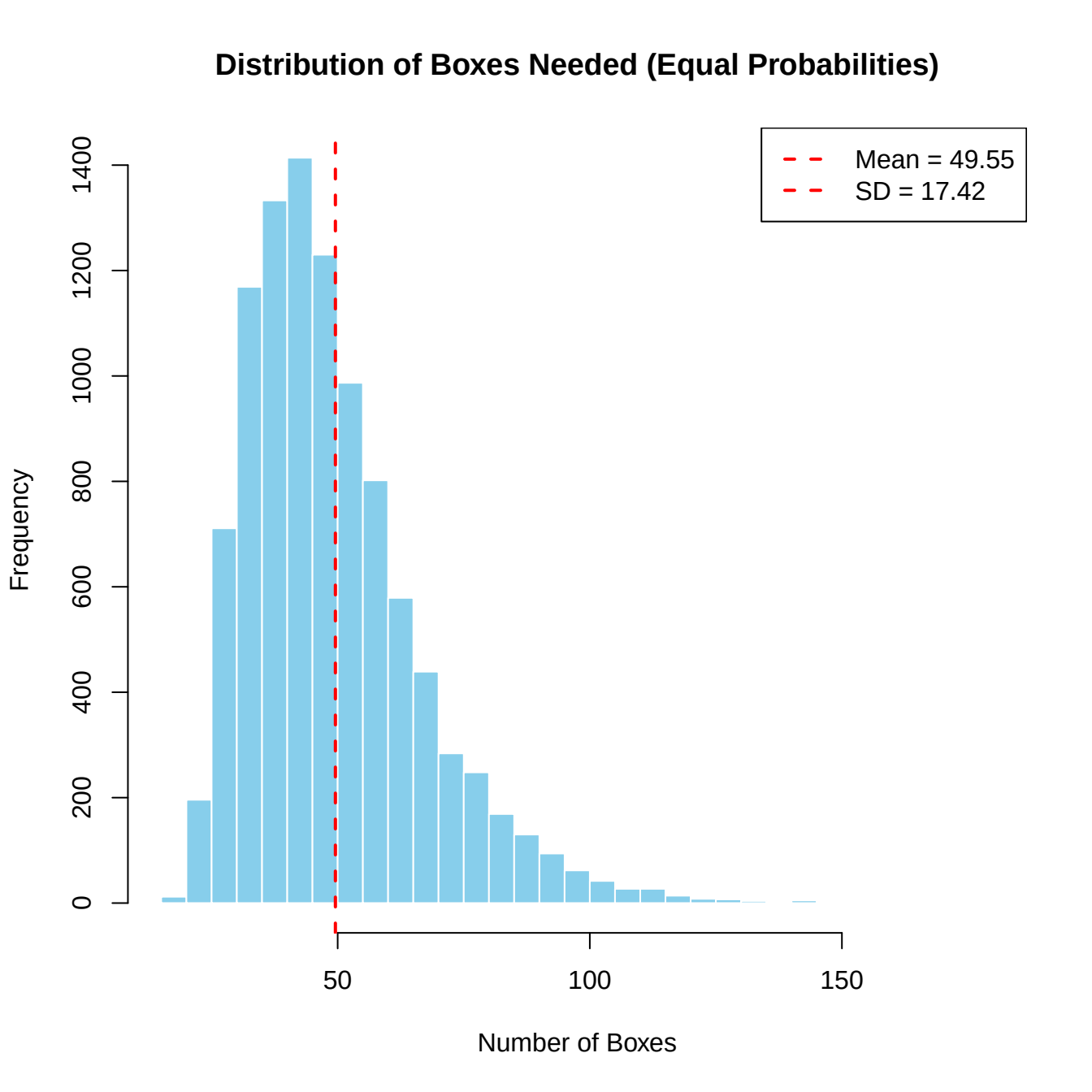
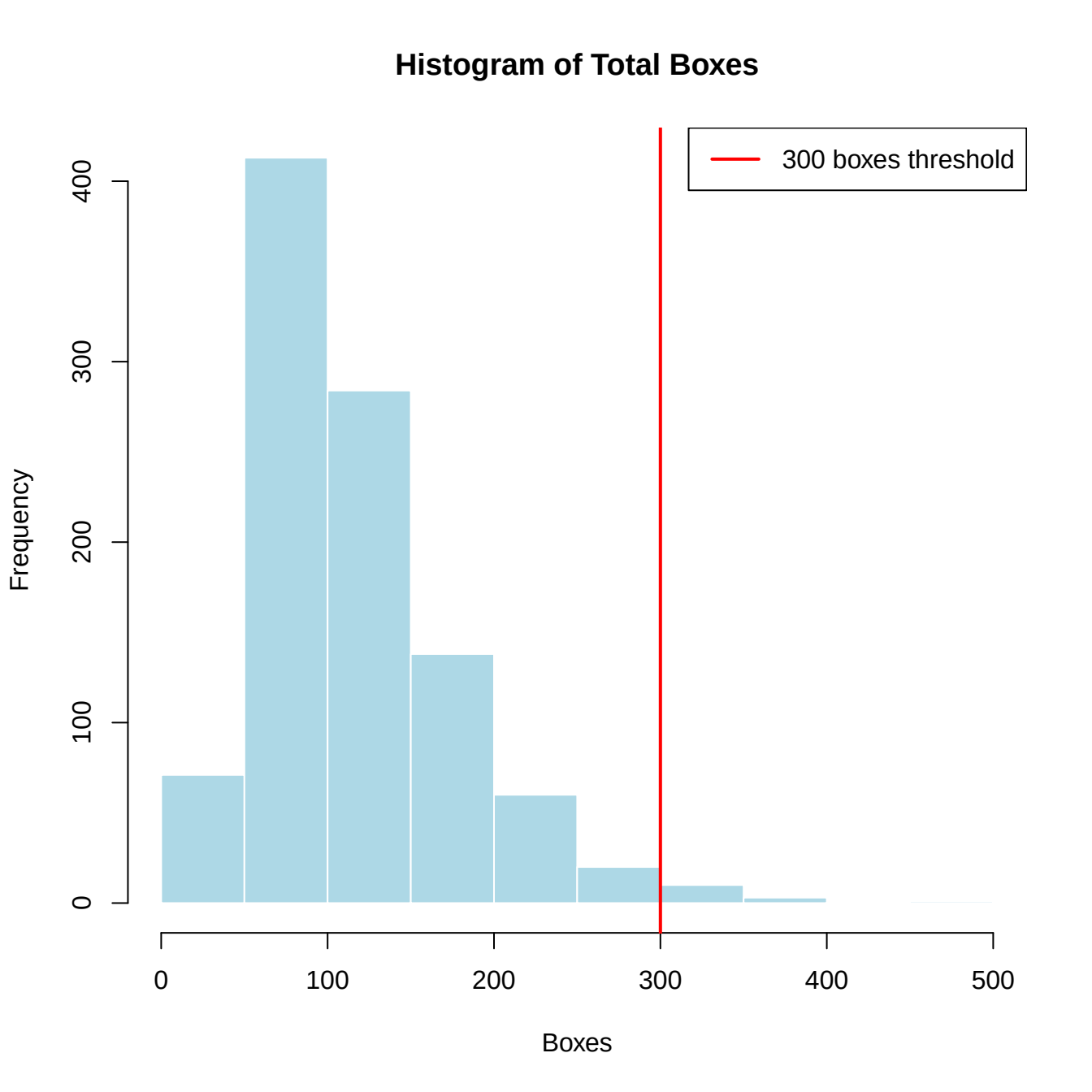
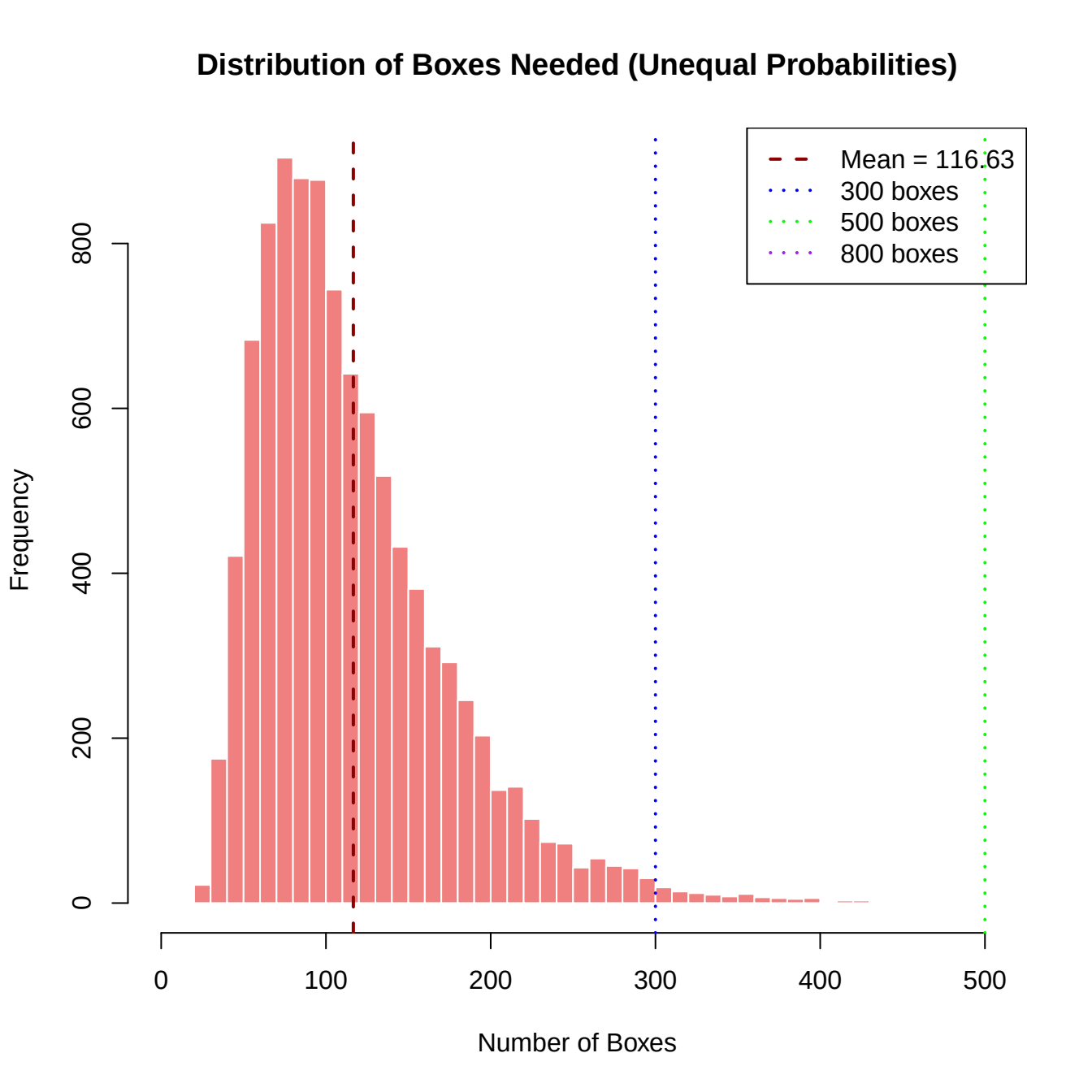
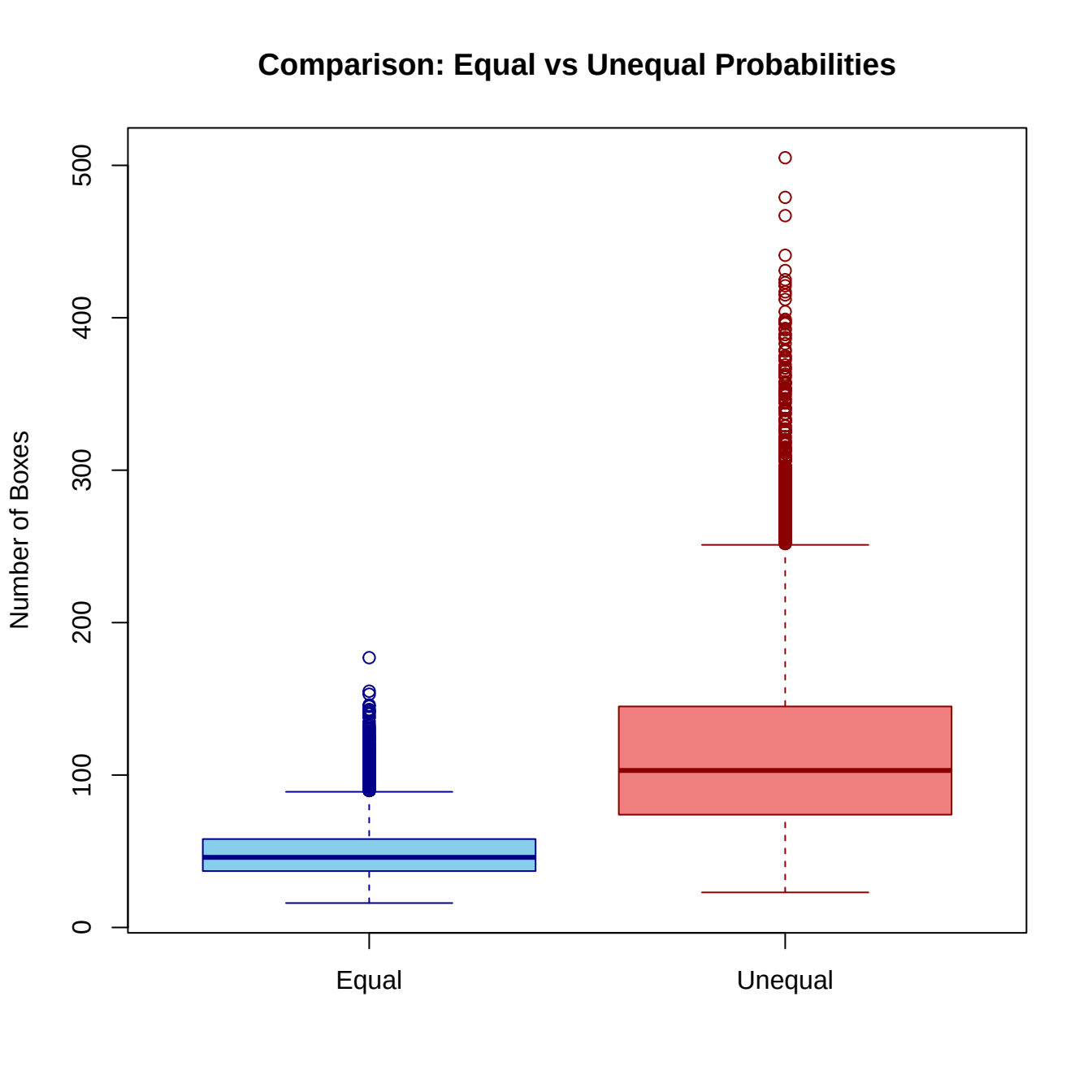
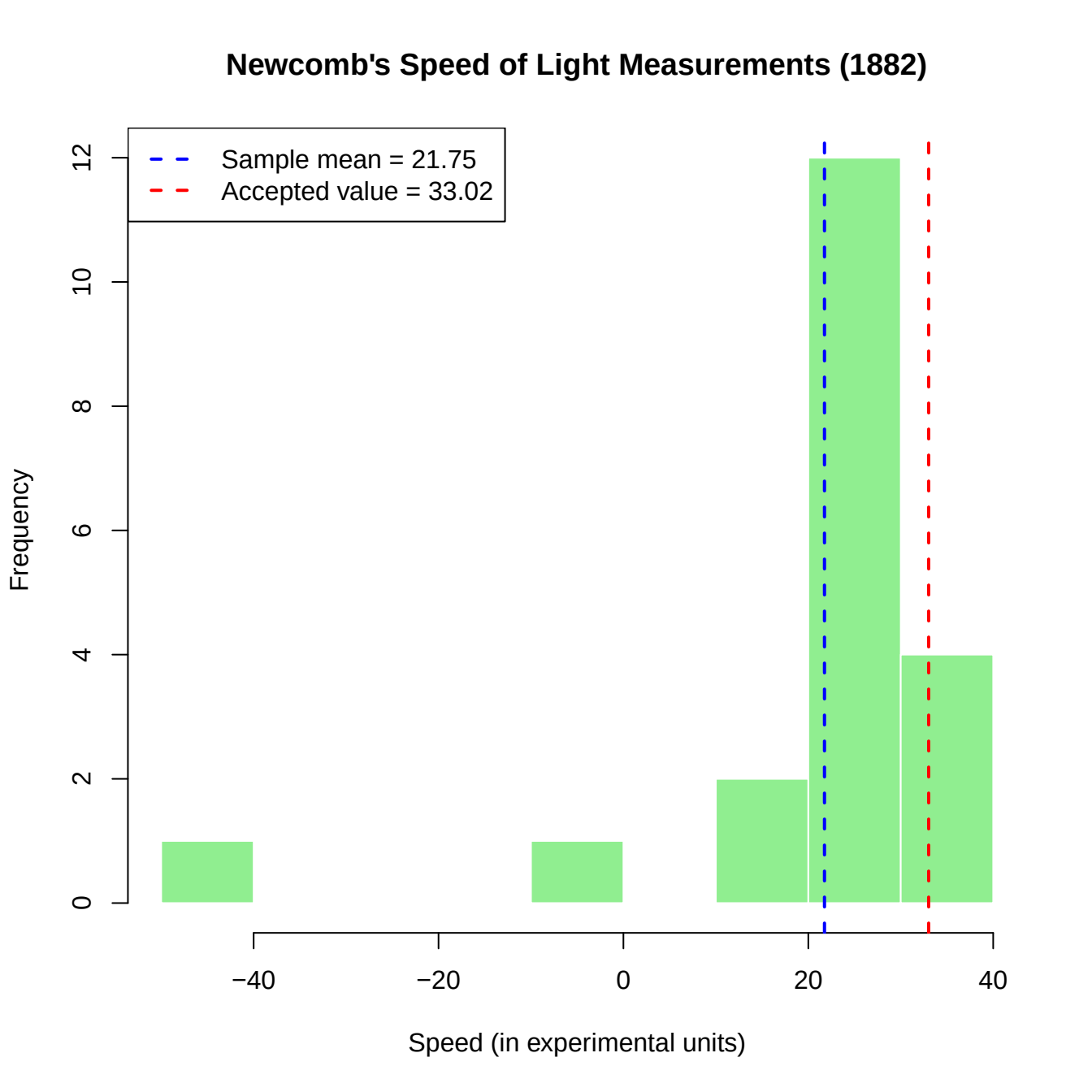
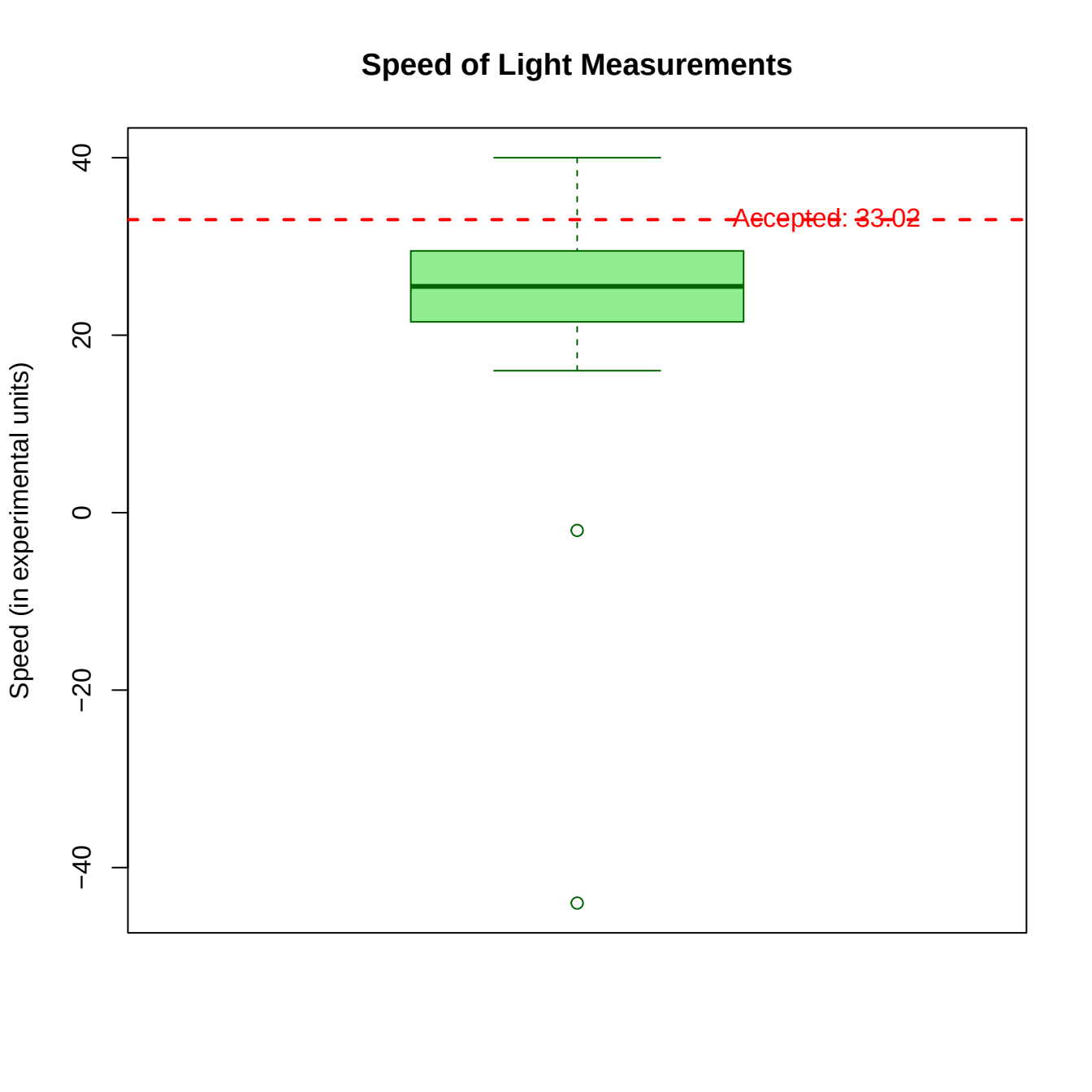

Distribution of Boxes Needed (Equal Probabilities)
Mean = 49.55
SD = 17.42
Frequency
0
200
400
600
800
1000
1200
1400
50
100
150
Number of Boxes

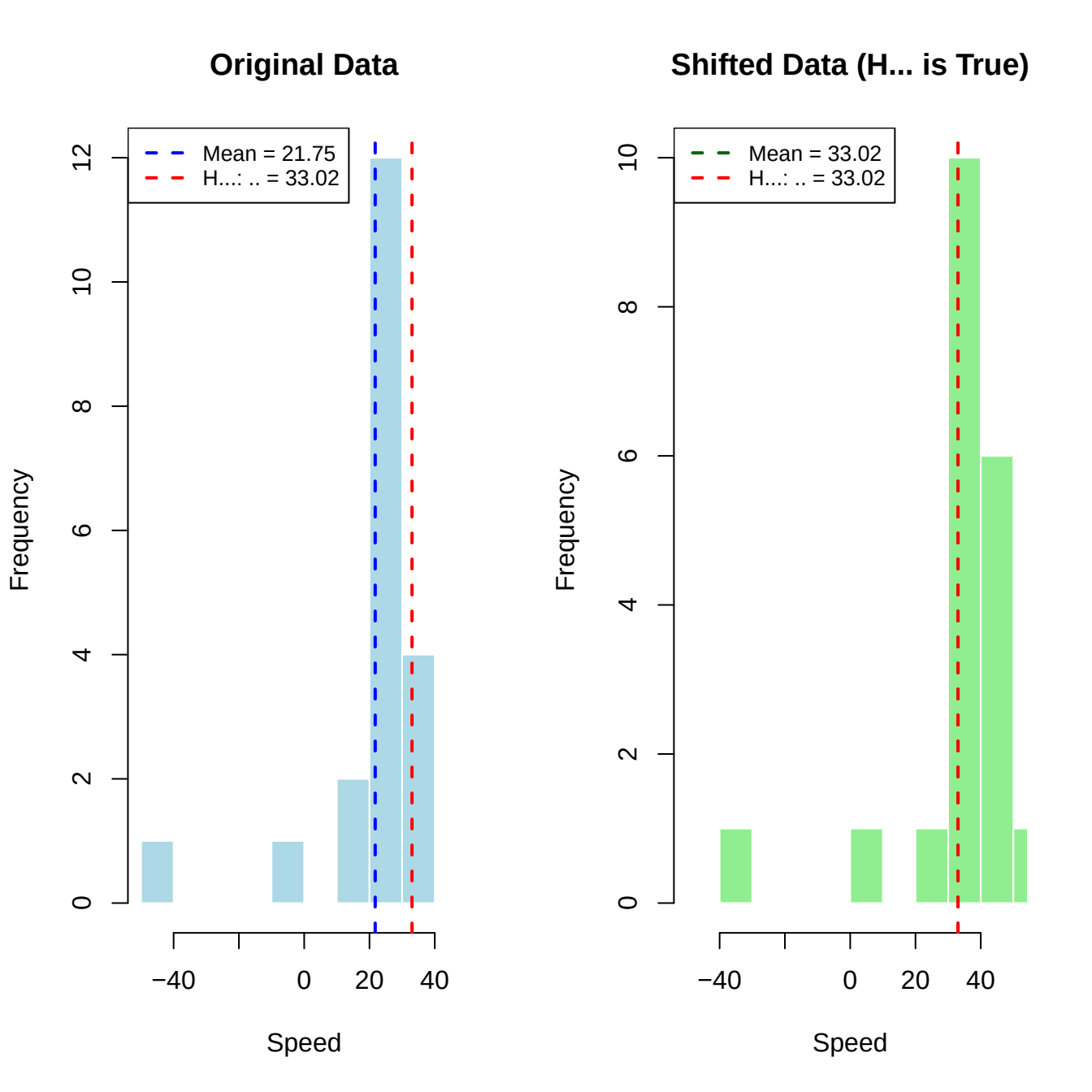

Histogram of Total Boxes
300 boxes threshold
Frequency
0
100
200
300
400
0
100
200
300
400
500
Boxes

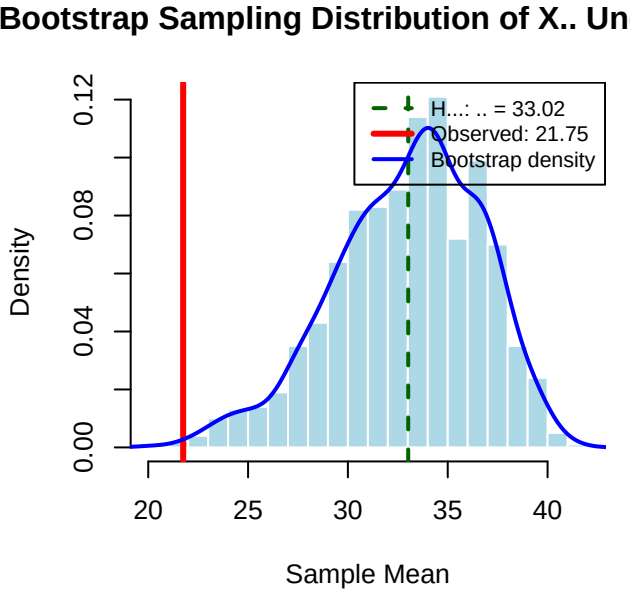

Distribution of Boxes Needed (Unequal Probabilities)
Mean = 116.63
300 boxes
500 boxes
800 boxes
Frequency
0
200
400
600
800
0
100
200
300
400
500
Number of Boxes

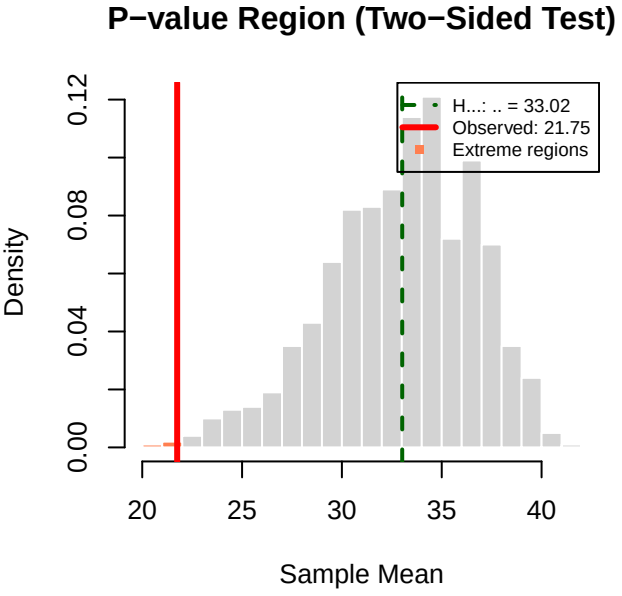

Comparison: Equal vs Unequal Probabilities
Number of Boxes
0
100
200
300
400
500
Equal
Unequal

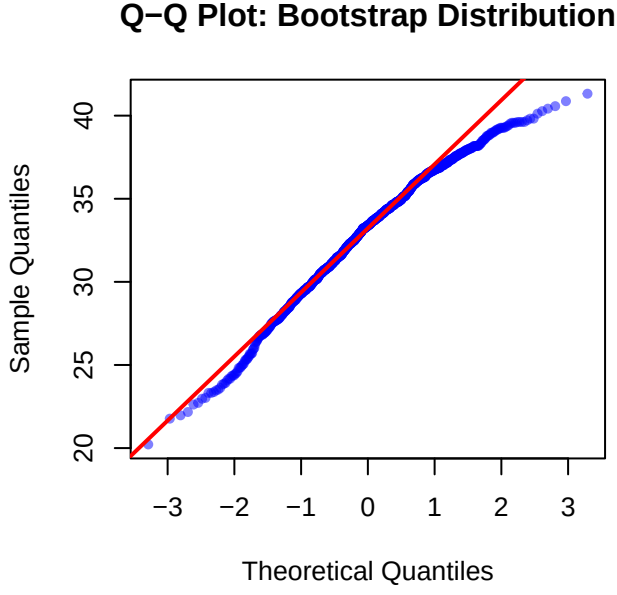

Newcomb's Speed of Light Measurements (1882)
Sample mean = 21.75
Accepted value = 33.02
Frequency
0
2
4
6
8
10
12
−40
−20
0
20
40
Speed (in experimental units)

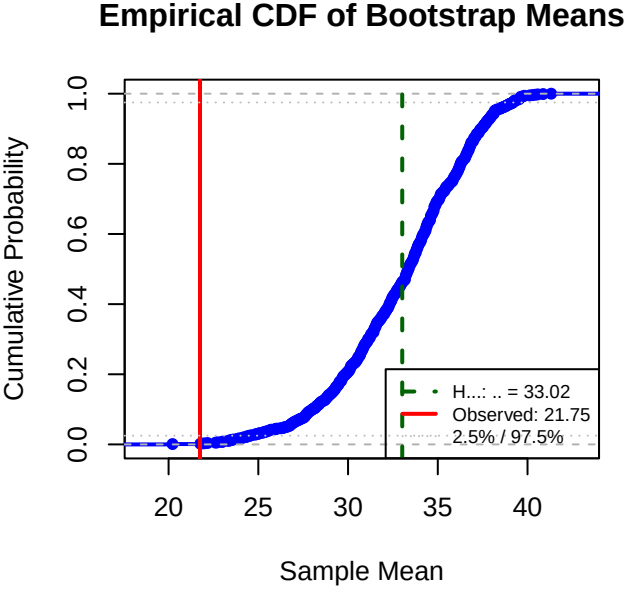

Speed of Light Measurements
Speed (in experimental units)
40
20
0
−20
−40
Accepted: 33.02

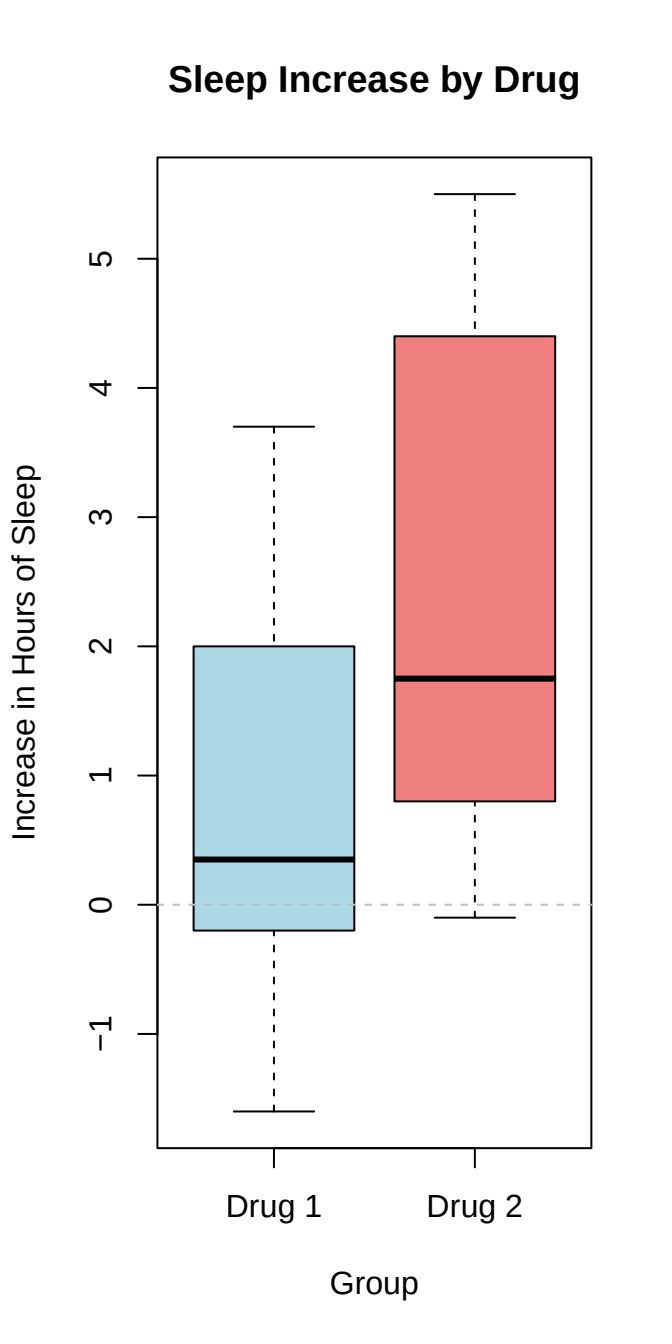

Original Data
Mean = 21.75
H...: .. = 33.02
Frequency
0
2
4
6
8
10
12
−40
0
20
40
Speed
Shifted Data (H... is True)
Mean = 33.02
H...: .. = 33.02
Frequency
0
2
4
6
8
10
−40
0
20
40
Speed

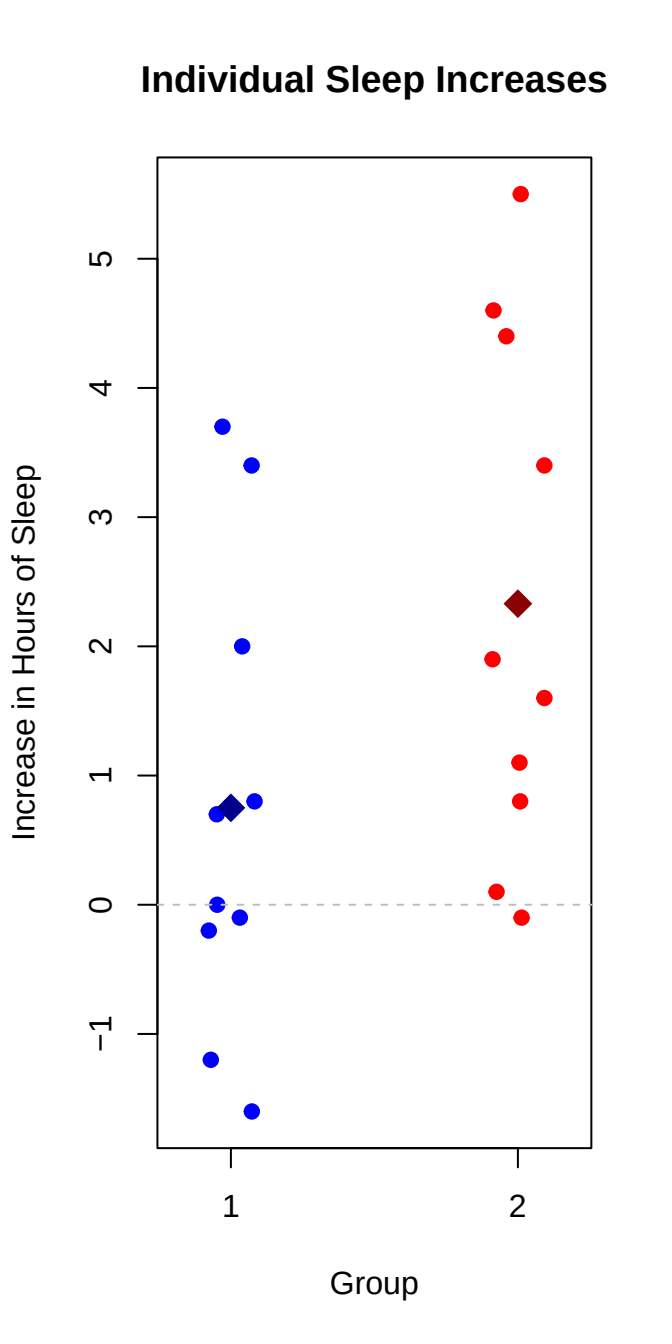

Bootstrap Sampling Distribution of X.. Under
H...: .. = 33.02
Observed: 21.75
Bootstrap density
Density
0.00
0.04
0.08
0.12
20
25
30
35
40
Sample Mean

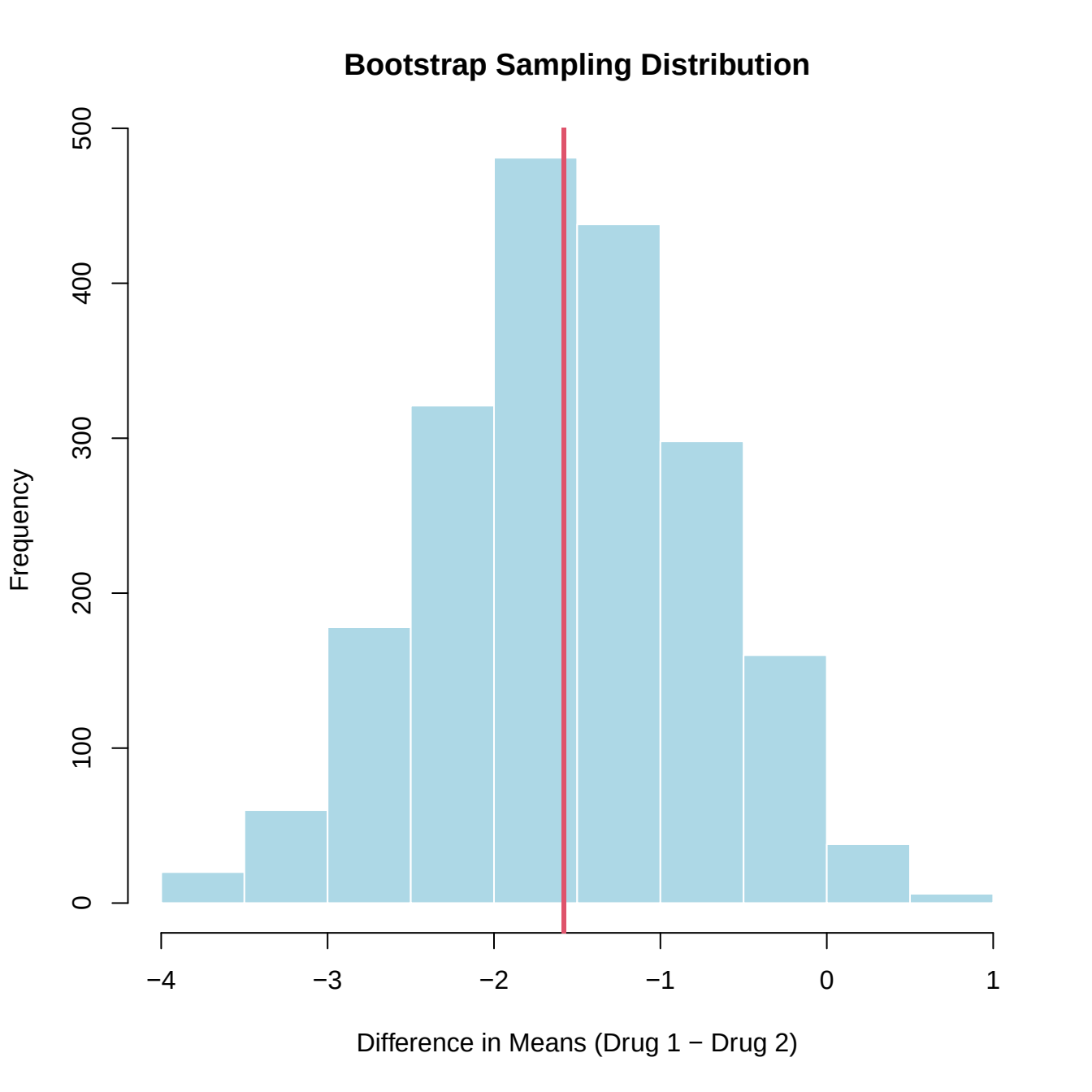

P−value Region (Two−Sided Test)
H...: .. = 33.02
Observed: 21.75
Extreme regions
Density
0.00
0.04
0.08
0.12
20
25
30
35
40
Sample Mean

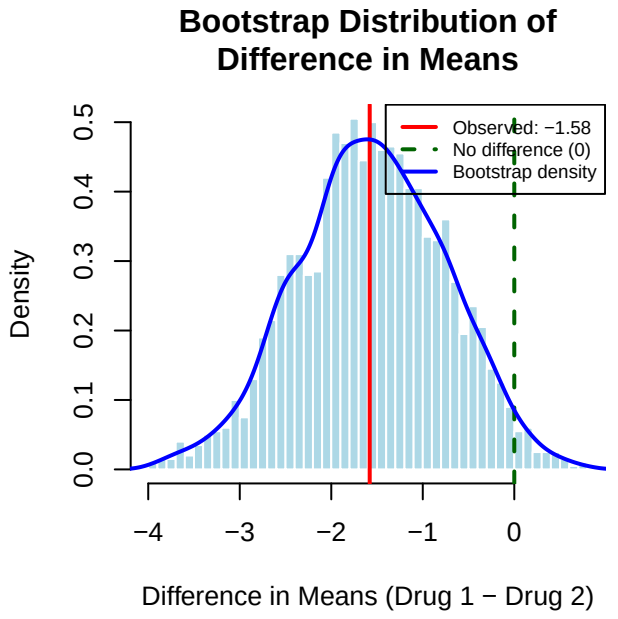

Q−Q Plot: Bootstrap Distribution
Sample Quantiles
20
25
30
35
40
−3
−2
−1
0
1
2
3
Theoretical Quantiles

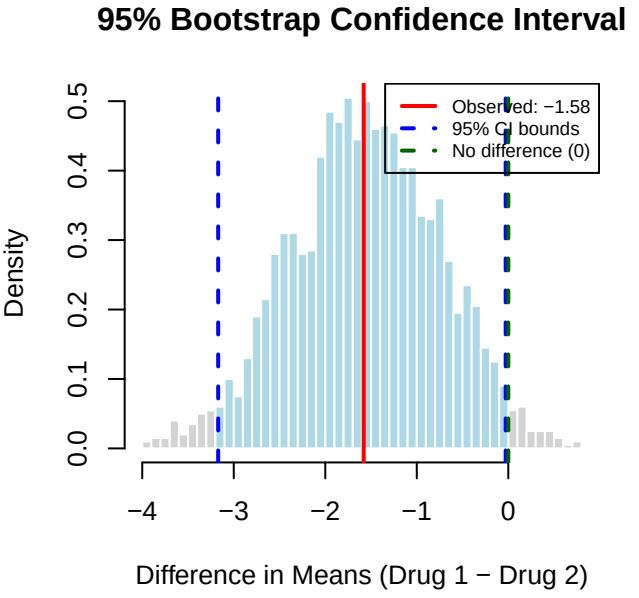

Empirical CDF of Bootstrap Means
Cumulative Probability
0.0
0.2
0.4
0.6
0.8
1.0
H...: .. = 33.02
Observed: 21.75
2.5% / 97.5%
20
25
30
35
40
Sample Mean

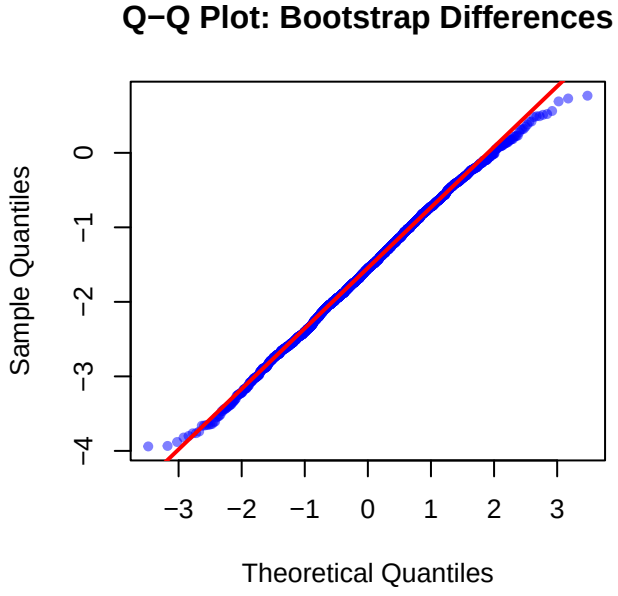

Sleep Increase by Drug
Increase in Hours of Sleep
5
4
3
2
1
0
−1
Drug 1
Drug 2
Group

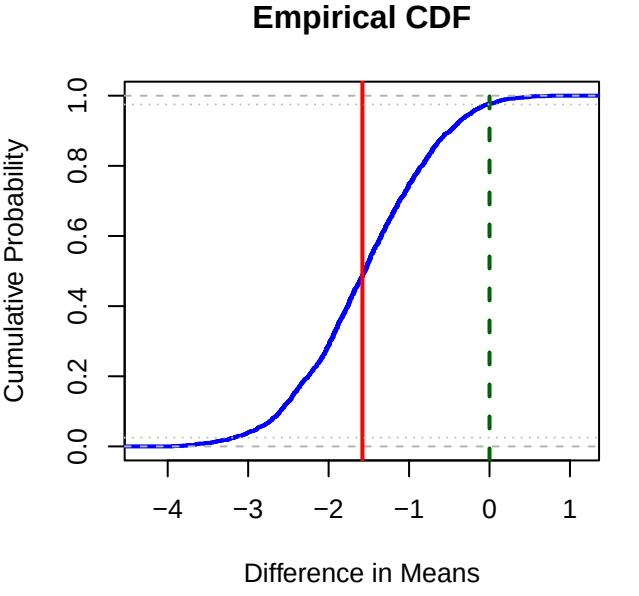

Individual Sleep Increases
Increase in Hours of Sleep
5
4
3
2
1
0
−1
1
2
Group

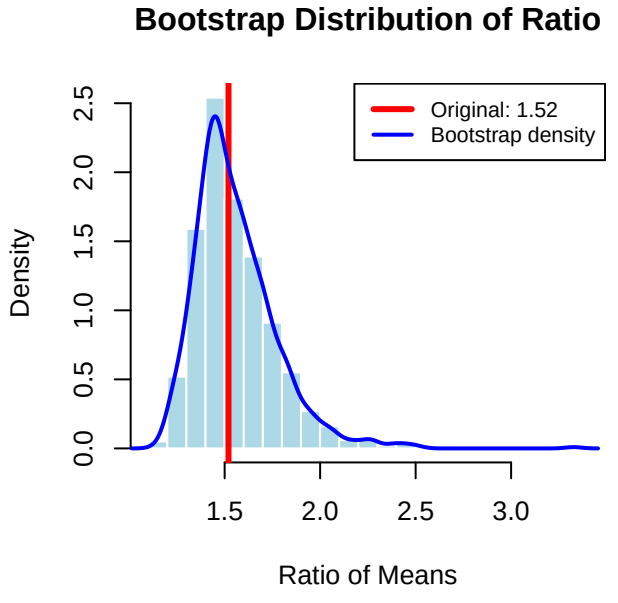

Bootstrap Sampling Distribution
Frequency
0
100
200
300
400
500
−4
−3
−2
−1
0
1
Difference in Means (Drug 1 − Drug 2)

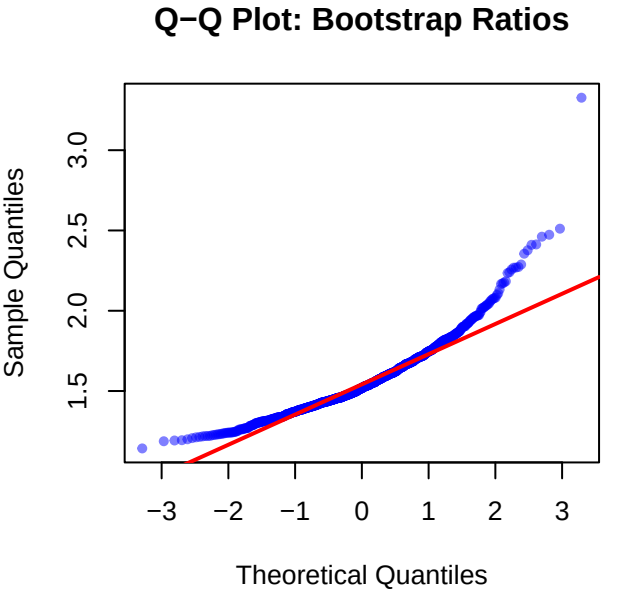

Bootstrap Distribution of Difference in Means
Observed: −1.58
No difference (0)
Bootstrap density
Density
0.0
0.1
0.2
0.3
0.4
0.5
−4
−3
−2
−1
0
Difference in Means (Drug 1 − Drug 2)

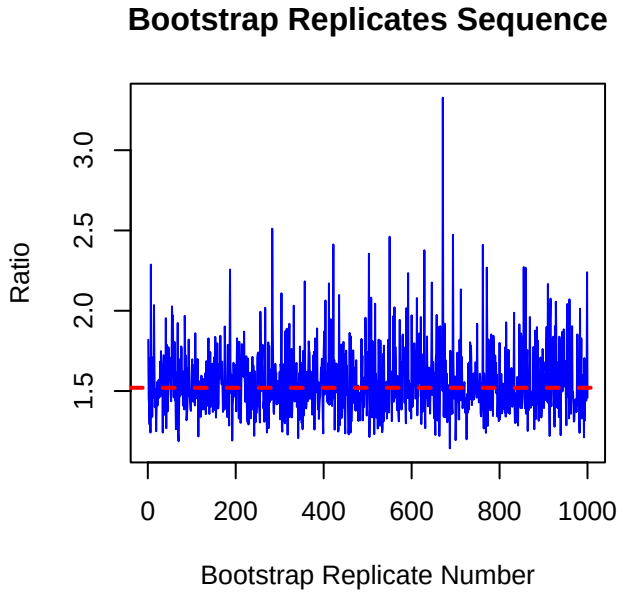

95% Bootstrap Confidence Interval
Observed: −1.58
95% CI bounds
No difference (0)
Density
0.0
0.1
0.2
0.3
0.4
0.5
−4
−3
−2
−1
0
Difference in Means (Drug 1 − Drug 2)

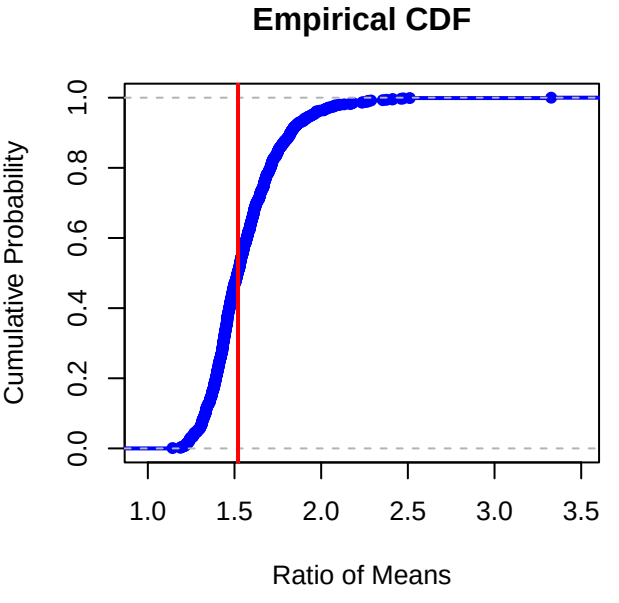

Q−Q Plot: Bootstrap Differences
Sample Quantiles
0
−1
−2
−3
−4
−3
−2
−1
0
1
2
3
Theoretical Quantiles

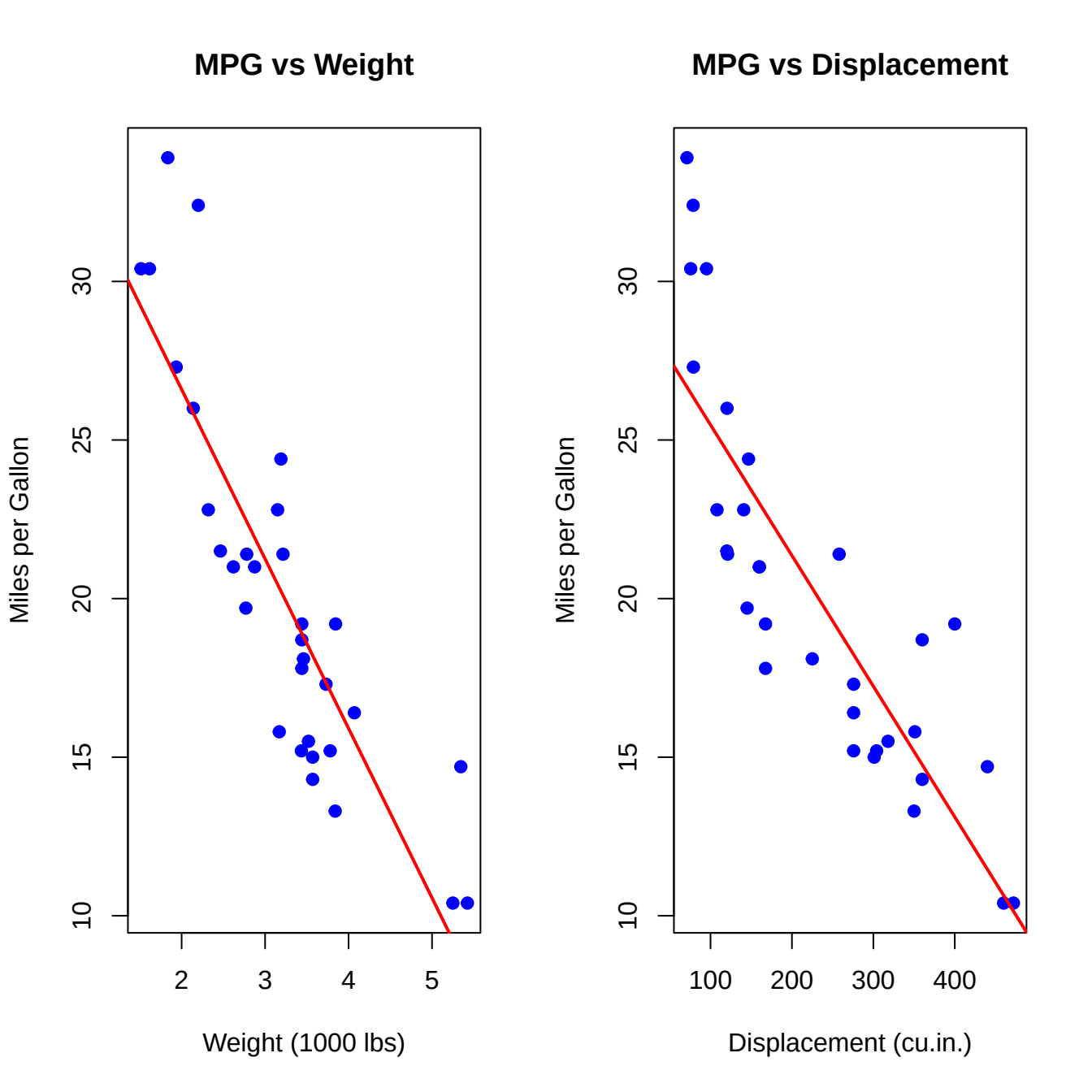

Empirical CDF
Cumulative Probability
0.0
0.2
0.4
0.6
0.8
1.0
−4
−3
−2
−1
0
1
Difference in Means

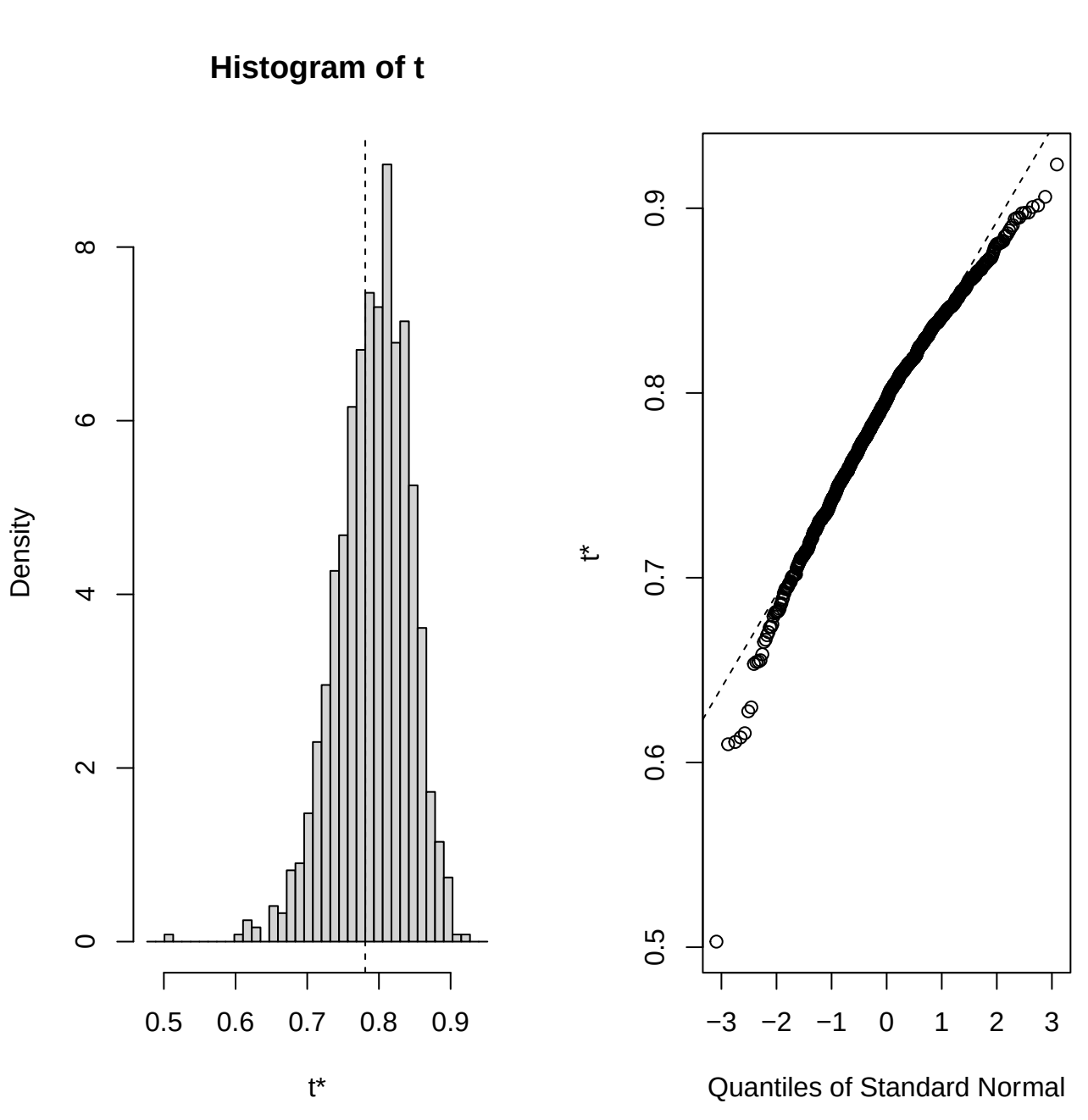

Bootstrap Distribution of Ratio
Original: 1.52
Bootstrap density
Density
0.0
0.5
1.0
1.5
2.0
2.5
1.5
2.0
2.5
3.0
Ratio of Means

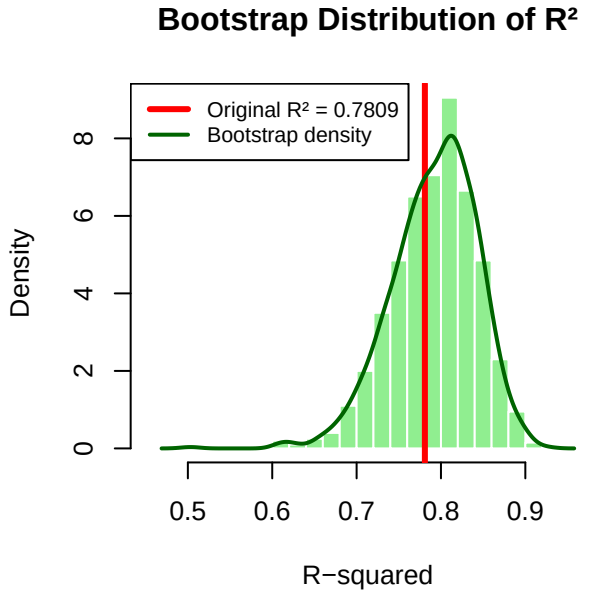

Q−Q Plot: Bootstrap Ratios
Sample Quantiles
1.5
2.0
2.5
3.0
−3
−2
−1
0
1
2
3
Theoretical Quantiles

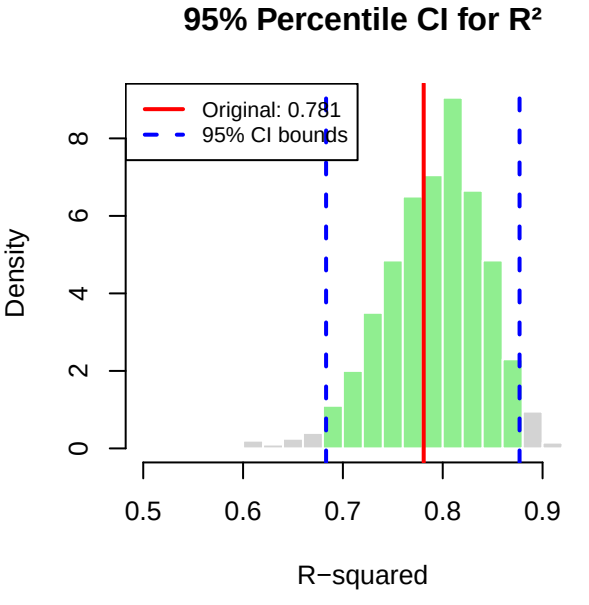

Bootstrap Replicates Sequence
Ratio
1.5
2.0
2.5
3.0
0
200
400
600
800
1000
Bootstrap Replicate Number

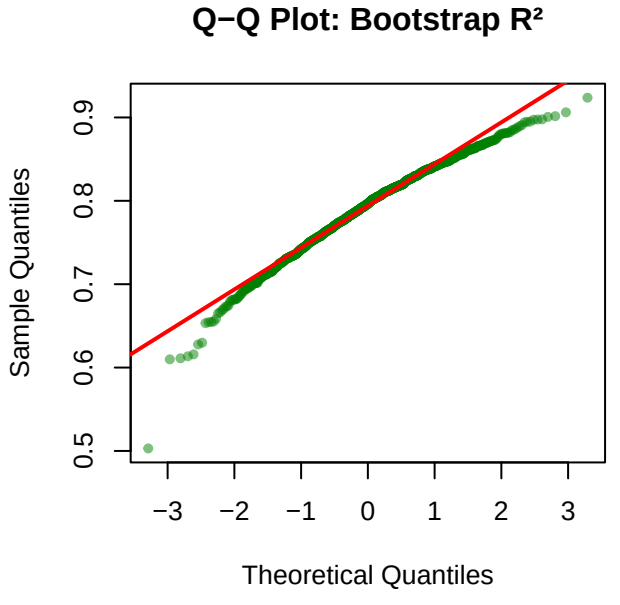

Empirical CDF
Cumulative Probability
0.0
0.2
0.4
0.6
0.8
1.0
1.0
1.5
2.0
2.5
3.0
3.5
Ratio of Means

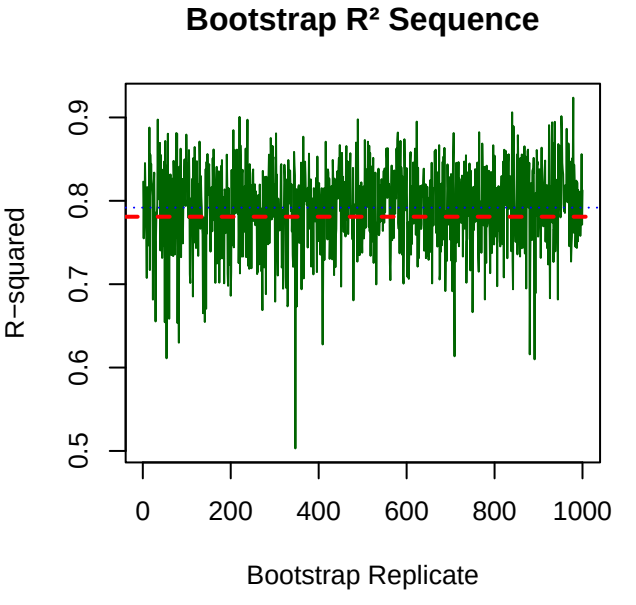

MPG vs Weight
Miles per Gallon
10
15
20
25
30
2
3
4
5
Weight (1000 lbs)
MPG vs Displacement
Miles per Gallon
10
15
20
25
30
100
200
300
400
Displacement (cu.in.)


Histogram of t
Density
0
2
4
6
8
0.5
0.6
0.7
0.8
0.9
t*
t*
0.5
0.6
0.7
0.8
0.9
−3
−2
−1
0
1
2
3
Quantiles of Standard Normal


Bootstrap Distribution of R²
Original R² = 0.7809
Bootstrap density
Density
0
2
4
6
8
0.5
0.6
0.7
0.8
0.9
R−squared


95% Percentile CI for R²
Original: 0.781
95% CI bounds
Density
0
2
4
6
8
0.5
0.6
0.7
0.8
0.9
R−squared


Q−Q Plot: Bootstrap R²
Sample Quantiles
0.5
0.6
0.7
0.8
0.9
−3
−2
−1
0
1
2
3
Theoretical Quantiles


Bootstrap R² Sequence
R−squared
0.5
0.6
0.7
0.8
0.9
0
200
400
600
800
1000
Bootstrap Replicate