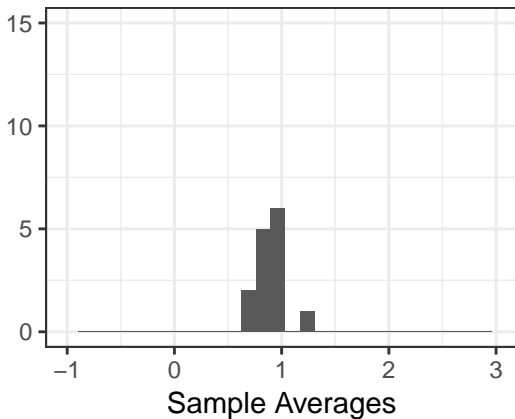average $= 1.0082$.

Keep collecting samples

1.481, *1.769*, *1.091*, *0.5779*, *2.814*, *0.8156*, *-0.6102*, *0.5413*, *2.496*, *0.6218*, *1.491*, *0.02393*, *0.04213*, *0.7429* and *0.2961*
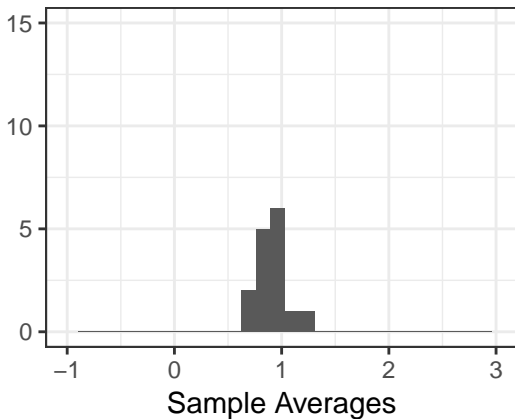
average $= 0.9462$.

Keep collecting samples

-0.04462, 1.258, 1.036, 1.491, 0.8509, 1.334, 0.4359, 0.9218, 0.02393, 2.118, 0.7051, 0.3599, 2.884, 0.6507 and *1.887*
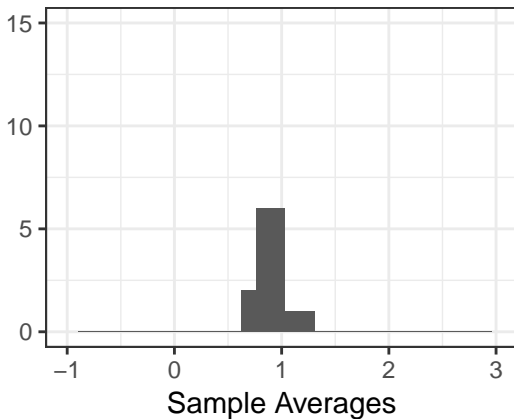
average $= 1.0607$.

Keep collecting samples

1.512, *-0.4197*, *2.478*, *0.9096*, *1.985*, *0.916*, *-0.1908*, *0.04213*, *0.5352*, *2.166*, *0.239*, *0.342*, *0.5779*, *0.6507* and *0.7429*
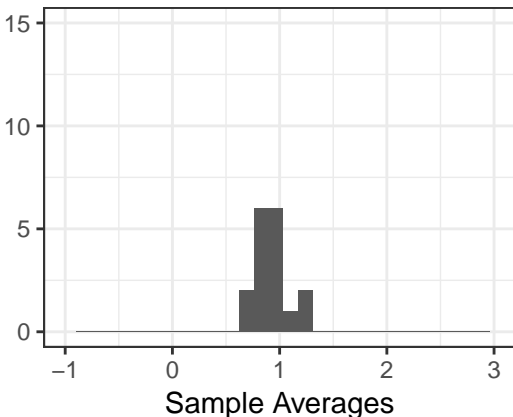
average $= 0.8325$.

Keep collecting samples

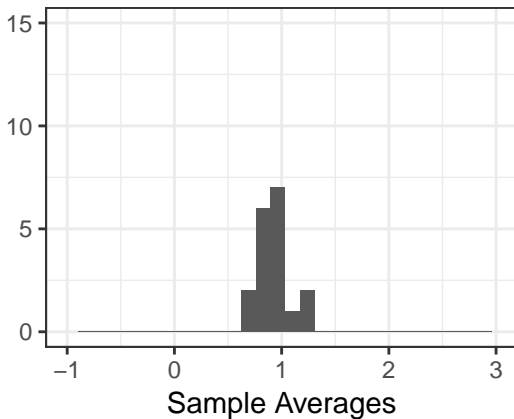*-0.3896, 0.5381, 1.475, 2.496, 1.197, 1.423, 3.542, 1.011, 1.323, 1.431, 1.334, 1.281, 0.239, 0.3671* and *0.7365*

average $= 1.2001$.

Keep collecting samples

1.968, *1.475*, *0.8364*, *1.512*, *-0.2365*, *0.9096*, *1.011*, *0.7627*, *0.239*, *2.783*, *-0.1908*, *1.767*, *0.5413*, *-0.6102* and *1.23*
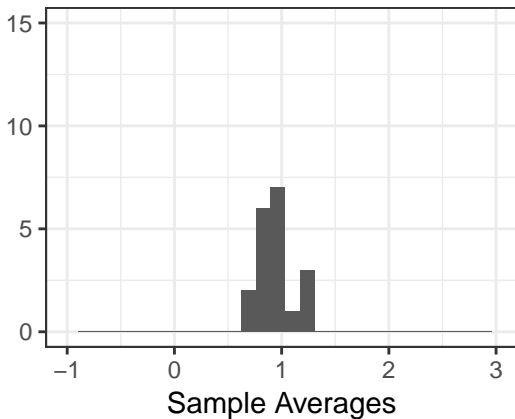
average $= 0.9331$.

Keep collecting samples

1.512, 1.759, 0.7627, 0.5329, 0.7878, 0.5779, 0.8364, -0.2097,
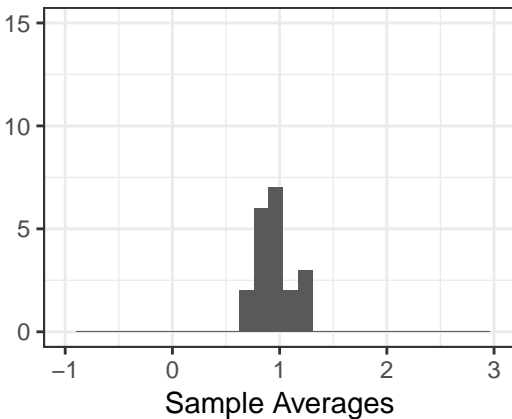*2.118, 1.887, 1.985, 1.148, -0.4197, 1.968* and *2.794*

average $= 1.2027$.

Keep collecting samples

0.9218, *-0.04462*, *1.887*, *0.8156*, *2.478*, *1.832*, *1.968*, *0.4641*, *1.862*, *0.9007*, *0.493*, *0.8509*, *0.916*, *0.5381* and *0.4359*
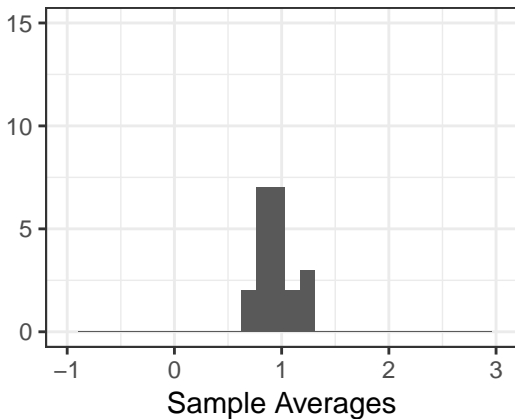
average $= 1.0879$.

Keep collecting samples

-0.5545, 1.309, 1.475, 0.02393, 0.493, 0.3599, 0.5381, -0.4197, 1.323, 1.431, 0.239, 0.8156, 2.814, 0.4641 and *1.769*
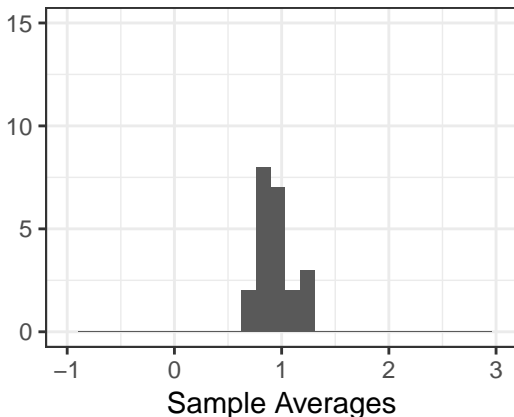
average $= 0.8053$.

Keep collecting samples

3.542, *0.02393*, *-0.1171*, *2.164*, *-0.4197*, *1.036*, *-0.5559*, *0.7627*, *0.8509*, *1.481*, *-0.6102*, *1.019*, *1.197*, *0.9096* and *0.3132*

average $= 0.7731$.

Keep collecting samples

0.7365, *1.573*, *1.091*, *1.712*, *0.6889*, *1.767*, *2.496*, *0.8364*, *0.5413*, *0.2961*, *0.5352*, *1.019*, *1.431*, *2.796* and *0.5329*
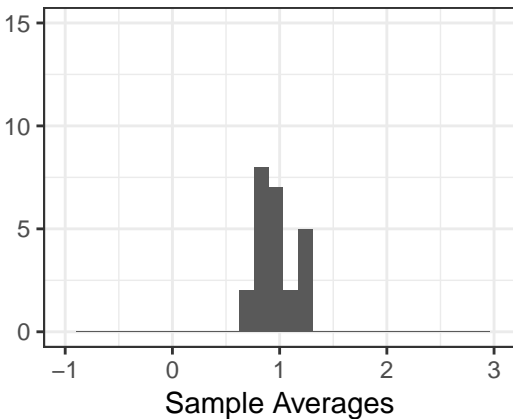
average $= 1.2035$.
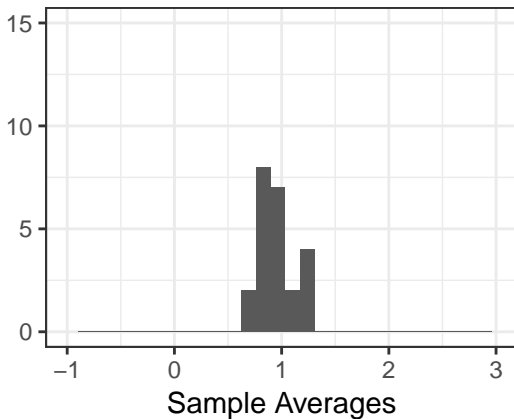
Keep collecting samples

*2.118, 0.4641, 1.281, 0.7878, 2.796, 2.814, 1.308, -0.4145, -0.2365,
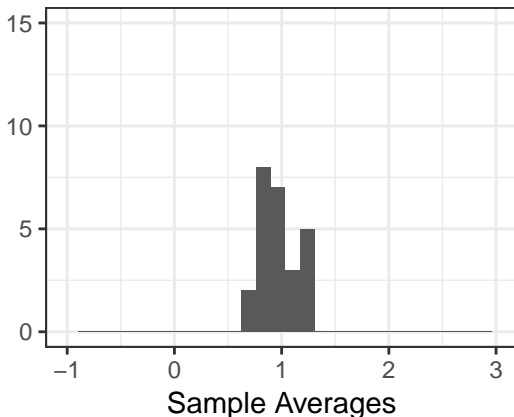2.509, 1.767, -0.5545, 2.761, 0.6889* and *0.8156*

average $= 1.2603$.

Keep collecting samples

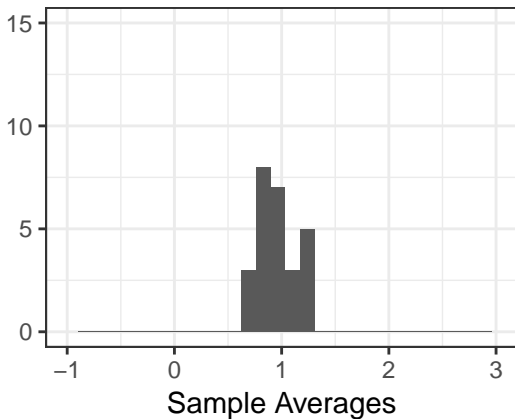*0.7429, 1.019, 1.862, 0.239, 2.814, 2.884, 3.542, 1.281, -0.3896, 0.6507, 0.493, 0.5352, 0.04213, -0.2855* and *1.423*

average $= 1.1235$.

Sample Averages

Keep collecting samples

1.49, *0.4359*, *0.02393*, *-0.5559*, *0.6889*, *1.769*, *0.239*, *-0.2365*, *2.814*, *0.5381*, *0.7627*, *-0.1908*, *-0.2097*, *0.4641* and *1.308*

average $= 0.6227$.

Keep collecting samples

-0.5545, *1.23*, *1.49*, *1.431*, *0.8364*, *0.0759*, *0.6889*, *1.481*, *0.7429*, *0.04213*, *0.9971*, *0.5749*, *0.6507*, *-0.1908* and *1.712*

average $= 0.7472$.
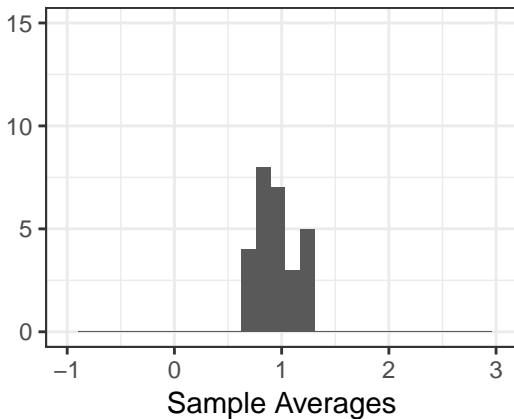
Sample Averages

Keep collecting samples

2.166, *1.308*, *0.6218*, *0.3599*, *1.23*, *1.887*, *1.475*, *1.767*, *1.019*, *0.5352*, *1.309*, *2.884*, *-0.2855*, *0.9855* and *0.5381*

average $= 1.1866$.
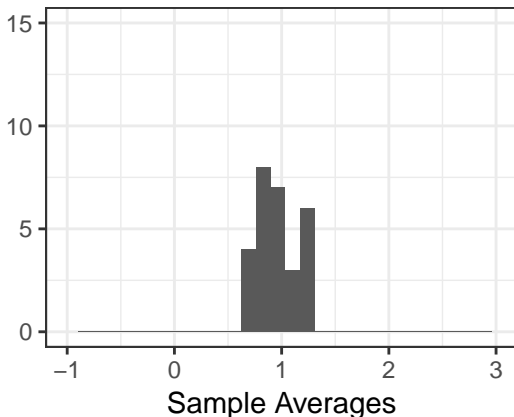
Keep collecting samples

0.239, *0.5779*, *-0.2365*, *0.3671*, *0.6507*, *1.759*, *0.3599*, *0.2961*, *1.148*, *0.9096*, *0.6889*, *0.8509*, *0.9007*, *-0.5545* and *0.0759*
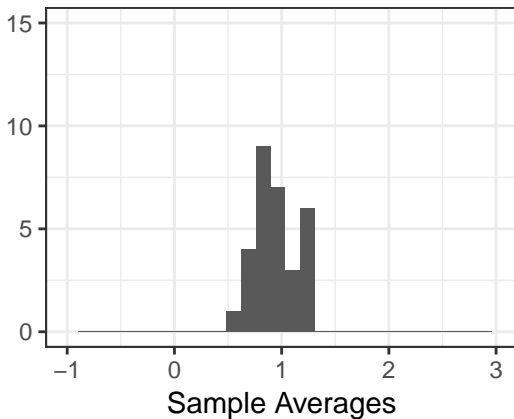
average $= 0.5355$.
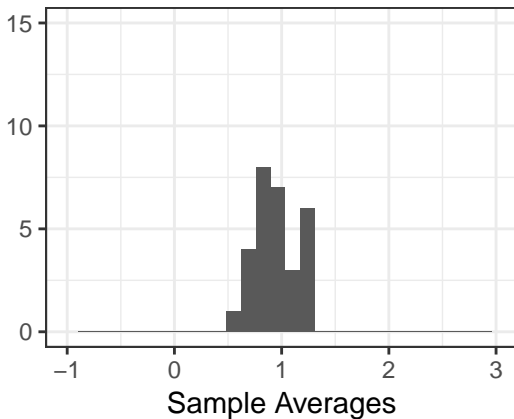
Keep collecting samples

1.036, 0.8156, 1.308, 0.6507, 1.481, 0.9007, 0.8509, 0.6889, 0.4359, 1.862, 0.5413, 0.4641, 0.3599, 0.7051 and *1.334*
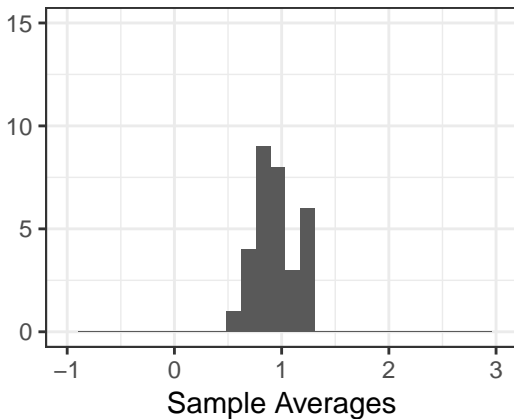
average $= 0.8956$.

Keep collecting samples

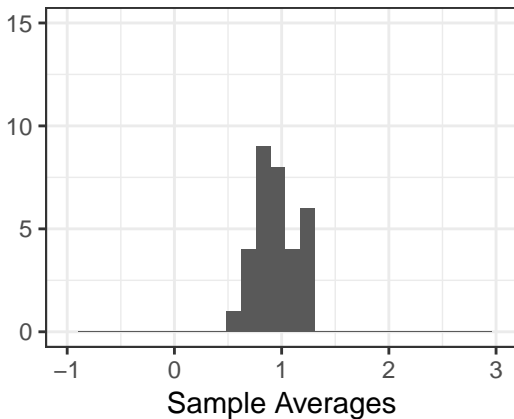*1.862, 1.475, 1.309, 0.2961, 0.5381, 0.4641, 0.6889, 1.712, 1.985, 0.0759, 0.9644, 0.04213, 1.281, -0.3896* and *1.573*

average $= 0.9251$.

Keep collecting samples

1.23, *0.9644*, *-0.5545*, *-0.6102*, *1.572*, *1.887*, *2.884*, *1.258*, *-0.2097*, *1.712*, *0.7627*, *0.7429*, *1.011*, *2.796* and *0.5779*

average $= 1.0683$.

Keep collecting samples

1.985, *1.968*, *2.884*, *1.818*, *1.983*, *1.769*, *1.512*, *0.9218*, *1.23*, *-0.6102*, *2.164*, *1.887*, *0.3671*, *0.2961* and *0.7051*

average $= 1.3919$.
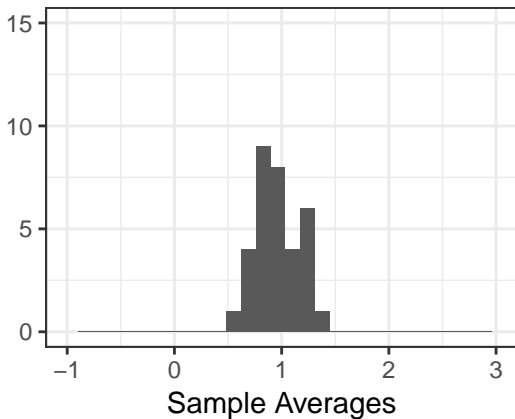
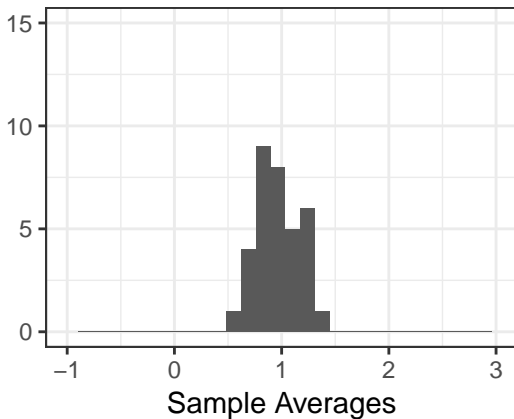Sample Averages

Keep collecting samples

*-0.04462, 1.769, 1.258, 1.49, 1.091, -0.1171, 0.5381, 0.9855,
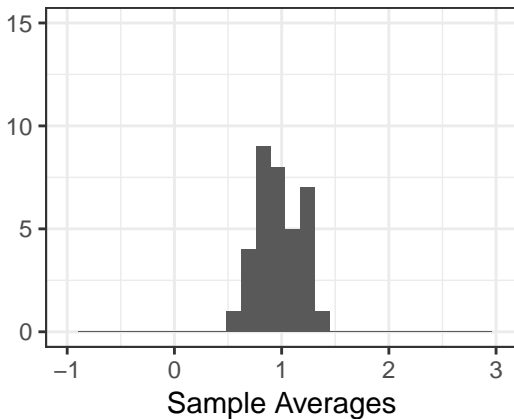-0.1908, 2.783, 1.323, 0.5352, 1.334, 1.481* and *1.431*

average $= 1.0444$.

Keep collecting samples

1.769, 0.9855, 0.493, 1.334, 0.916, 0.5381, 1.281, 1.983, 1.887, 2.783, 1.258, 2.796, 0.02393, 1.423 and *-0.2855*
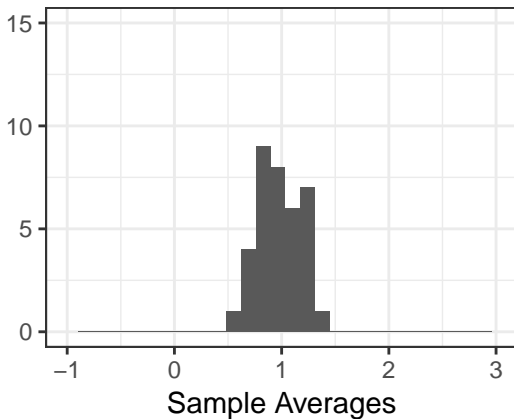
average $= 1.279$.

Keep collecting samples

0.5413, 0.3132, 1.334, 1.985, 1.769, 0.9644, 1.983, 1.23, 0.4359, 1.171, 1.091, -0.1171, 1.148, 0.6889 and *1.887*
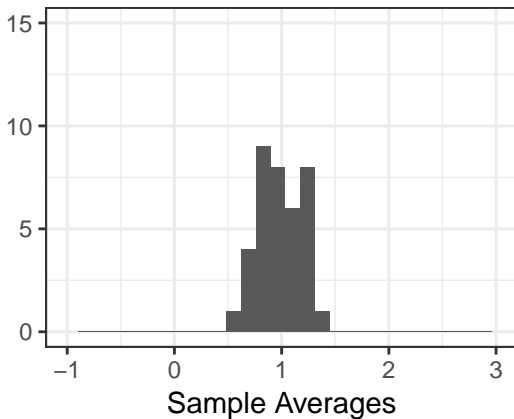
average $= 1.095$.

Keep collecting samples

0.5779, 1.712, 0.5749, -0.1908, 2.783, 1.759, 0.5381, 1.281, 1.512, 1.573, 0.9644, 1.423, 1.49, 0.3671 and *2.496*
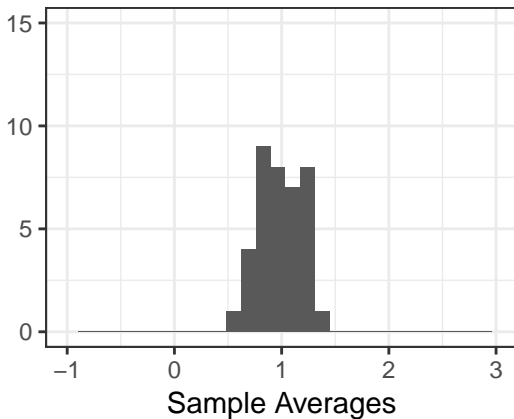
average $= 1.2574$.

Keep collecting samples

1.983, *1.712*, *2.164*, *1.491*, *2.783*, *0.8364*, *-0.2365*, *0.0759*, *0.9096*, *-0.5559*, *1.019*, *1.309*, *0.9971*, *1.171* and *1.572*

average $= 1.1487$.

Keep collecting samples

0.7365, *2.814*, *0.9007*, *1.308*, *0.916*, *0.1168*, *0.6218*, *1.983*, *1.281*, *0.7878*, *1.036*, *-0.5559*, *1.512*, *0.7627* and *1.197*

average $= 1.0278$.
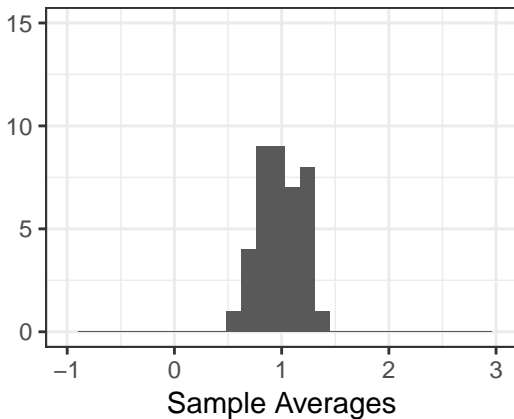
Sample Averages

Keep collecting samples

0.04213, *1.572*, *1.309*, *0.916*, *-0.5545*, *0.7051*, *0.7878*, *0.986*, *1.148*, *-0.1171*, *1.573*, *0.9007*, *0.02393*, *2.884* and *-0.3829*

average $= 0.7863$.
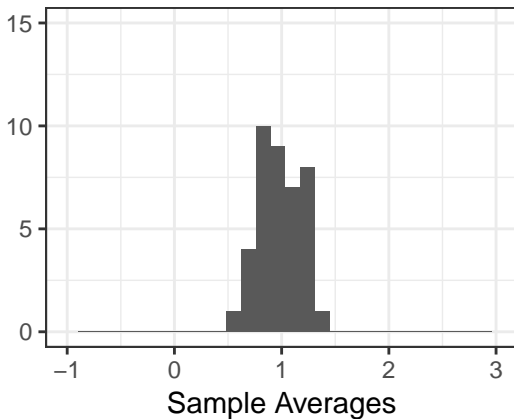
Keep collecting samples

2.164, *-0.2855*, *1.197*, *1.832*, *0.3671*, *0.1168*, *1.281*, *1.712*, *0.02393*, *-0.4145*, *1.431*, *0.5329*, *1.091*, *1.258* and *0.2961*
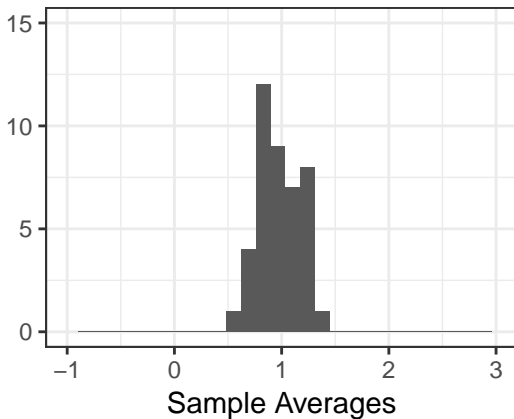
average $= 0.8401$.
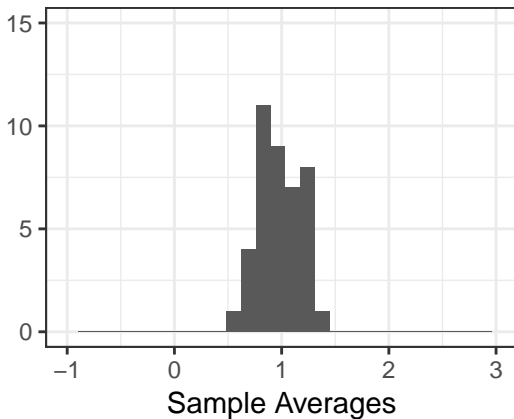
Keep collecting samples

-0.4292, 0.6889, 0.9855, 1.573, 0.4359, 1.148, 0.5352, 0.7051, 1.887, 0.5749, 1.832, 0.9644, 1.769, 0.239 and *0.3599*
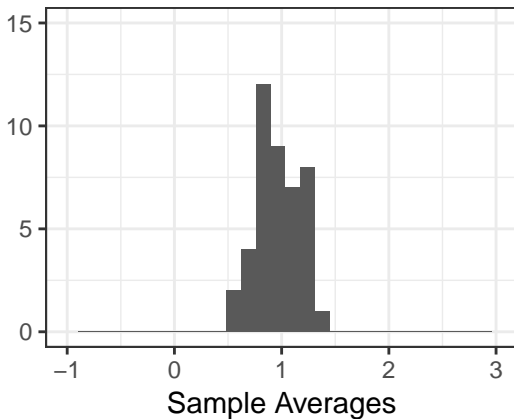
average $= 0.8846$.

Keep collecting samples

0.9218, *0.5749*, *-0.1908*, *-0.4145*, *1.23*, *1.323*, *1.423*, *-0.04462*,
0.1168, *0.2961*, *0.7051*, *1.712*, *0.5329*, *-0.2097* and *-0.4197*

average $= 0.5037$.

Keep collecting samples

0.3671, *0.239*, *2.794*, *2.783*, *1.258*, *2.496*, *-0.3829*, *-0.5545*, *1.148*, *1.767*, *0.04213*, *1.491*, *-0.4145*, *0.493* and *1.49*

average $= 1.0011$.
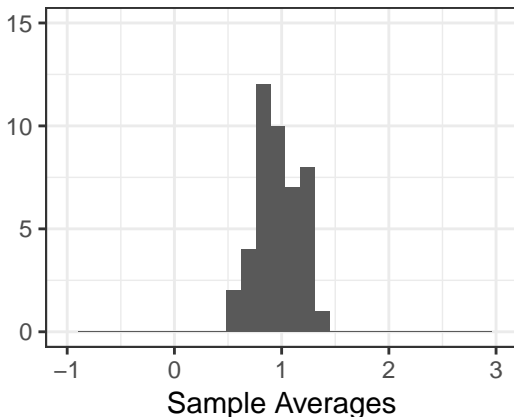
Keep collecting samples

0.04213, *0.9644*, *-0.2365*, *1.712*, *1.148*, *0.7051*, *-0.2855*, *1.011*, *2.164*, *1.23*, *-0.4197*, *-0.5545*, *1.281*, *1.334* and *1.968*

average $= 0.8042$.
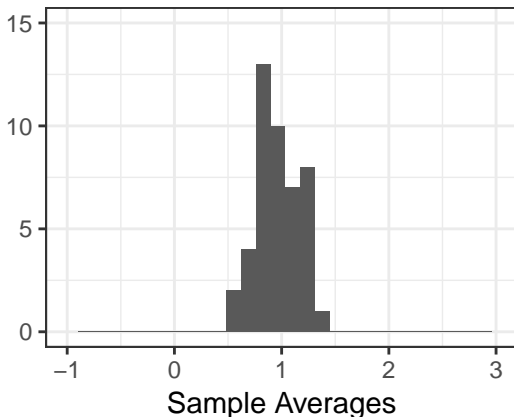
Keep collecting samples

2.884, *2.164*, *2.794*, *2.509*, *1.019*, *0.9644*, *1.985*, *1.818*, *-0.6102*, *0.986*, *0.5749*, *2.761*, *1.309*, *1.832* and *1.431*

average $= 1.628$.
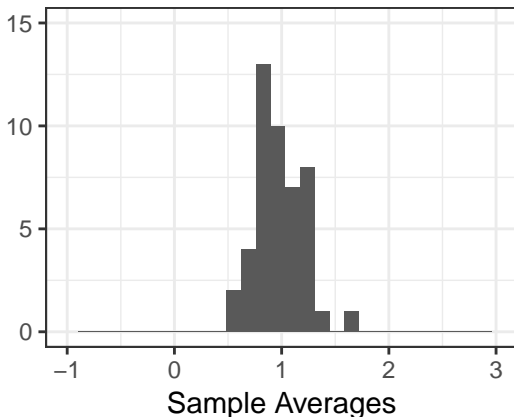
Keep collecting samples

1.308, *-0.04462*, *1.281*, *1.759*, *1.036*, *-0.3896*, *1.019*, *2.814*, *1.091*, *1.309*, *1.23*, *1.769*, *-0.6172*, *2.496* and *0.0759*

average $= 1.0757$.
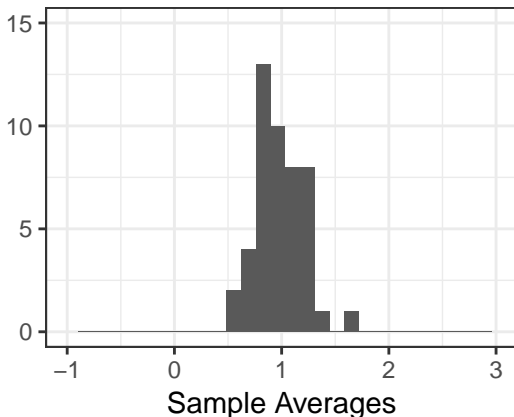
Keep collecting samples

0.04213, 1.197, -0.4145, 0.986, 0.5413, 1.985, 0.3132, 0.6889, 2.118, 0.2961, 1.011, 1.091, 2.884, 0.916 and *-0.04462*

average $= 0.9074$.