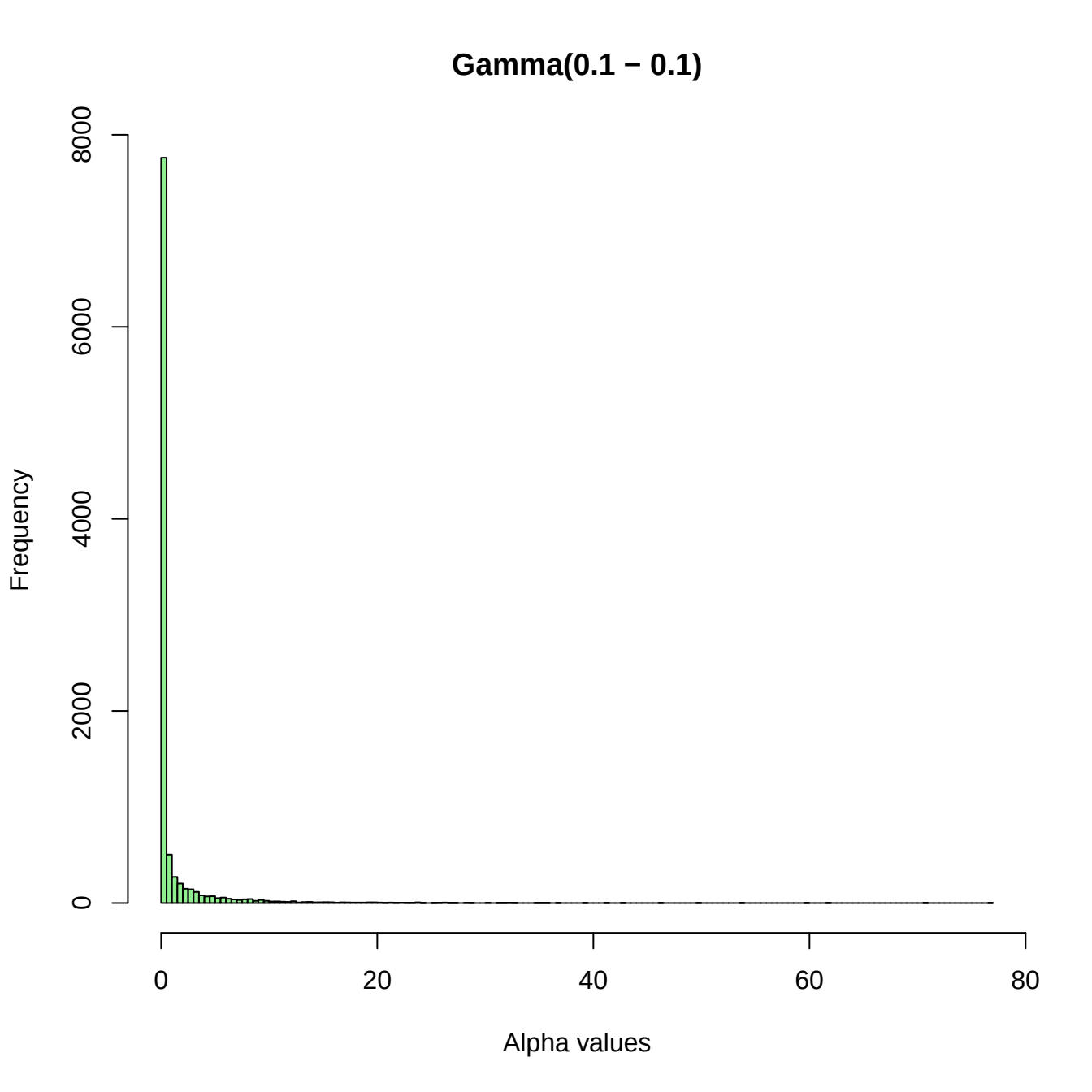
Gamma(0.1 − 0.1)
Frequency
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2000
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6000
8000
0
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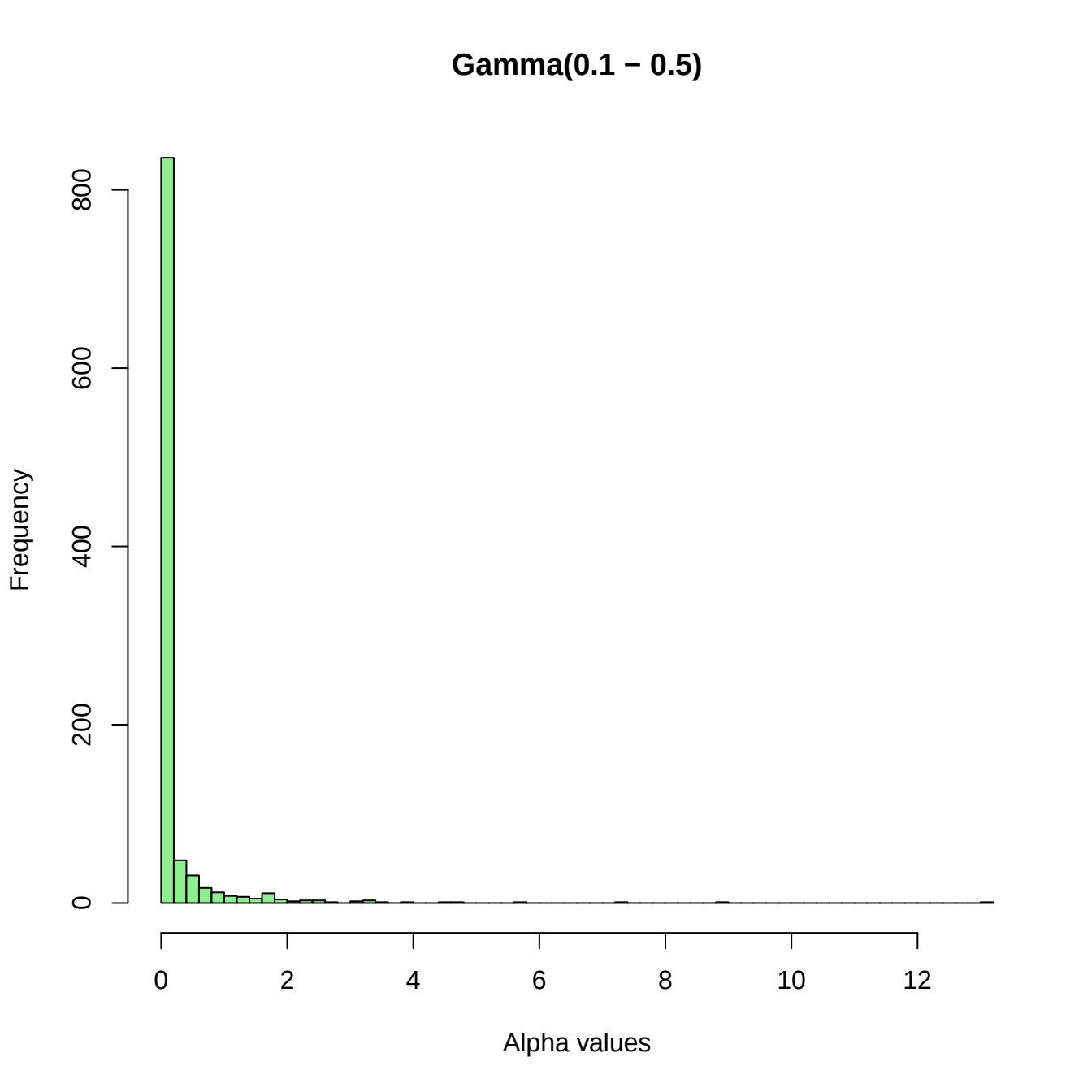
40
60
80
Alpha values


Gamma(0.1 − 0.5)
Frequency
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200
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800
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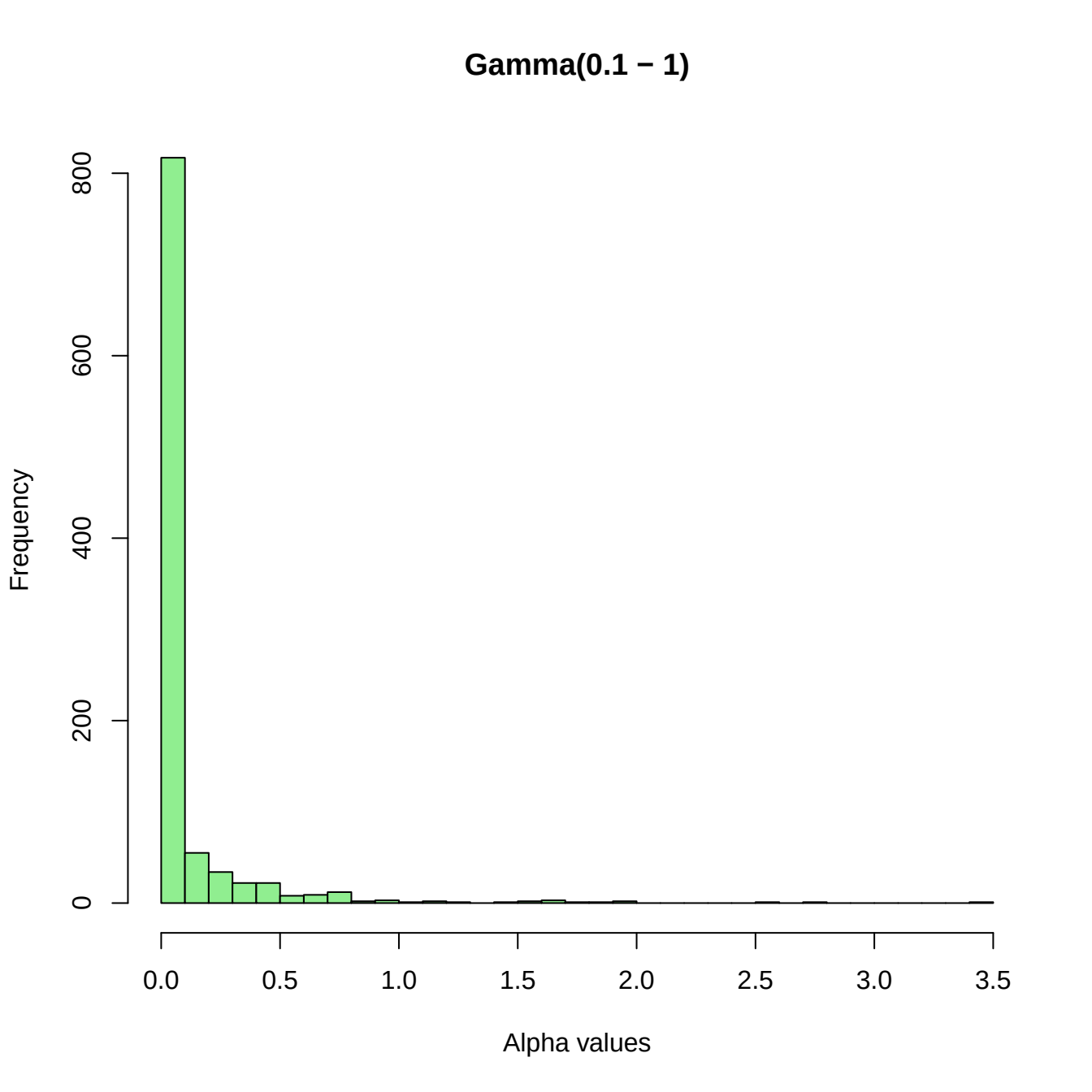
12
Alpha values


Gamma(0.1 − 1)
Frequency
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800
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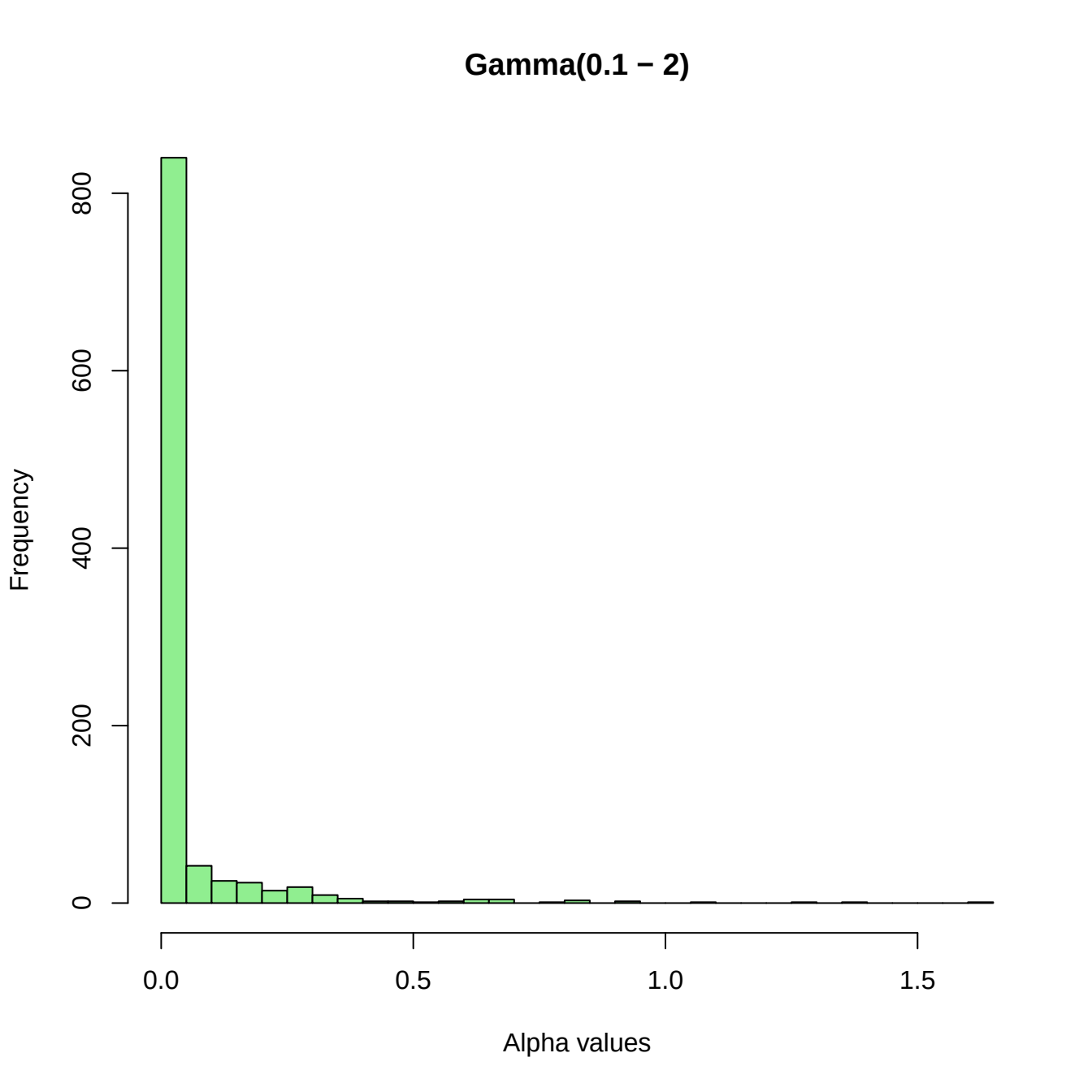
1.0
1.5
2.0
2.5
3.0
3.5
Alpha values


Gamma(0.1 − 2)
Frequency
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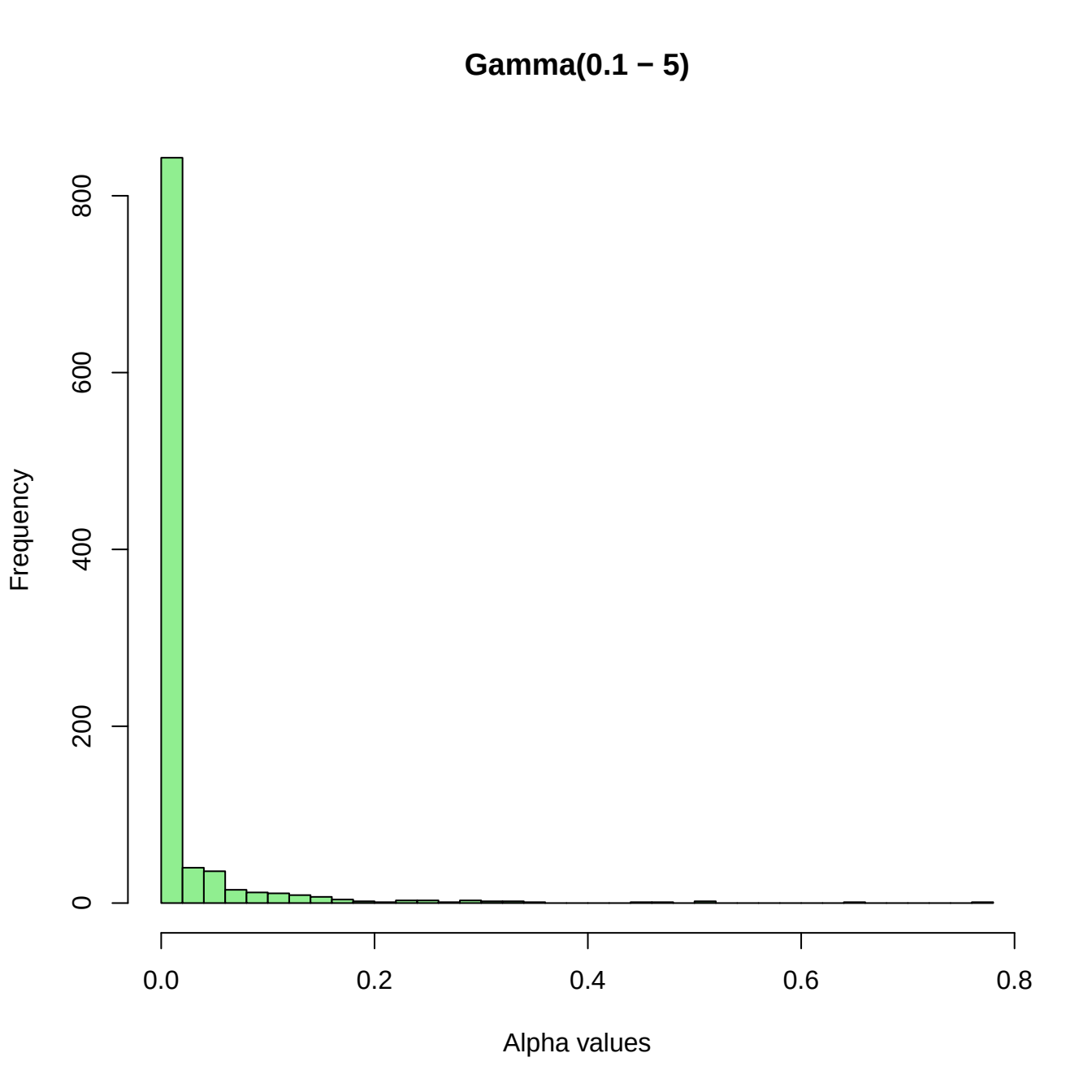
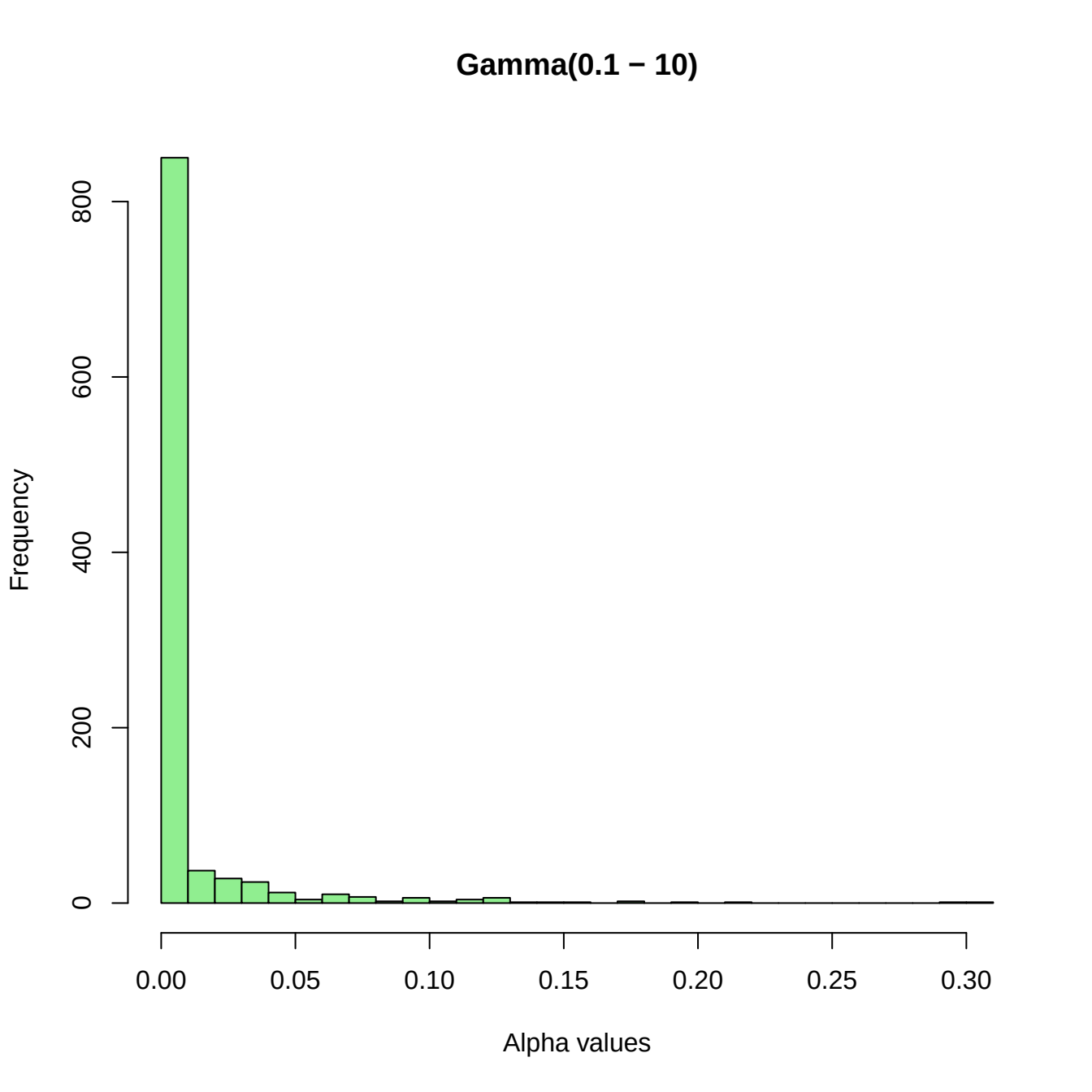
400
600
800
0.0
0.5
1.0
1.5
Alpha values


Gamma(0.1 − 5)
Frequency
0
200
400
600
800
0.0
0.2
0.4
0.6
0.8
Alpha values


Gamma(0.1 − 10)
Frequency
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400
600
800
0.00
0.05
0.10
0.15
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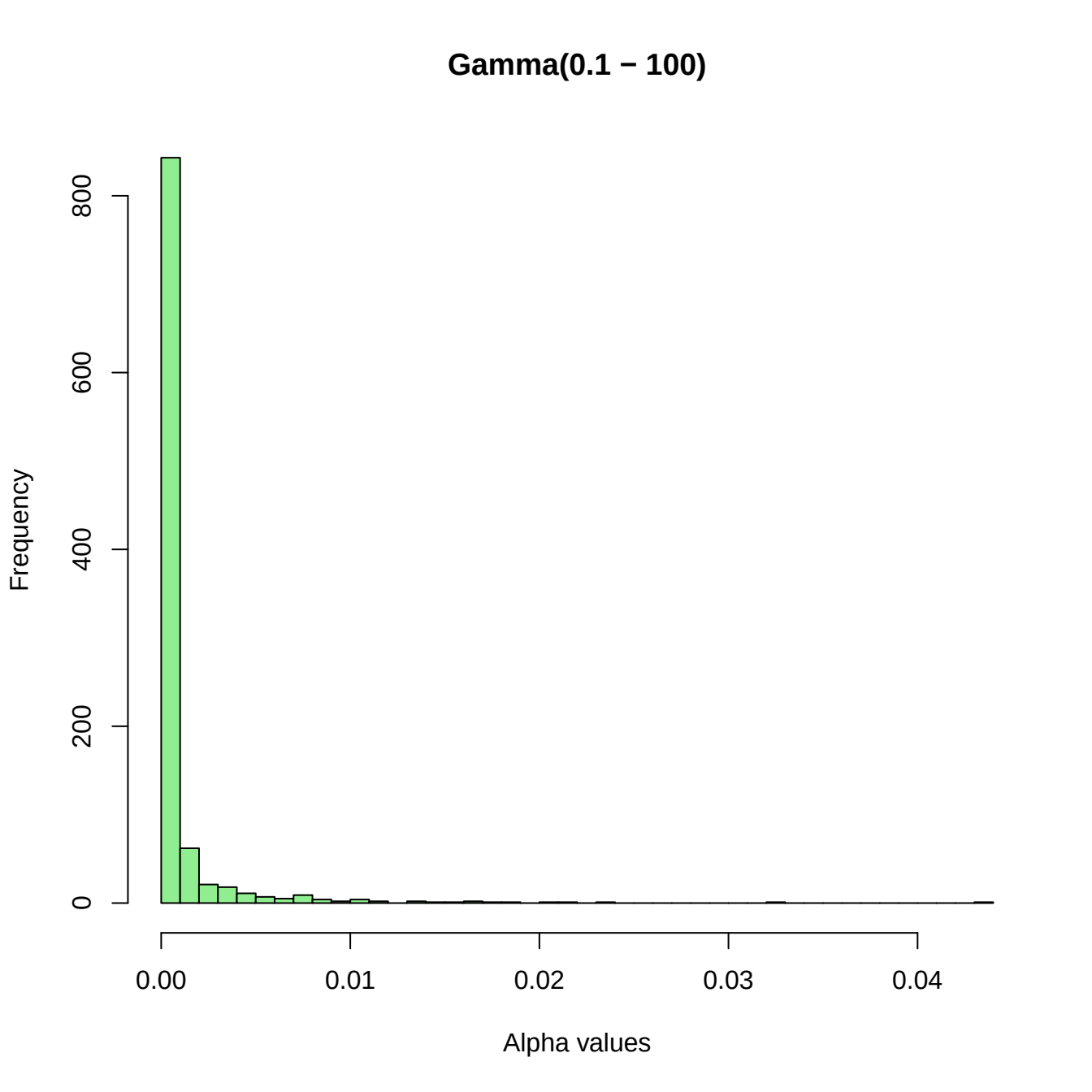
0.25
0.30
Alpha values


Gamma(0.1 − 100)
Frequency
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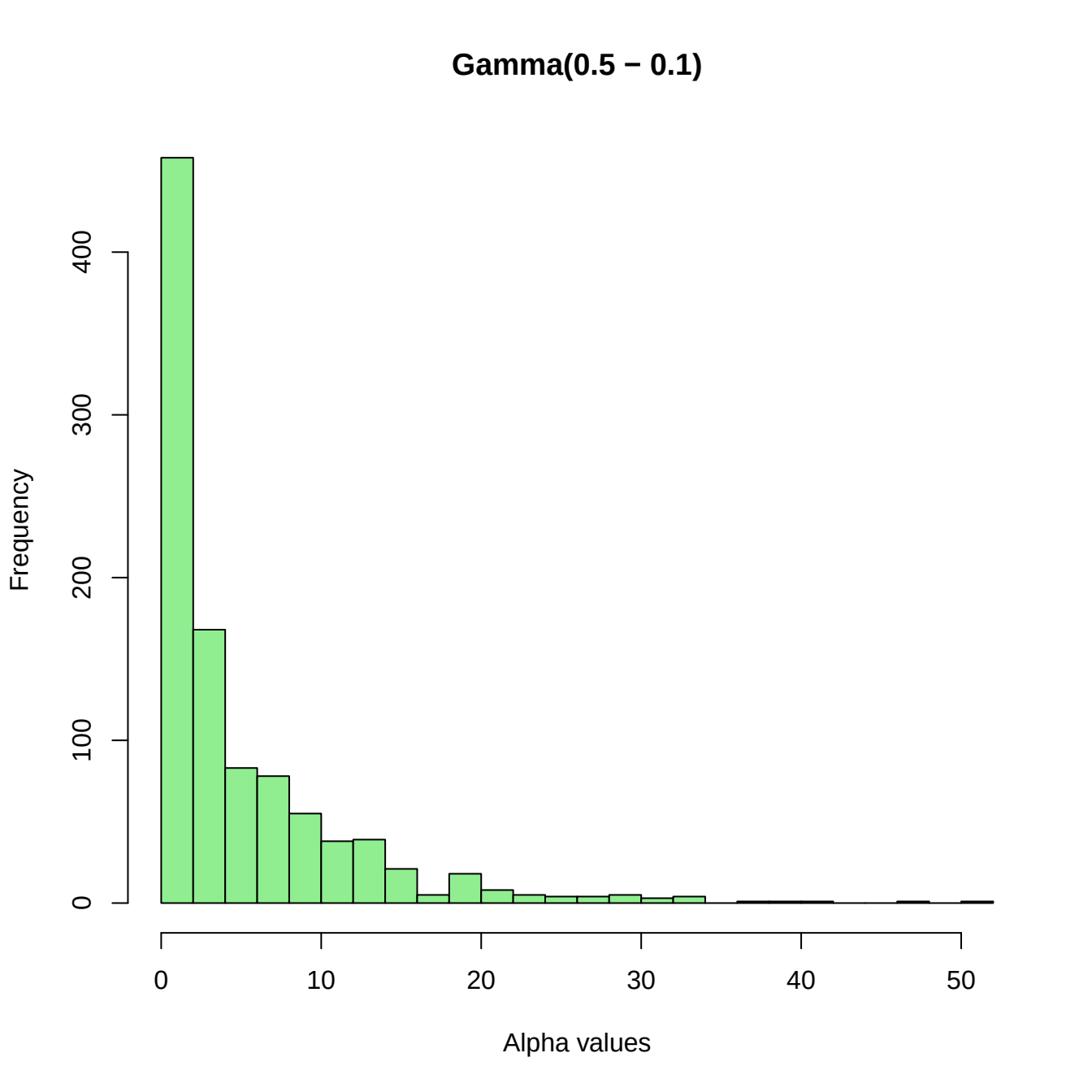
800
0.00
0.01
0.02
0.03
0.04
Alpha values


Gamma(0.5 − 0.1)
Frequency
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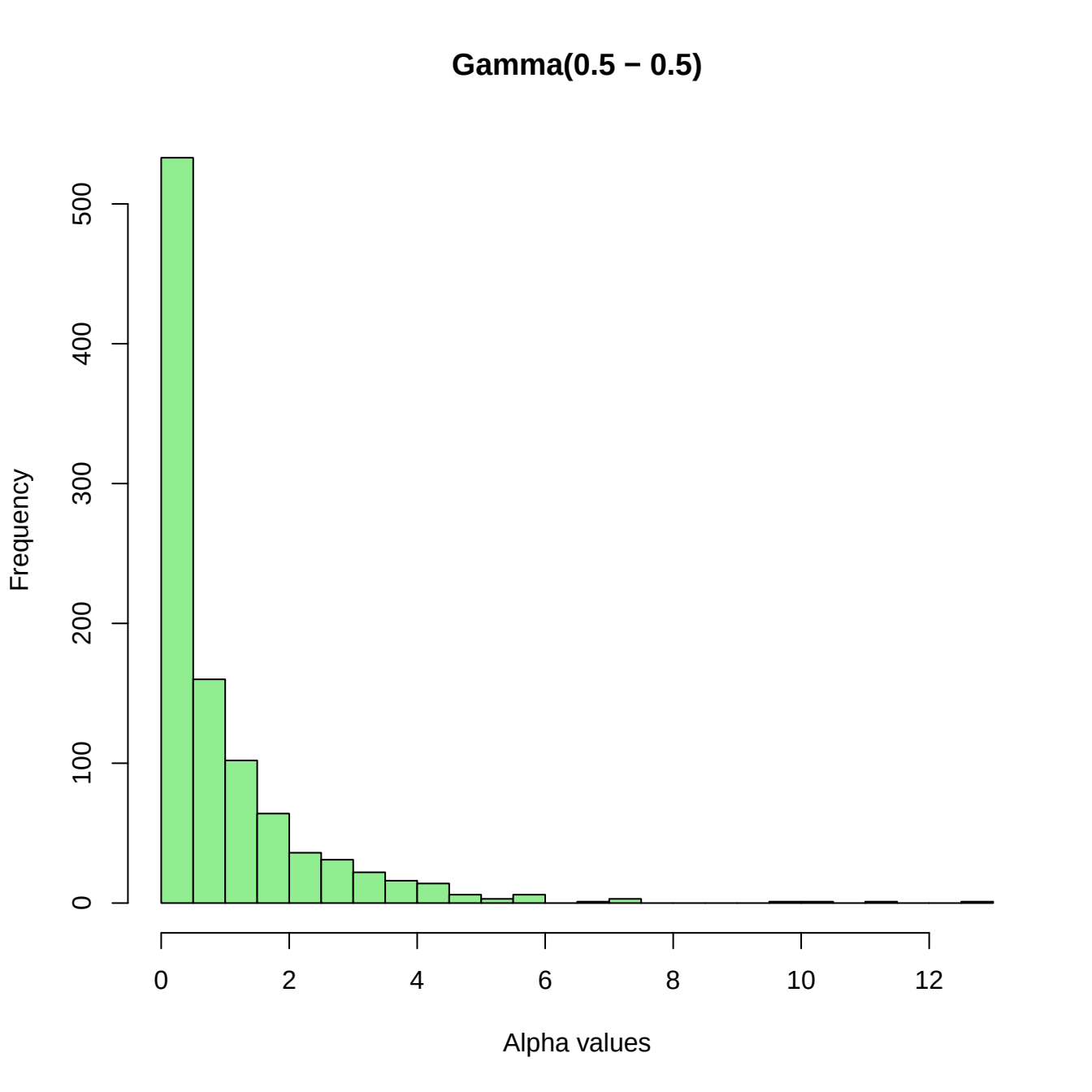
100
200
300
400
0
10
20
30
40
50
Alpha values


Gamma(0.5 − 0.5)
Frequency
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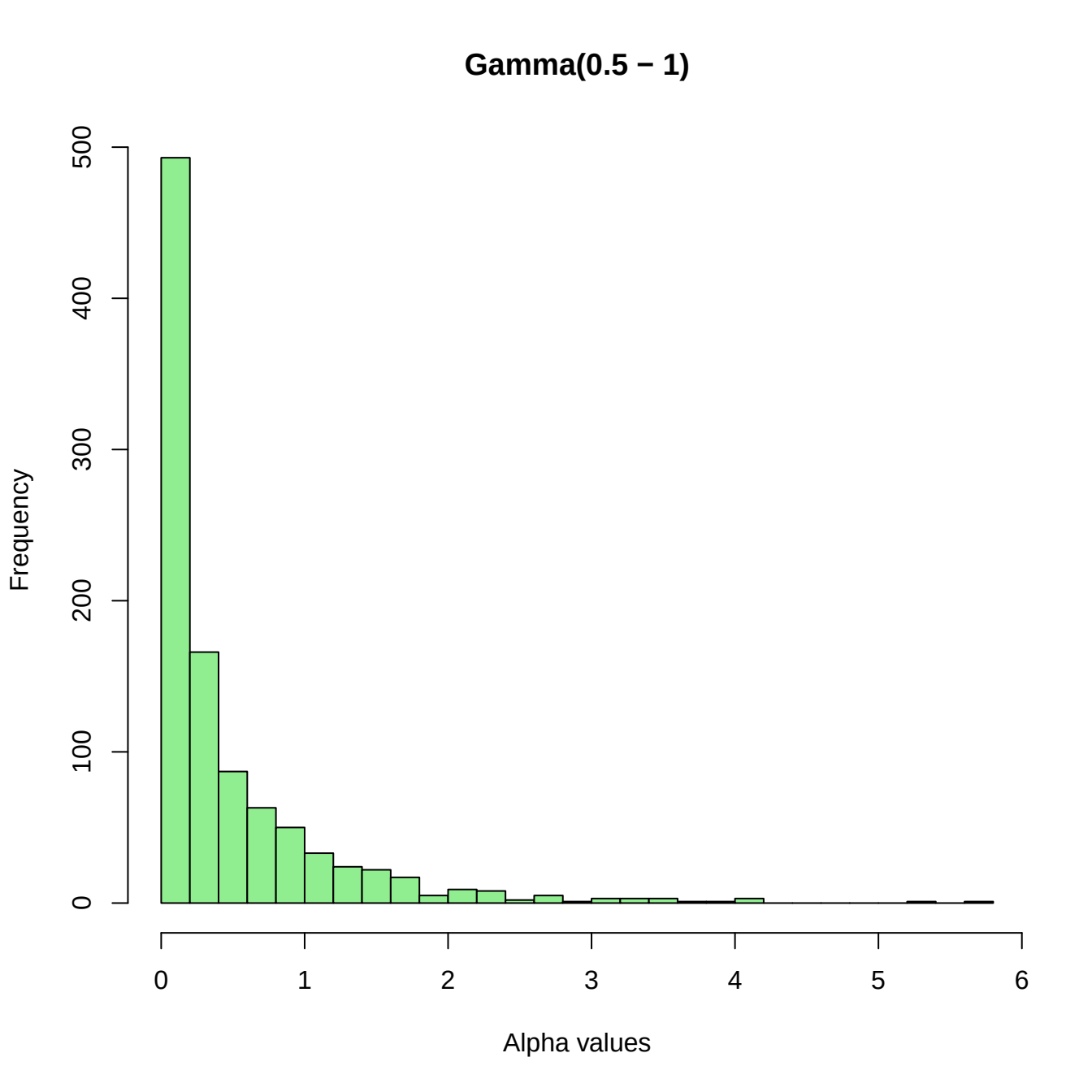
100
200
300
400
500
0
2
4
6
8
10
12
Alpha values


Gamma(0.5 − 1)
Frequency
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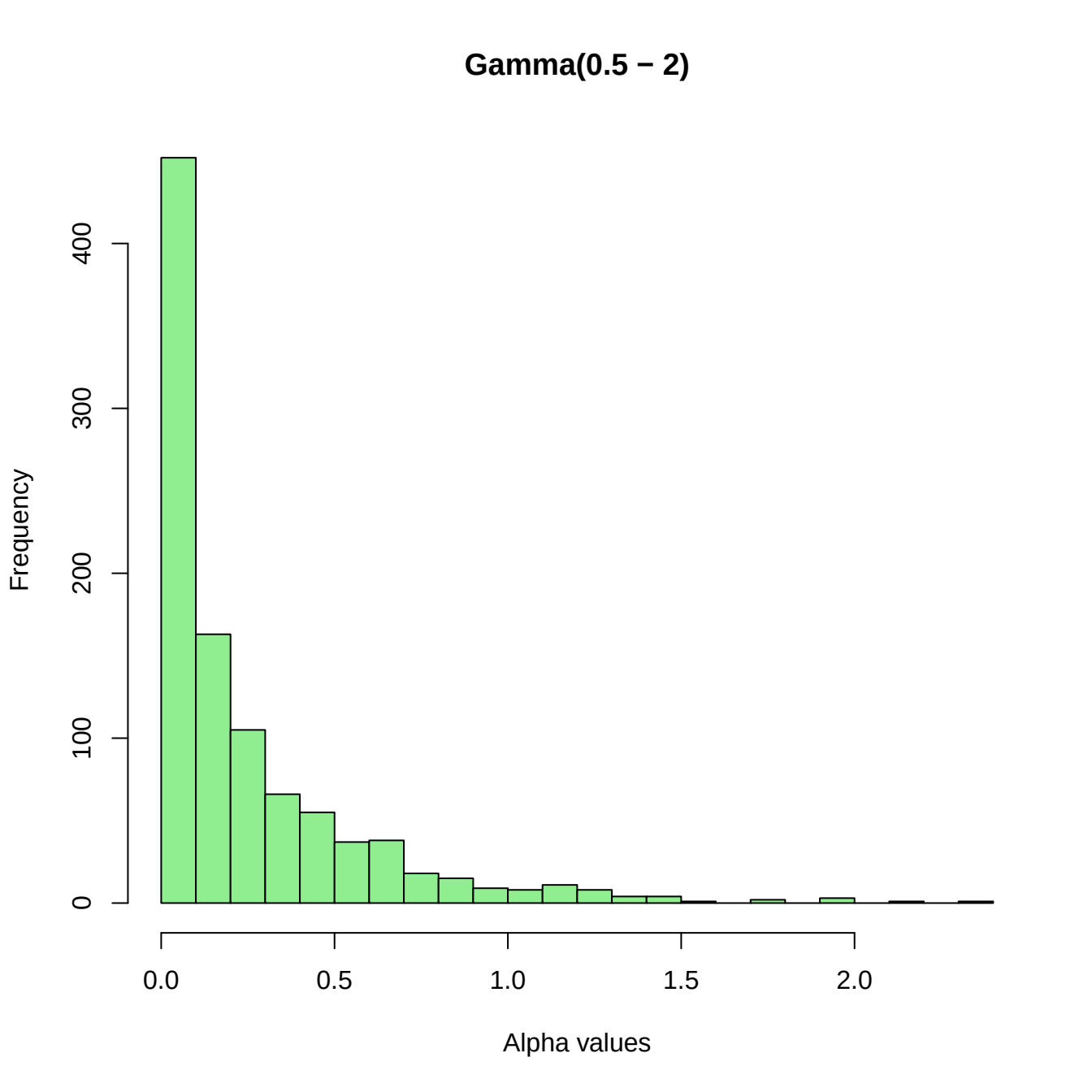
100
200
300
400
500
0
1
2
3
4
5
6
Alpha values


Gamma(0.5 − 2)
Frequency
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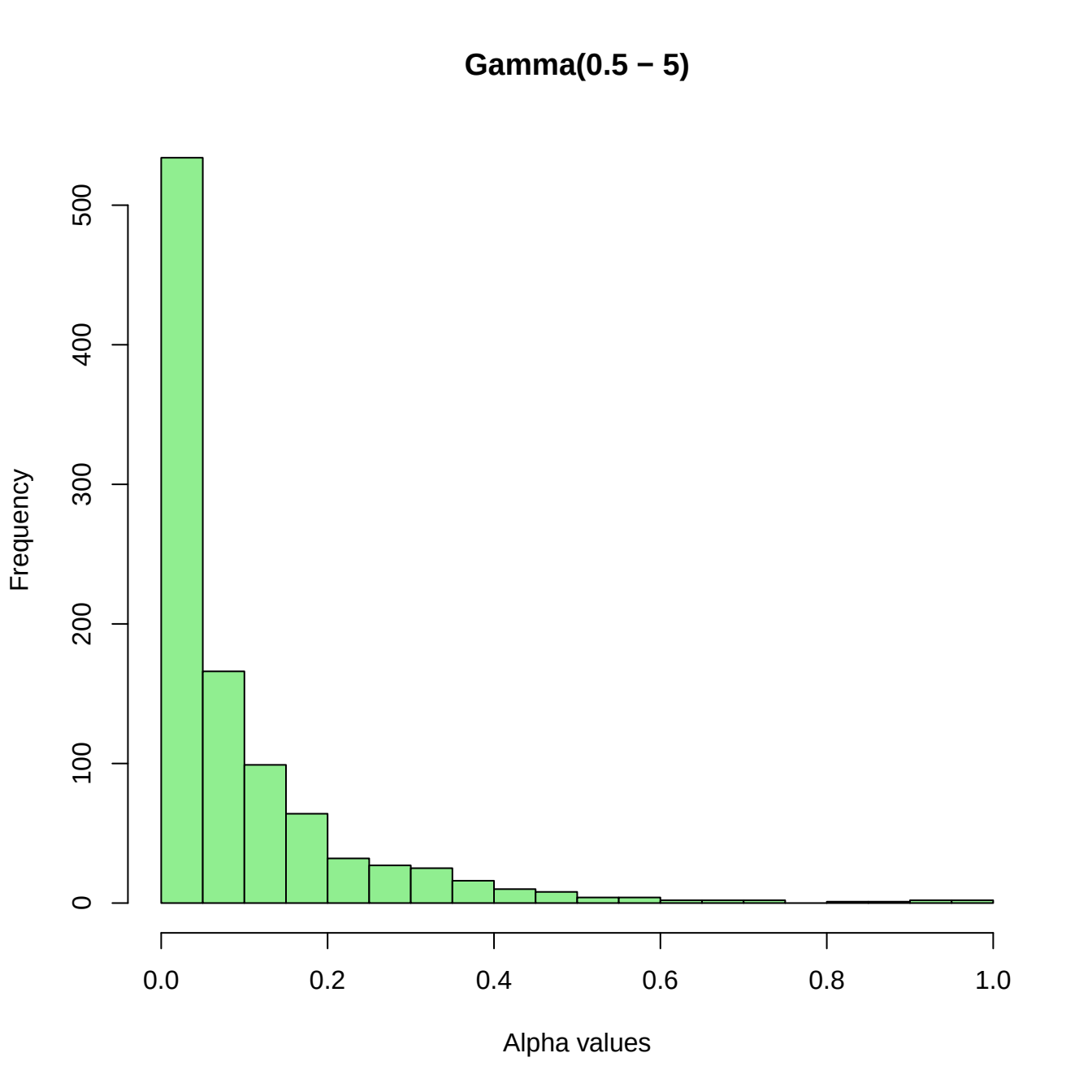
200
300
400
0.0
0.5
1.0
1.5
2.0
Alpha values


Gamma(0.5 − 5)
Frequency
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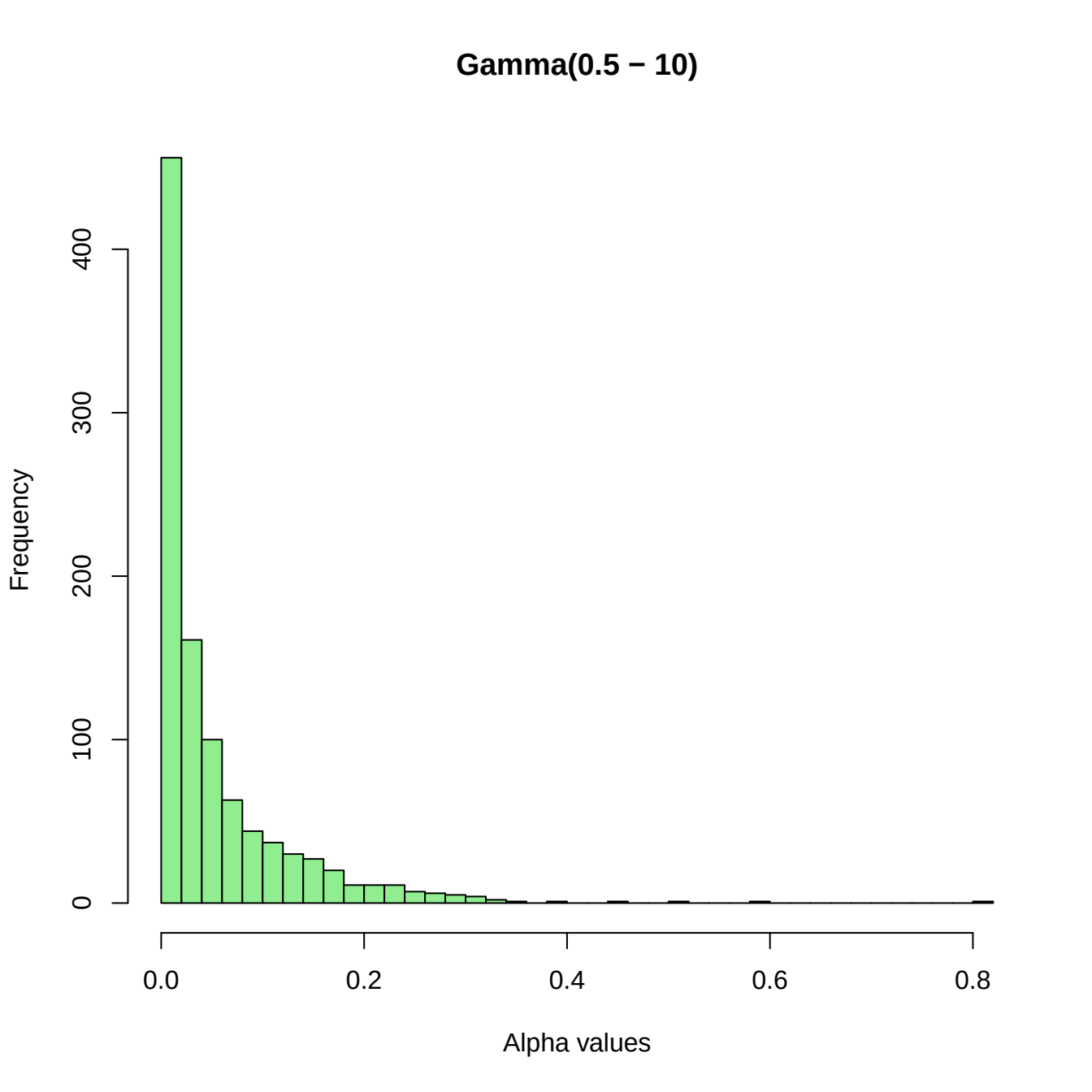
100
200
300
400
500
0.0
0.2
0.4
0.6
0.8
1.0
Alpha values


Gamma(0.5 − 10)
Frequency
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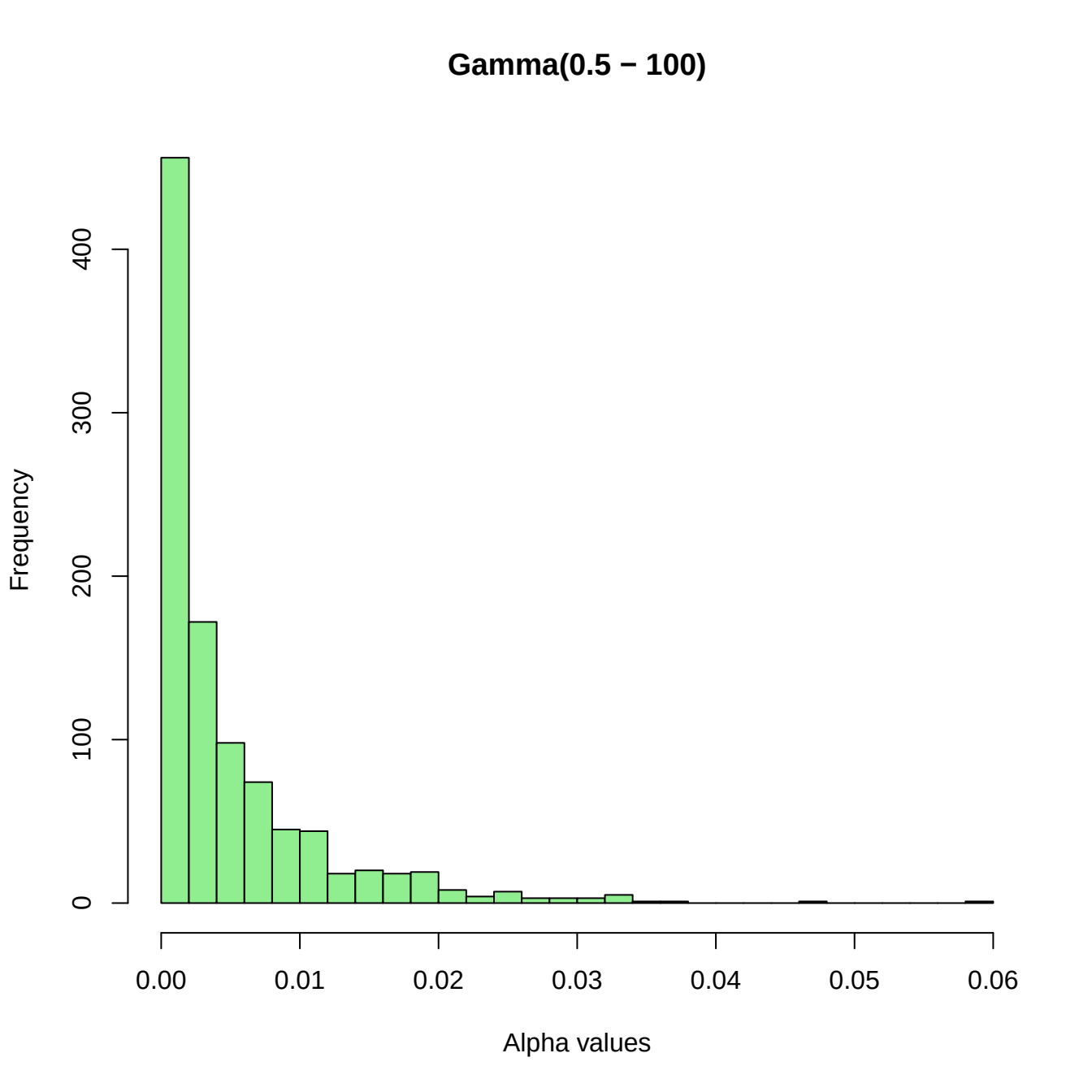
100
200
300
400
0.0
0.2
0.4
0.6
0.8
Alpha values


Gamma(0.5 − 100)
Frequency
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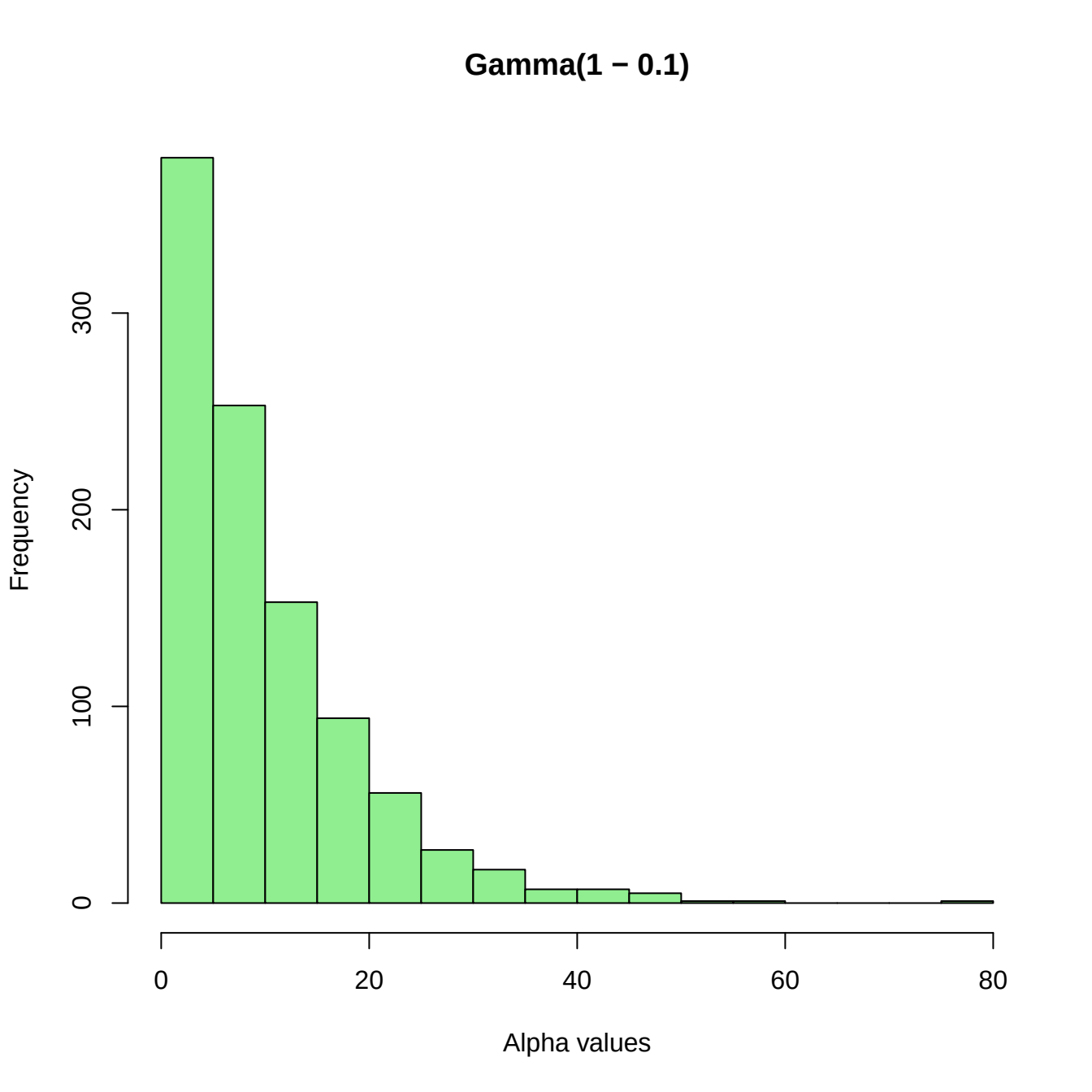
100
200
300
400
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Alpha values


Gamma(1 − 0.1)
Frequency
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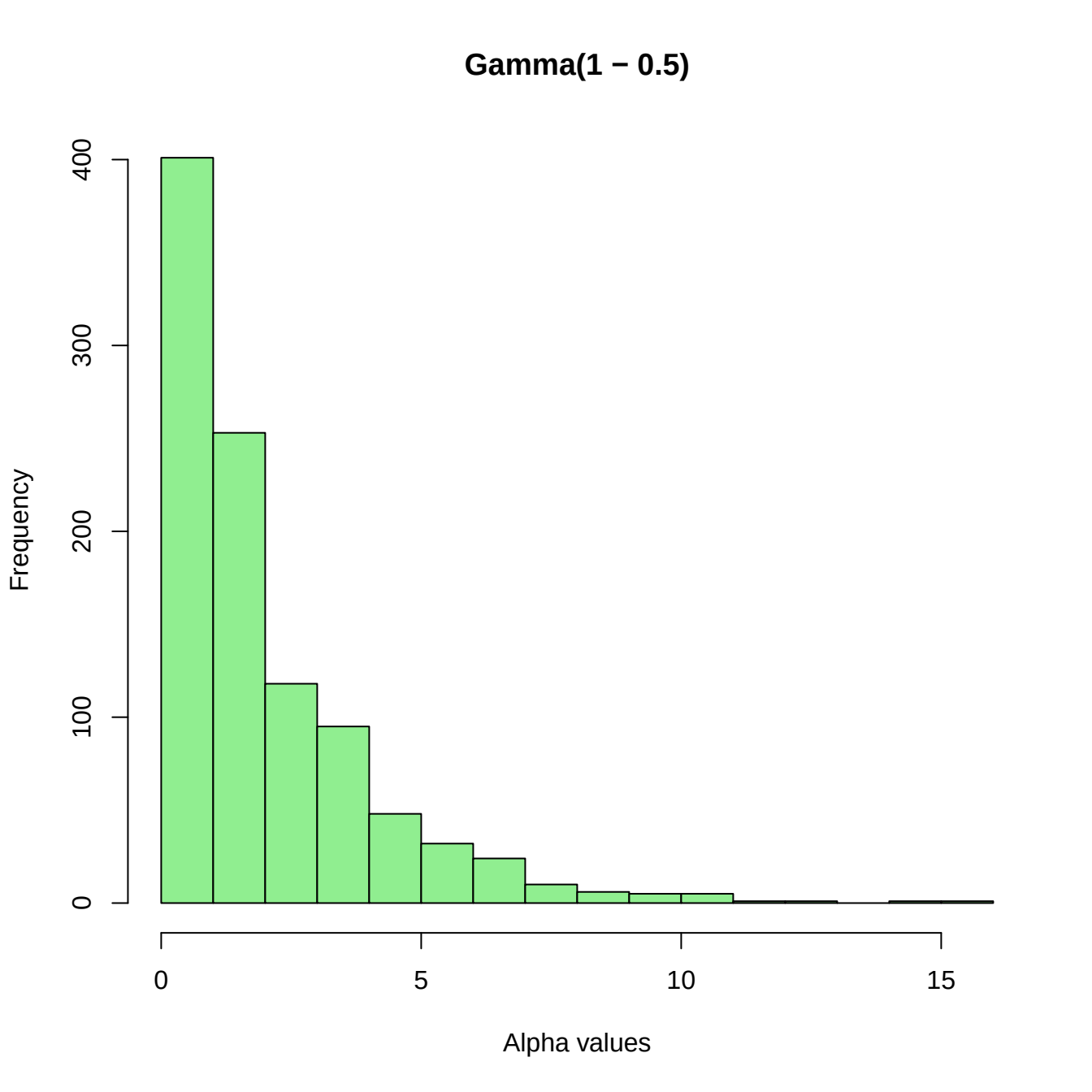
100
200
300
0
20
40
60
80
Alpha values


Gamma(1 − 0.5)
Frequency
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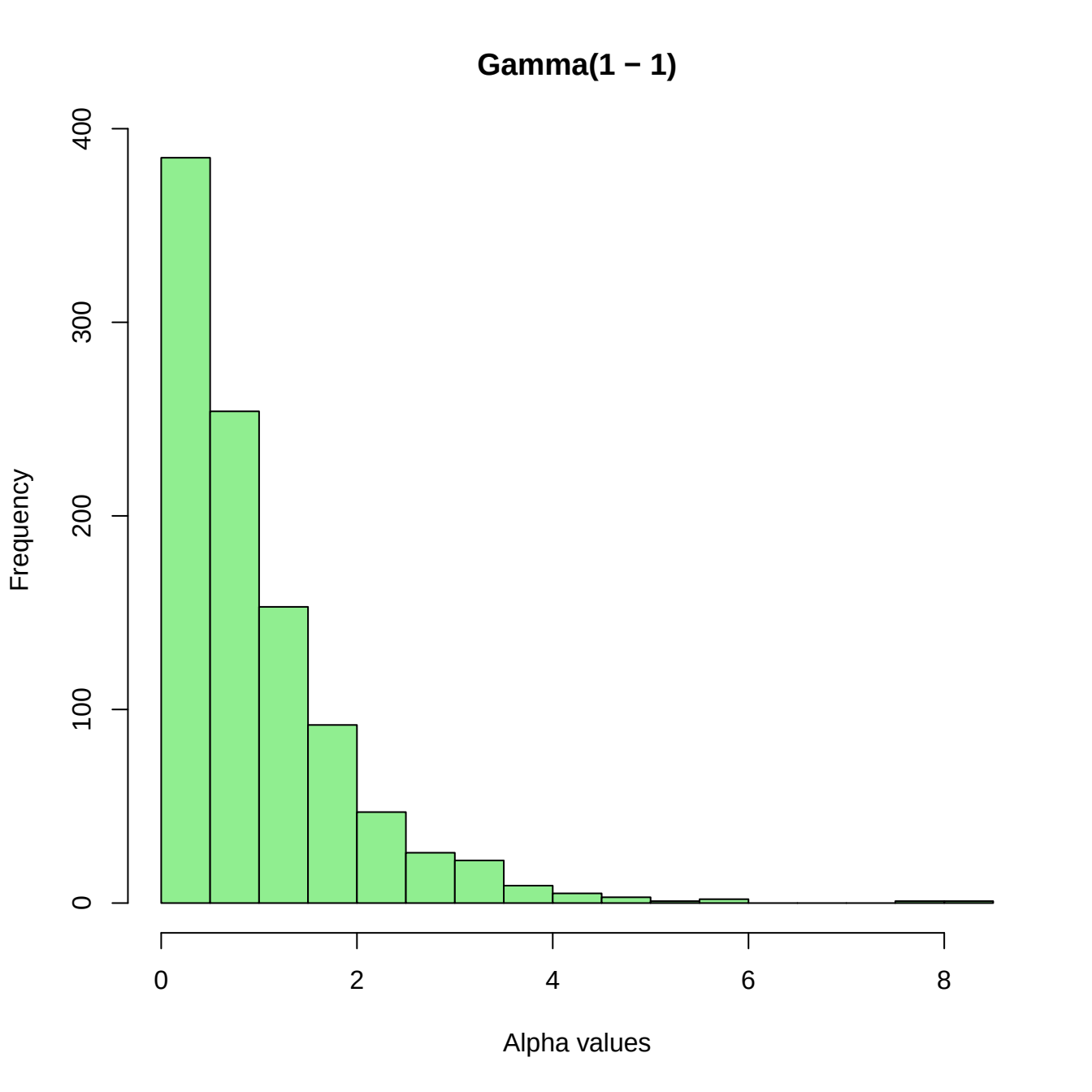
100
200
300
400
0
5
10
15
Alpha values


Gamma(1 − 1)
Frequency
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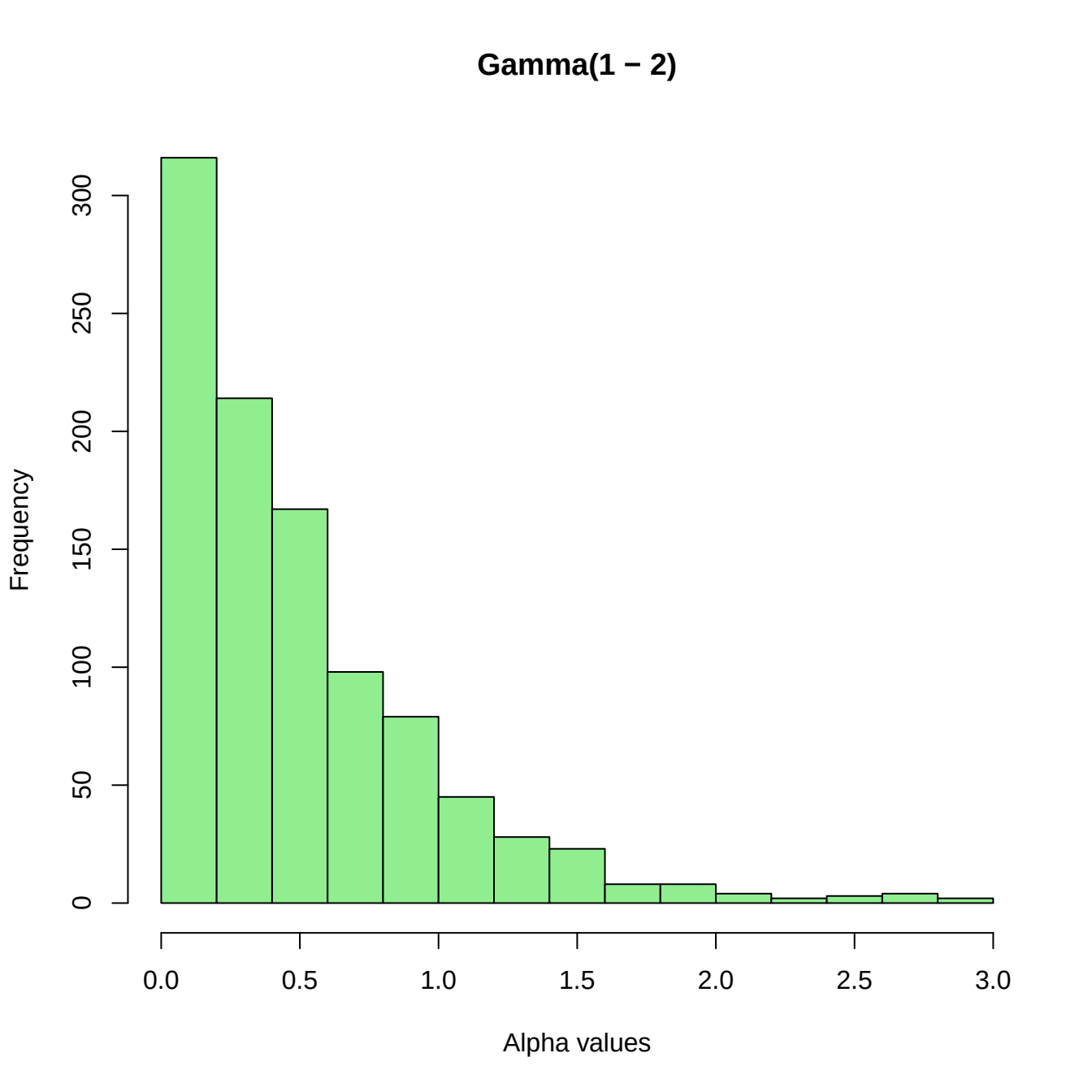
100
200
300
400
0
2
4
6
8
Alpha values


Gamma(1 − 2)
Frequency
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200
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300
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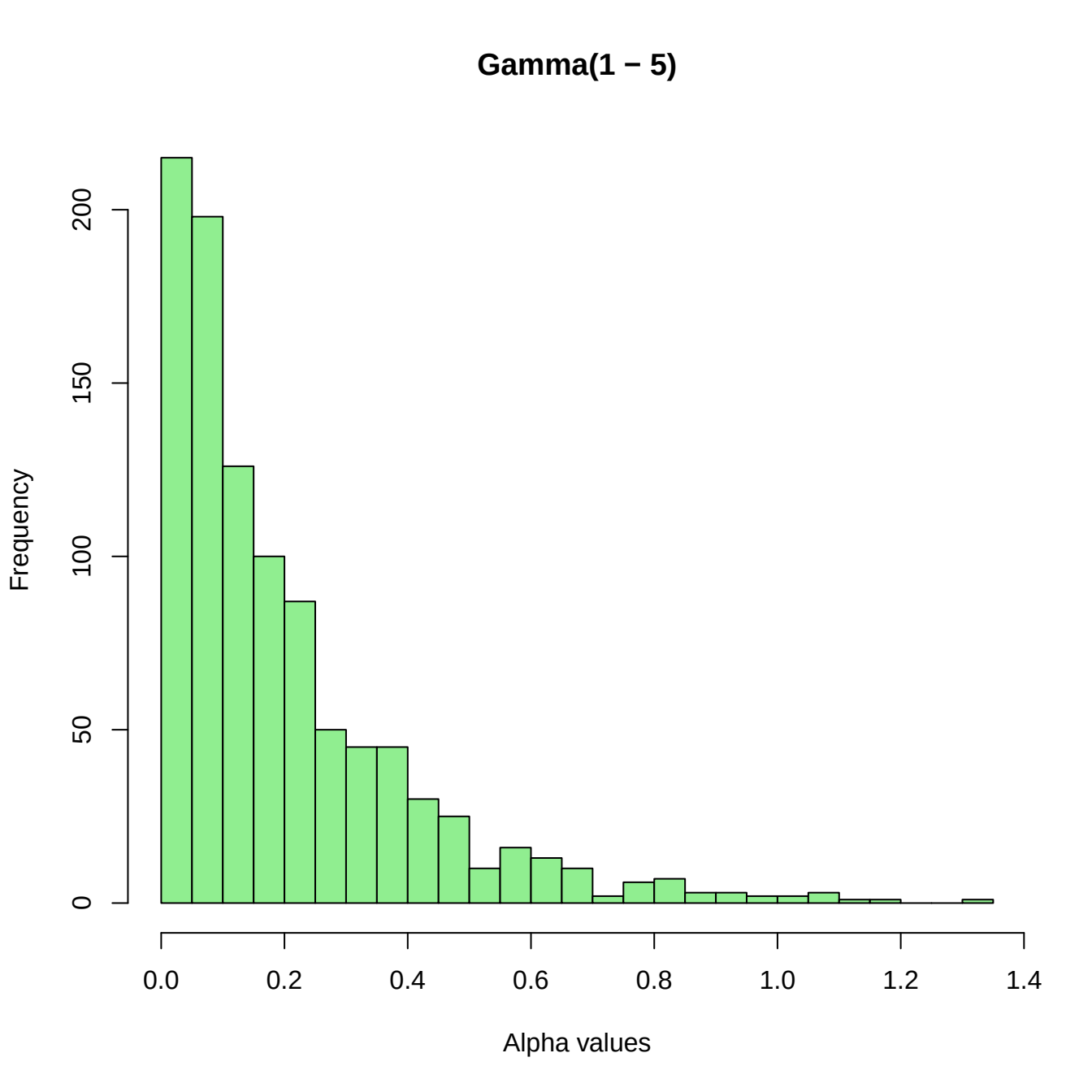
0.5
1.0
1.5
2.0
2.5
3.0
Alpha values


Gamma(1 − 5)
Frequency
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200
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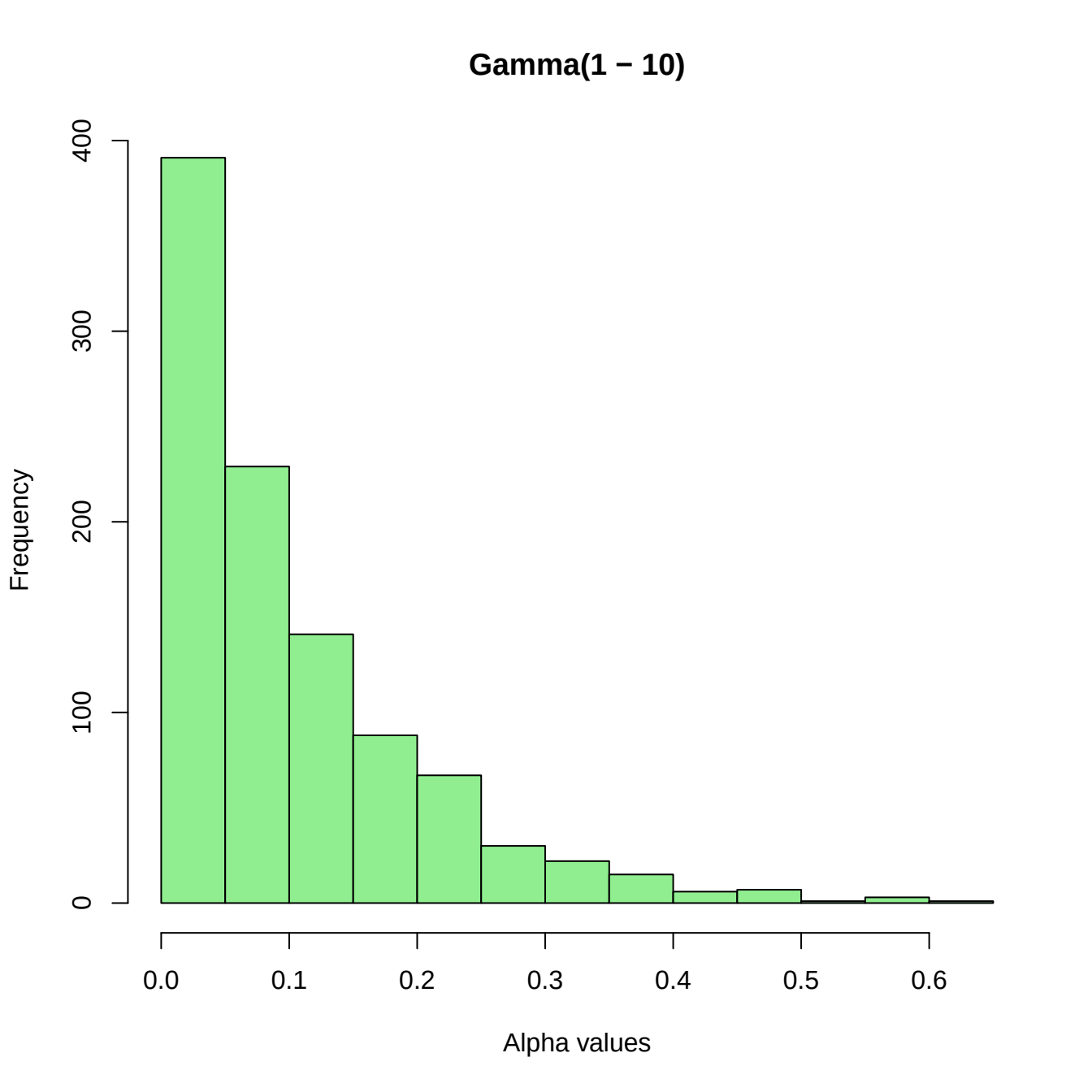
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Alpha values


Gamma(1 − 10)
Frequency
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200
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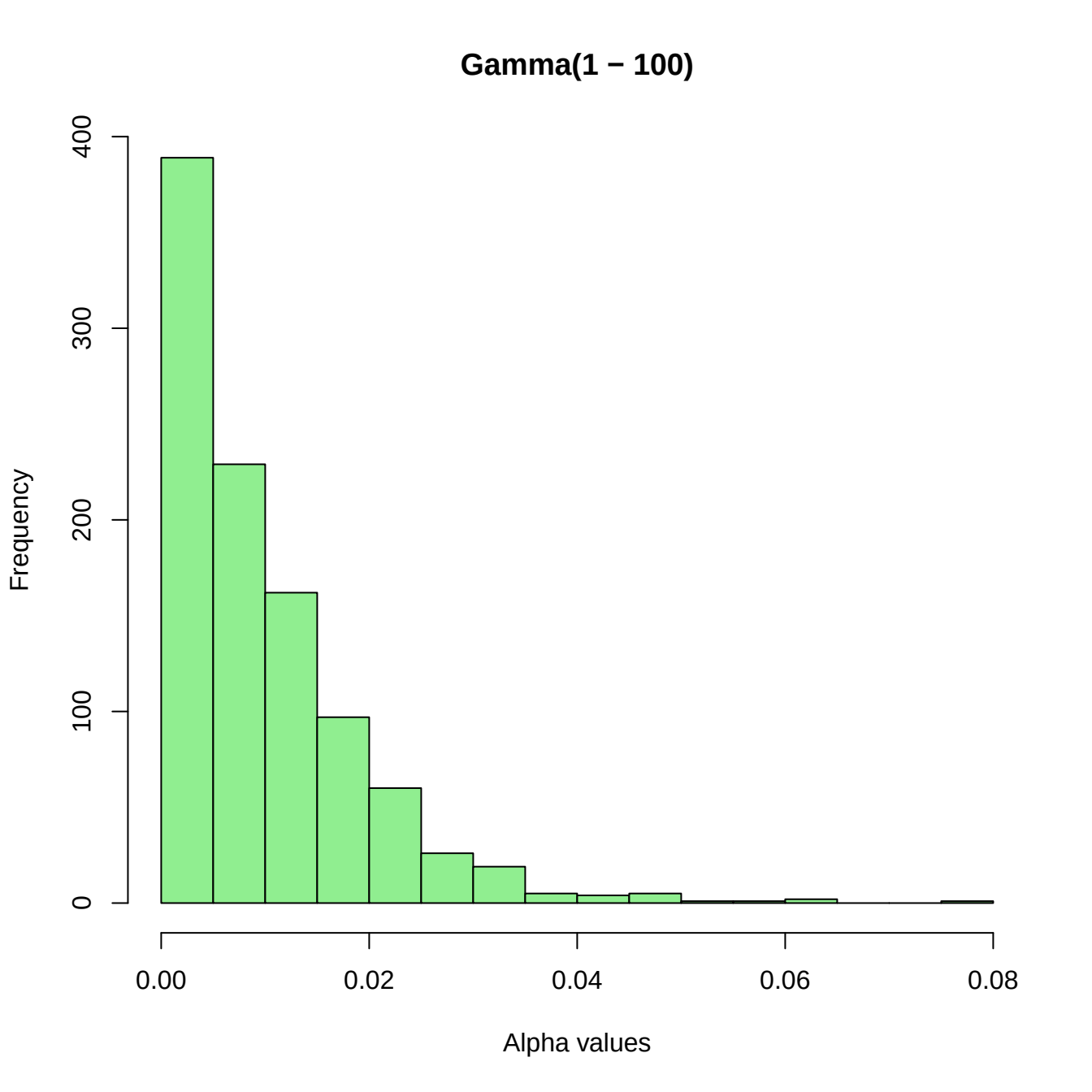
400
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Alpha values


Gamma(1 − 100)
Frequency
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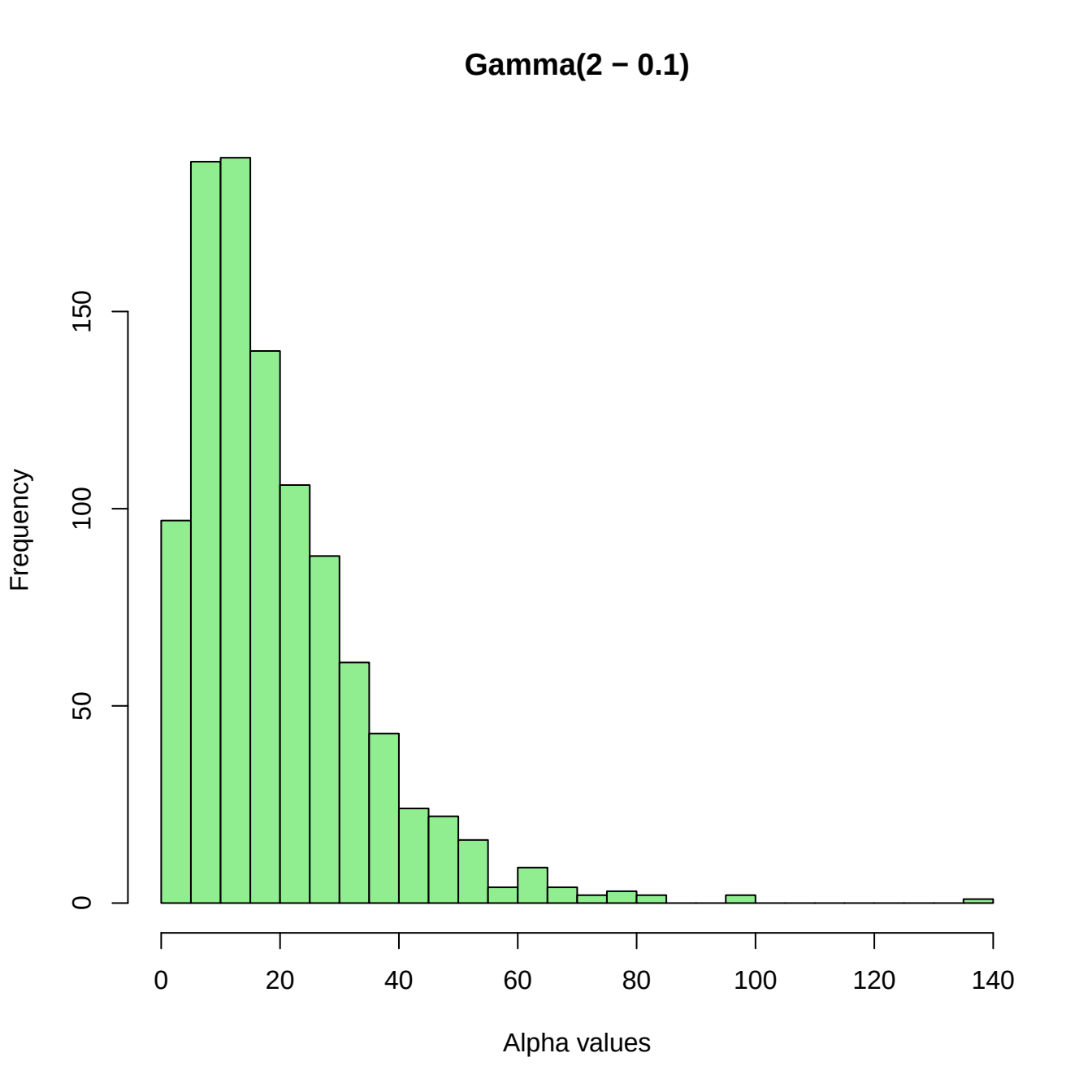
100
200
300
400
0.00
0.02
0.04
0.06
0.08
Alpha values


Gamma(2 − 0.1)
Frequency
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100
150
0
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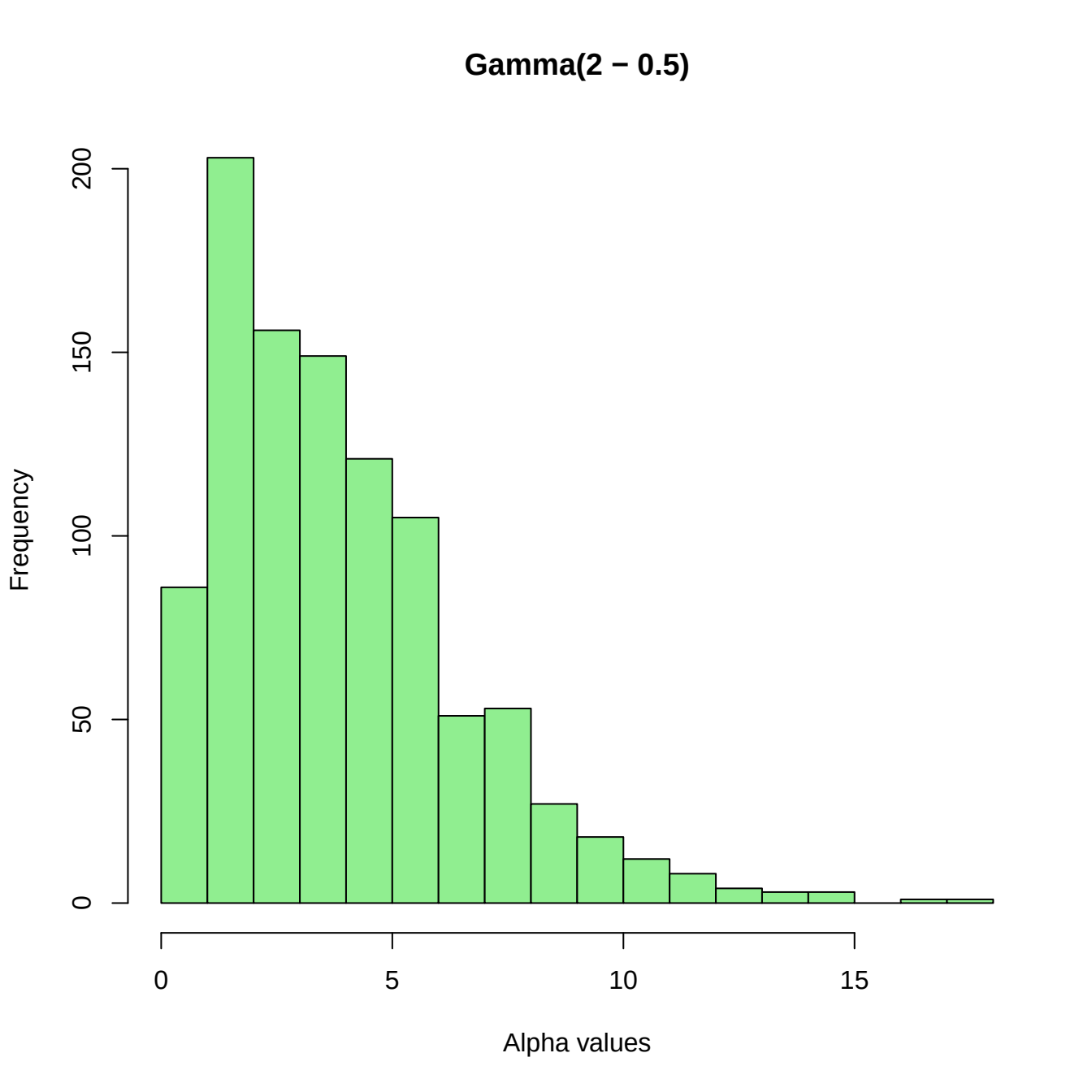
60
80
100
120
140
Alpha values


Gamma(2 − 0.5)
Frequency
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100
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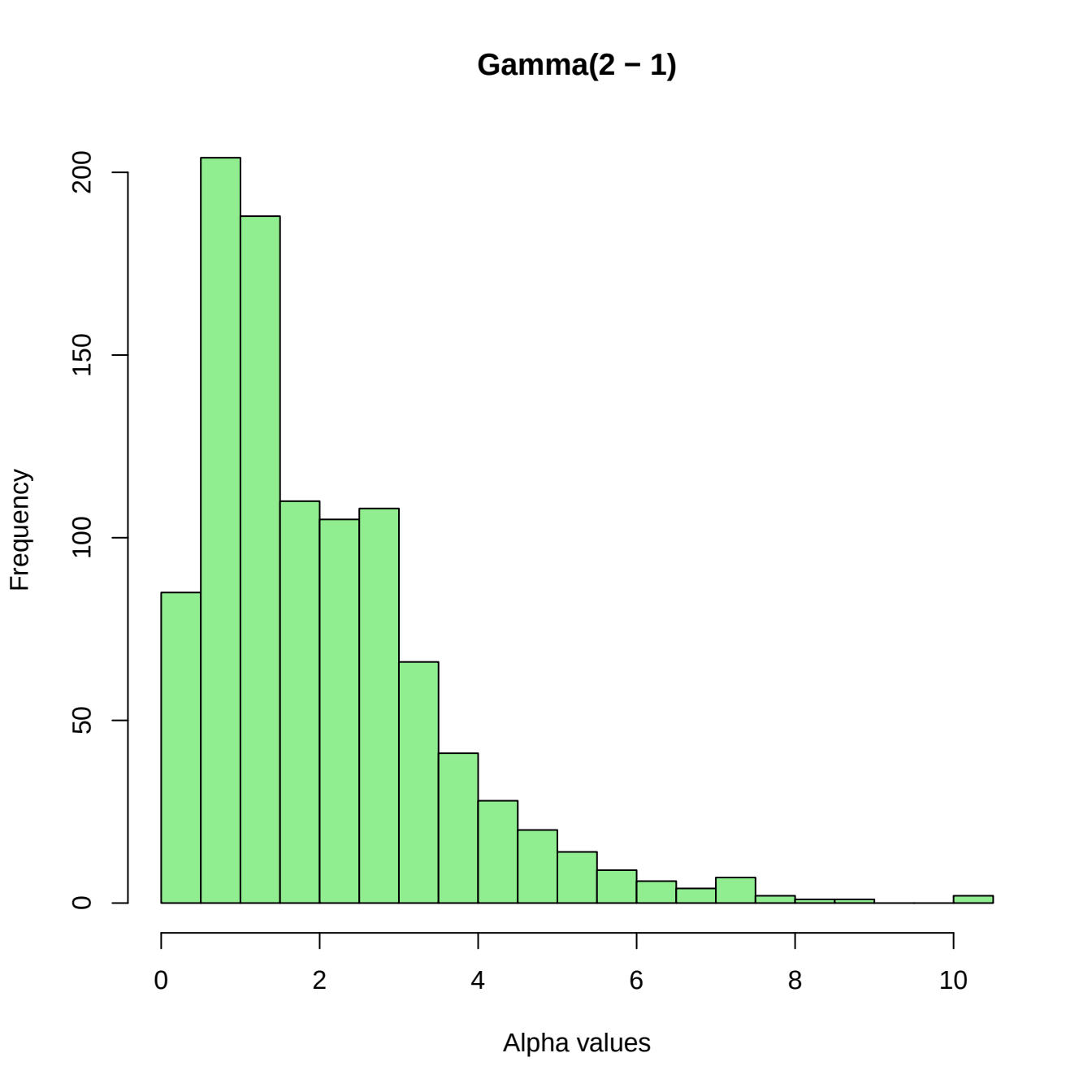
200
0
5
10
15
Alpha values


Gamma(2 − 1)
Frequency
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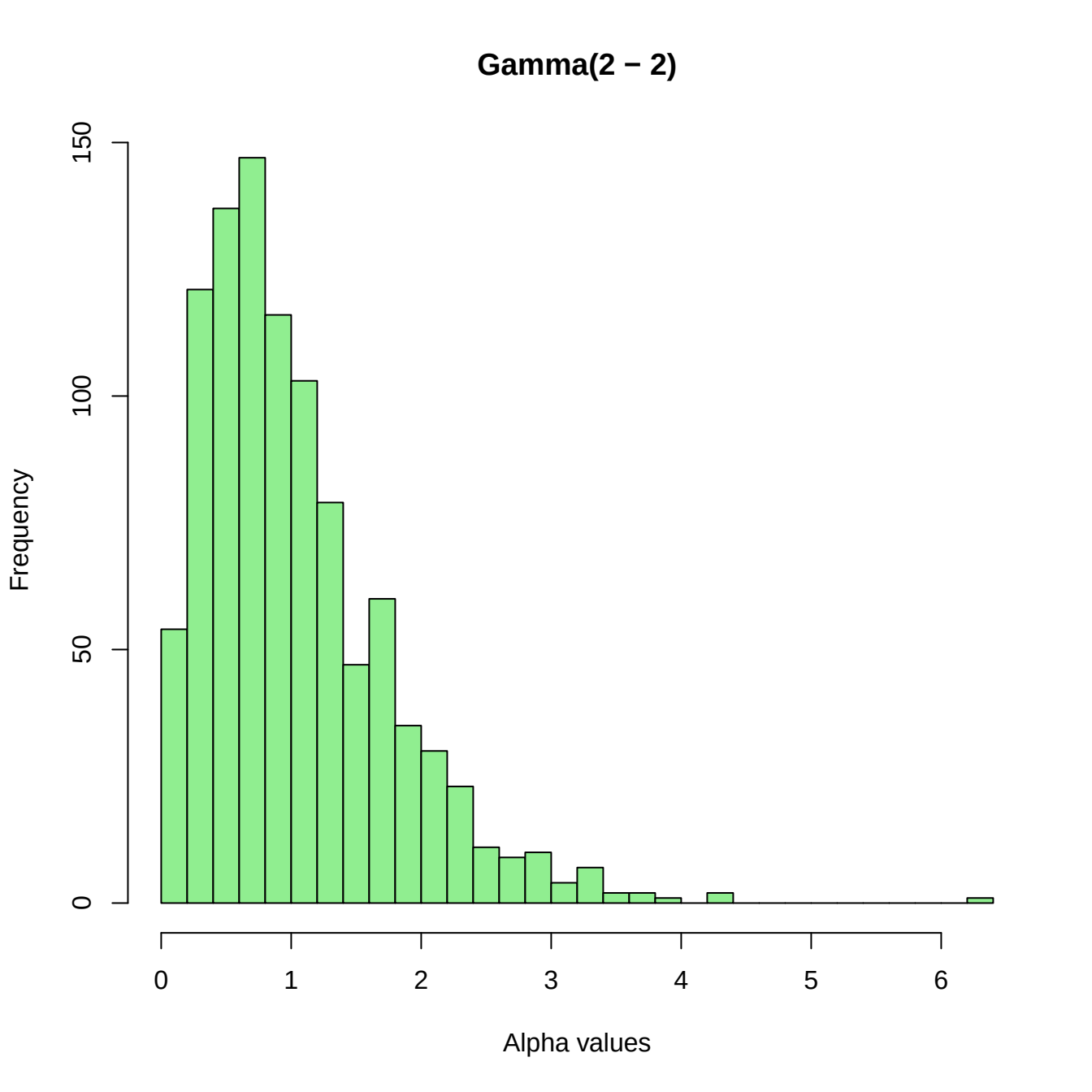
100
150
200
0
2
4
6
8
10
Alpha values


Gamma(2 − 2)
Frequency
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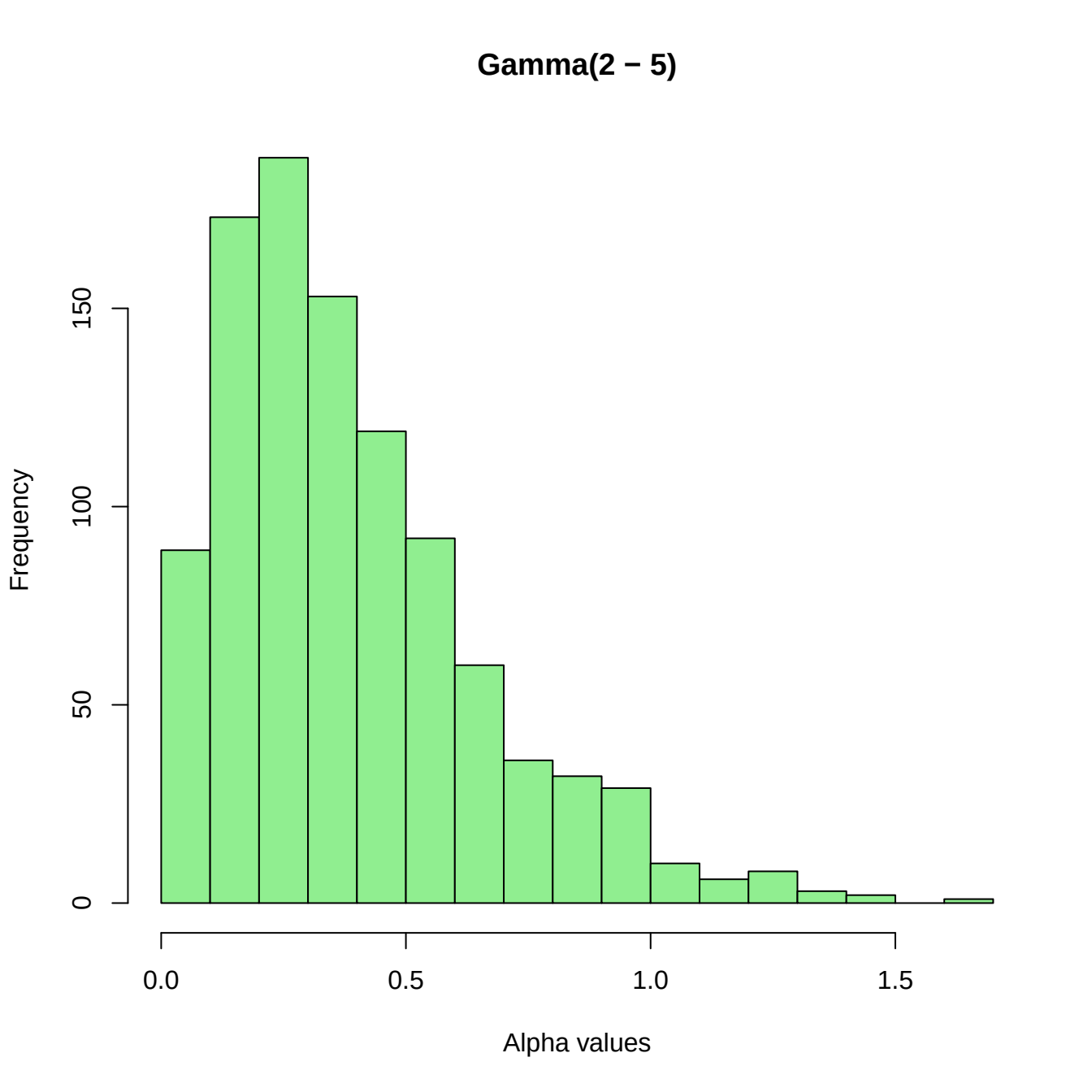
100
150
0
1
2
3
4
5
6
Alpha values


Gamma(2 − 5)
Frequency
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100
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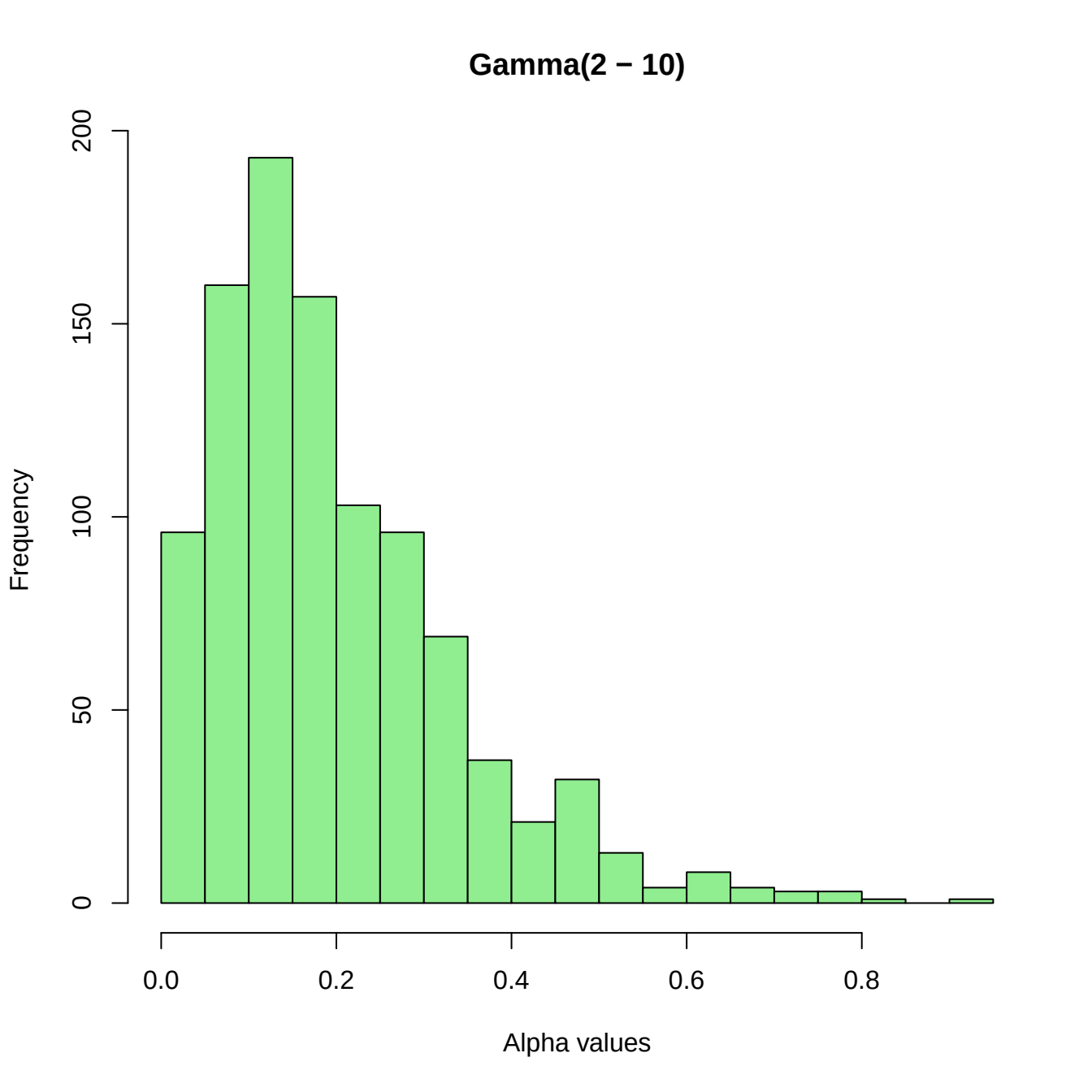
0.5
1.0
1.5
Alpha values


Gamma(2 − 10)
Frequency
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100
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200
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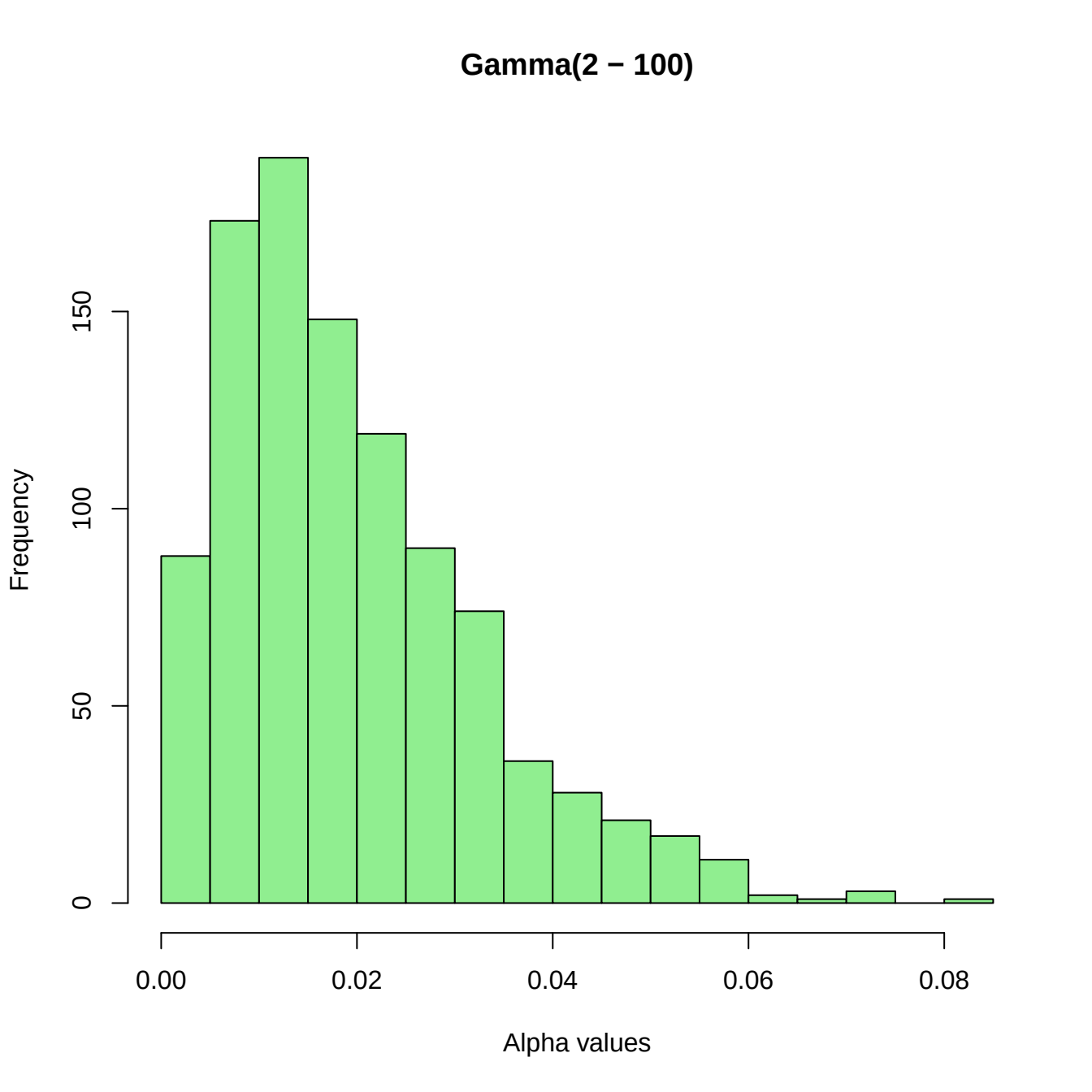
0.2
0.4
0.6
0.8
Alpha values


Gamma(2 − 100)
Frequency
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100
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0.00
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0.04
0.06
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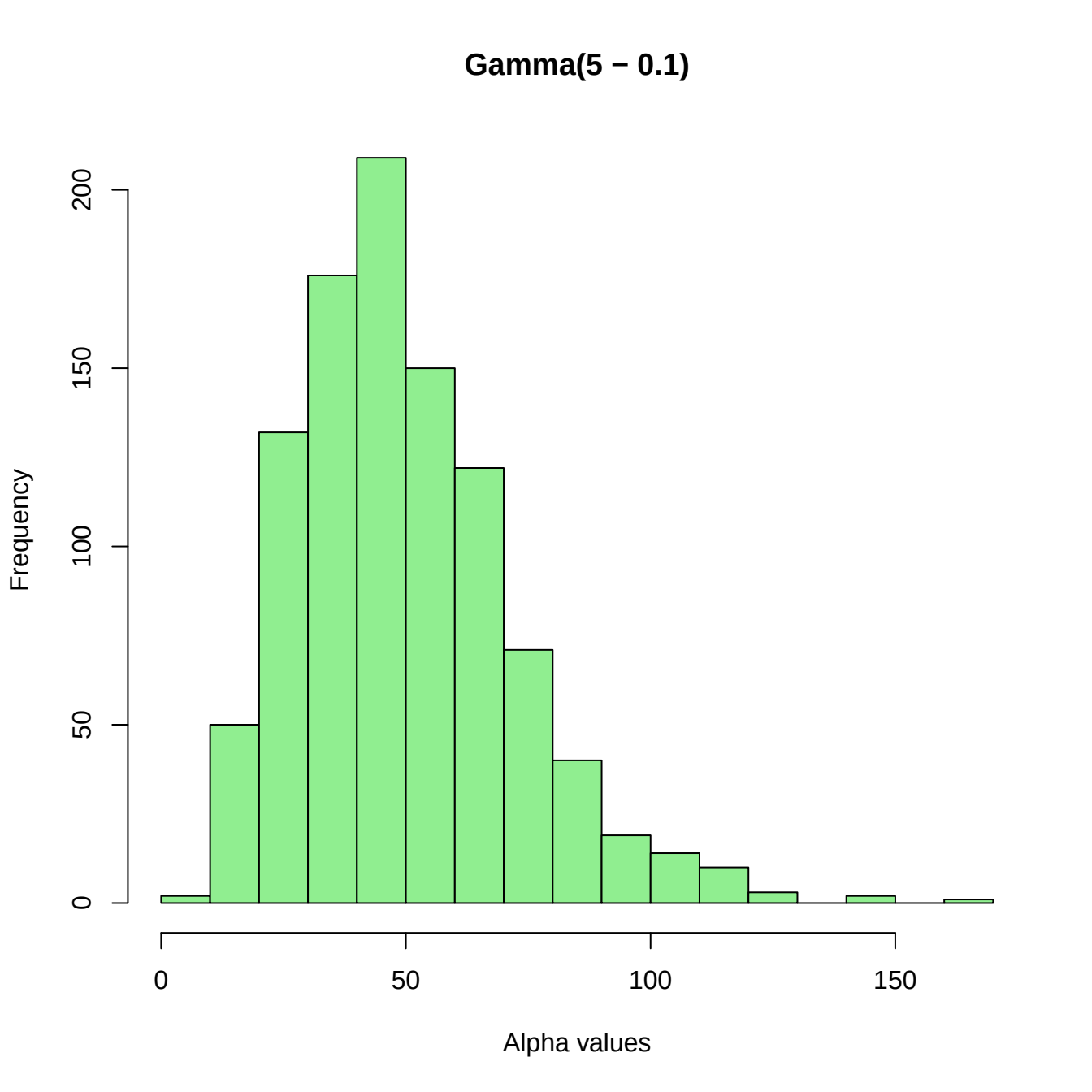
Alpha values


Gamma(5 − 0.1)
Frequency
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100
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200
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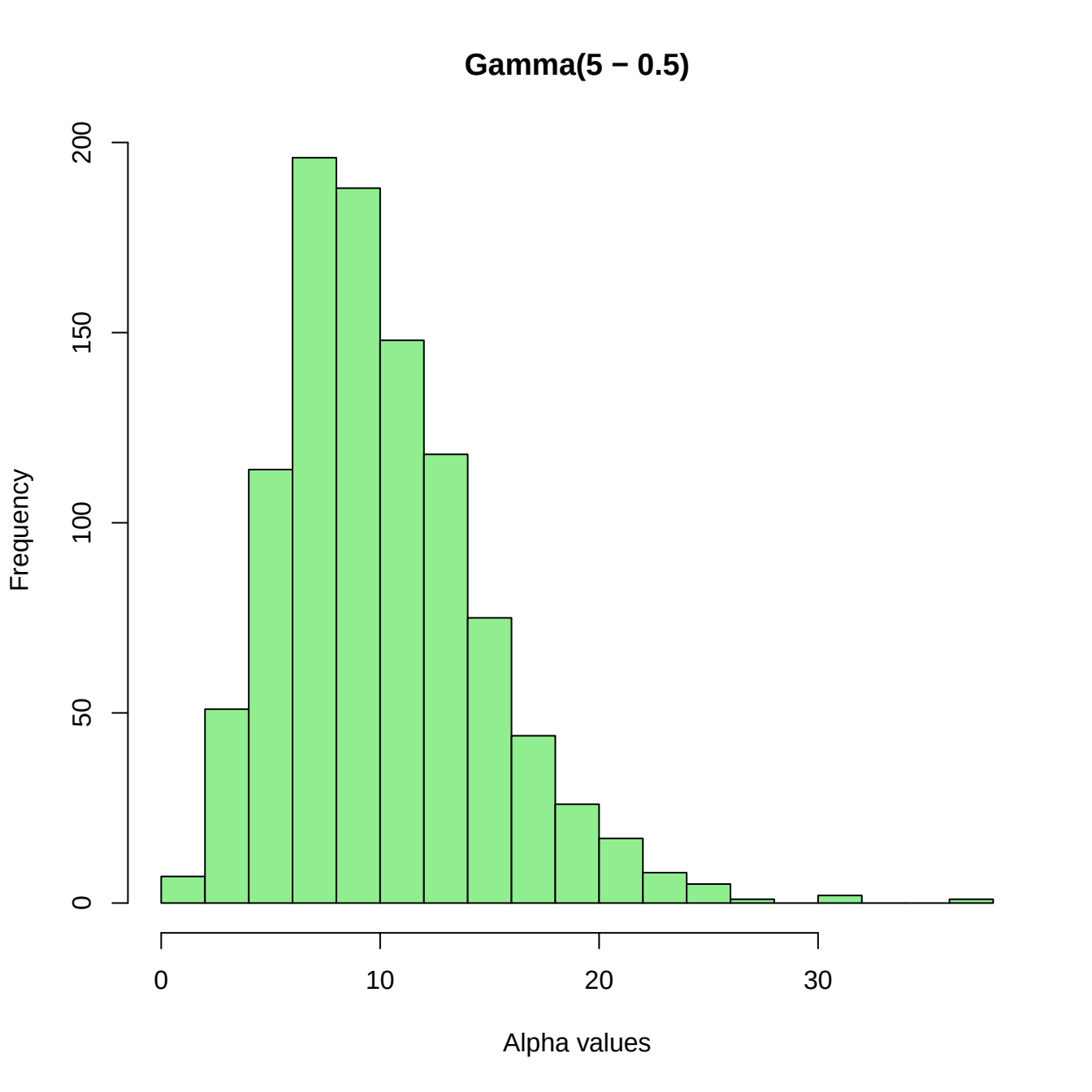
50
100
150
Alpha values


Gamma(5 − 0.5)
Frequency
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100
150
200
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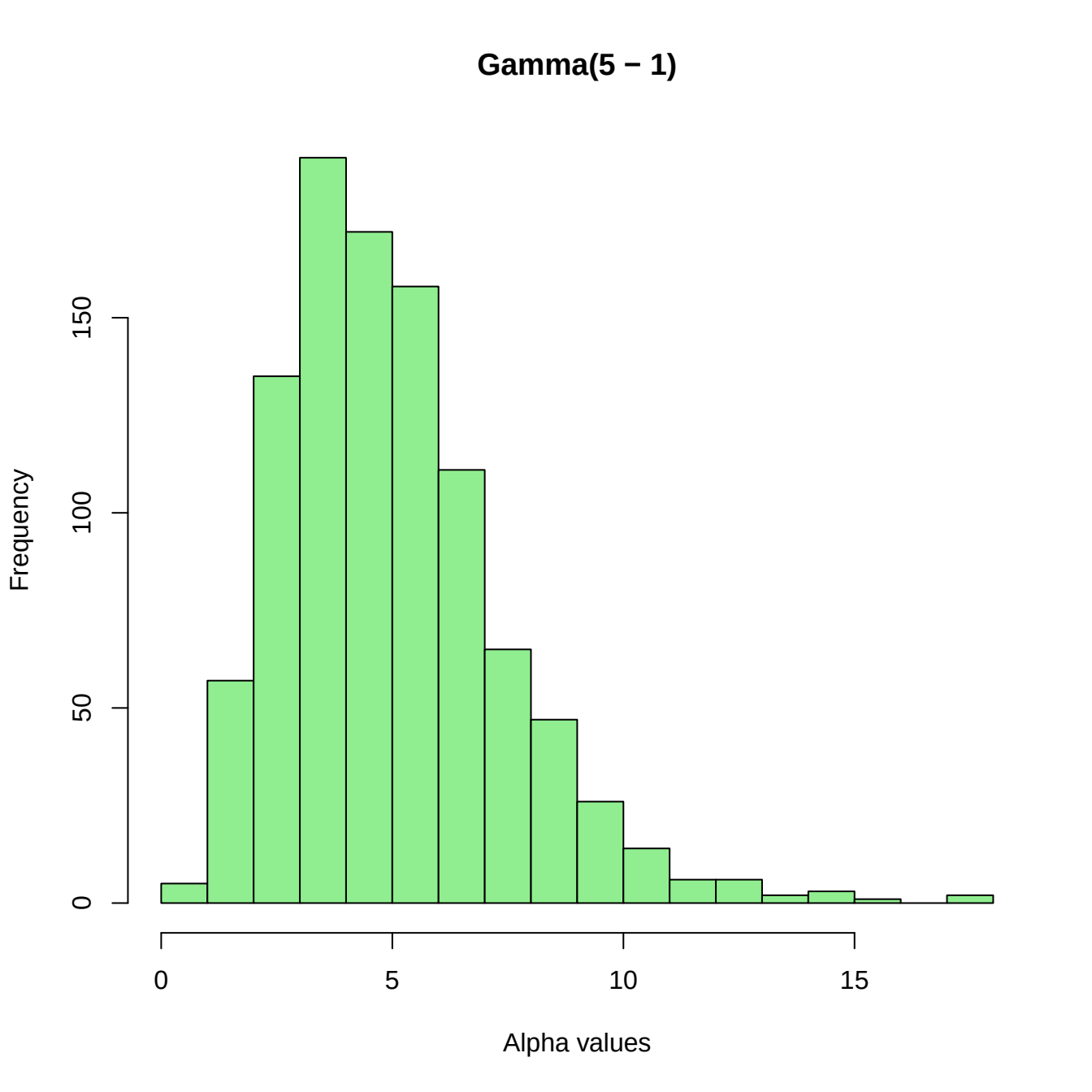
10
20
30
Alpha values


Gamma(5 − 1)
Frequency
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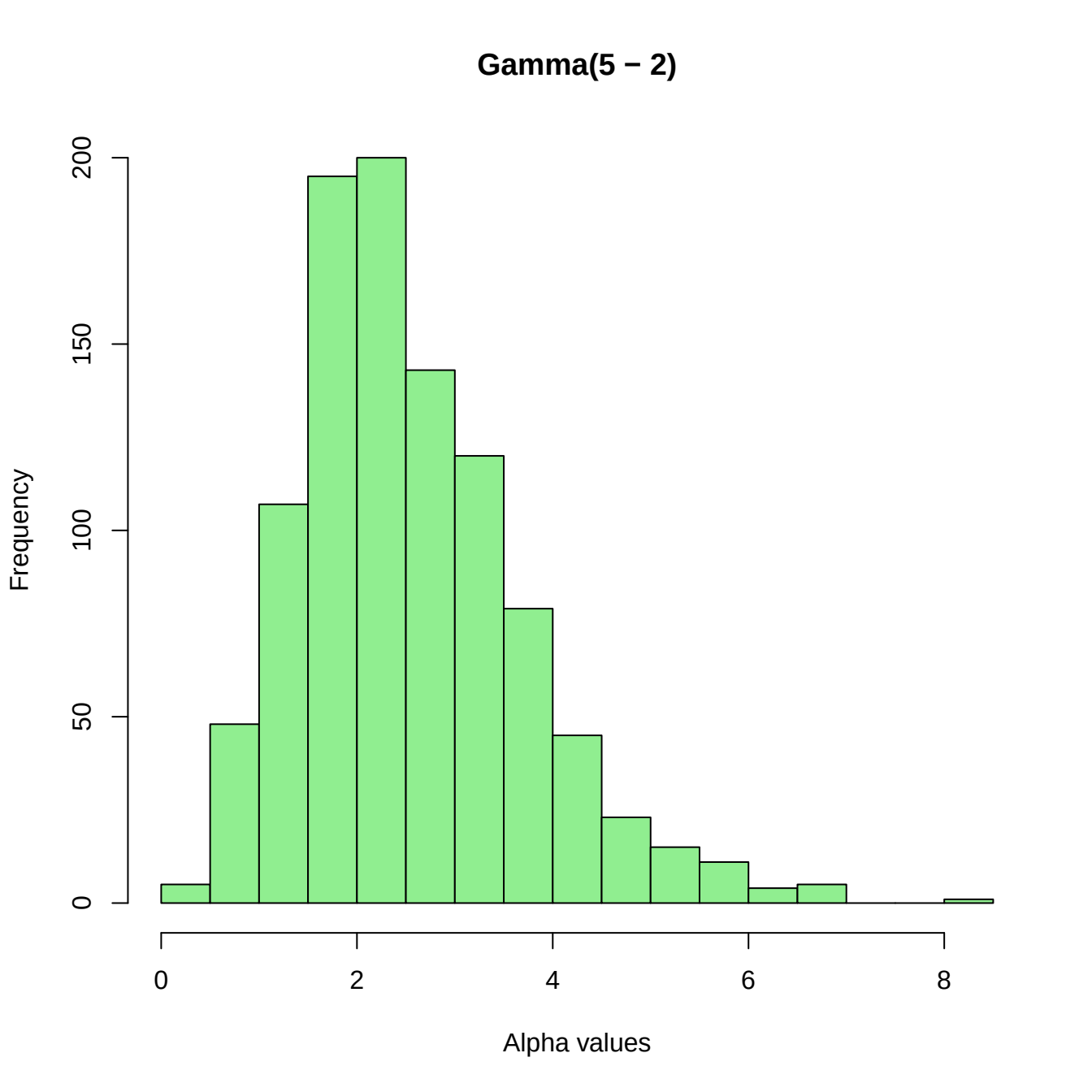
100
150
0
5
10
15
Alpha values


Gamma(5 − 2)
Frequency
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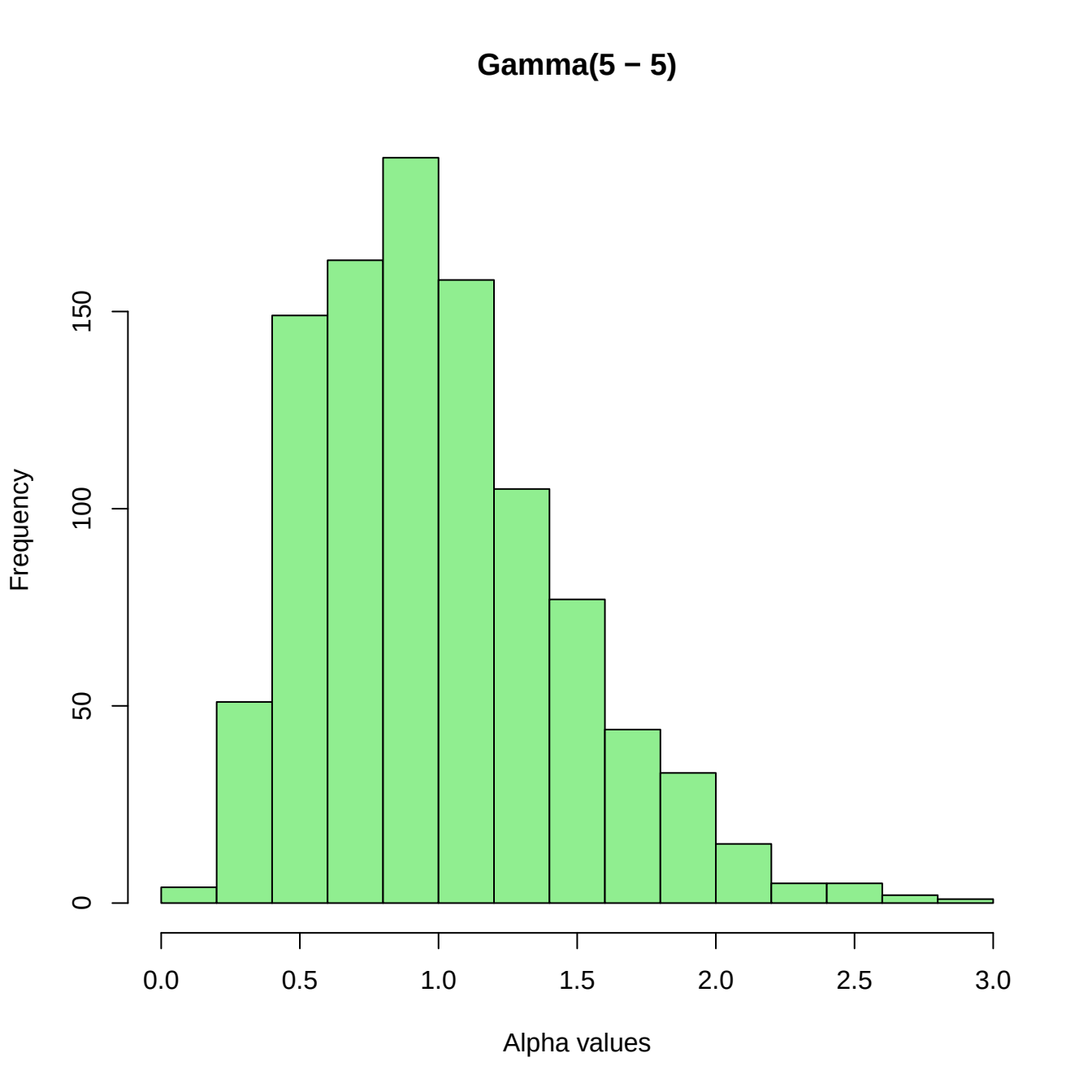
100
150
200
0
2
4
6
8
Alpha values


Gamma(5 − 5)
Frequency
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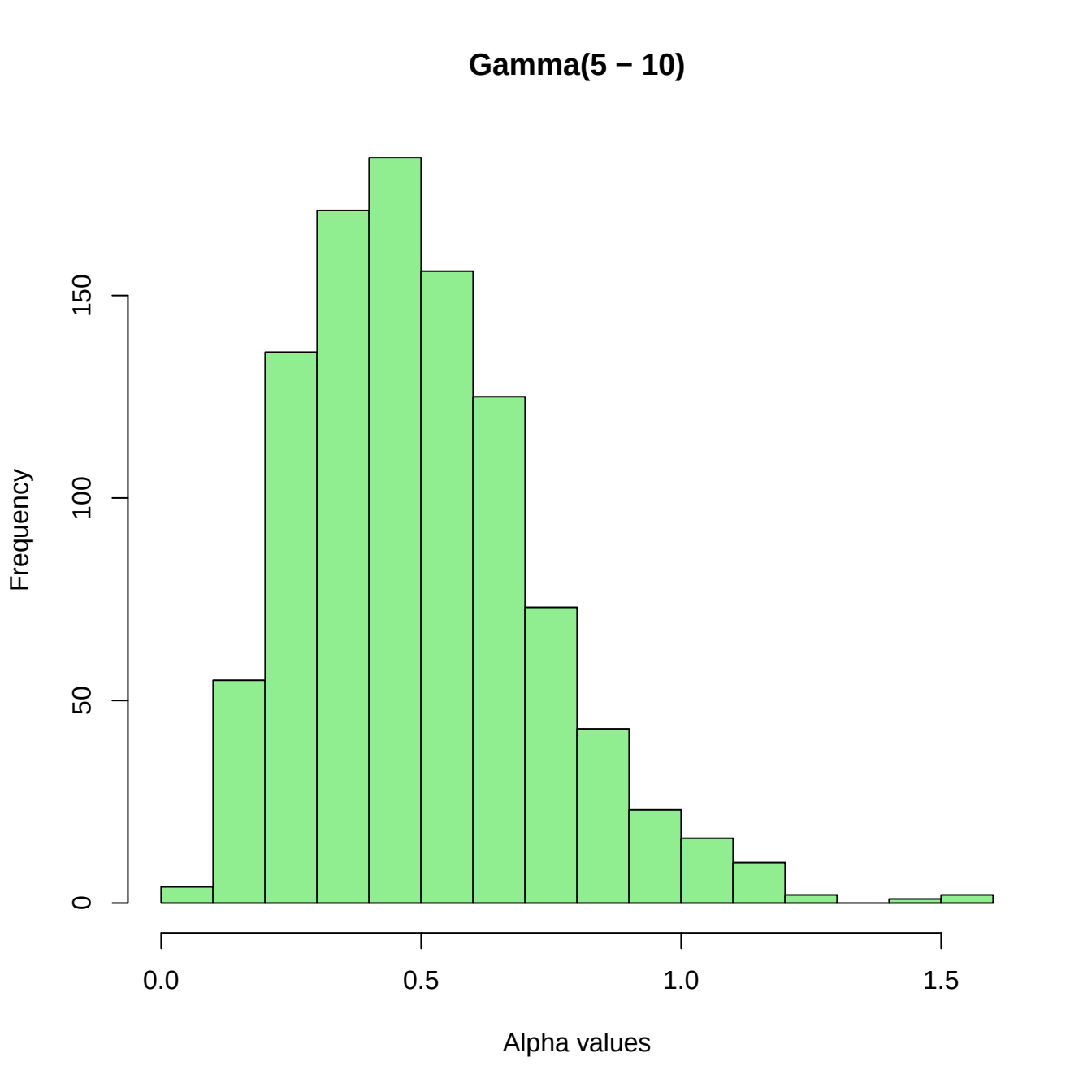
0.5
1.0
1.5
2.0
2.5
3.0
Alpha values


Gamma(5 − 10)
Frequency
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150
0.0
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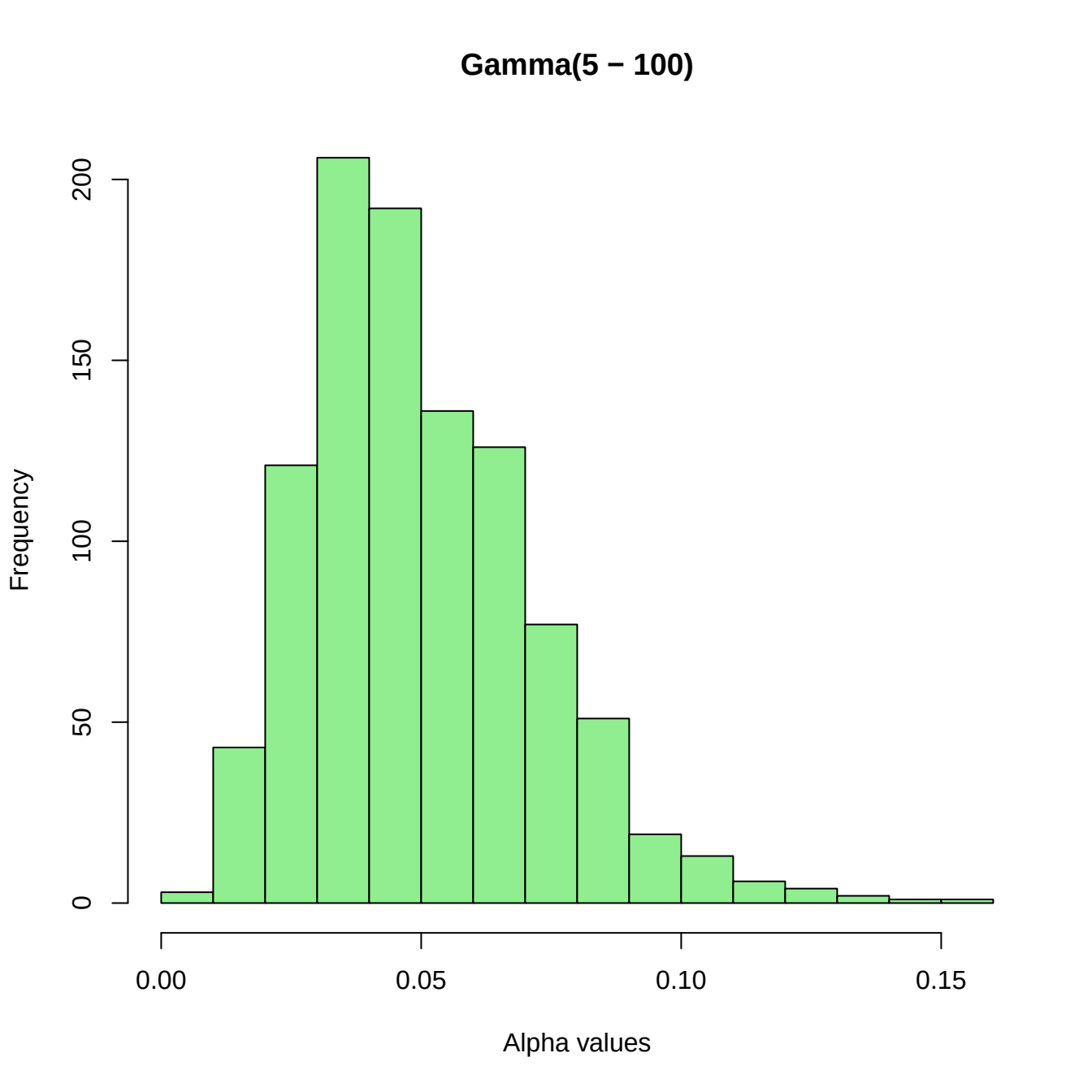
1.0
1.5
Alpha values


Gamma(5 − 100)
Frequency
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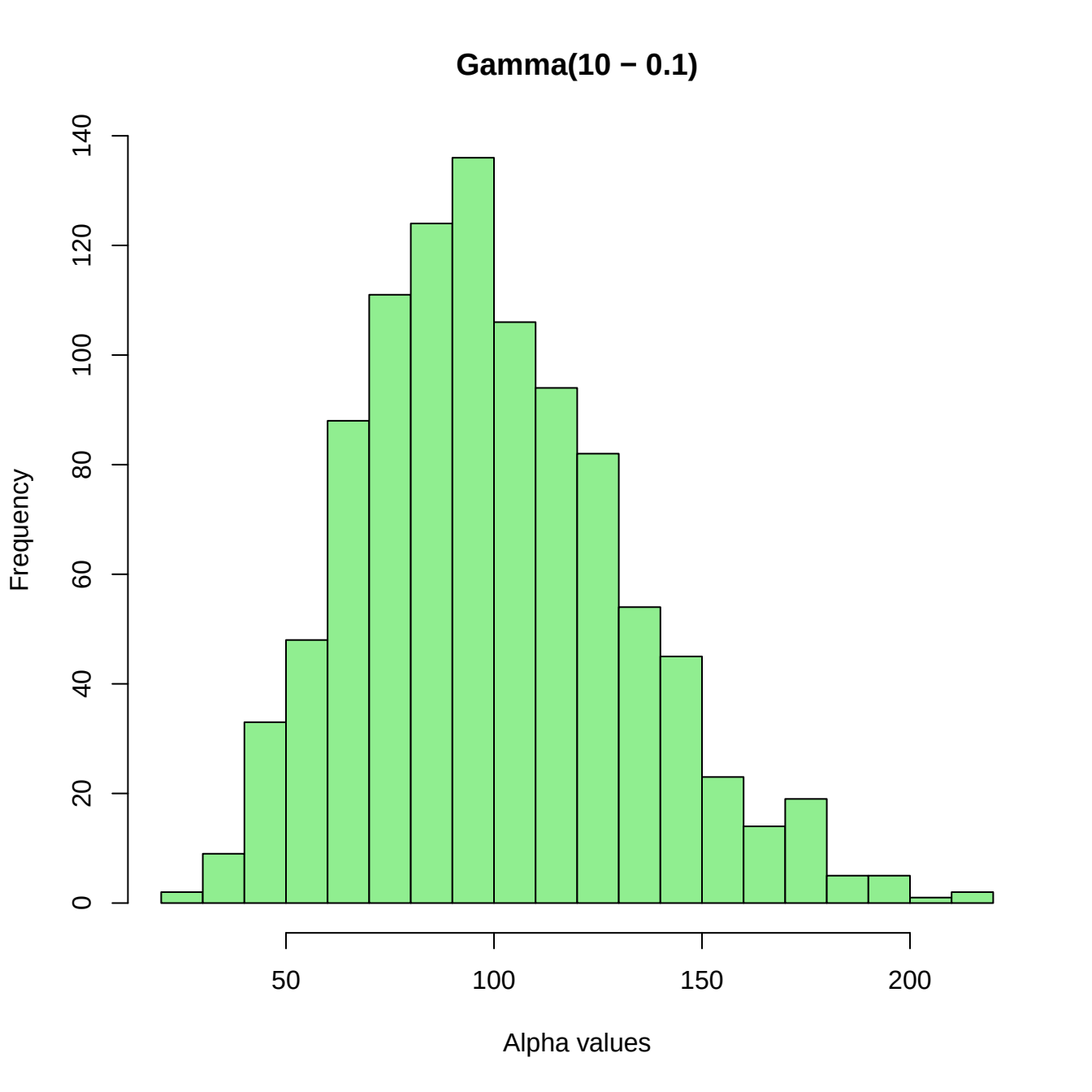
Alpha values


Gamma(10 − 0.1)
Frequency
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20
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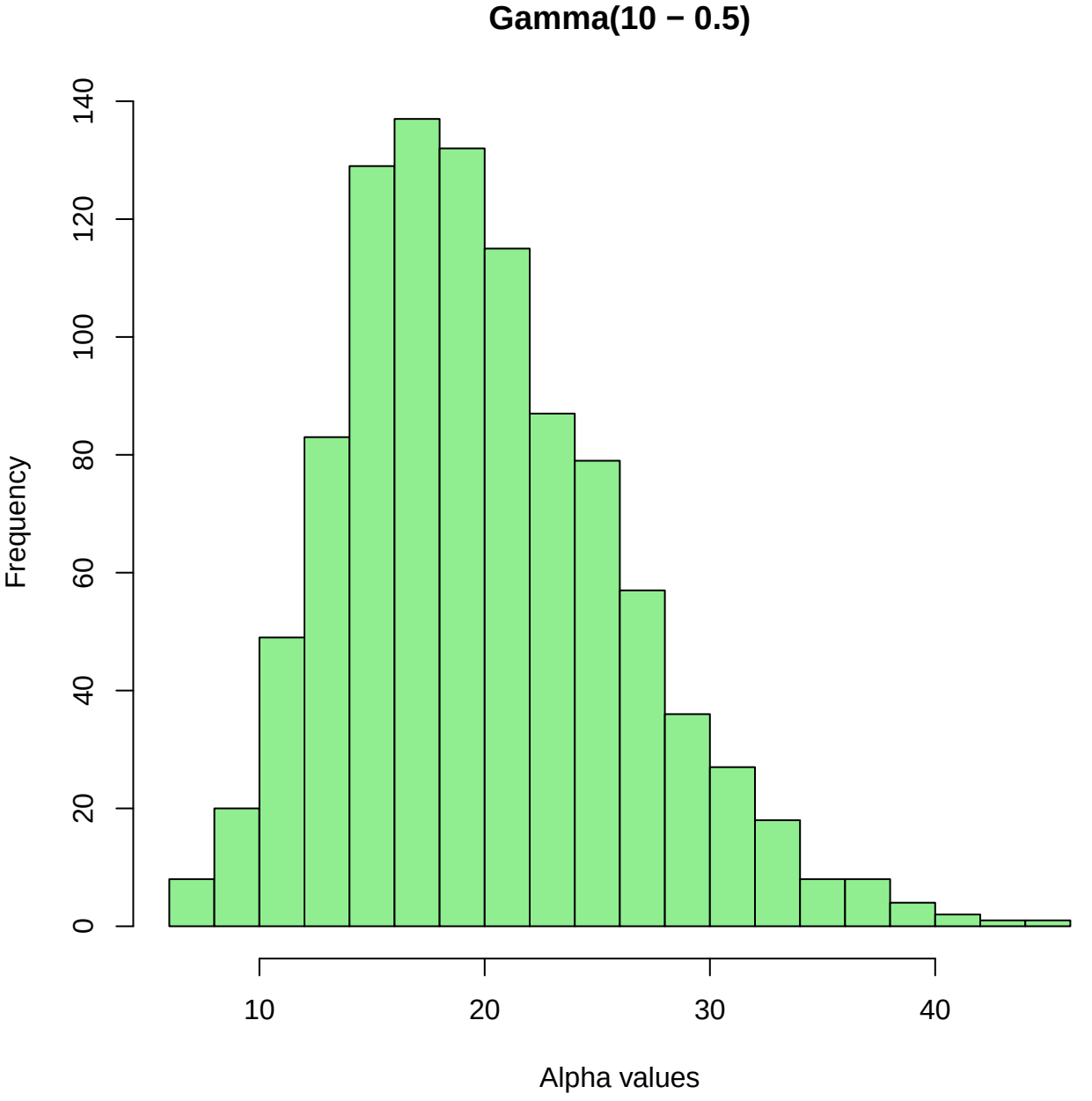
60
80
100
120
140
50
100
150
200
Alpha values


Gamma(10 − 0.5)
Frequency
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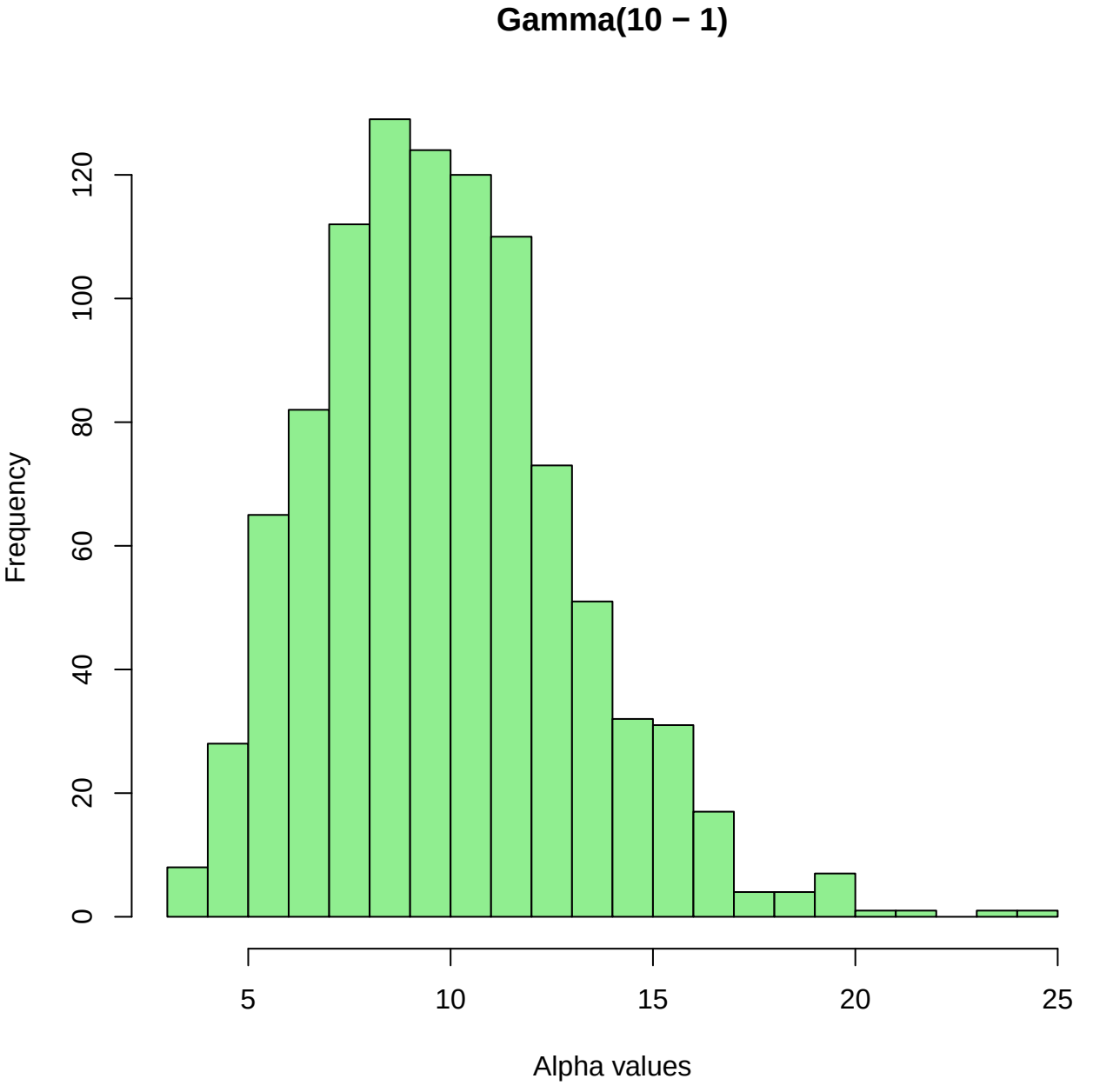
60
80
100
120
140
10
20
30
40
Alpha values


Gamma(10 − 1)
Frequency
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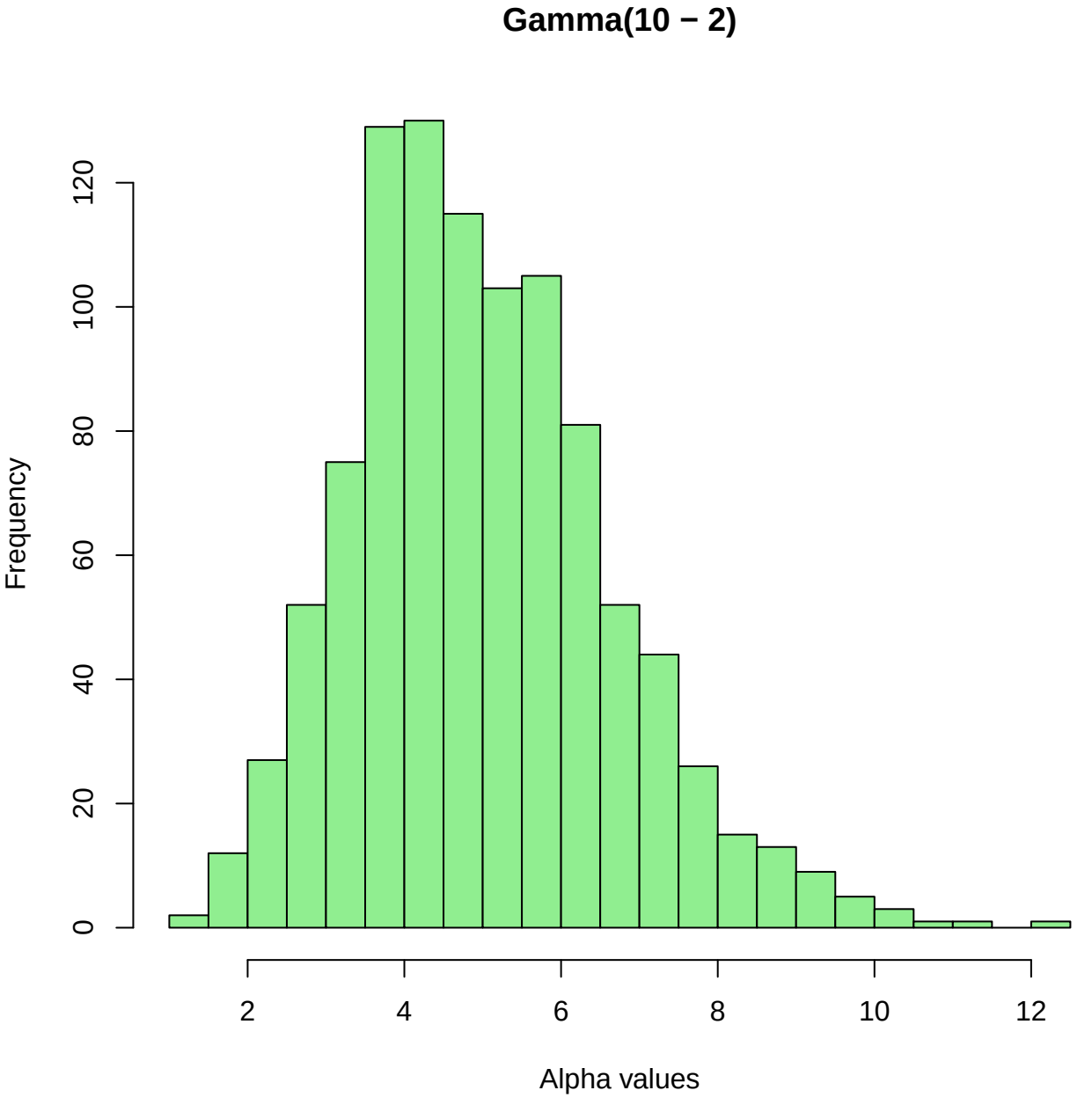
20
40
60
80
100
120
5
10
15
20
25
Alpha values


Gamma(10 − 2)
Frequency
0
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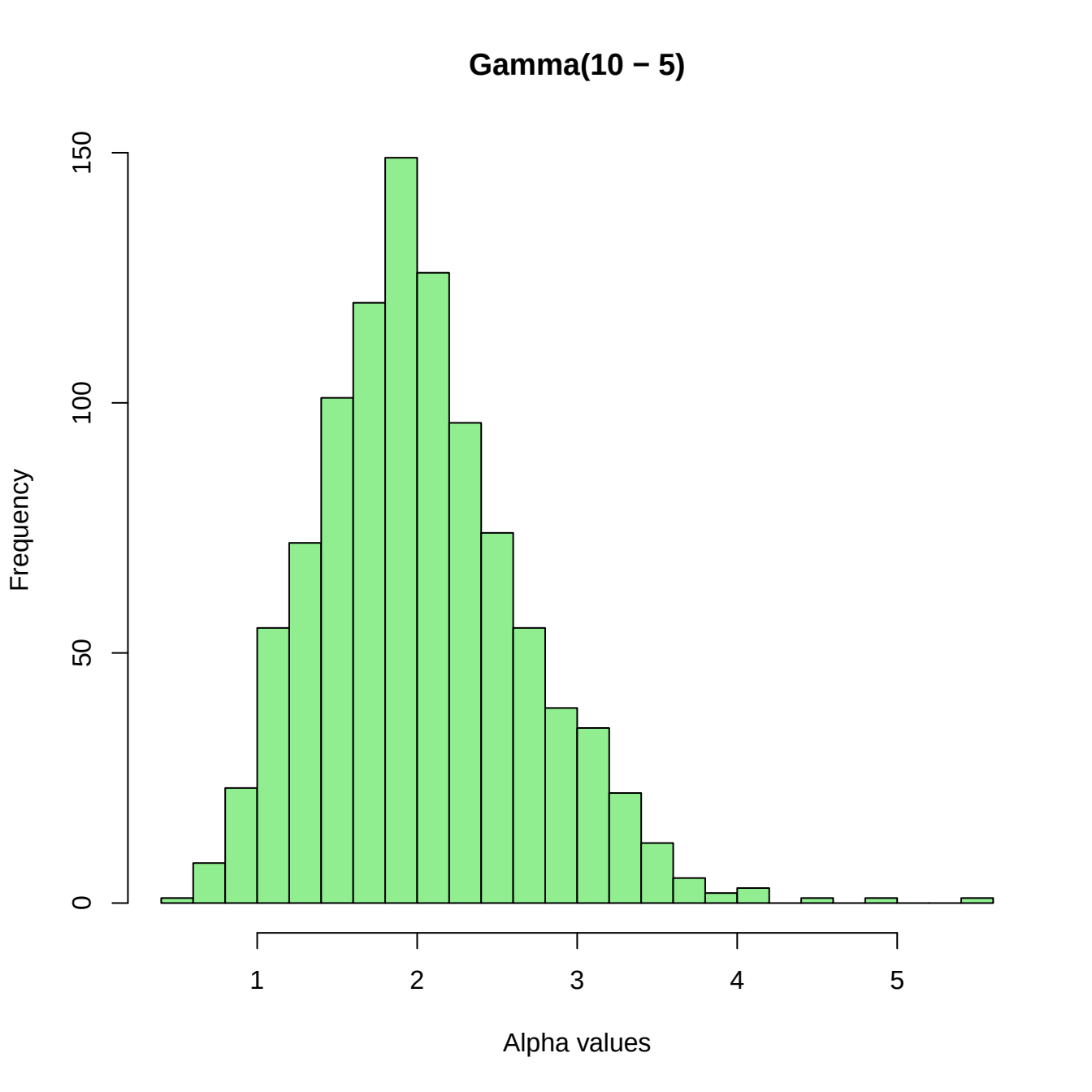
40
60
80
100
120
2
4
6
8
10
12
Alpha values


Gamma(10 − 5)
Frequency
0
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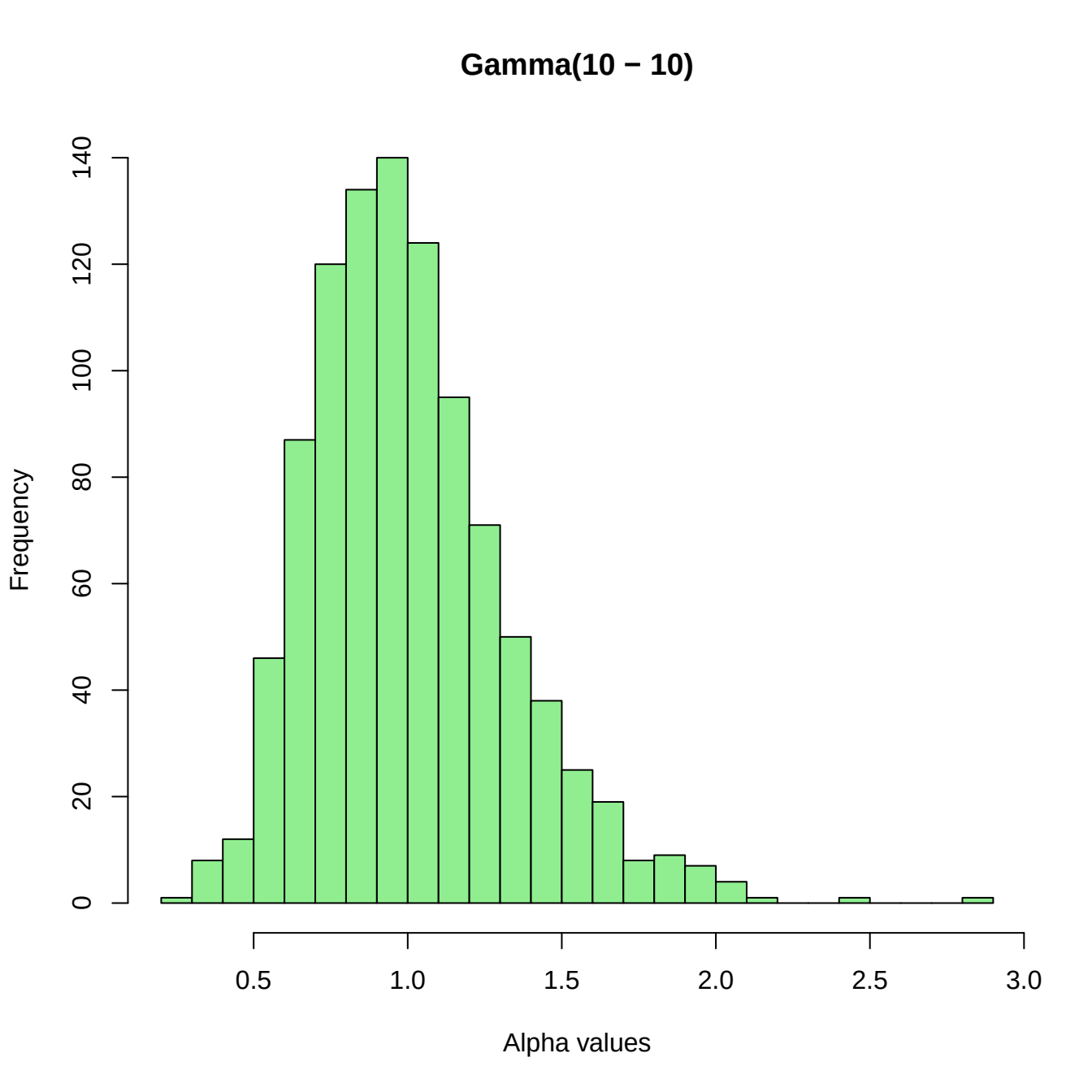
100
150
1
2
3
4
5
Alpha values


Gamma(10 − 10)
Frequency
0
20
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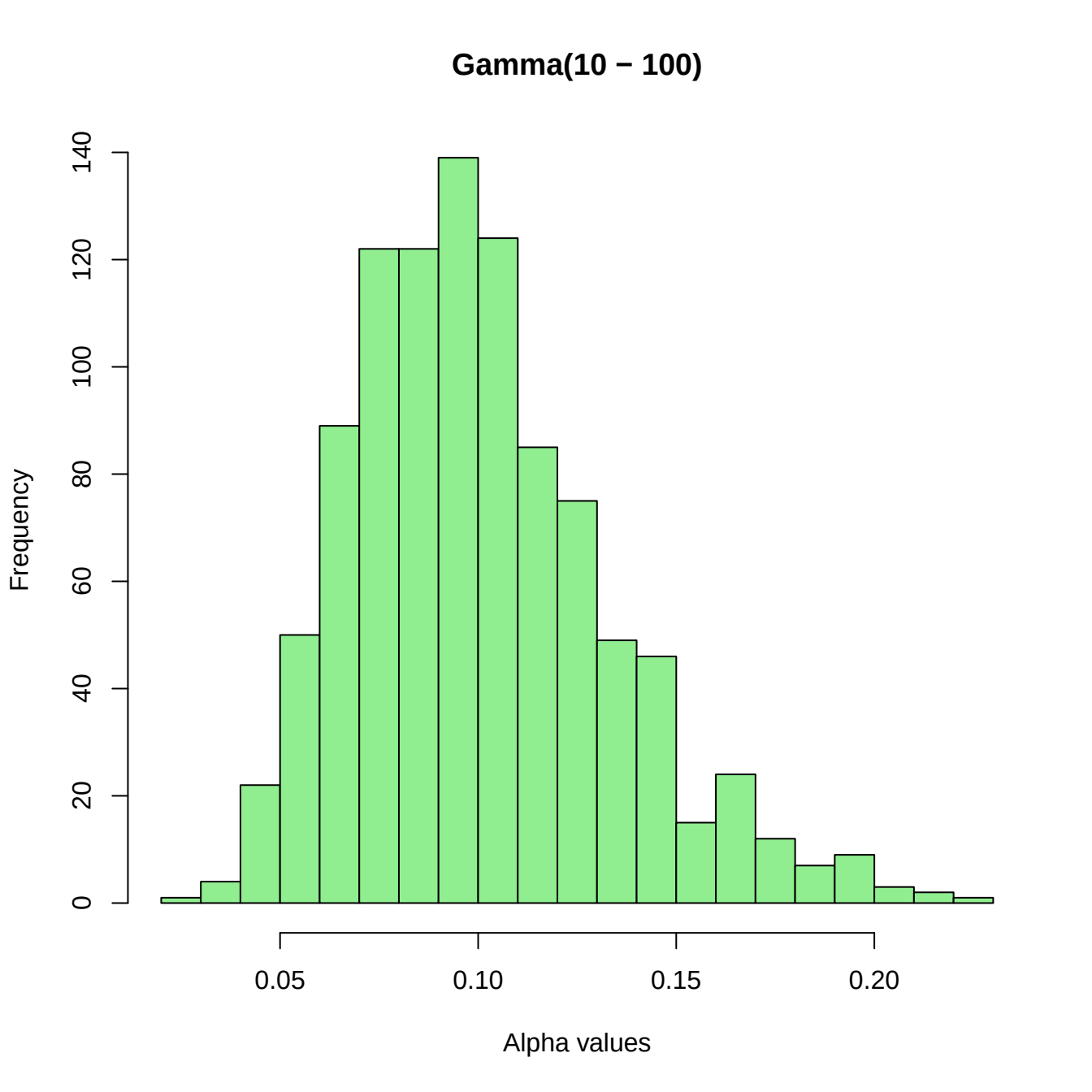
60
80
100
120
140
0.5
1.0
1.5
2.0
2.5
3.0
Alpha values


Gamma(10 − 100)
Frequency
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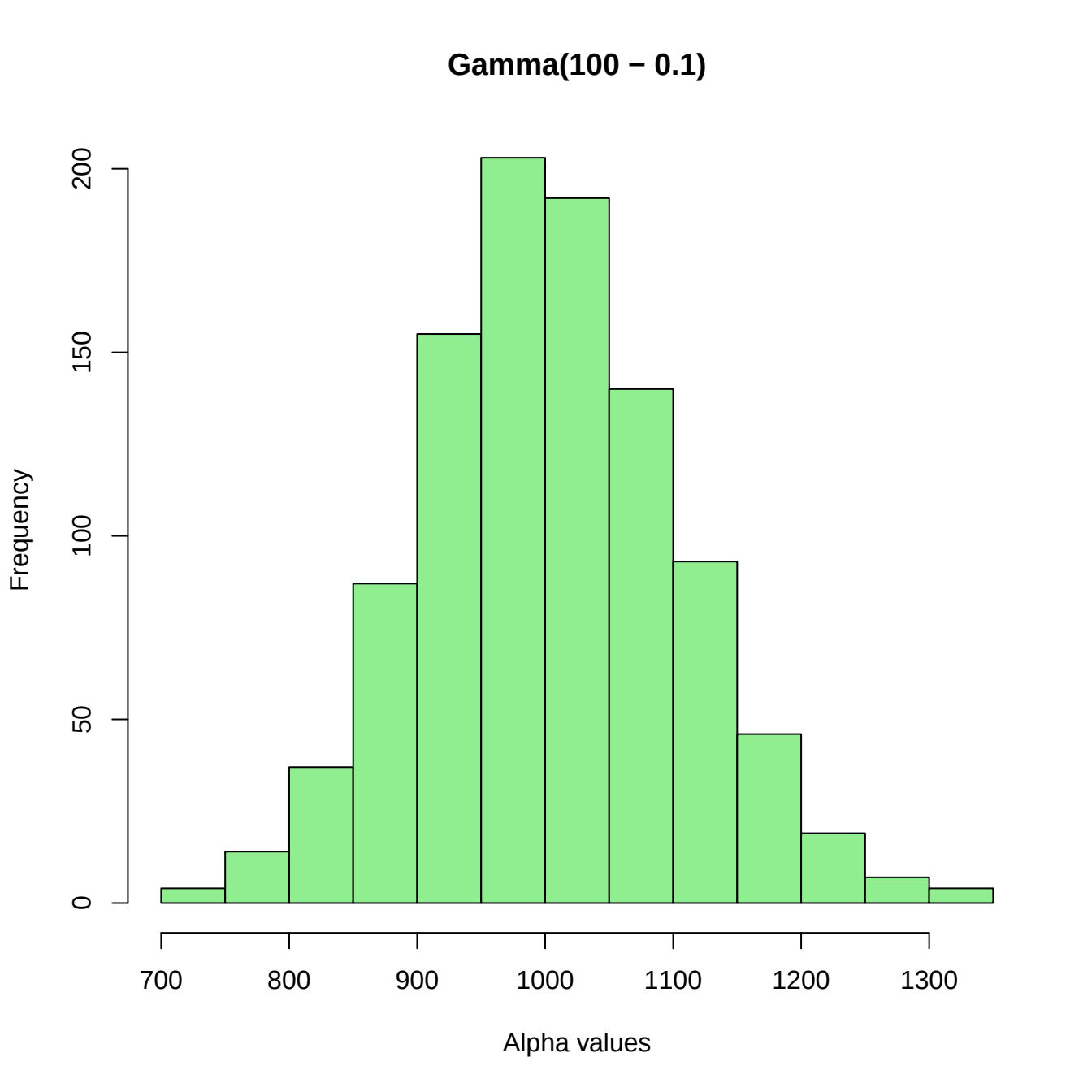
60
80
100
120
140
0.05
0.10
0.15
0.20
Alpha values


Gamma(100 − 0.1)
Frequency
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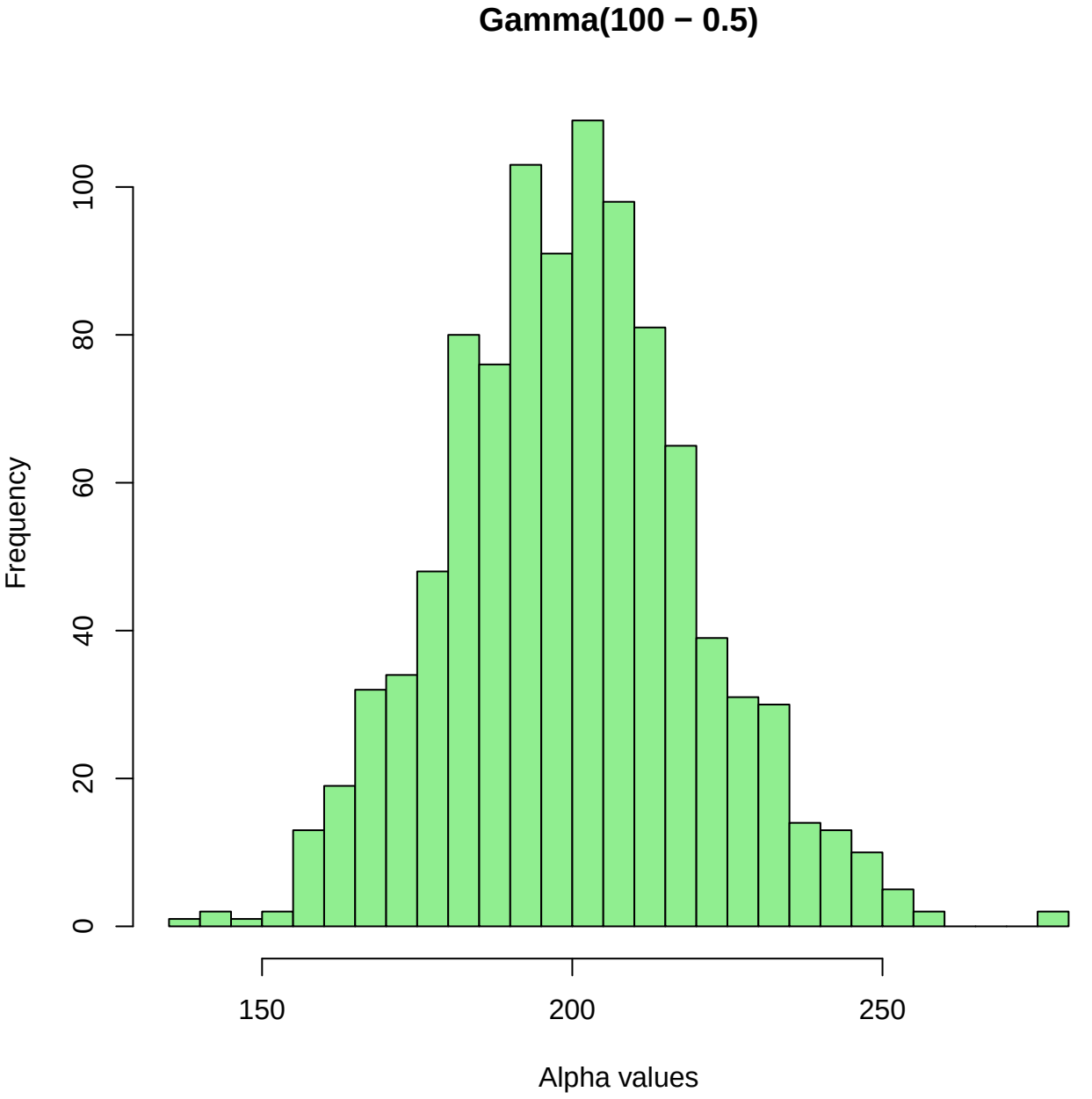
100
150
200
700
800
900
1000
1100
1200
1300
Alpha values


Gamma(100 − 0.5)
Frequency
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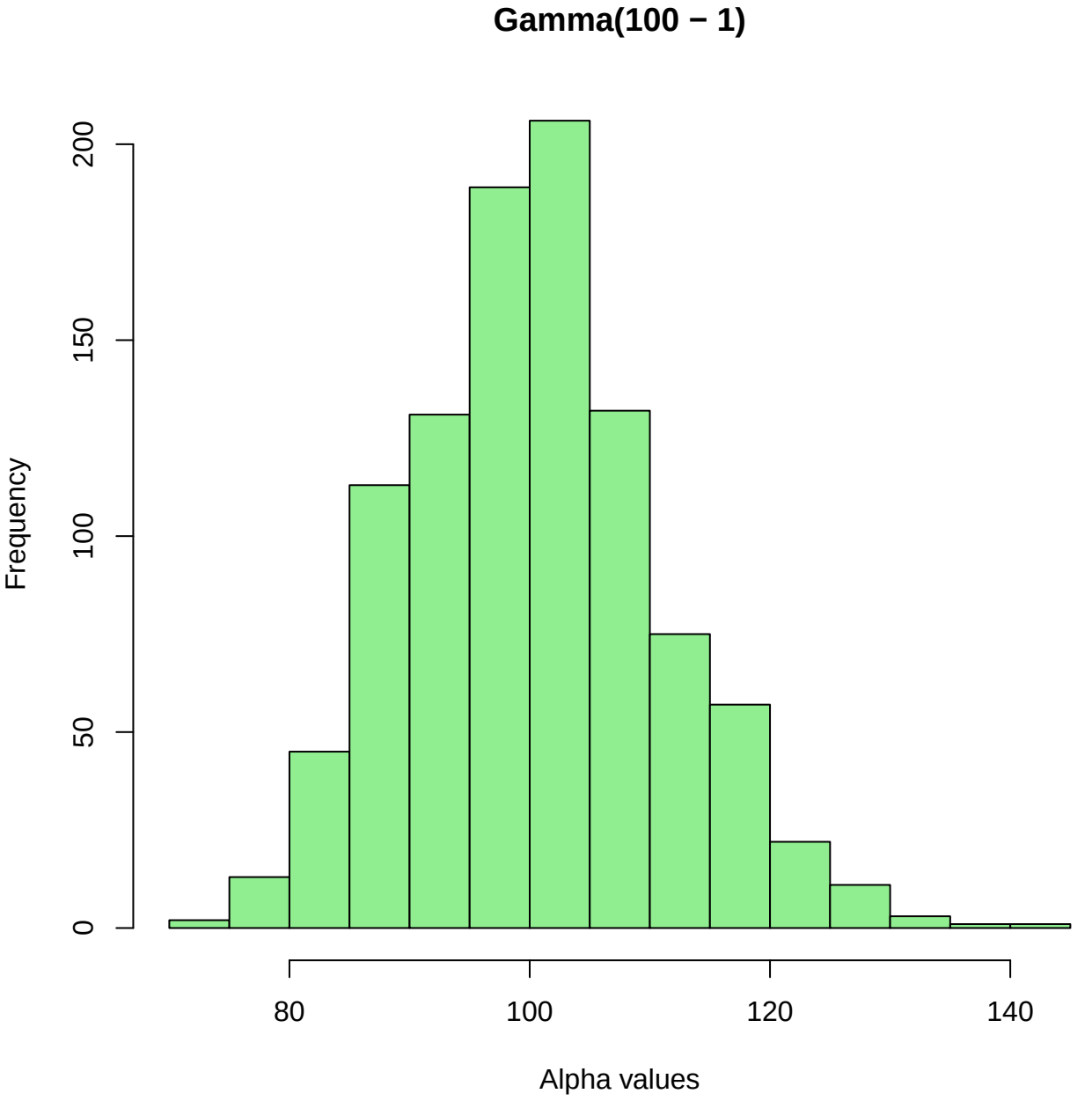
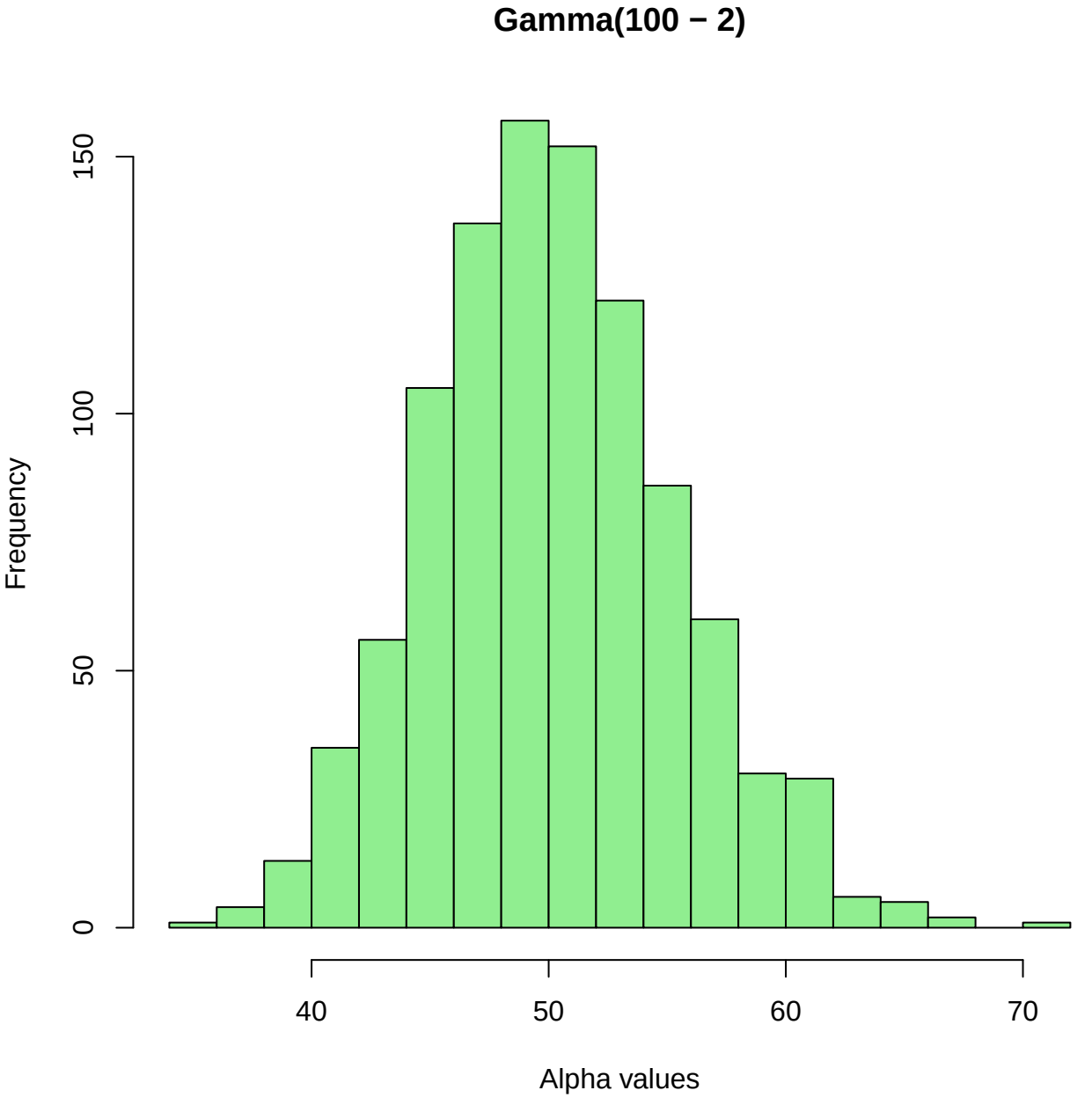
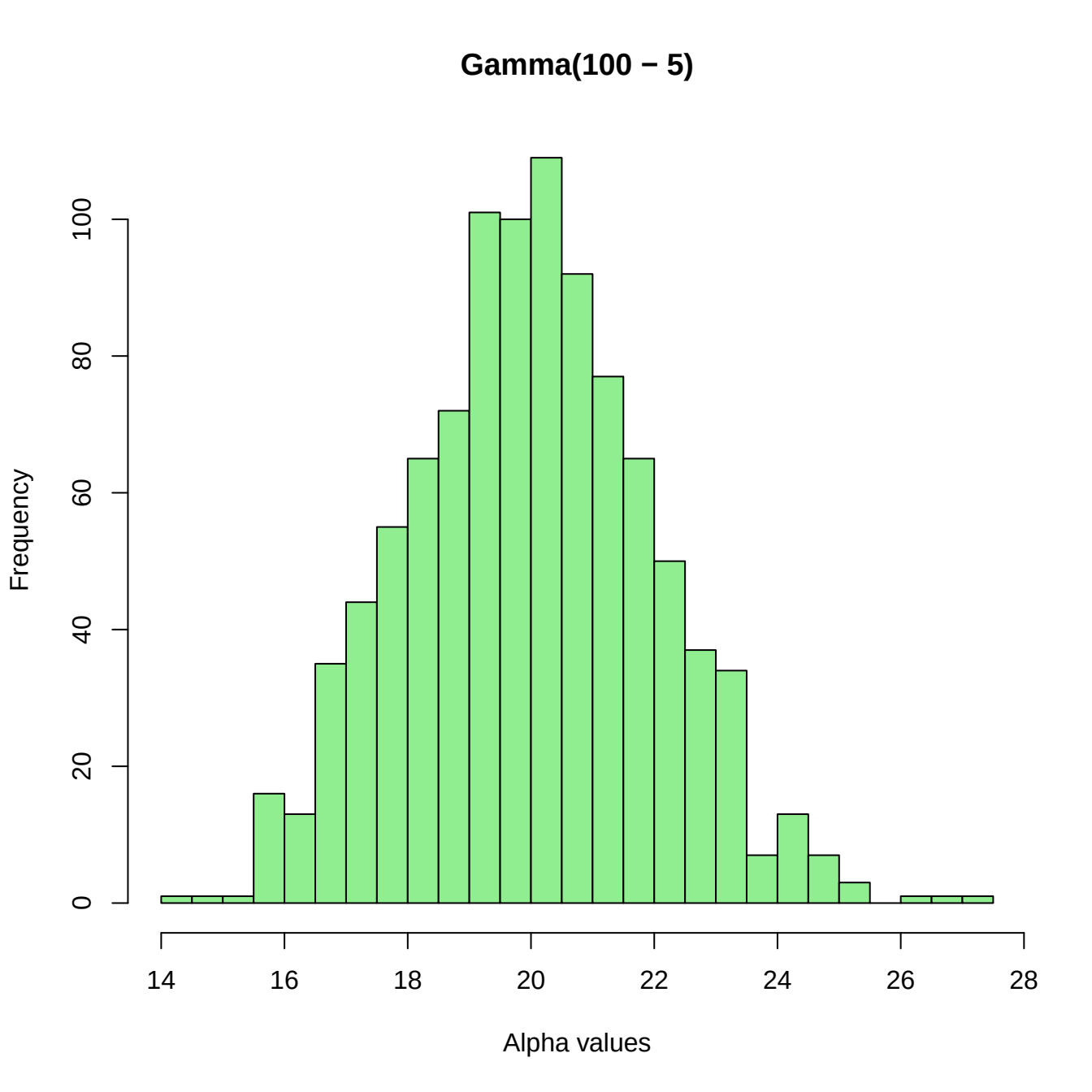
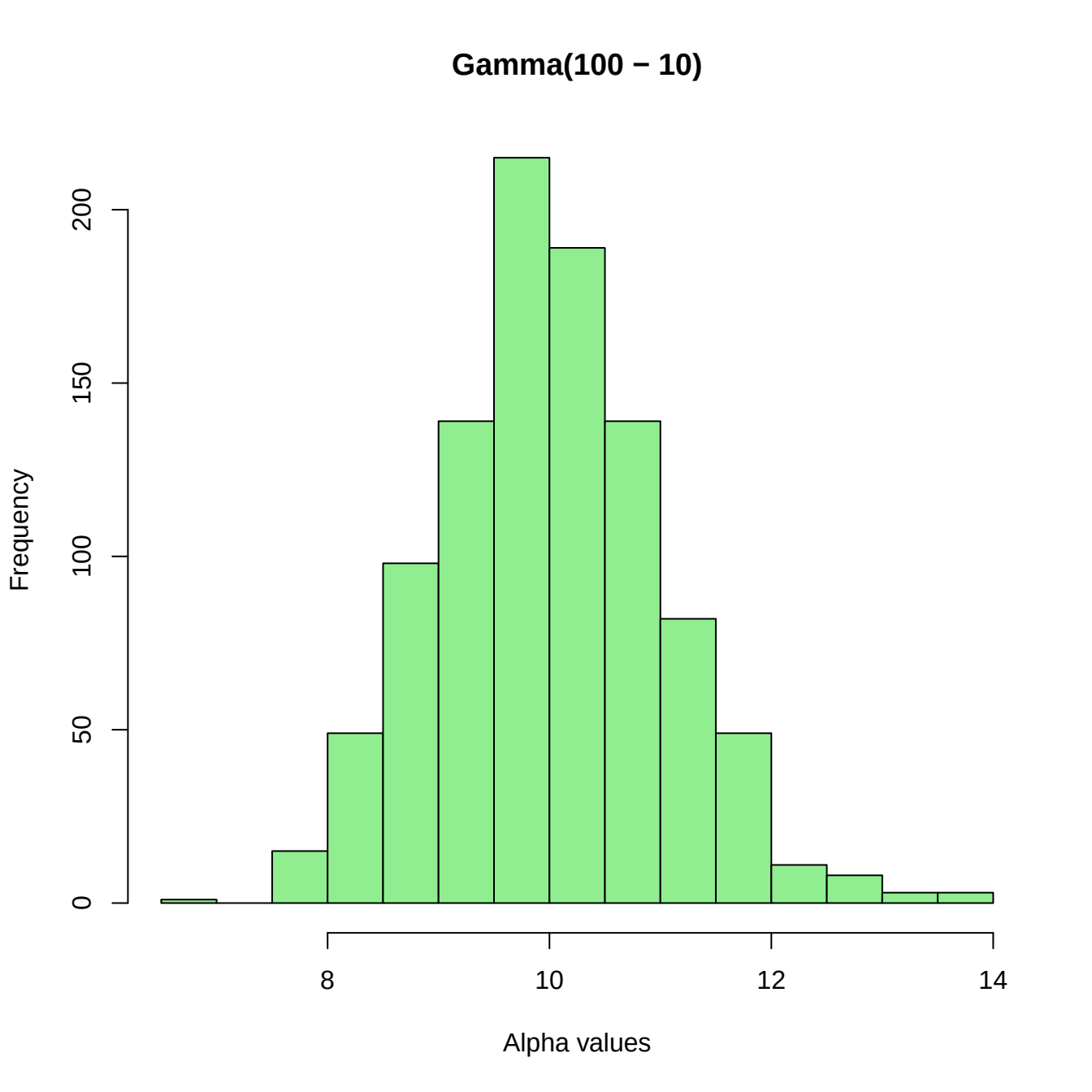
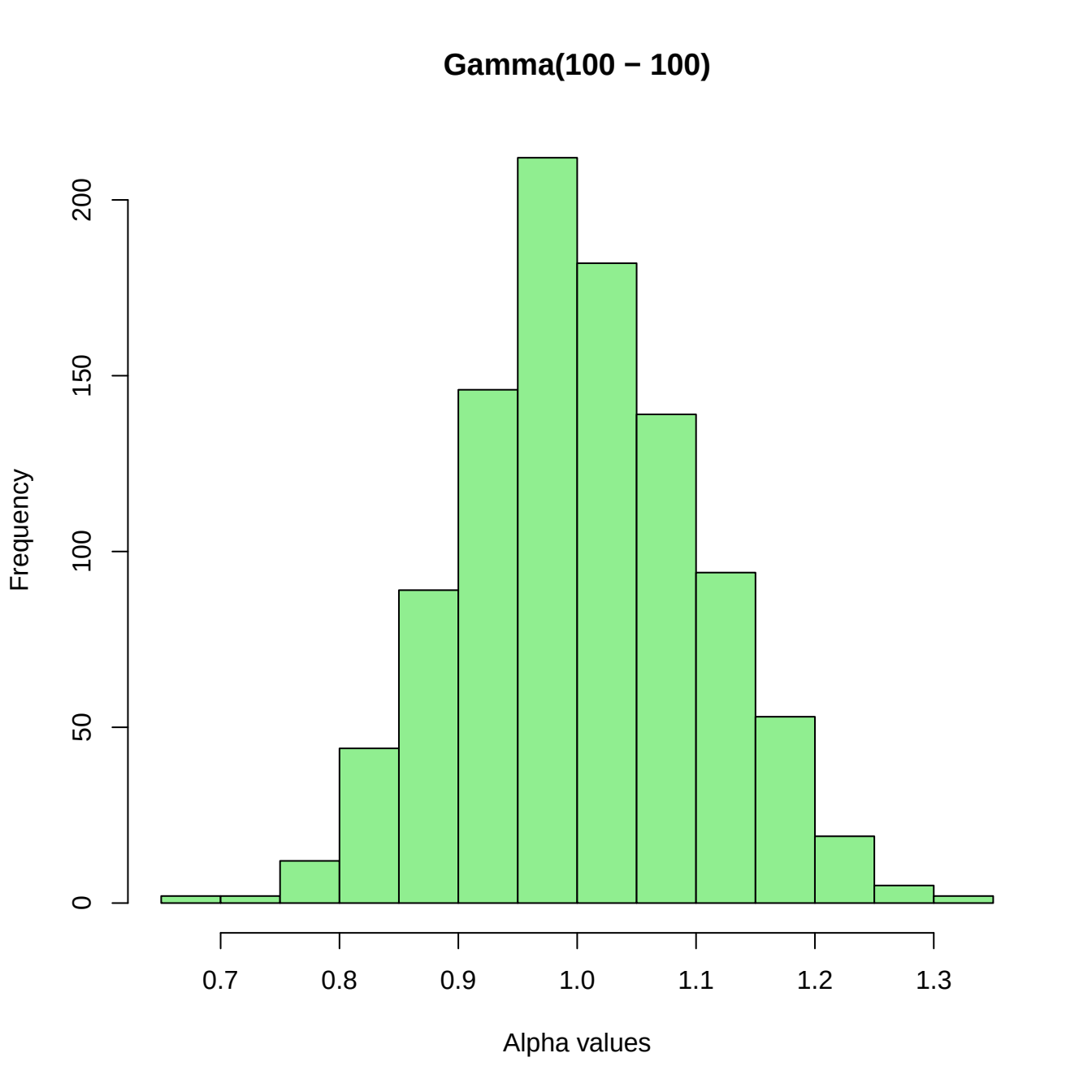
40
60
80
100
150
200
250
Alpha values

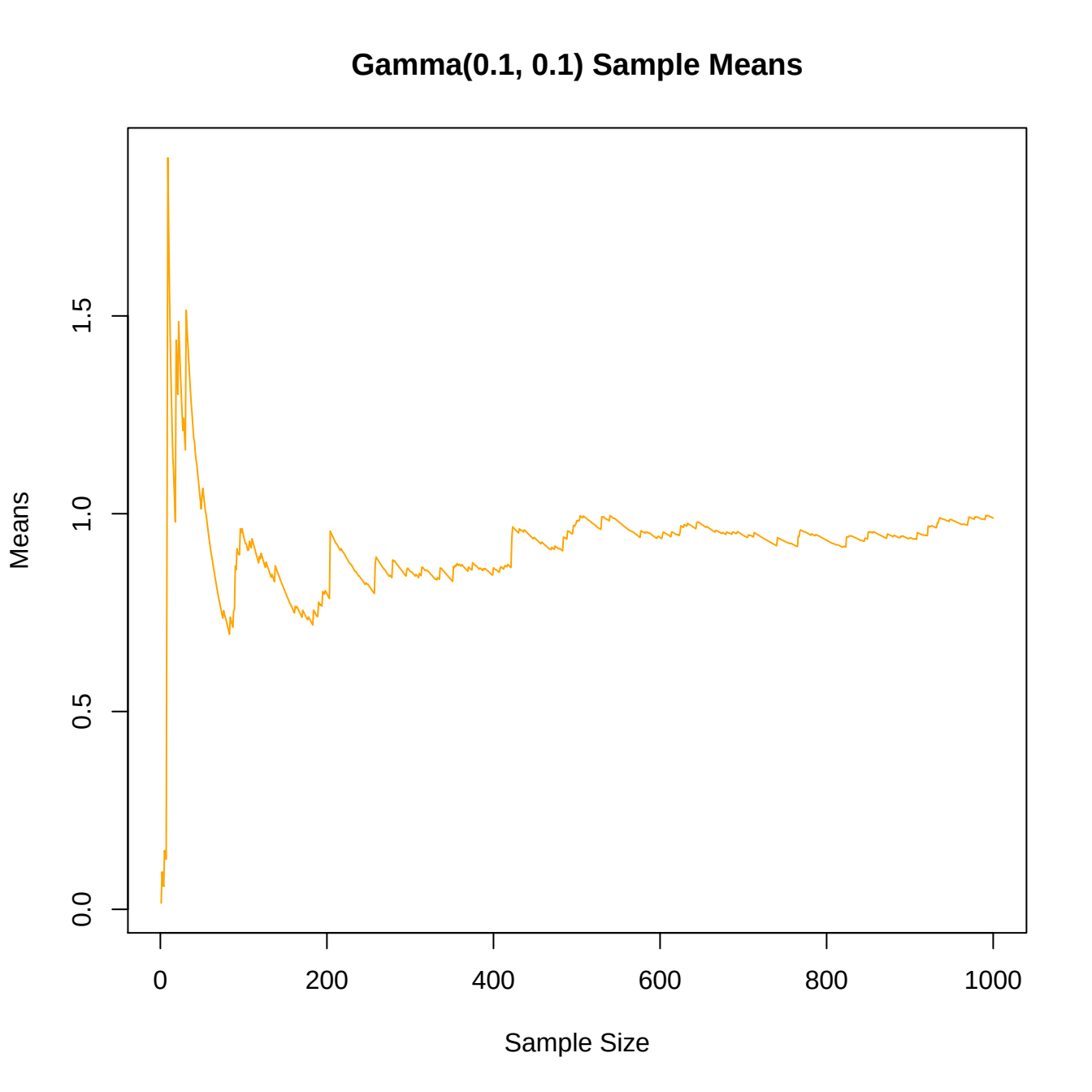

Gamma(100 − 1)
Frequency
0
50
100
150
200
80
100
120
140
Alpha values

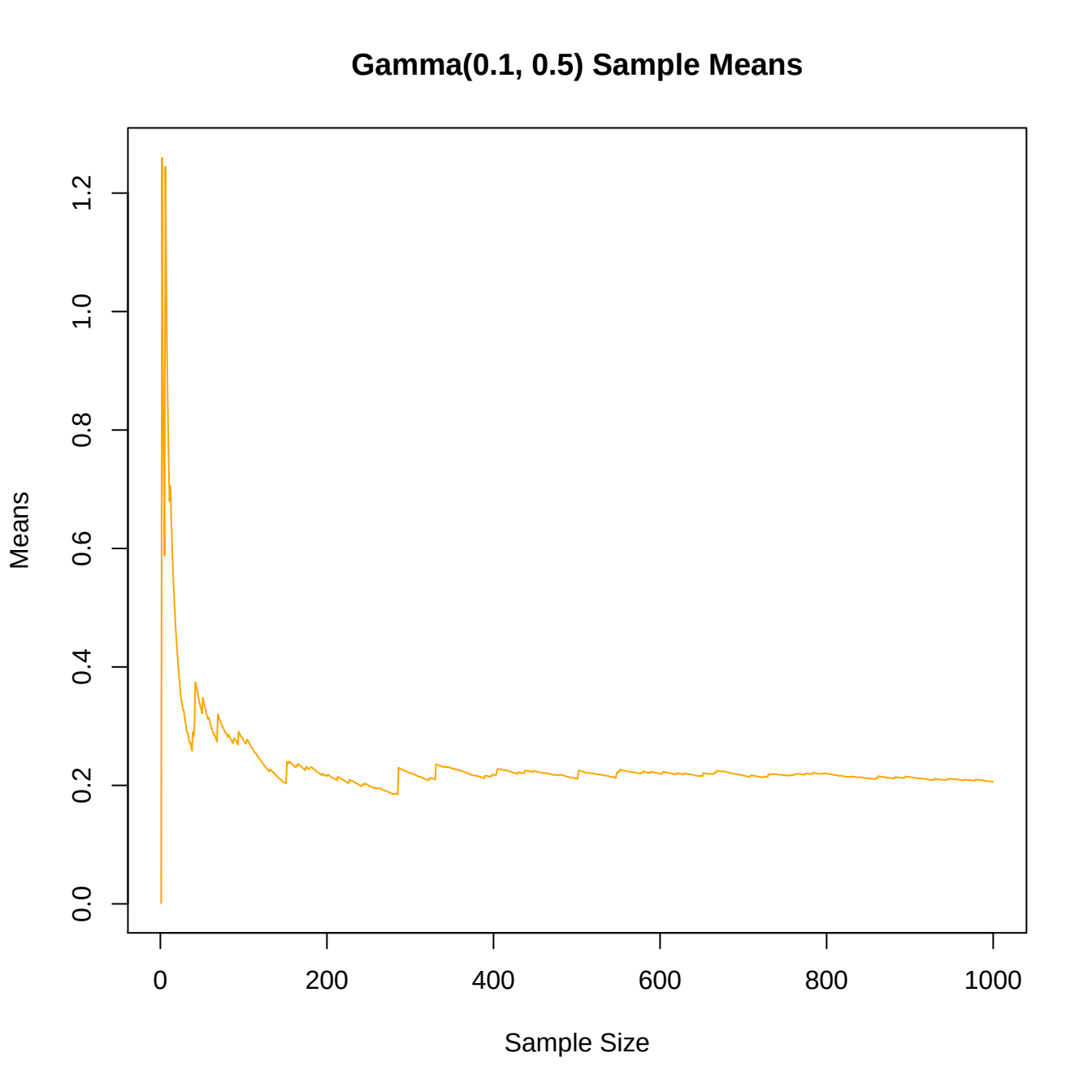

Gamma(100 − 2)
Frequency
0
50
100
150
40
50
60
70
Alpha values

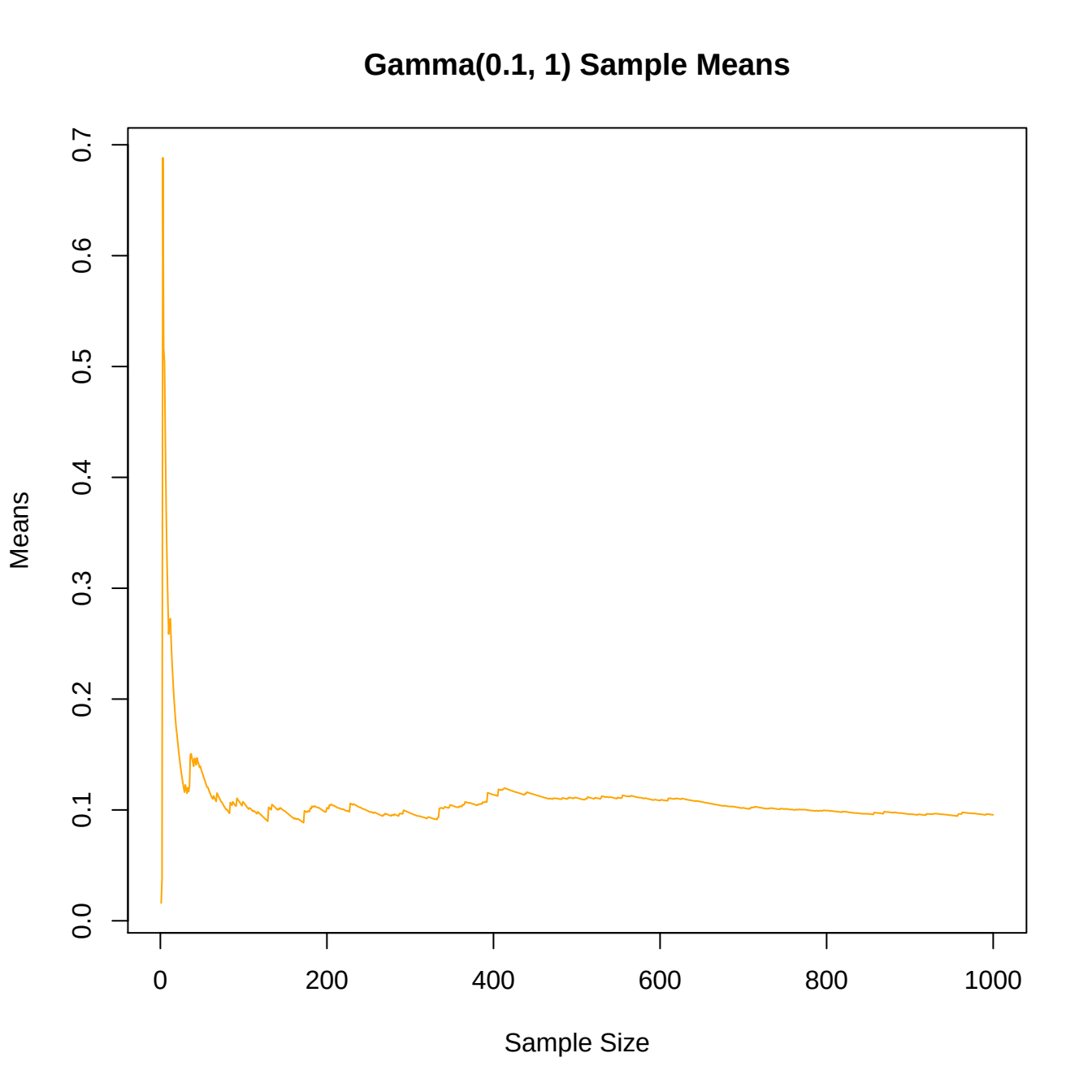

Gamma(100 − 5)
Frequency
0
20
40
60
80
100
14
16
18
20
22
24
26
28
Alpha values

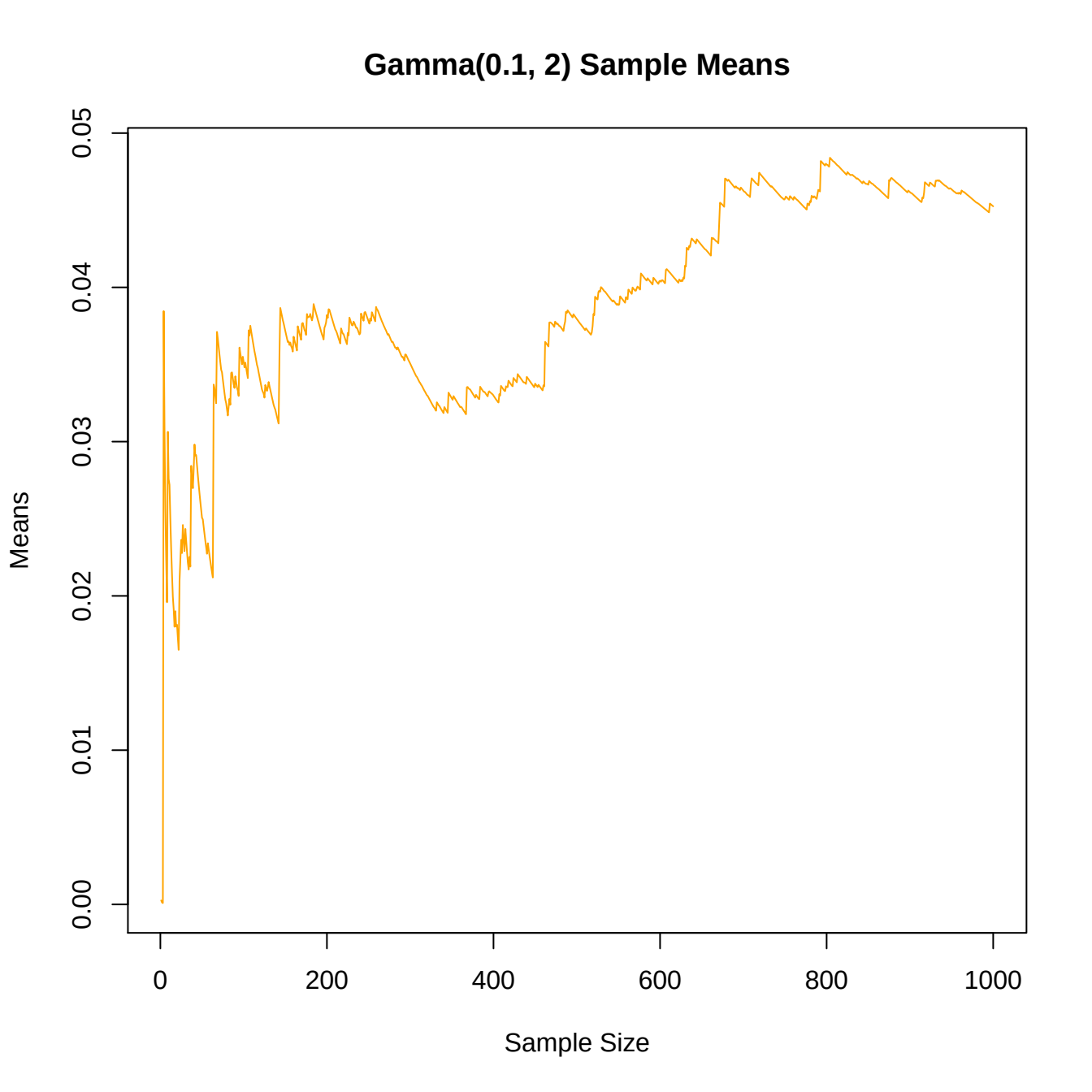

Gamma(100 − 10)
Frequency
0
50
100
150
200
8
10
12
14
Alpha values

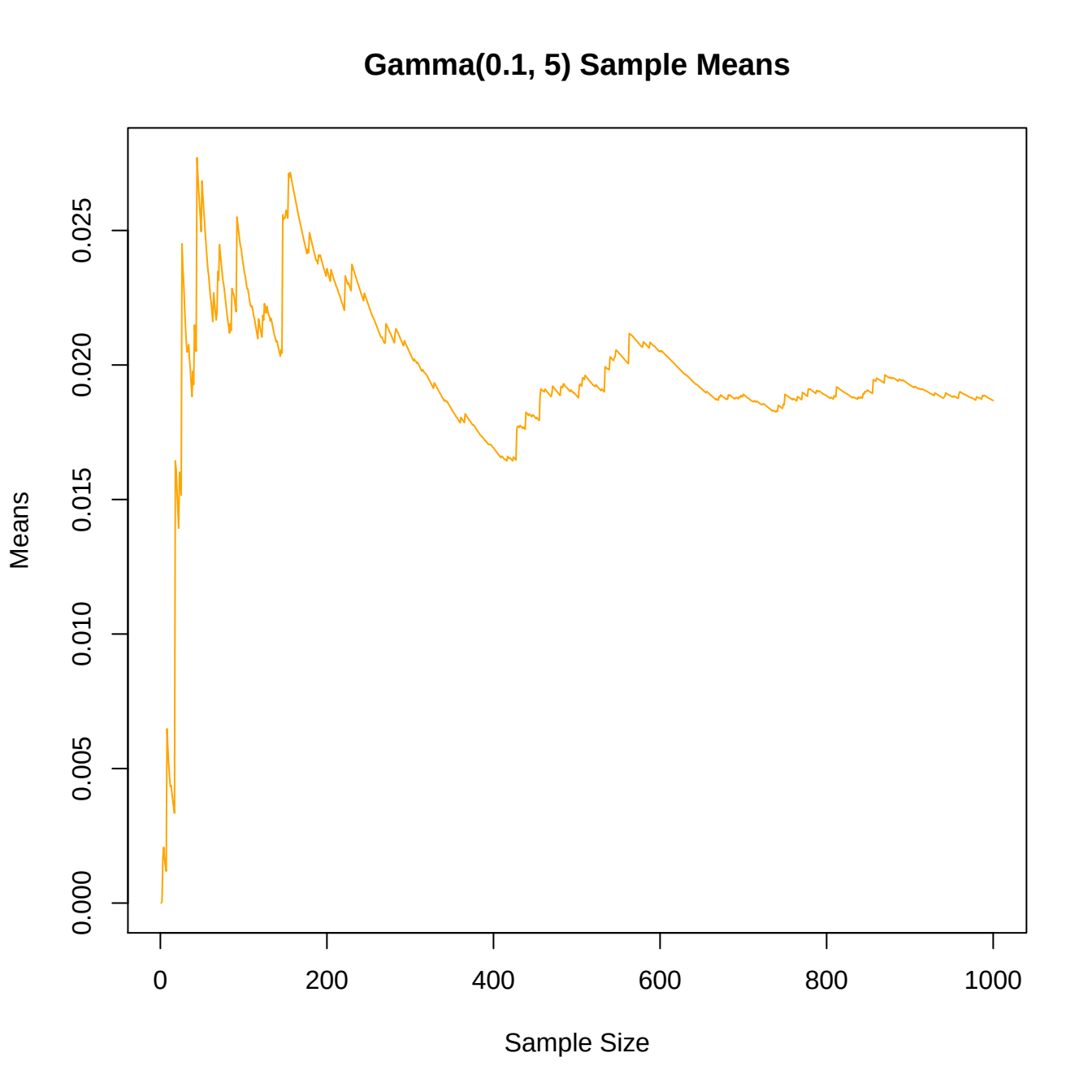

Gamma(100 − 100)
Frequency
0
50
100
150
200
0.7
0.8
0.9
1.0
1.1
1.2
1.3
Alpha values

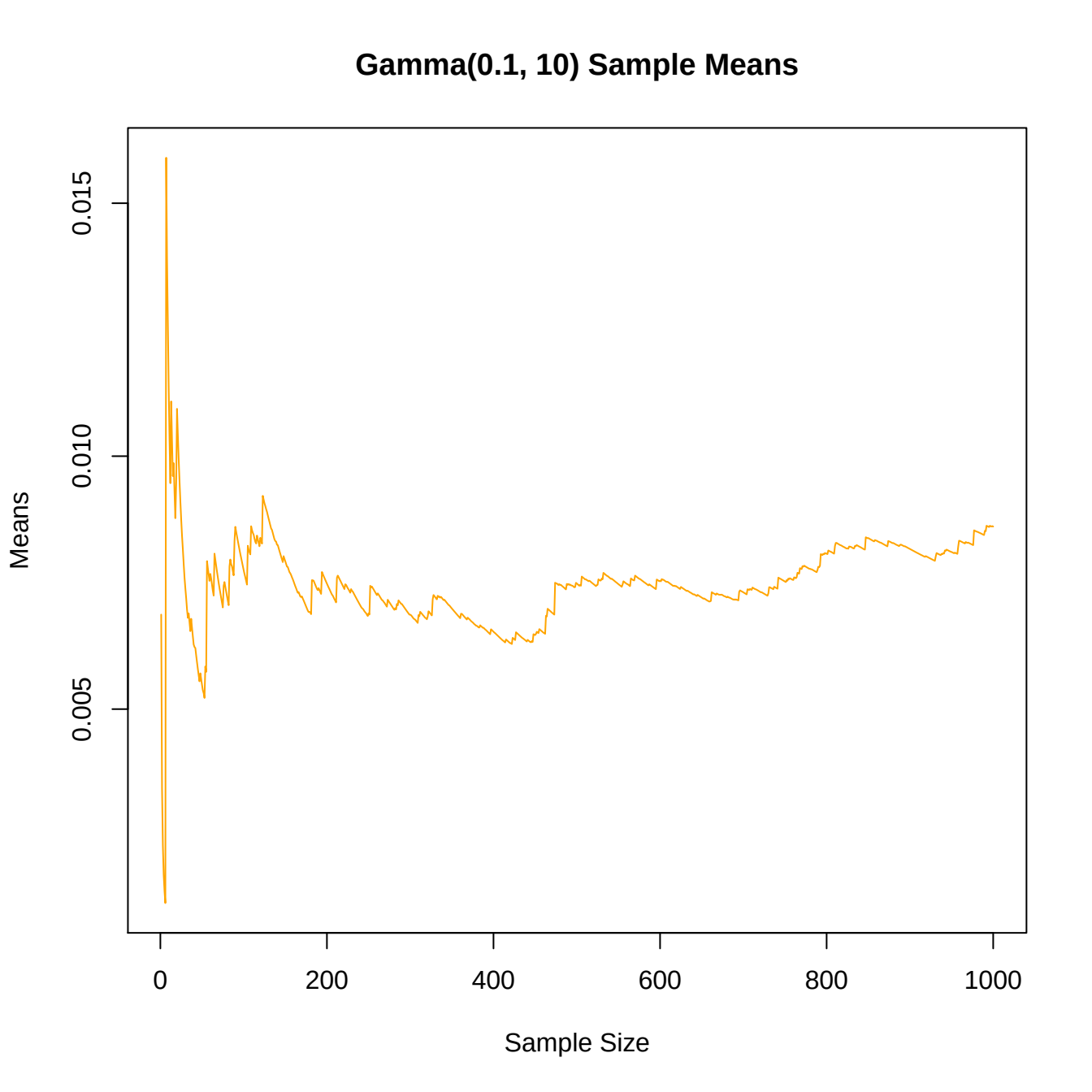

Gamma(0.1, 0.1) Sample Means
Means
0.0
0.5
1.0
1.5
0
200
400
600
800
1000
Sample Size

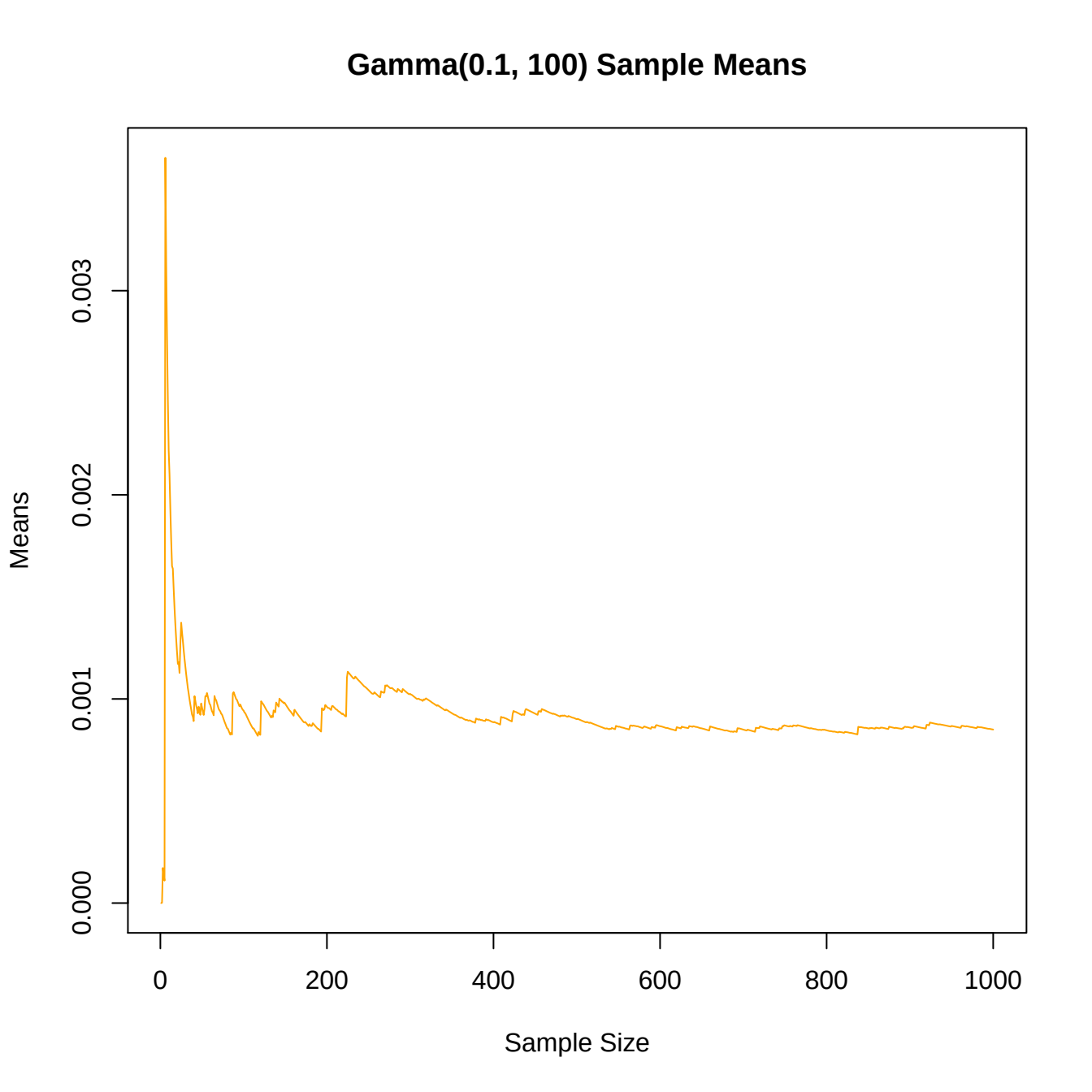

Gamma(0.1, 0.5) Sample Means
Means
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
200
400
600
800
1000
Sample Size

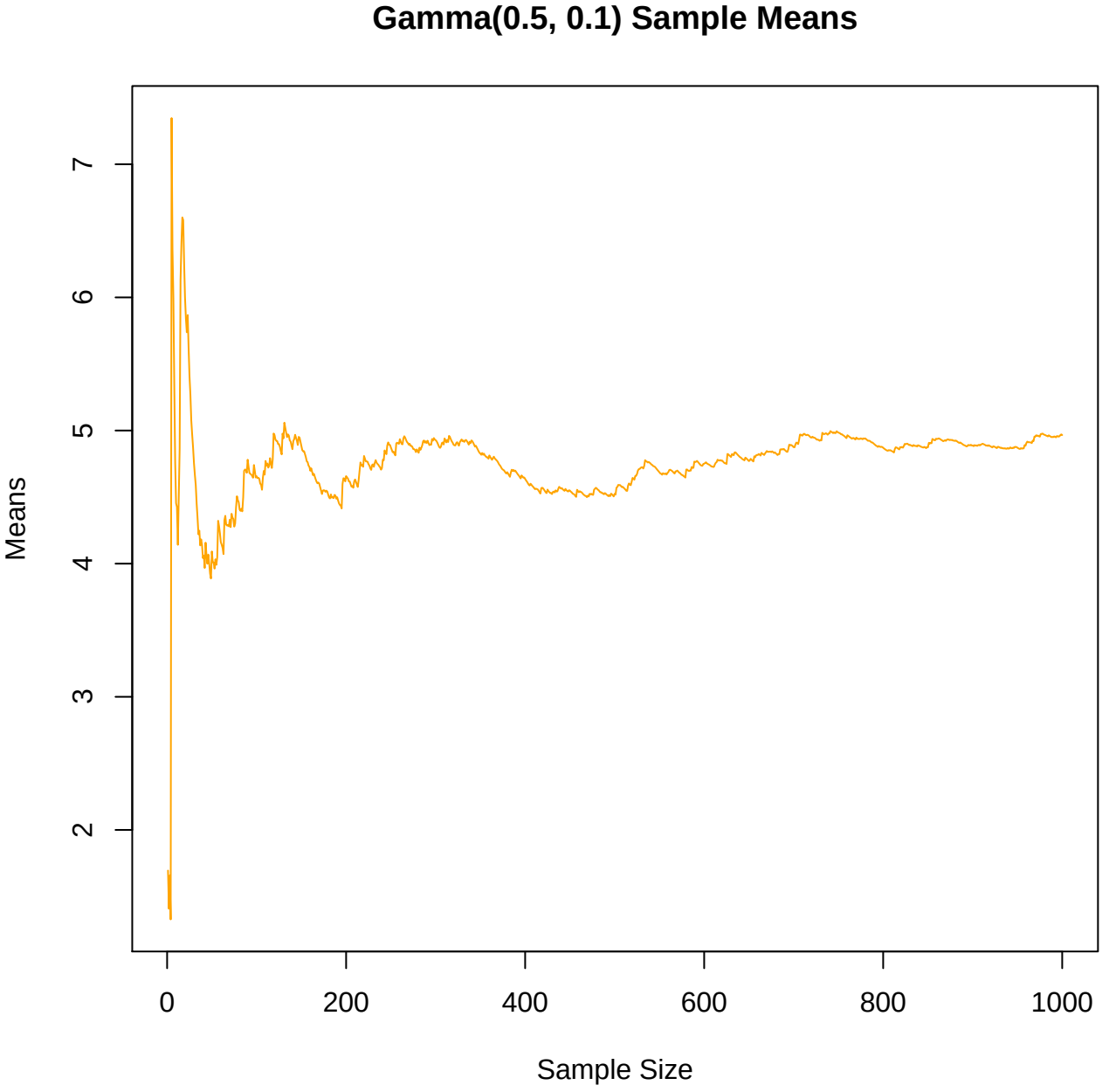

Gamma(0.1, 1) Sample Means
Means
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
200
400
600
800
1000
Sample Size

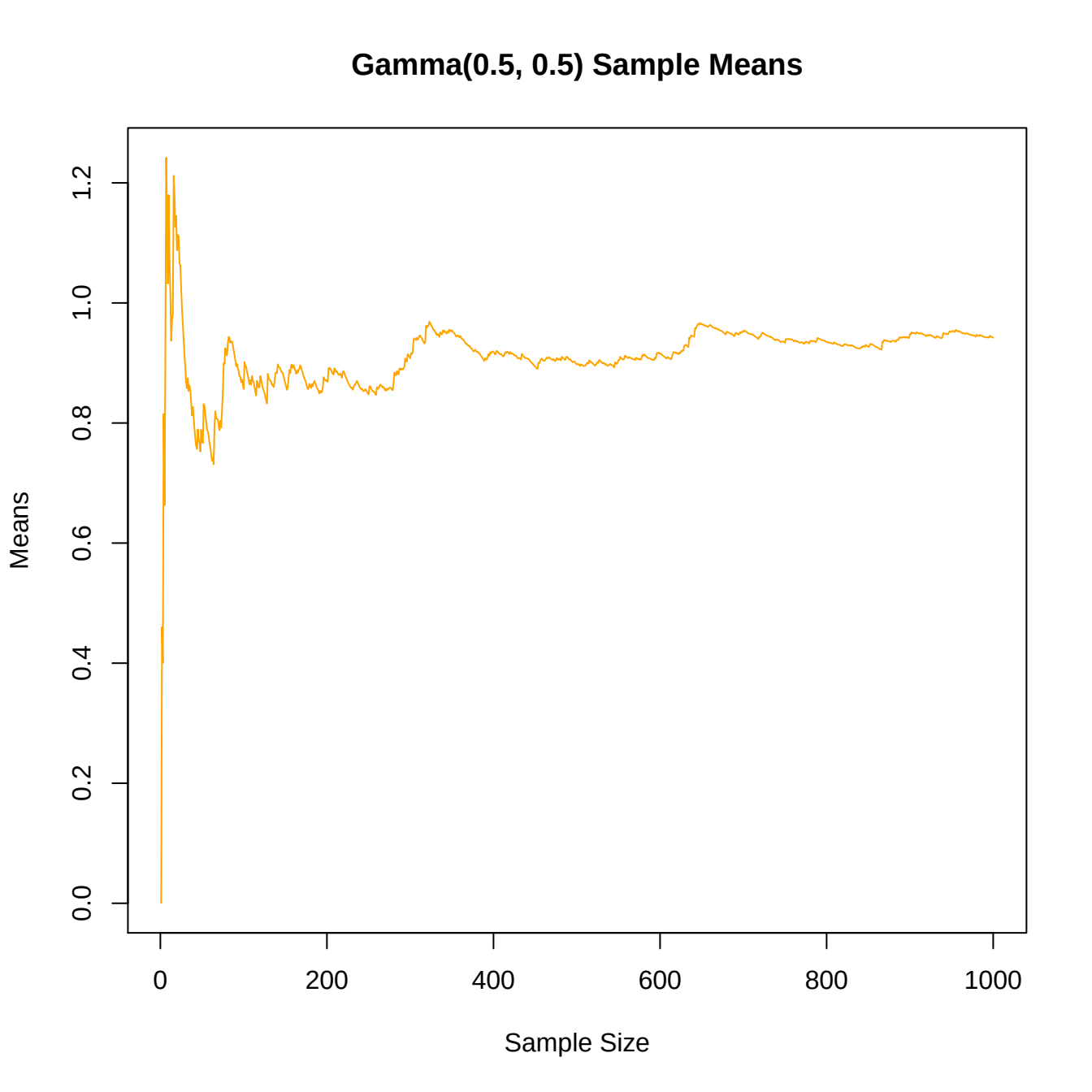

Gamma(0.1, 2) Sample Means
Means
0.00
0.01
0.02
0.03
0.04
0.05
0
200
400
600
800
1000
Sample Size

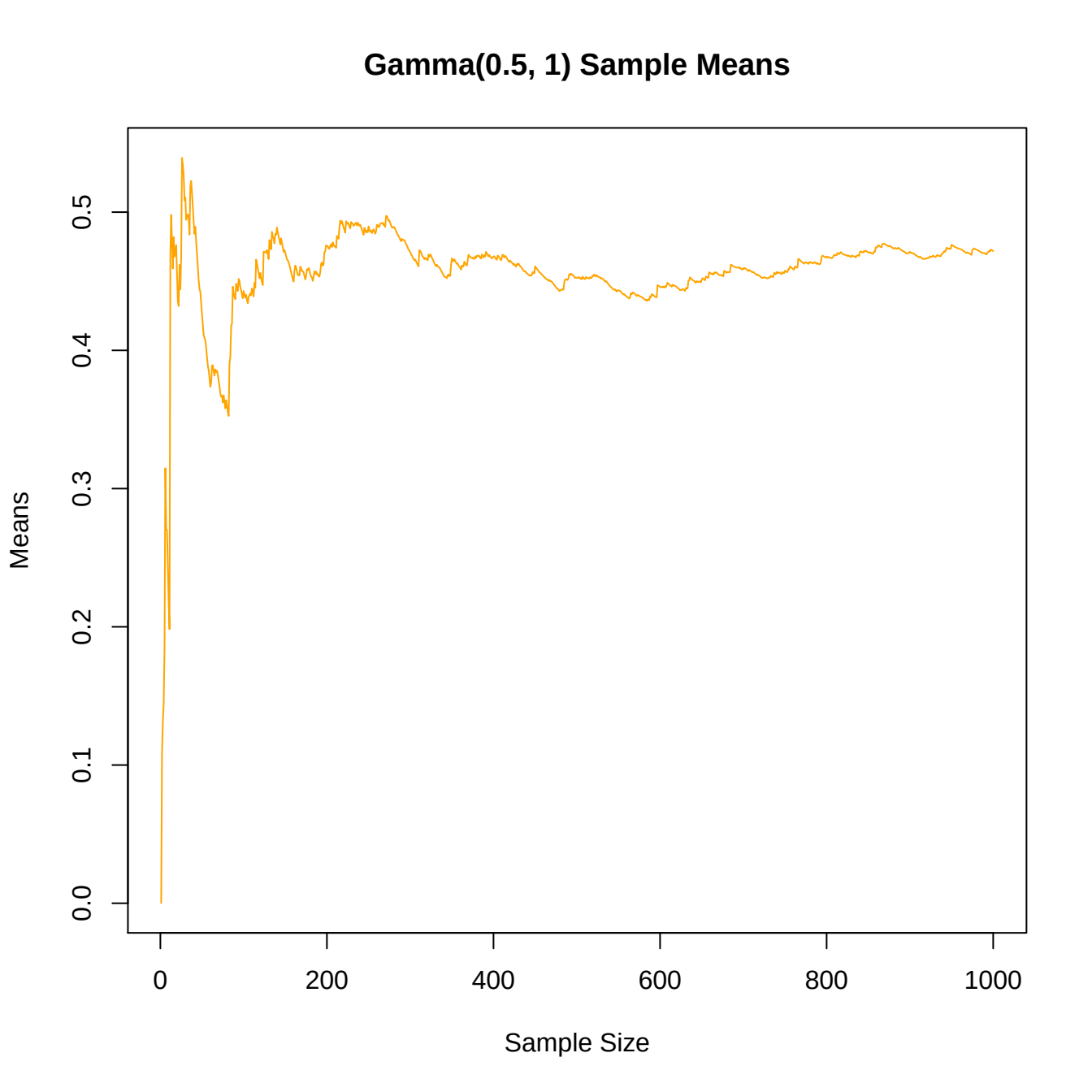

Gamma(0.1, 5) Sample Means
Means
0.000
0.005
0.010
0.015
0.020
0.025
0
200
400
600
800
1000
Sample Size

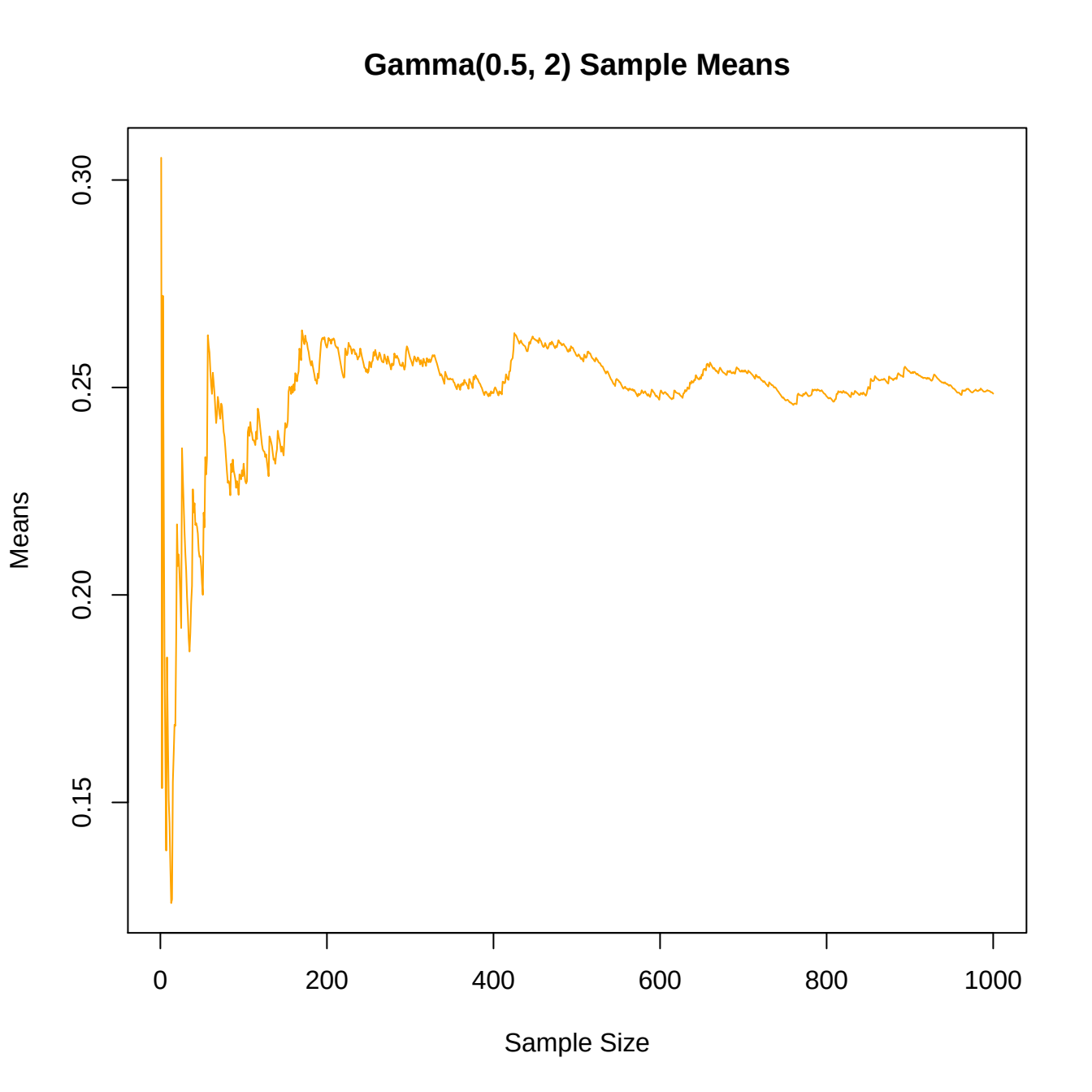

Gamma(0.1, 10) Sample Means
Means
0.005
0.010
0.015
0
200
400
600
800
1000
Sample Size

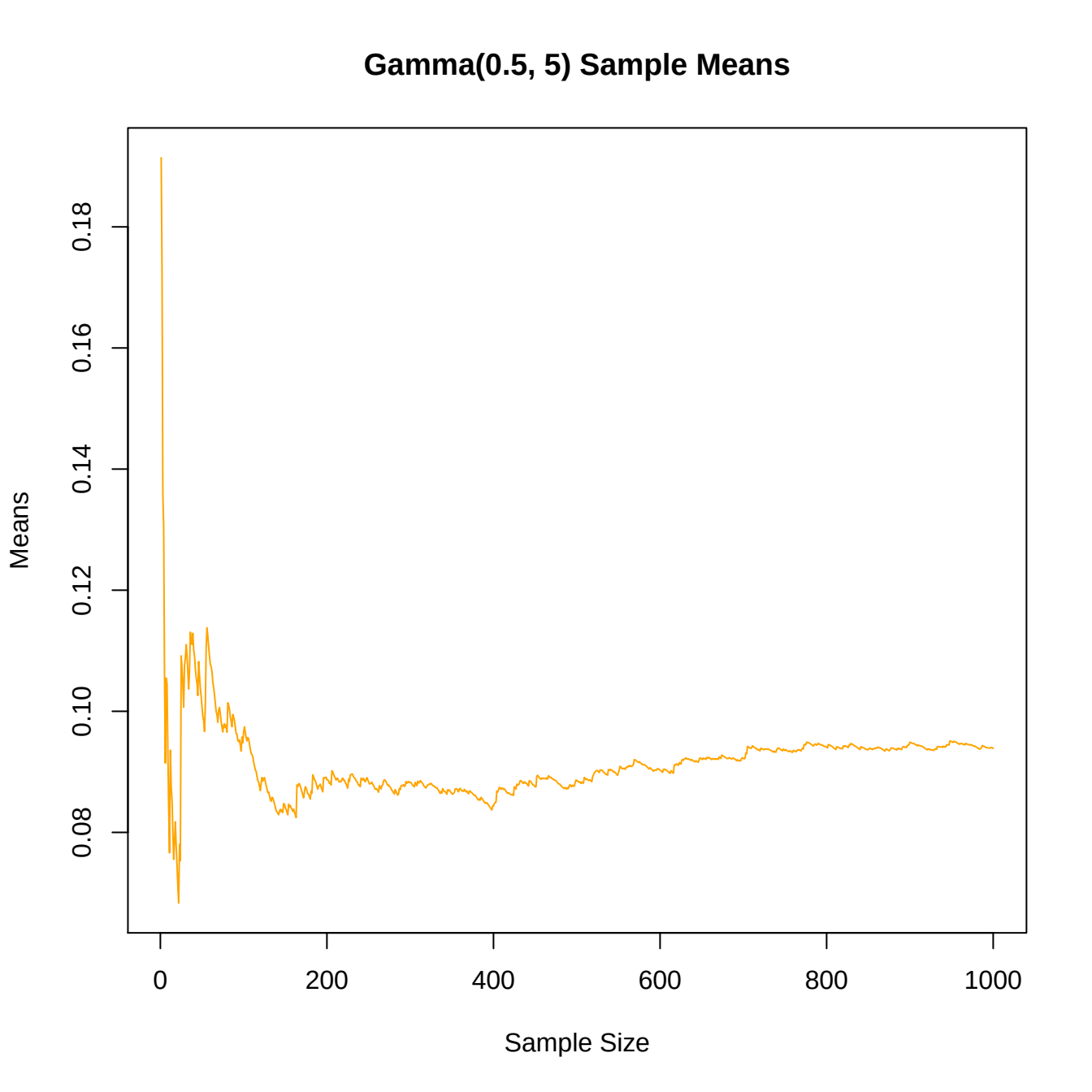

Gamma(0.1, 100) Sample Means
Means
0.000
0.001
0.002
0.003
0
200
400
600
800
1000
Sample Size

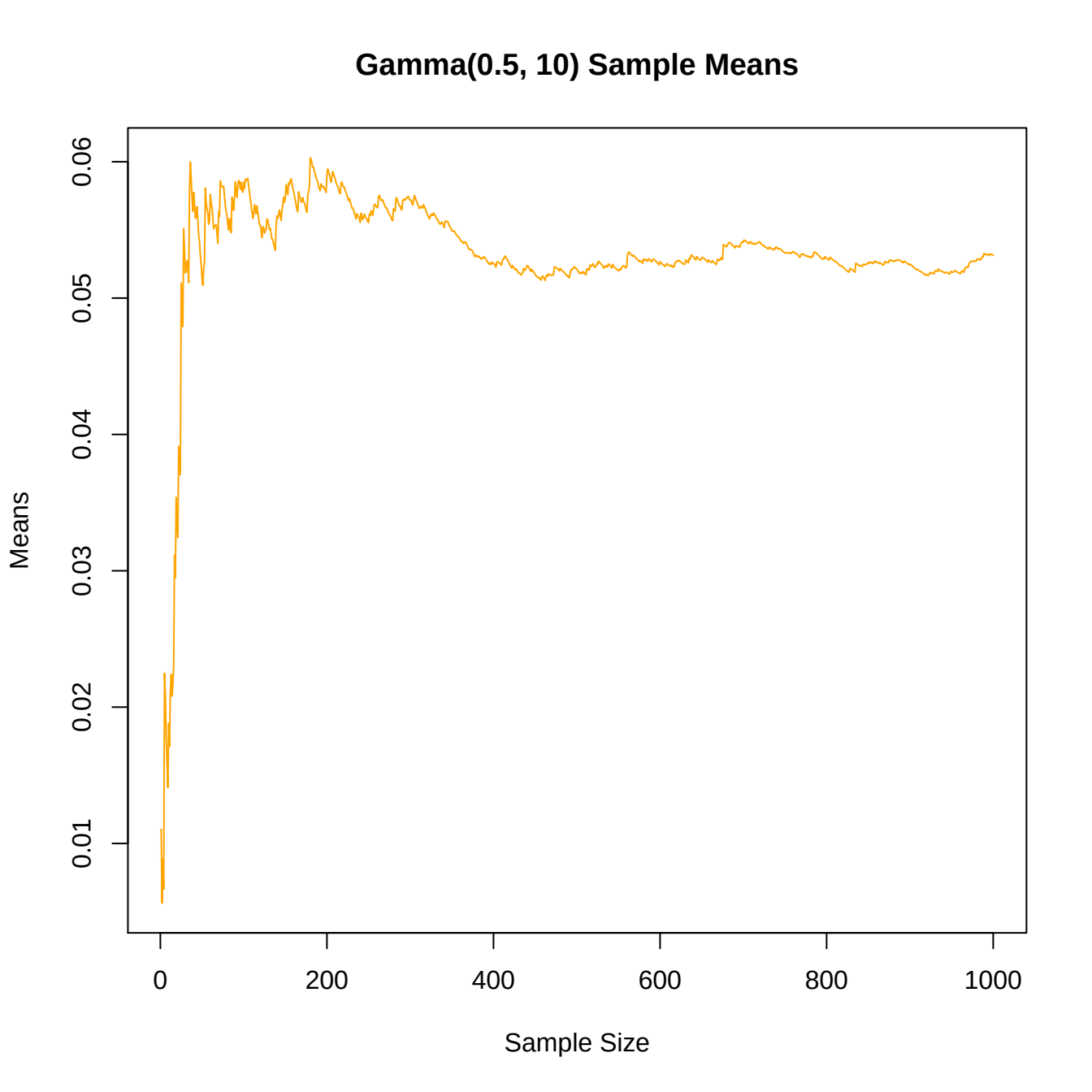

Gamma(0.5, 0.1) Sample Means
Means
2
3
4
5
6
7
0
200
400
600
800
1000
Sample Size

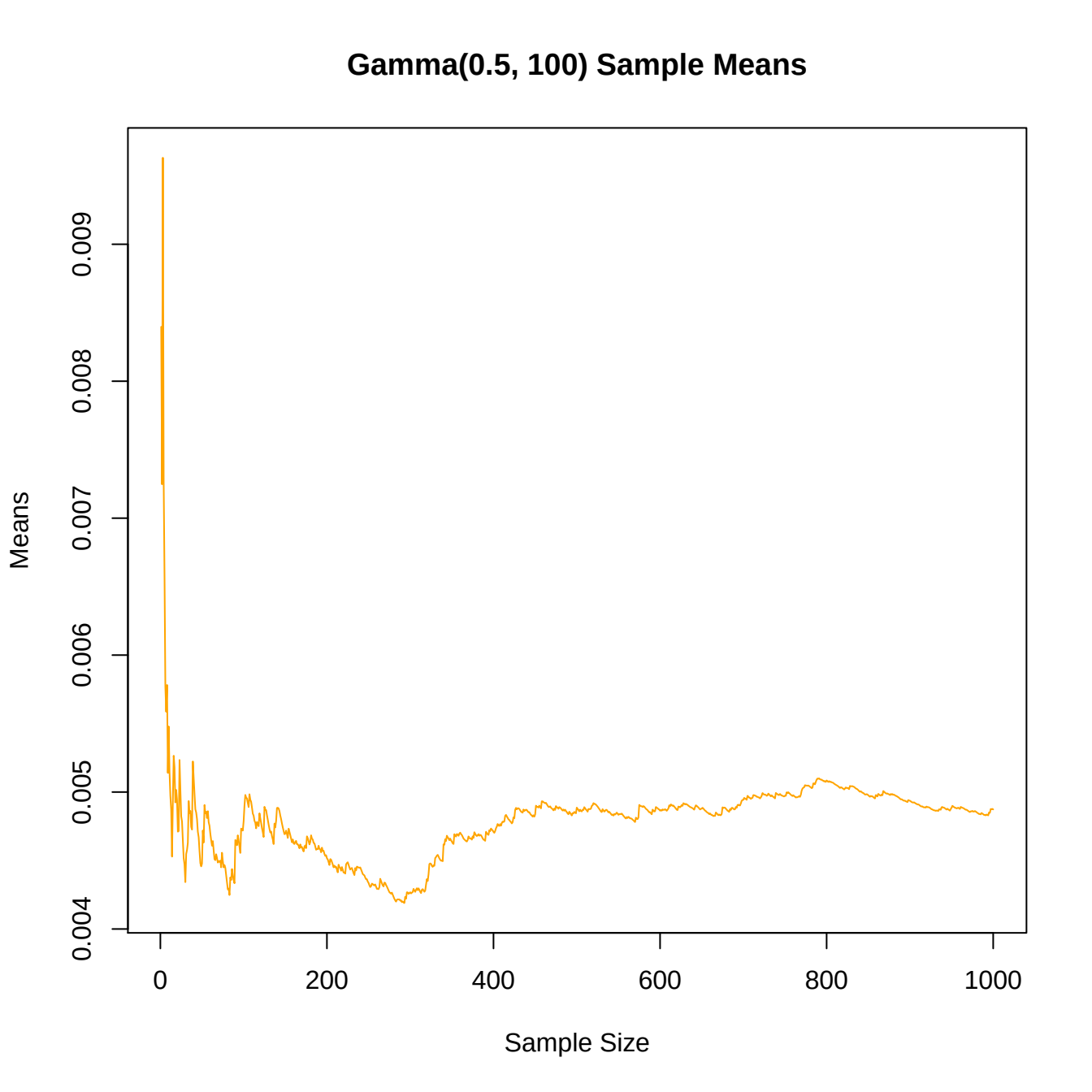

Gamma(0.5, 0.5) Sample Means
Means
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
200
400
600
800
1000
Sample Size

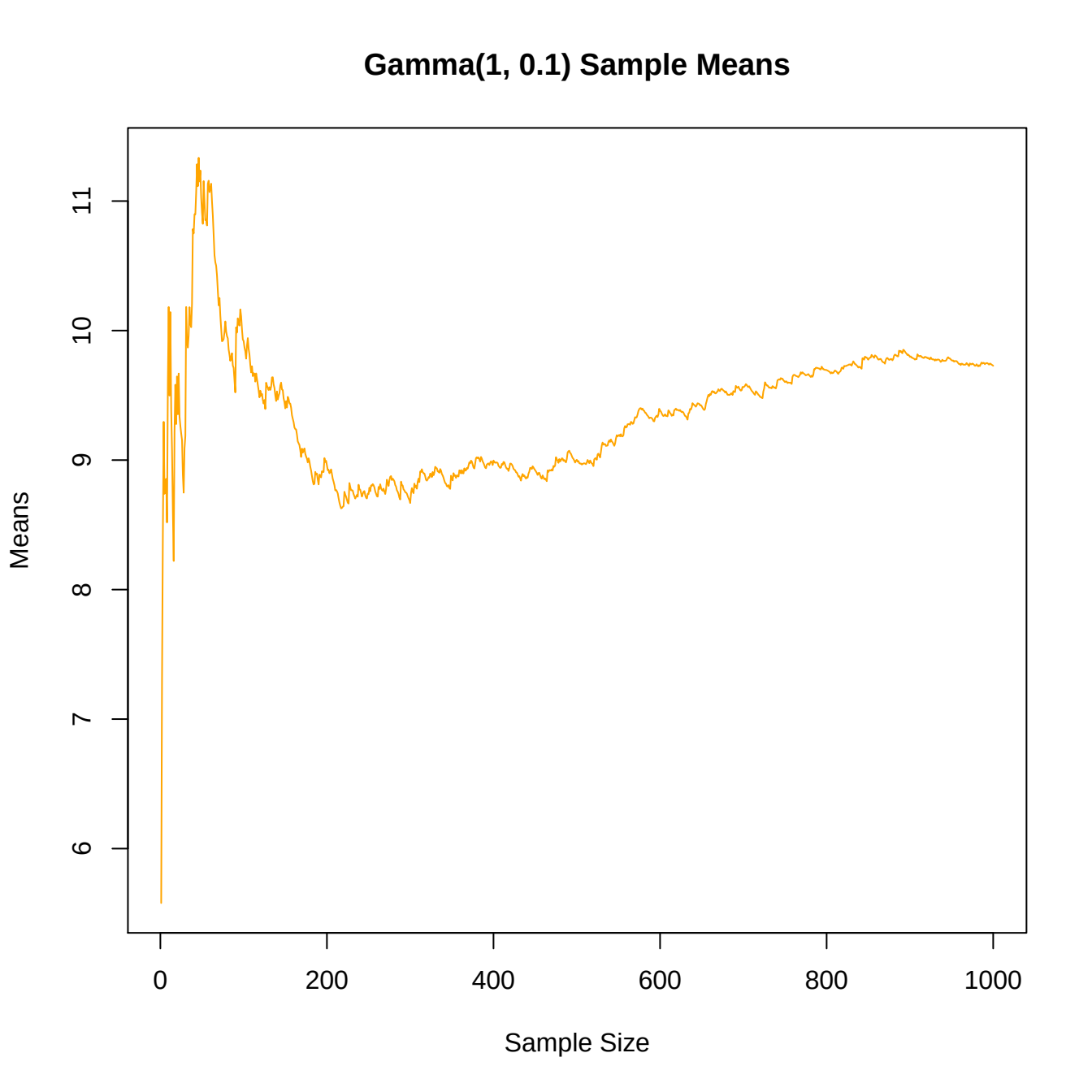

Gamma(0.5, 1) Sample Means
Means
0.0
0.1
0.2
0.3
0.4
0.5
0
200
400
600
800
1000
Sample Size

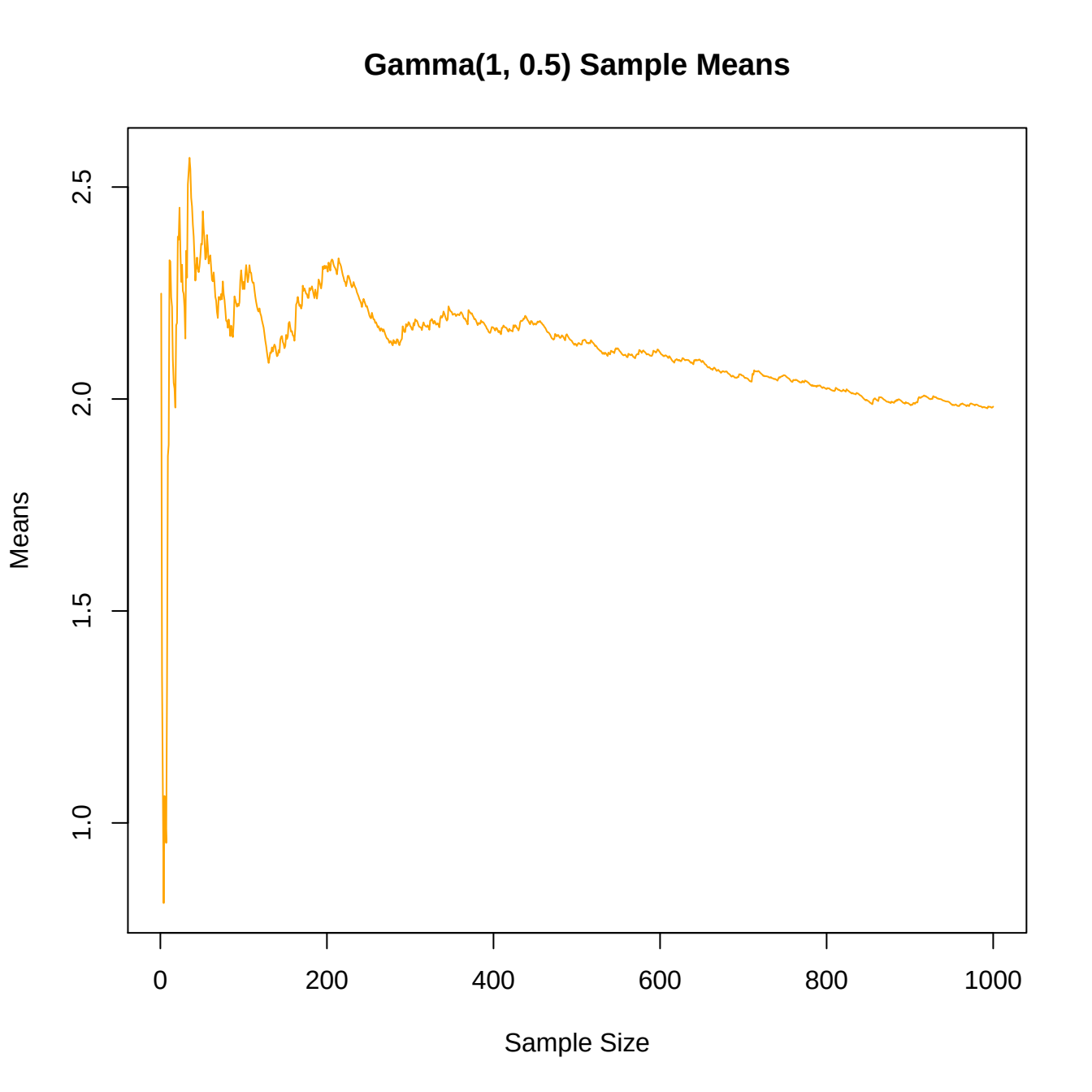

Gamma(0.5, 2) Sample Means
Means
0.15
0.20
0.25
0.30
0
200
400
600
800
1000
Sample Size

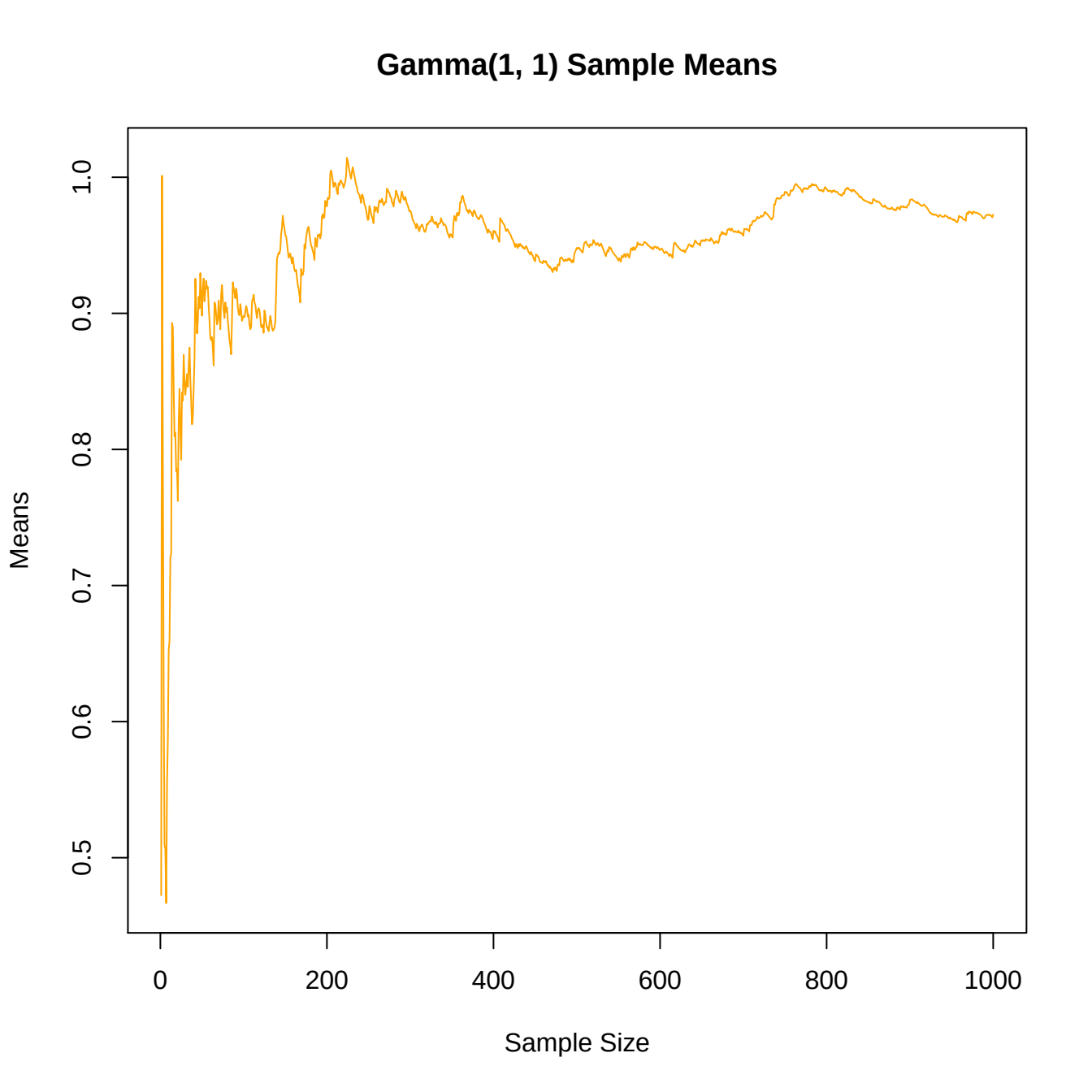

Gamma(0.5, 5) Sample Means
Means
0.08
0.10
0.12
0.14
0.16
0.18
0
200
400
600
800
1000
Sample Size

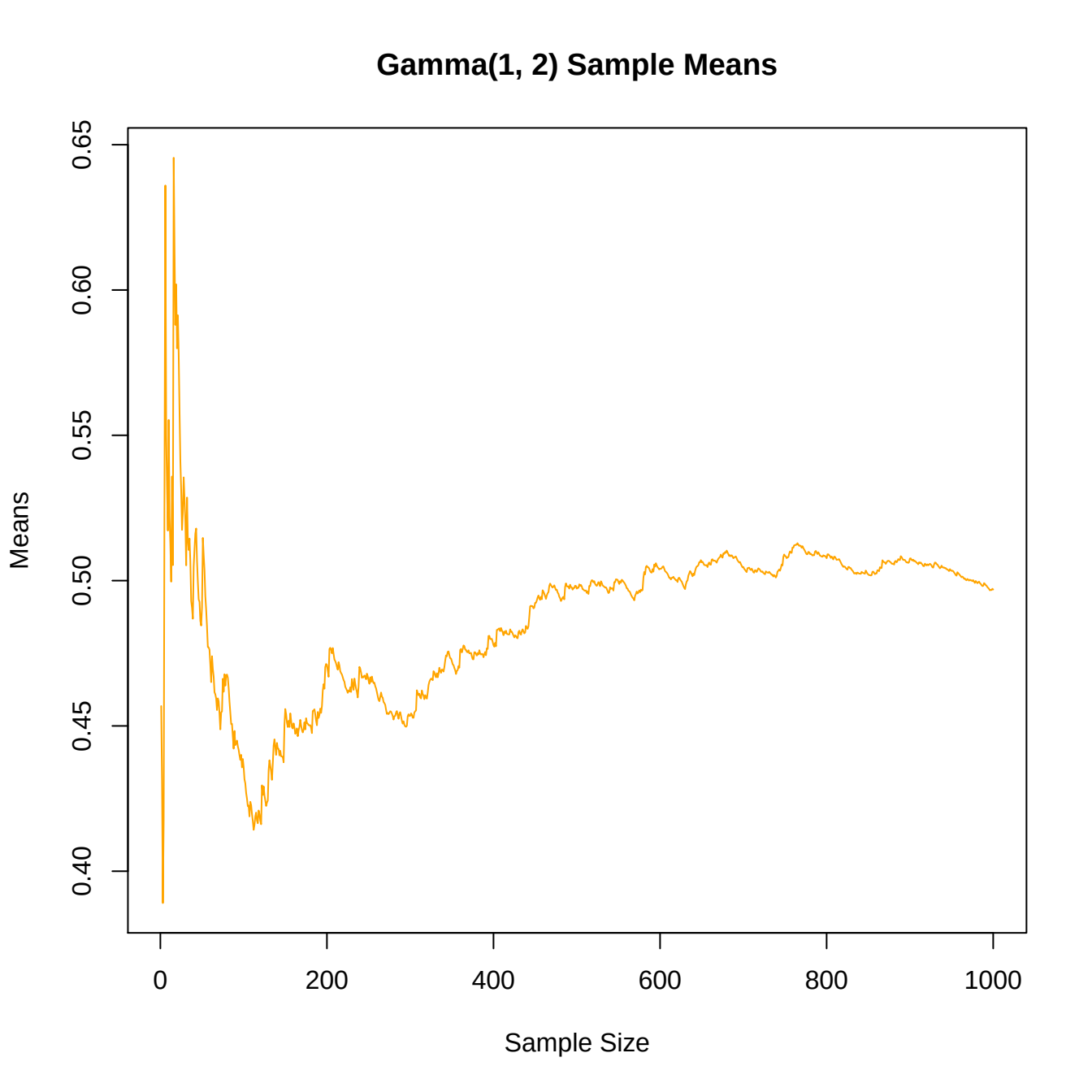

Gamma(0.5, 10) Sample Means
Means
0.01
0.02
0.03
0.04
0.05
0.06
0
200
400
600
800
1000
Sample Size

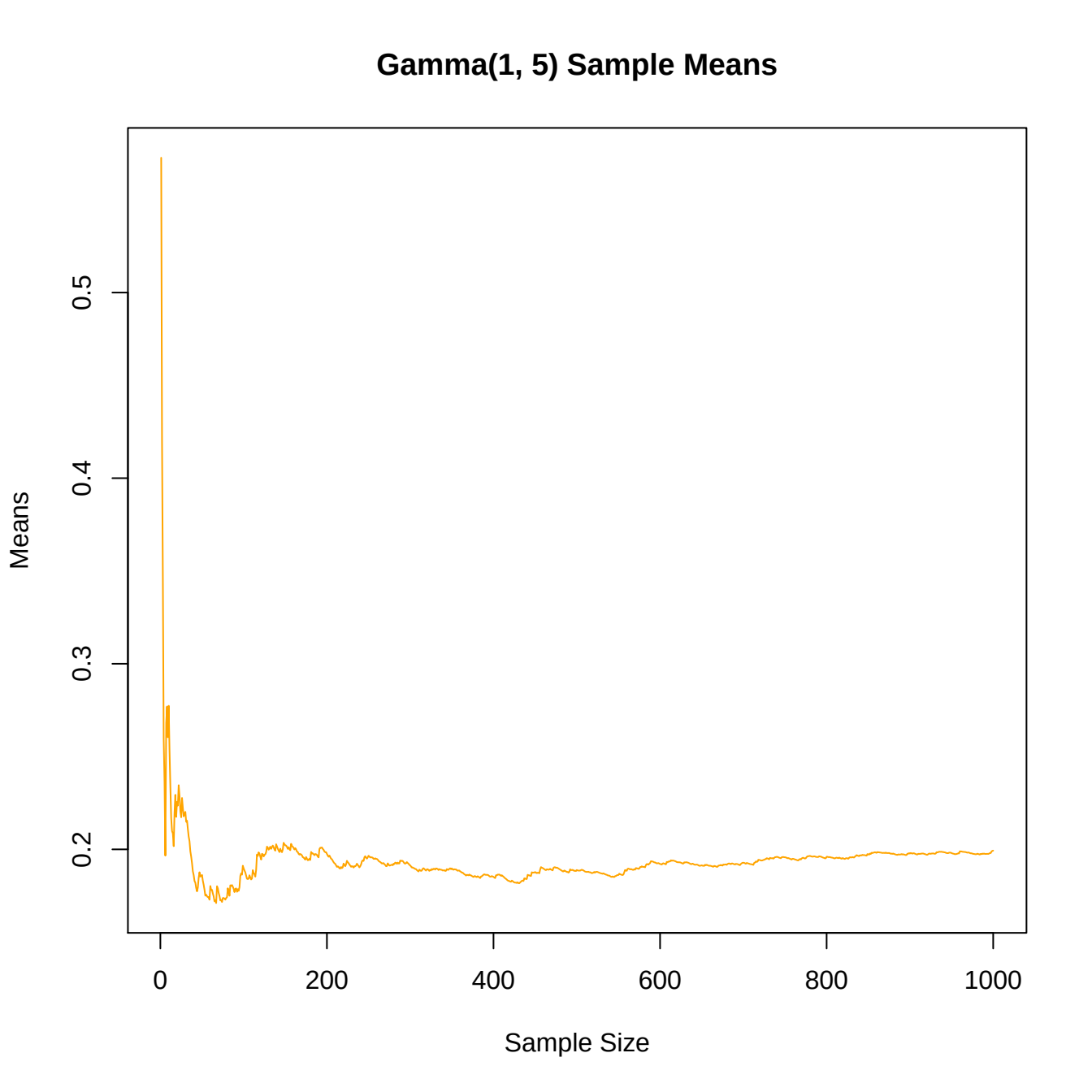

Gamma(0.5, 100) Sample Means
Means
0.004
0.005
0.006
0.007
0.008
0.009
0
200
400
600
800
1000
Sample Size

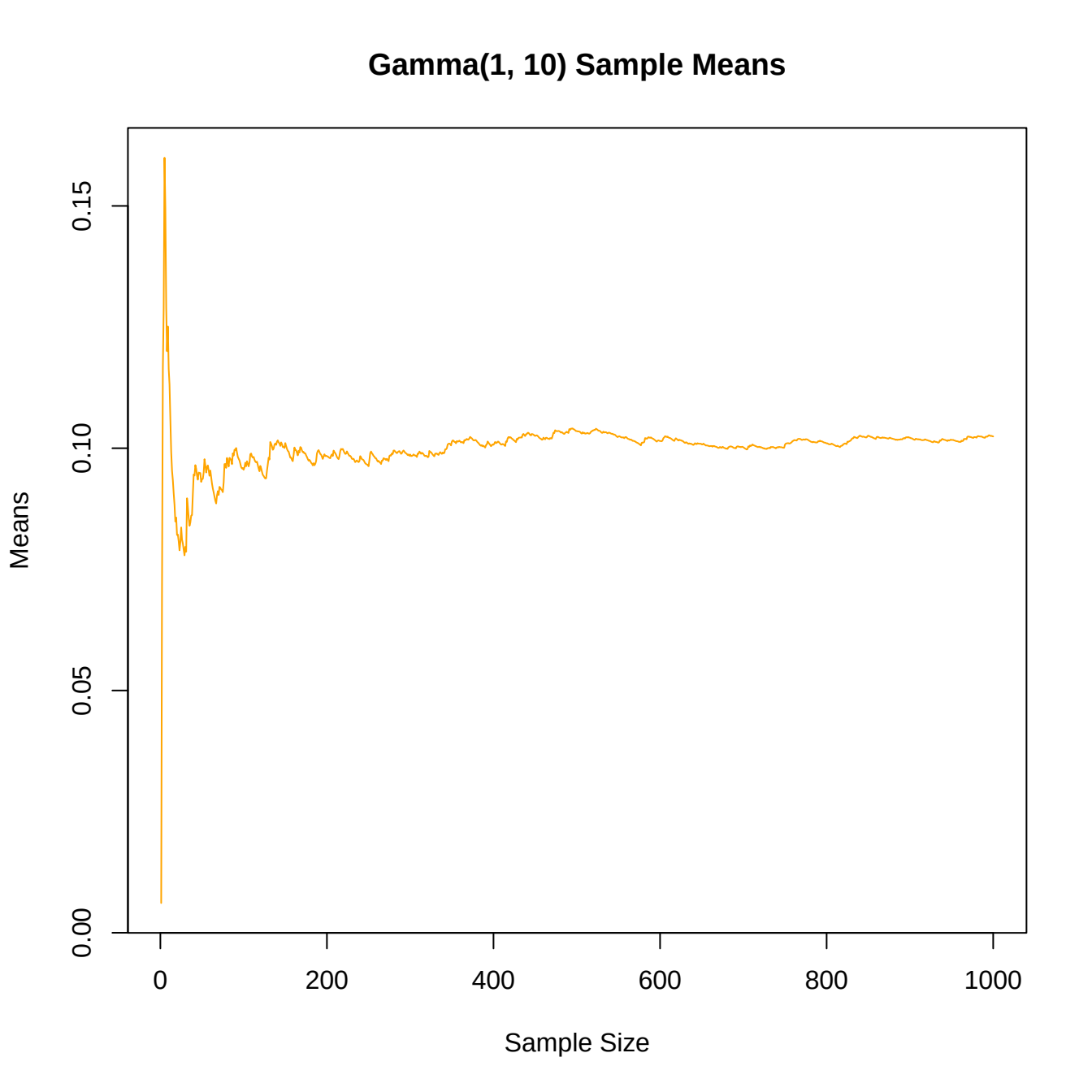

Gamma(1, 0.1) Sample Means
Means
6
7
8
9
10
11
0
200
400
600
800
1000
Sample Size

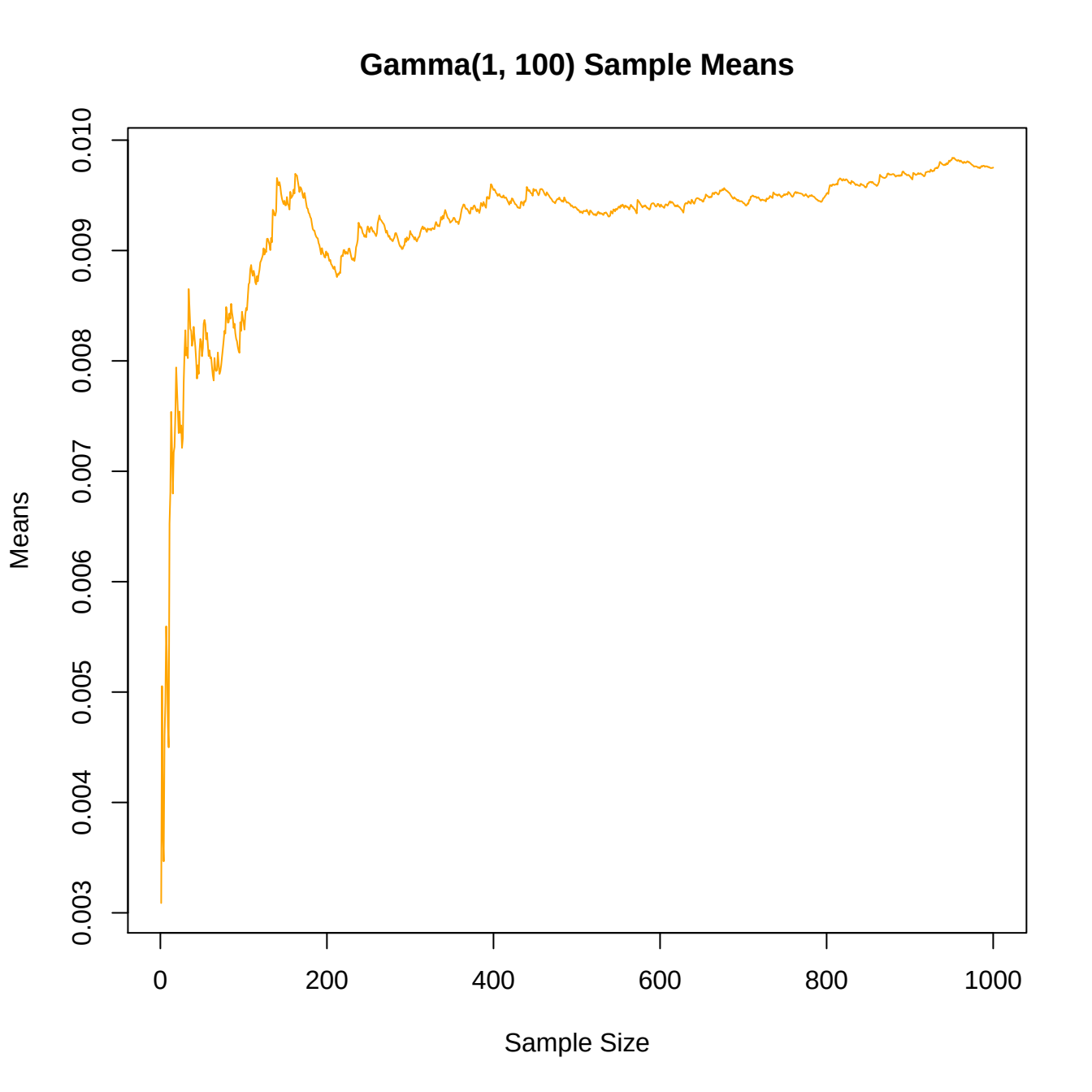

Gamma(1, 0.5) Sample Means
Means
1.0
1.5
2.0
2.5
0
200
400
600
800
1000
Sample Size

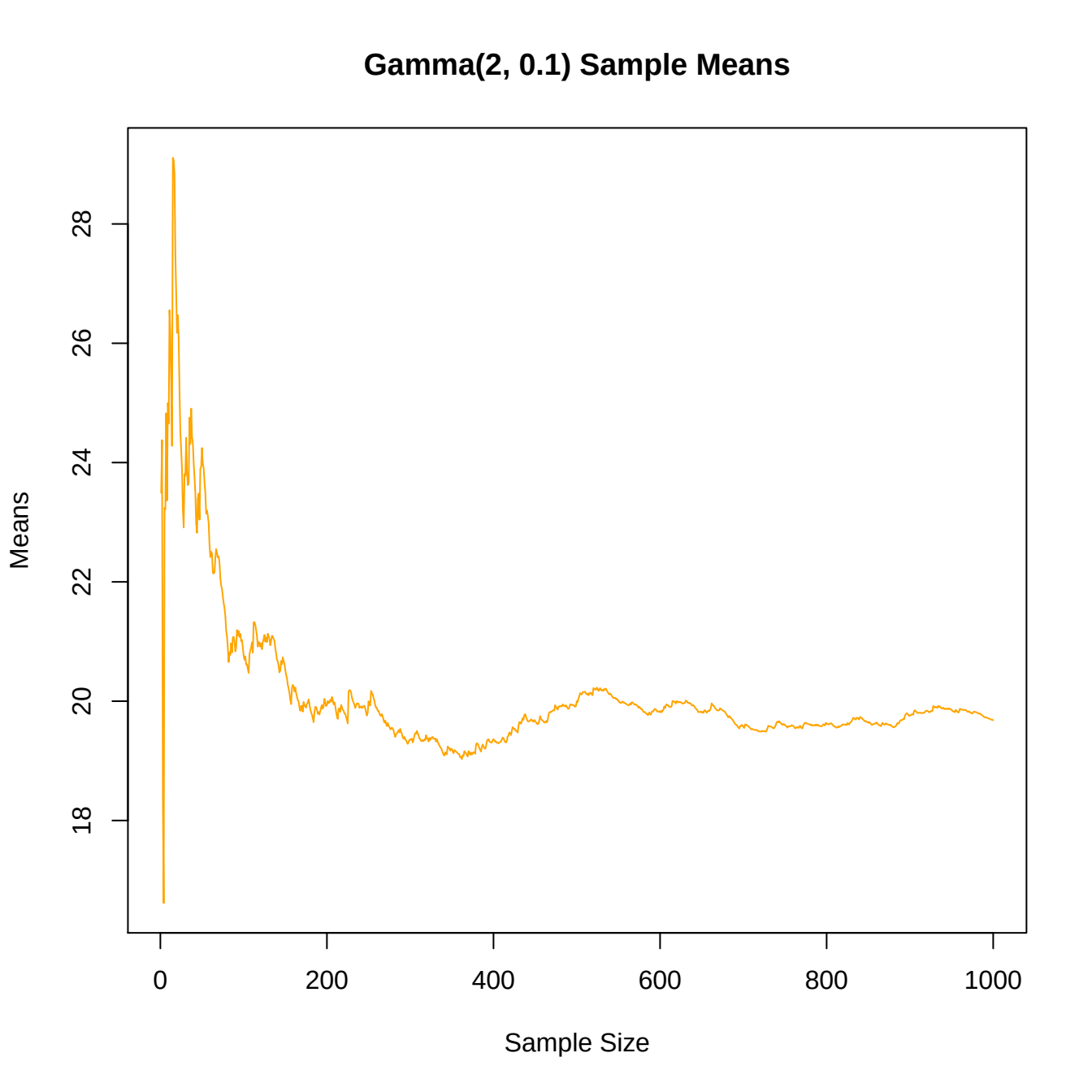

Gamma(1, 1) Sample Means
Means
1.0
0.9
0.8
0.7
0.6
0.5
0
200
400
600
800
1000
Sample Size

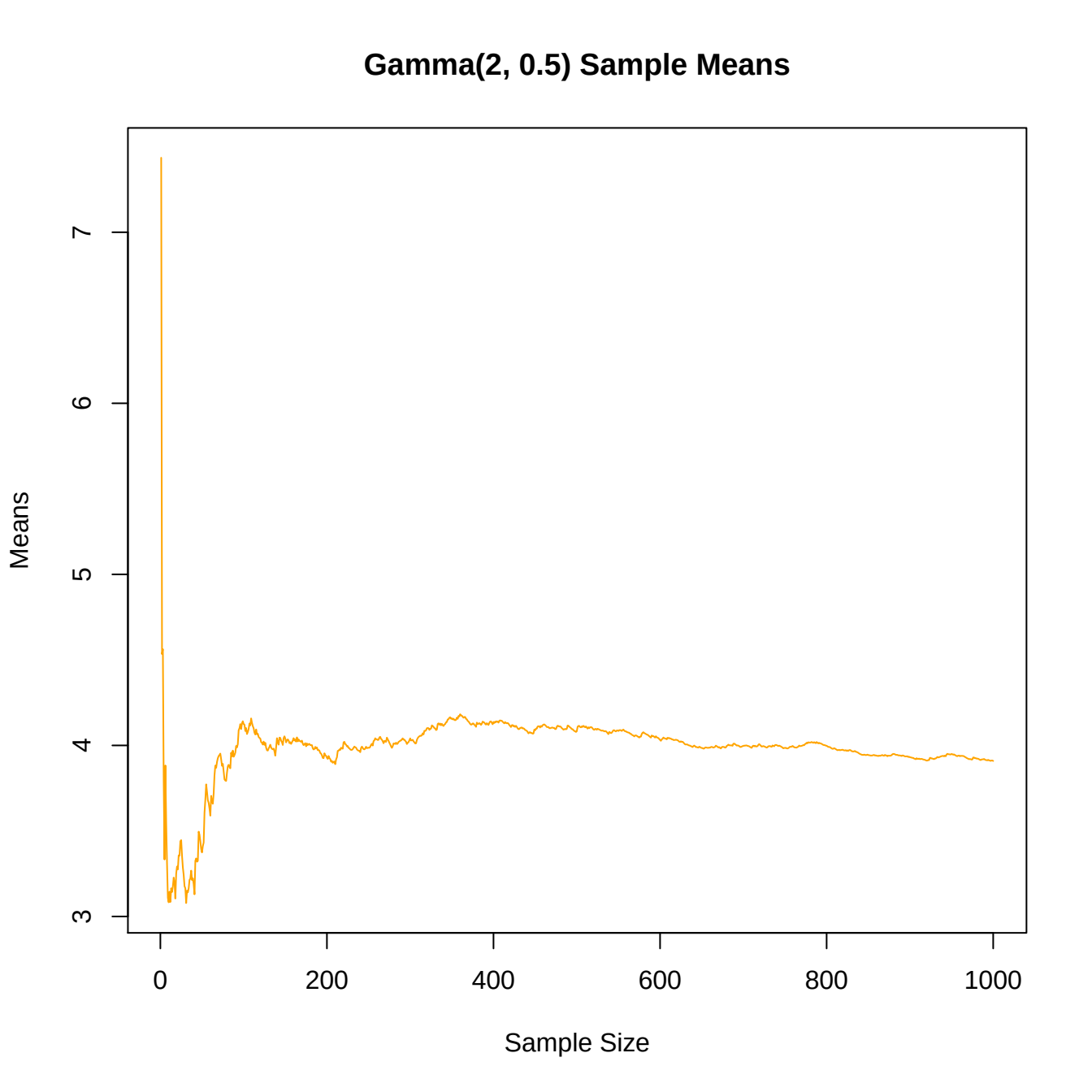

Gamma(1, 2) Sample Means
Means
0.40
0.45
0.50
0.55
0.60
0.65
0
200
400
600
800
1000
Sample Size

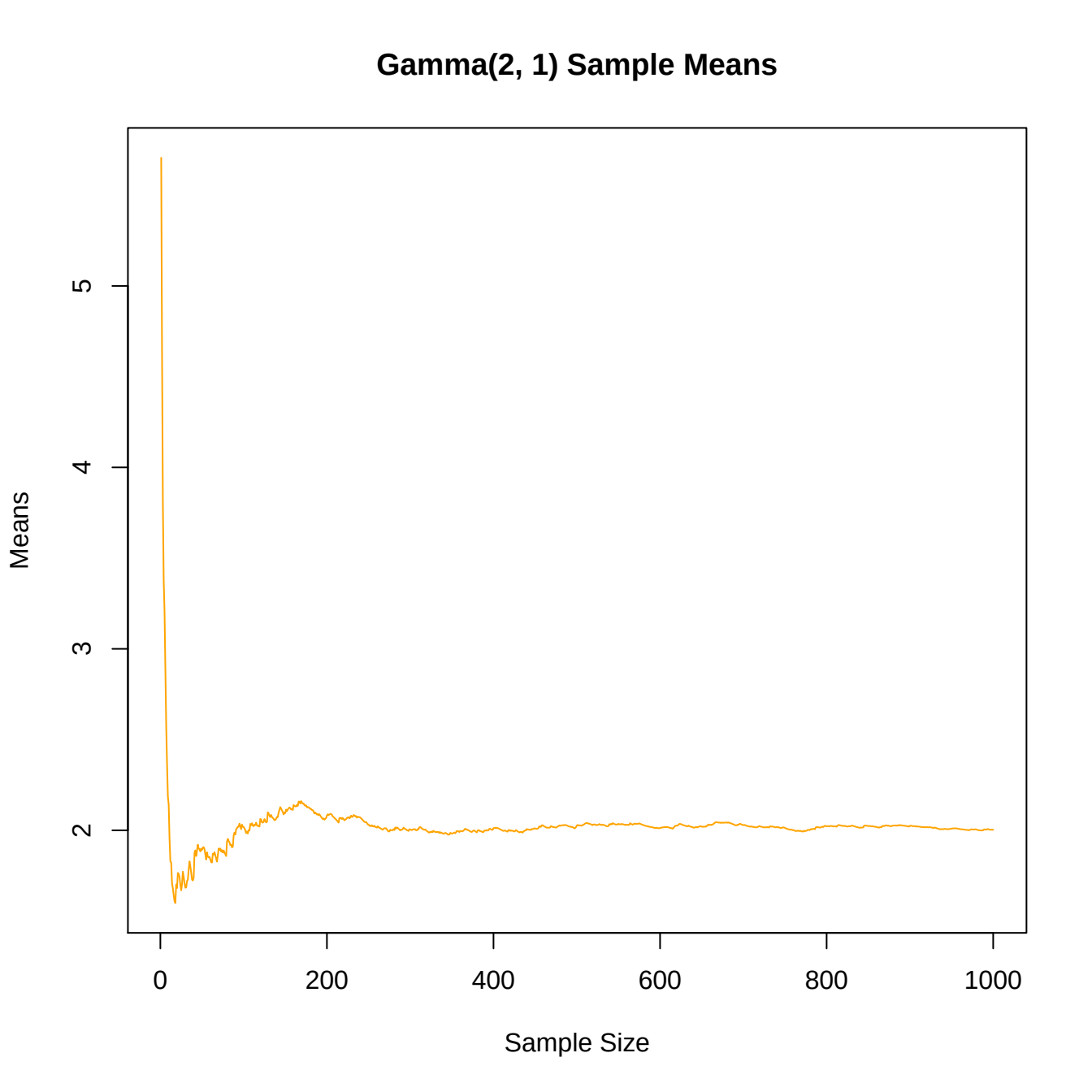

Gamma(1, 5) Sample Means
Means
0.2
0.3
0.4
0.5
0
200
400
600
800
1000
Sample Size

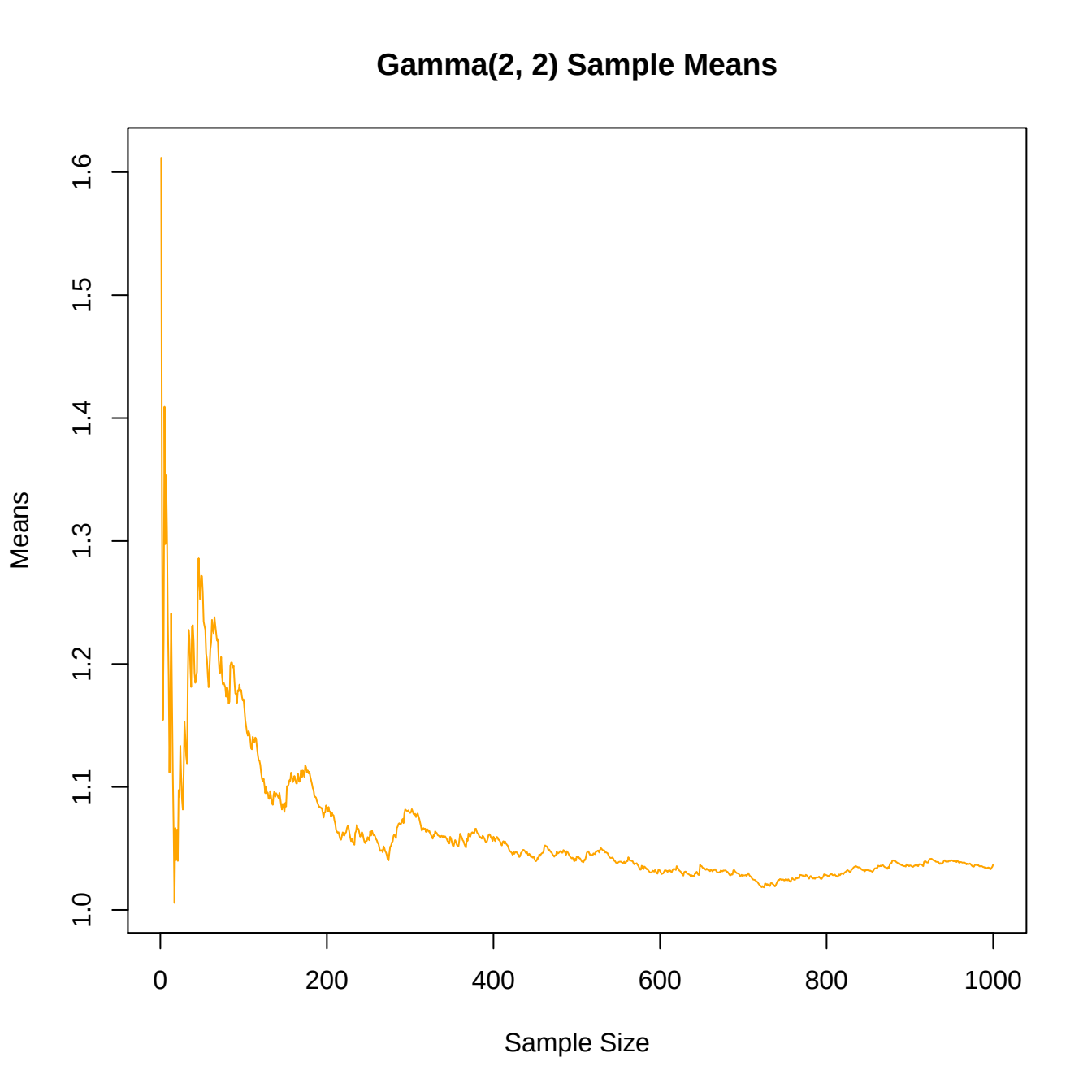

Gamma(1, 10) Sample Means
Means
0.00
0.05
0.10
0.15
0
200
400
600
800
1000
Sample Size

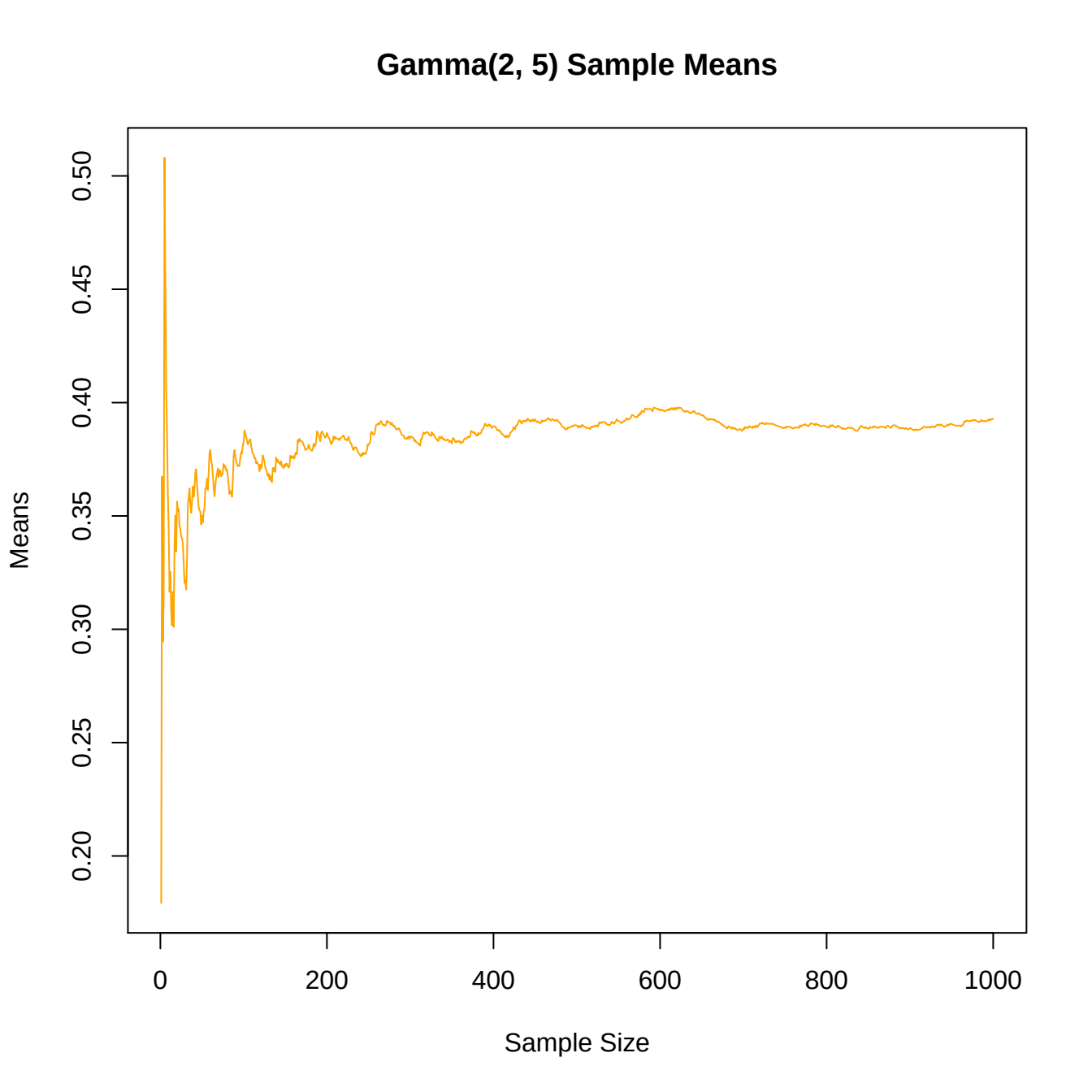

Gamma(1, 100) Sample Means
Means
0.003
0.004
0.005
0.006
0.007
0.008
0.009
0.010
0
200
400
600
800
1000
Sample Size

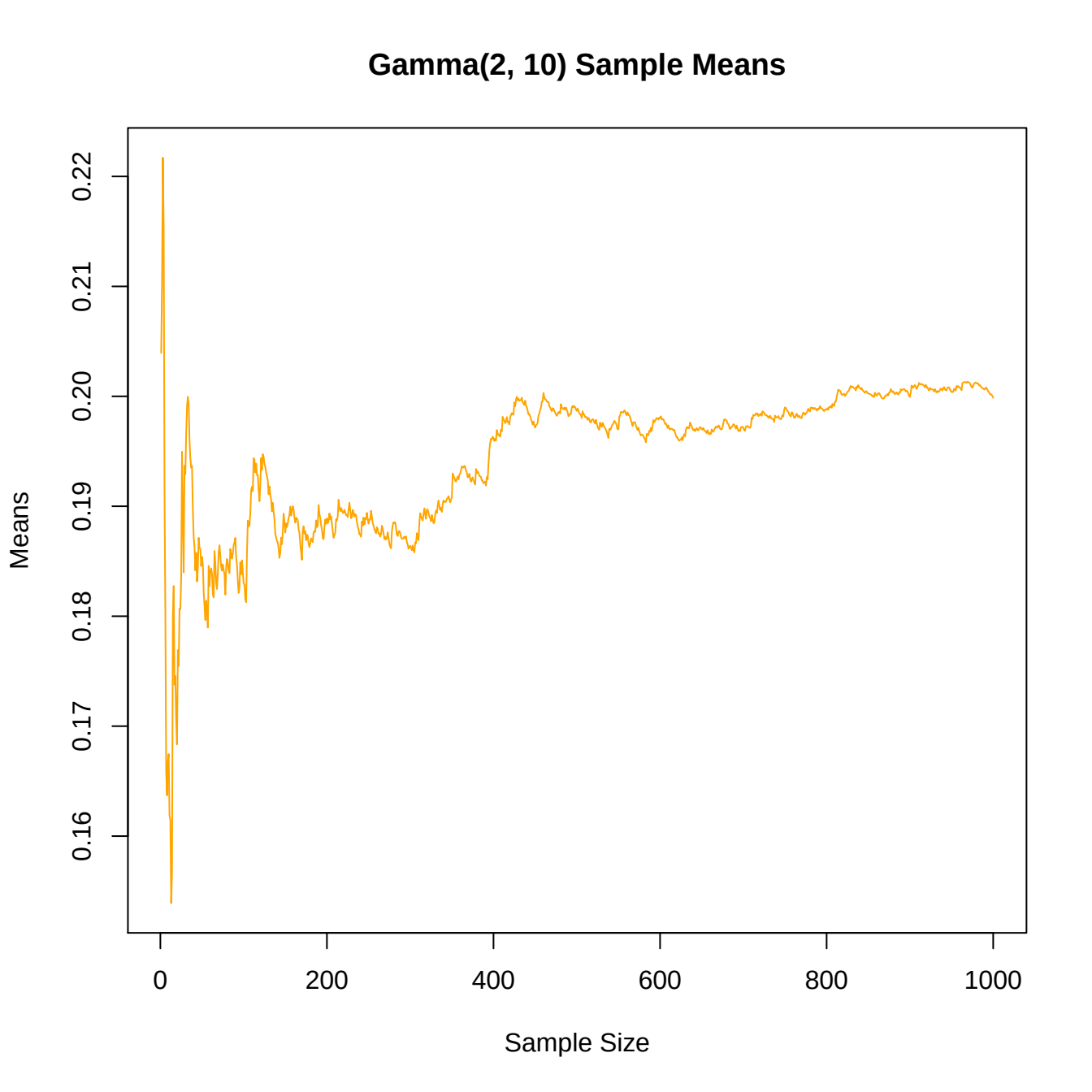

Gamma(2, 0.1) Sample Means
Means
18
20
22
24
26
28
0
200
400
600
800
1000
Sample Size

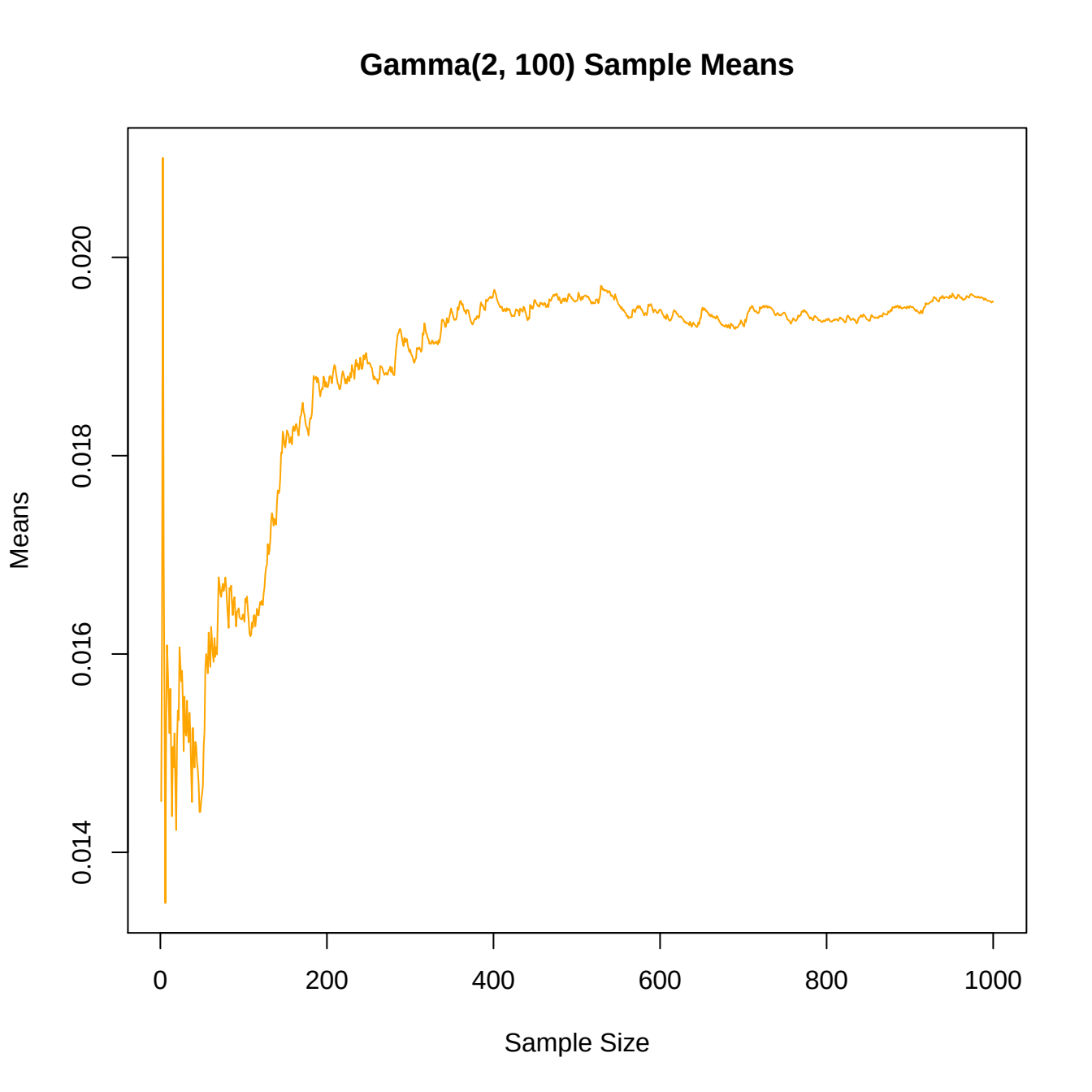

Gamma(2, 0.5) Sample Means
Means
3
4
5
6
7
0
200
400
600
800
1000
Sample Size

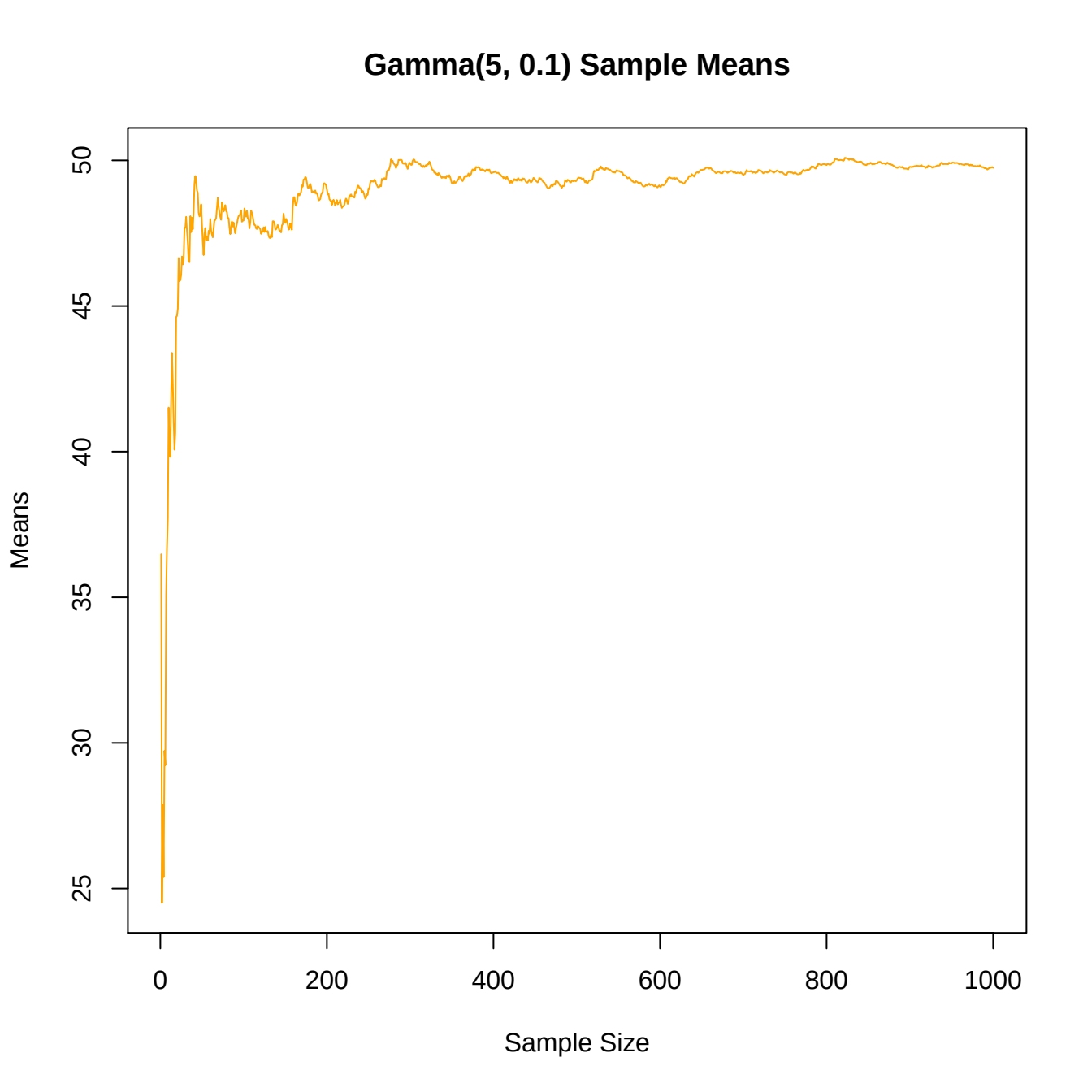

Gamma(2, 1) Sample Means
Means
2
3
4
5
0
200
400
600
800
1000
Sample Size

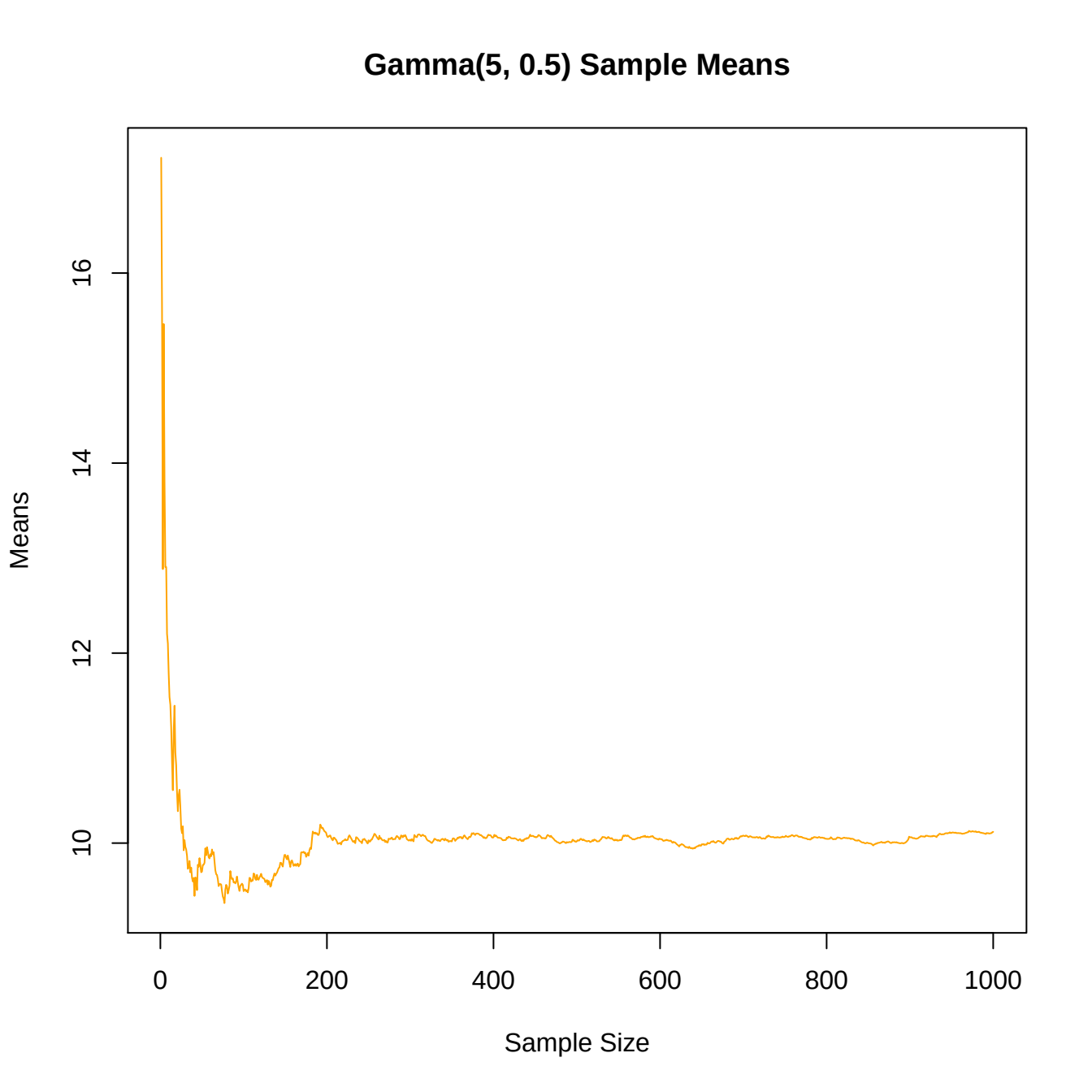

Gamma(2, 2) Sample Means
Means
1.0
1.1
1.2
1.3
1.4
1.5
1.6
0
200
400
600
800
1000
Sample Size

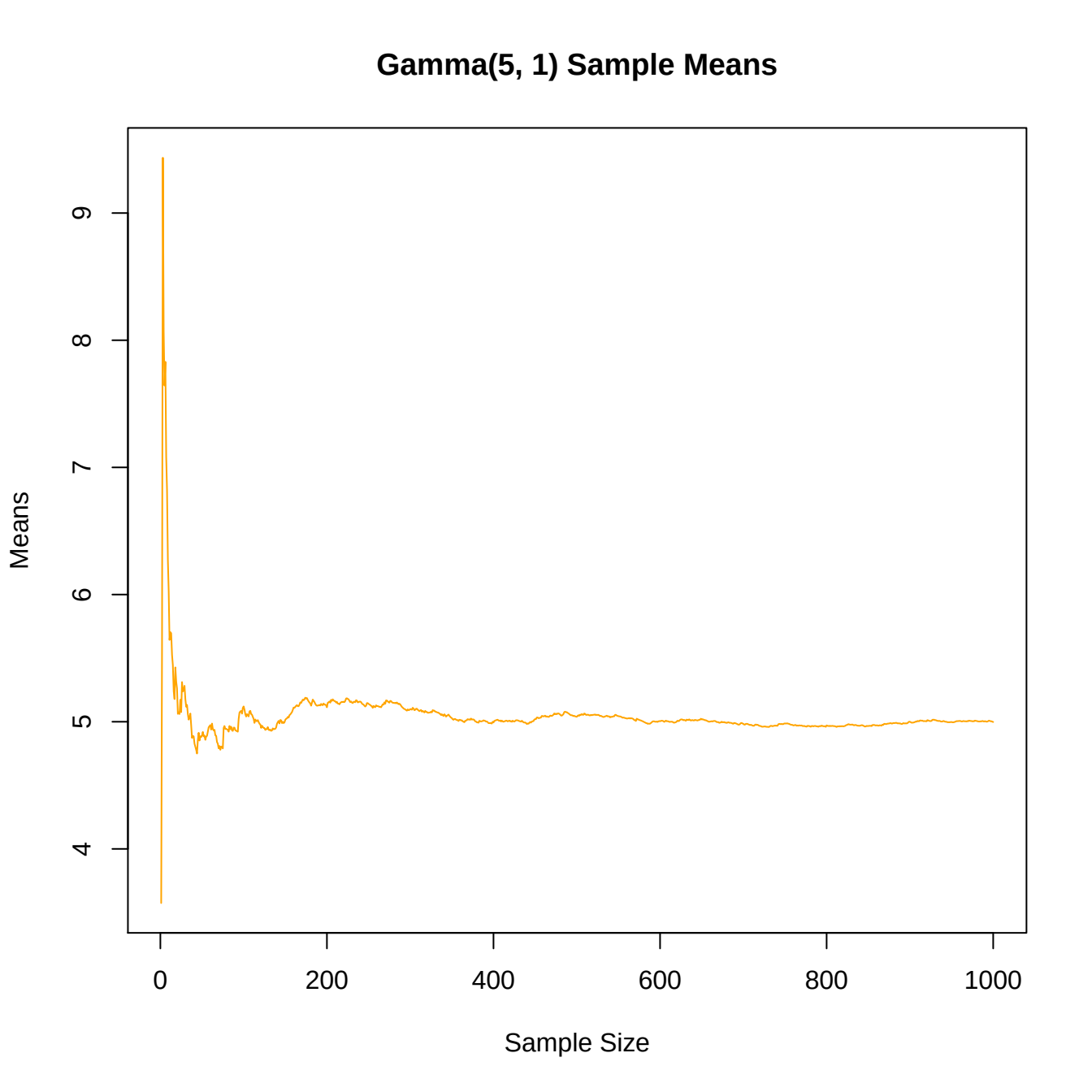

Gamma(2, 5) Sample Means
Means
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0
200
400
600
800
1000
Sample Size

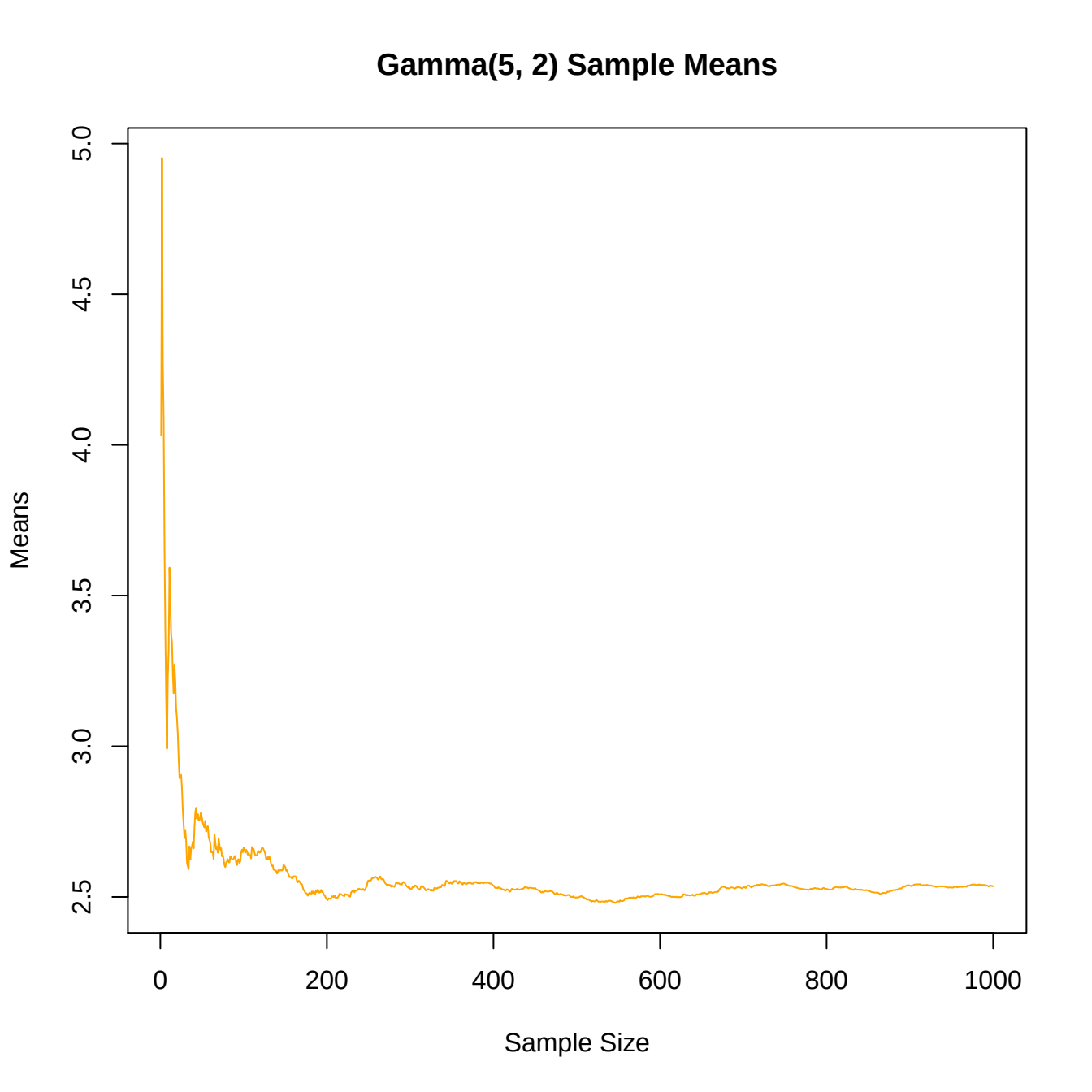

Gamma(2, 10) Sample Means
Means
0.16
0.17
0.18
0.19
0.20
0.21
0.22
0
200
400
600
800
1000
Sample Size

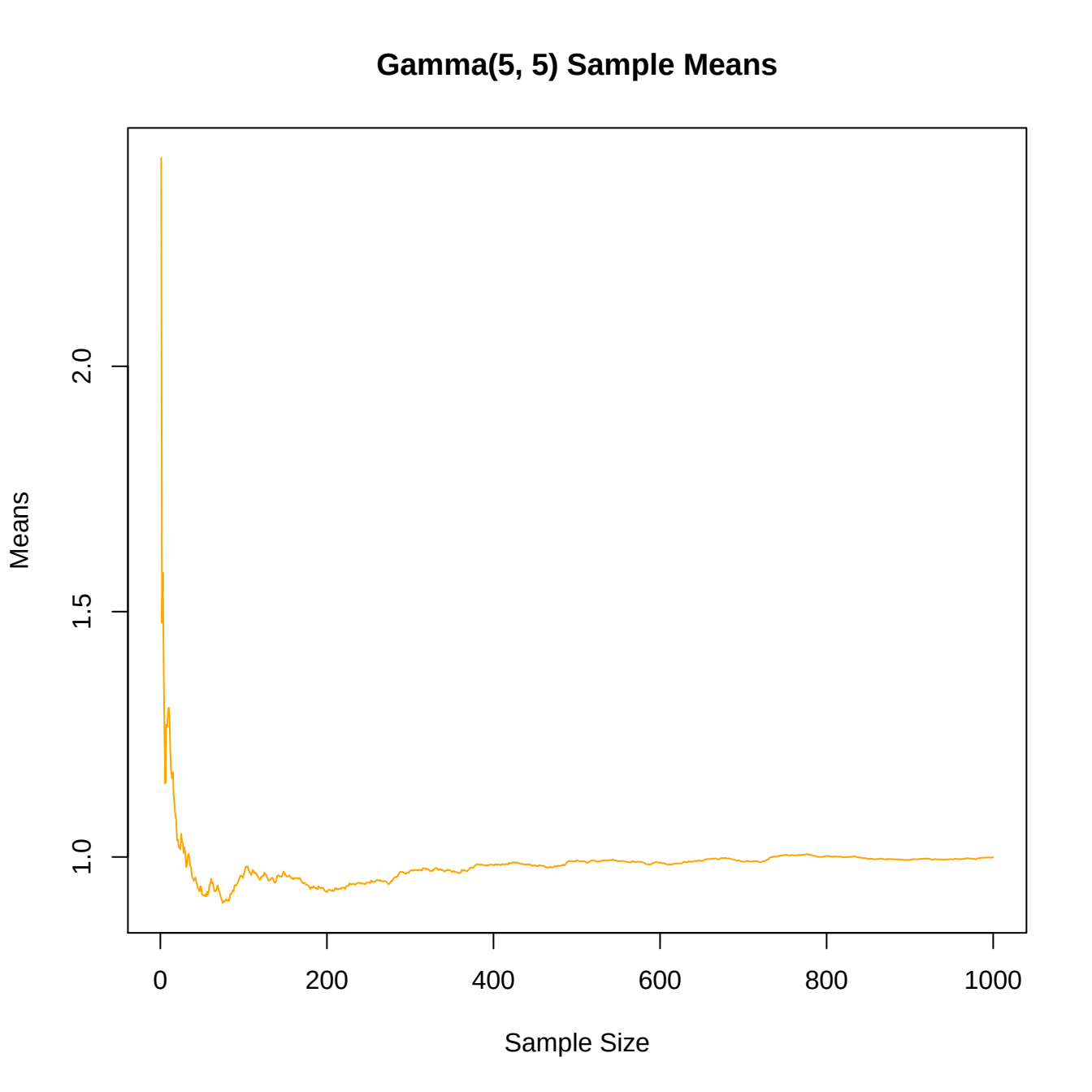

Gamma(2, 100) Sample Means
Means
0.014
0.016
0.018
0.020
0
200
400
600
800
1000
Sample Size

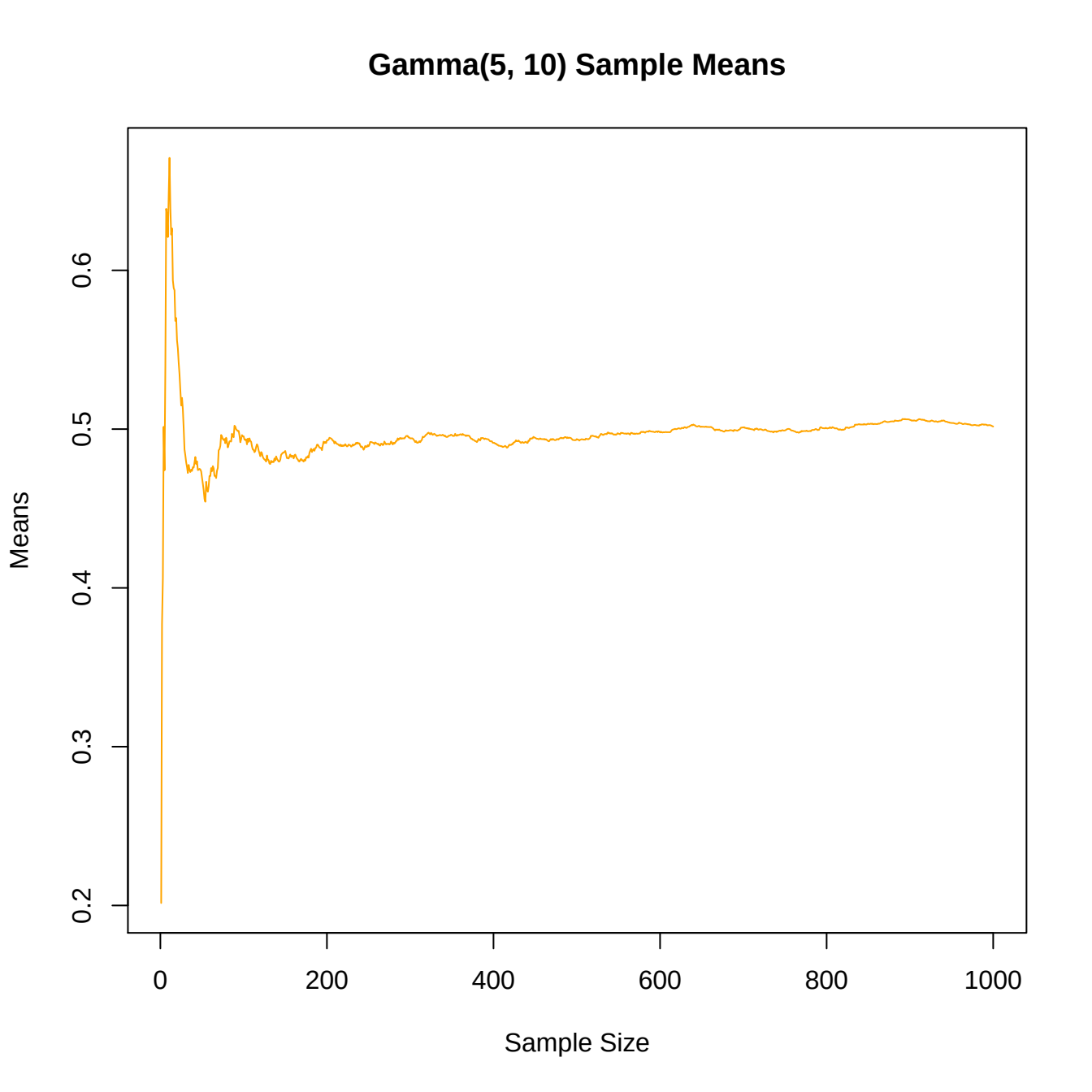

Gamma(5, 0.1) Sample Means
Means
25
30
35
40
45
50
0
200
400
600
800
1000
Sample Size

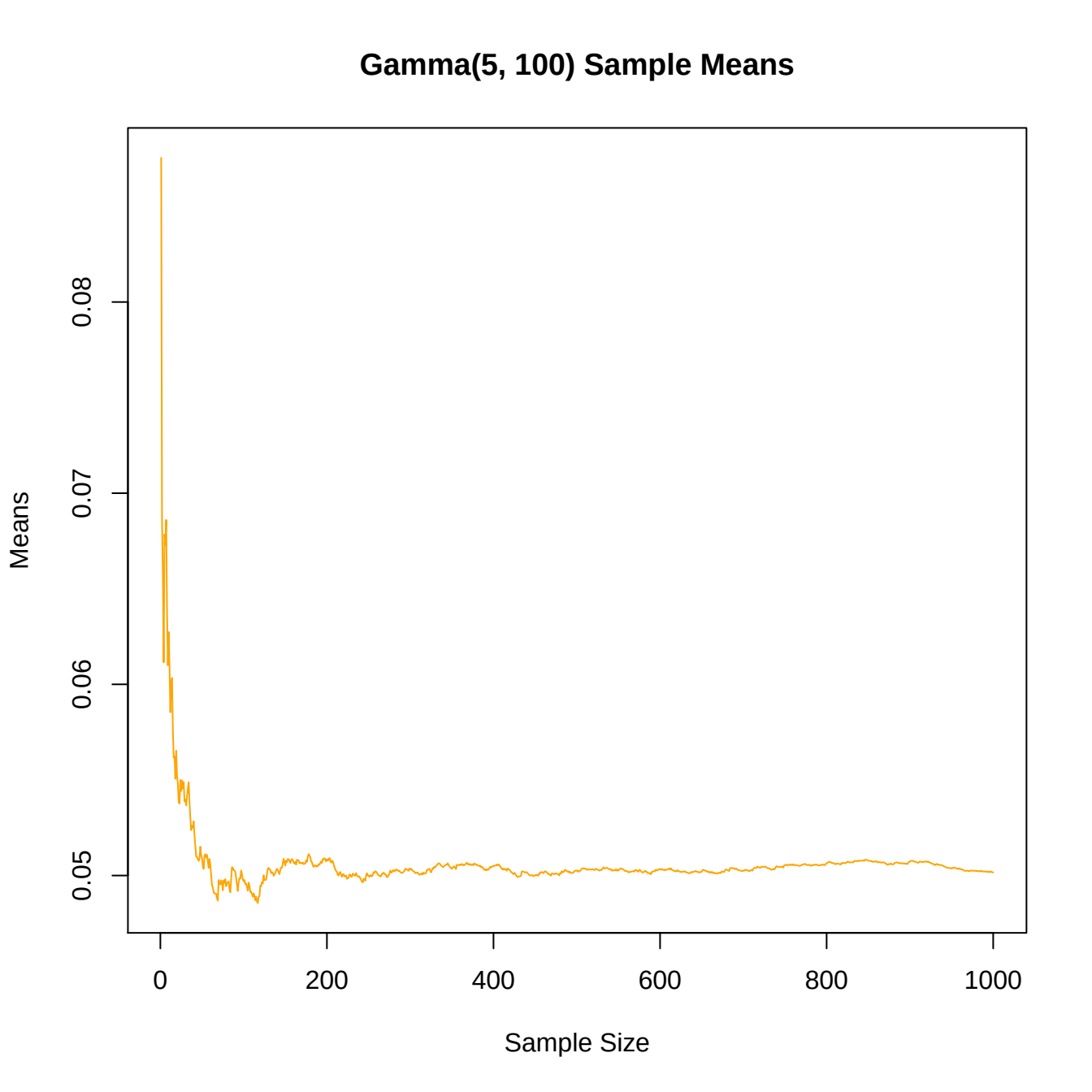

Gamma(5, 0.5) Sample Means
Means
10
12
14
16
0
200
400
600
800
1000
Sample Size

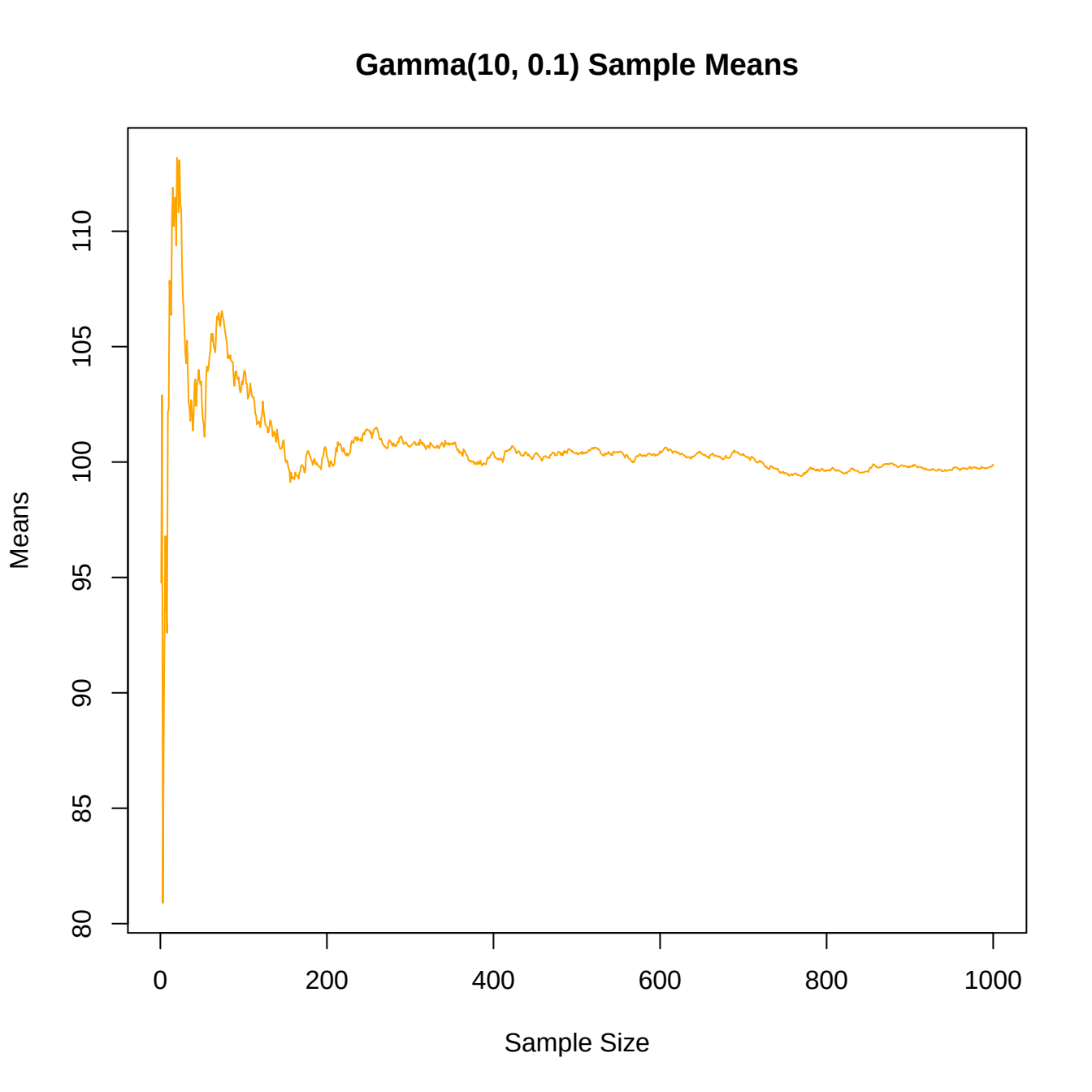

Gamma(5, 1) Sample Means
Means
4
5
6
7
8
9
0
200
400
600
800
1000
Sample Size

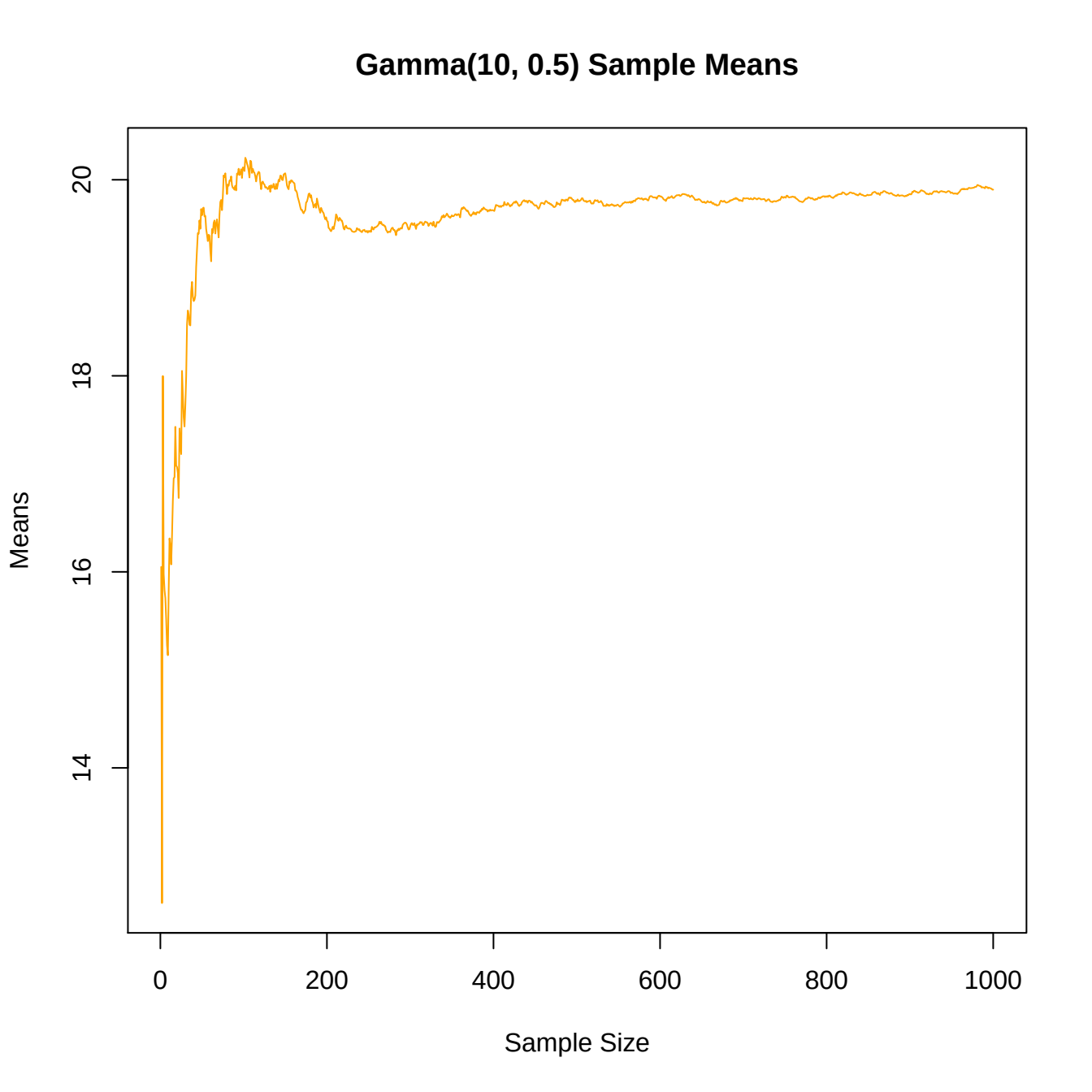

Gamma(5, 2) Sample Means
Means
5.0
4.5
4.0
3.5
3.0
2.5
0
200
400
600
800
1000
Sample Size

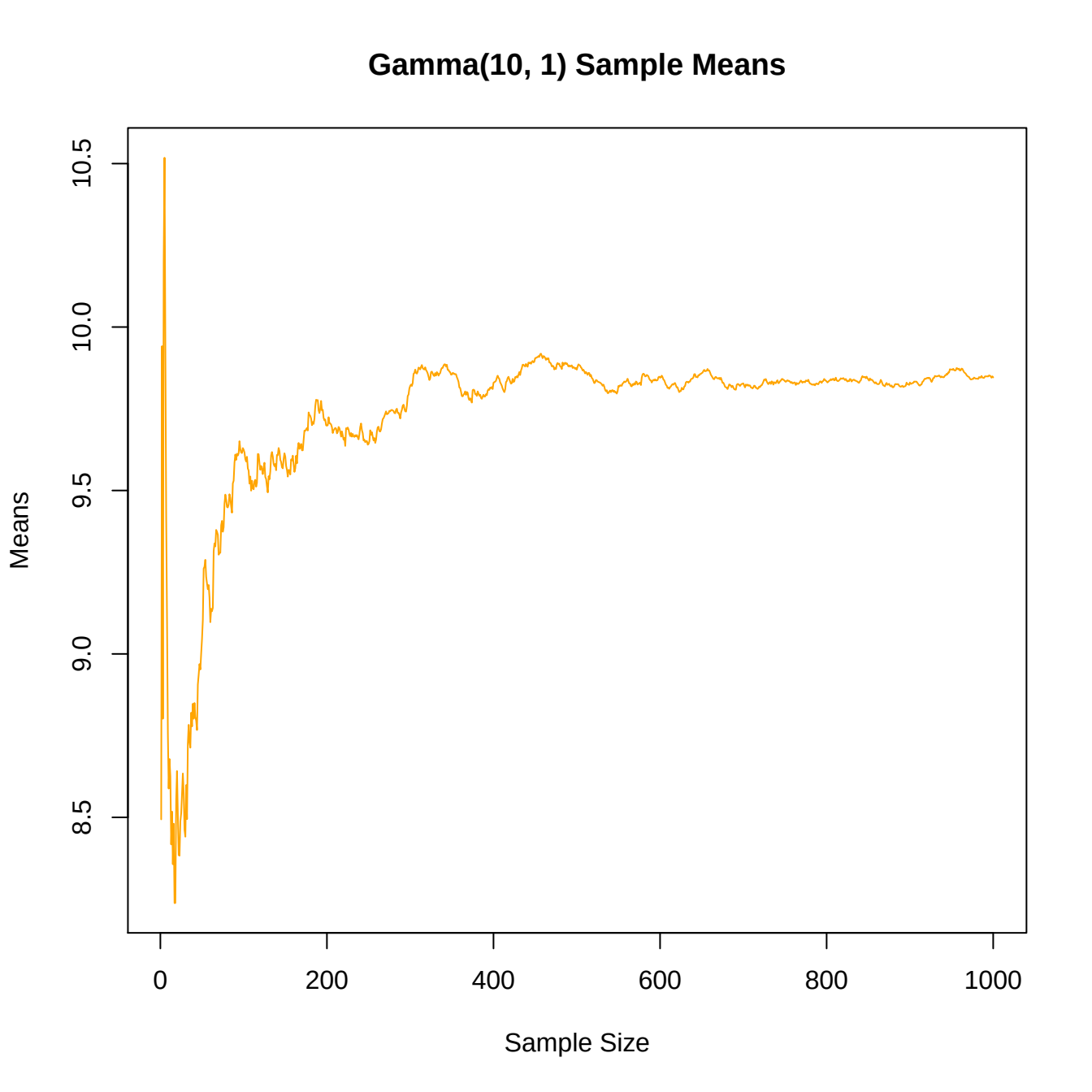

Gamma(5, 5) Sample Means
Means
1.0
1.5
2.0
0
200
400
600
800
1000
Sample Size

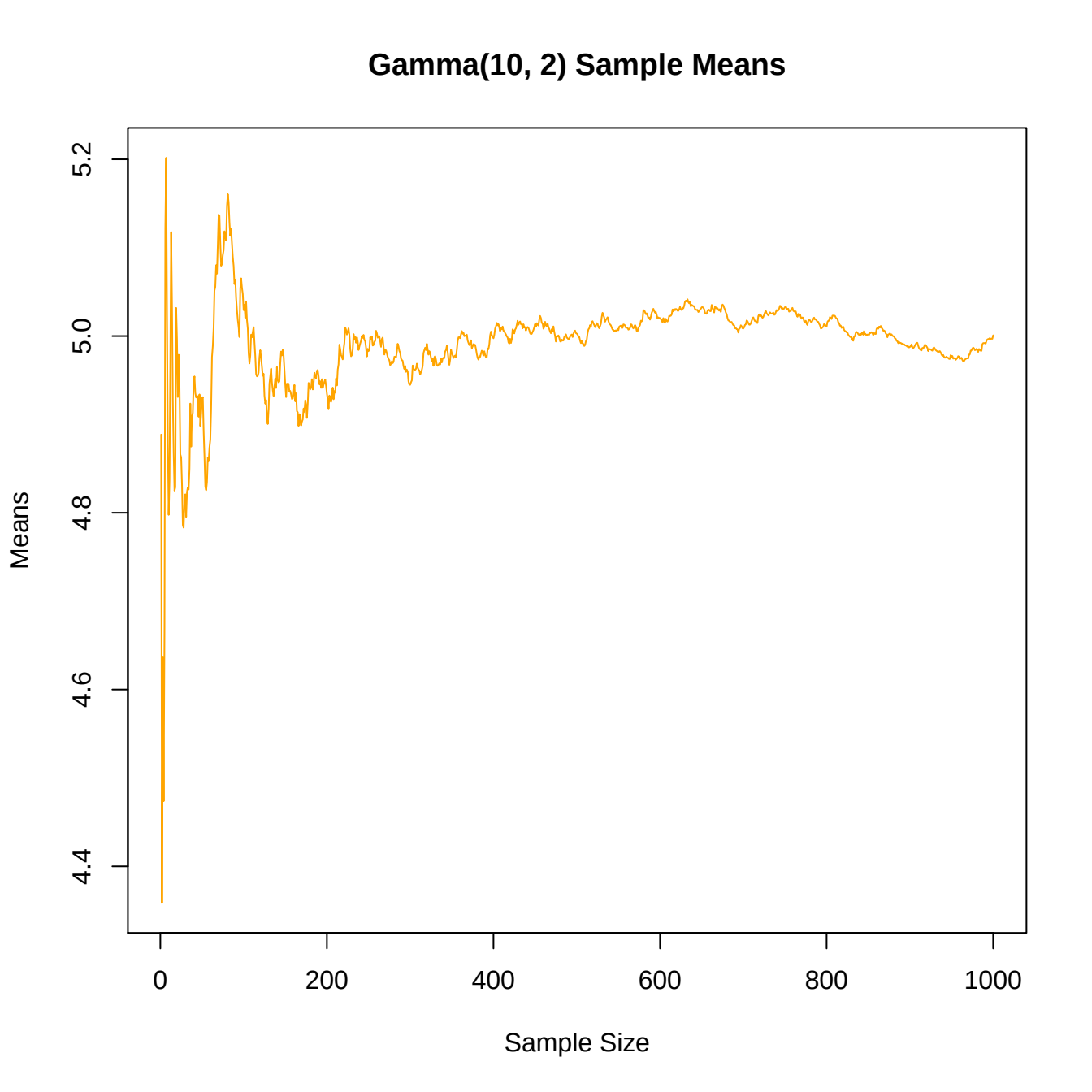

Gamma(5, 10) Sample Means
Means
0.2
0.3
0.4
0.5
0.6
0
200
400
600
800
1000
Sample Size

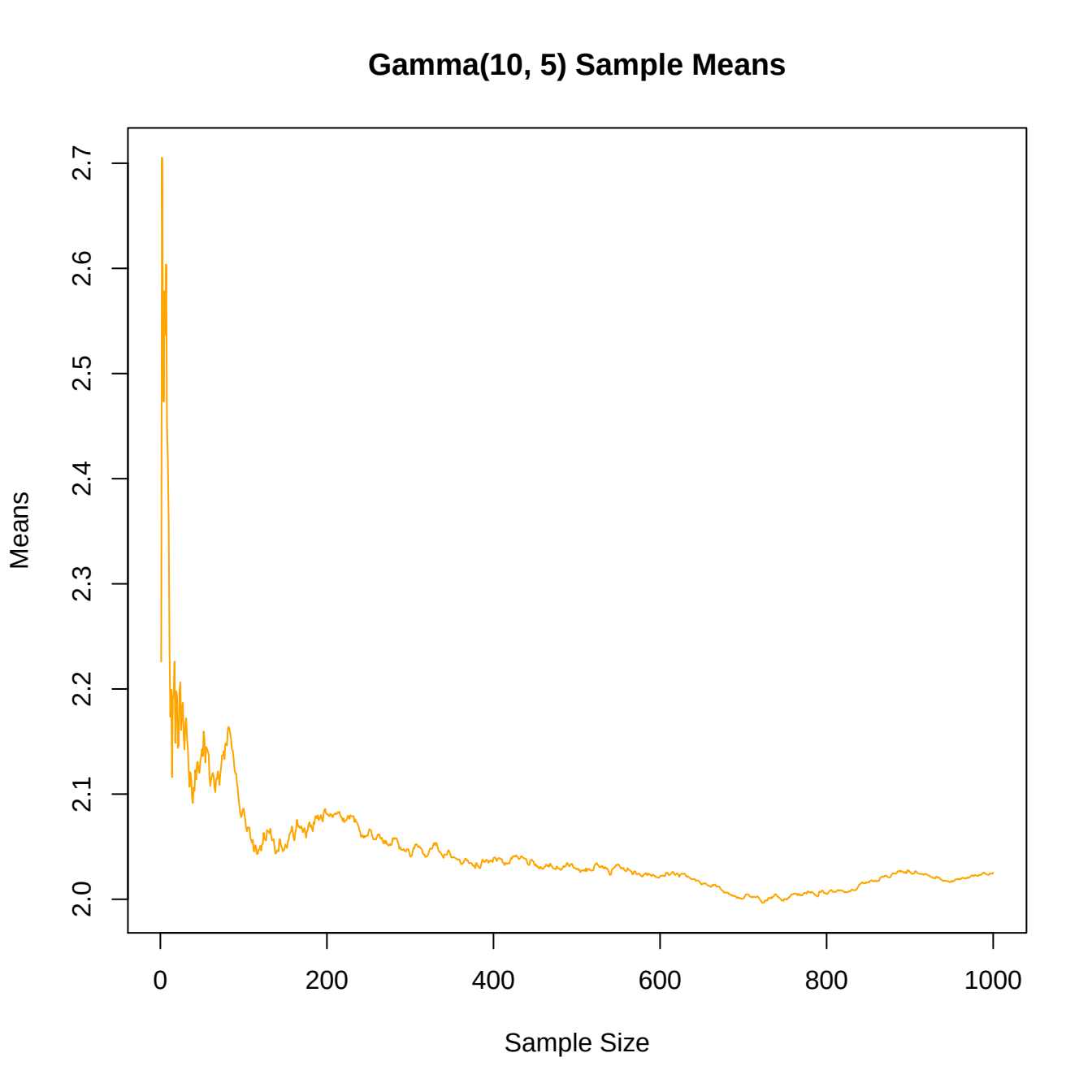

Gamma(5, 100) Sample Means
Means
0.05
0.06
0.07
0.08
0
200
400
600
800
1000
Sample Size

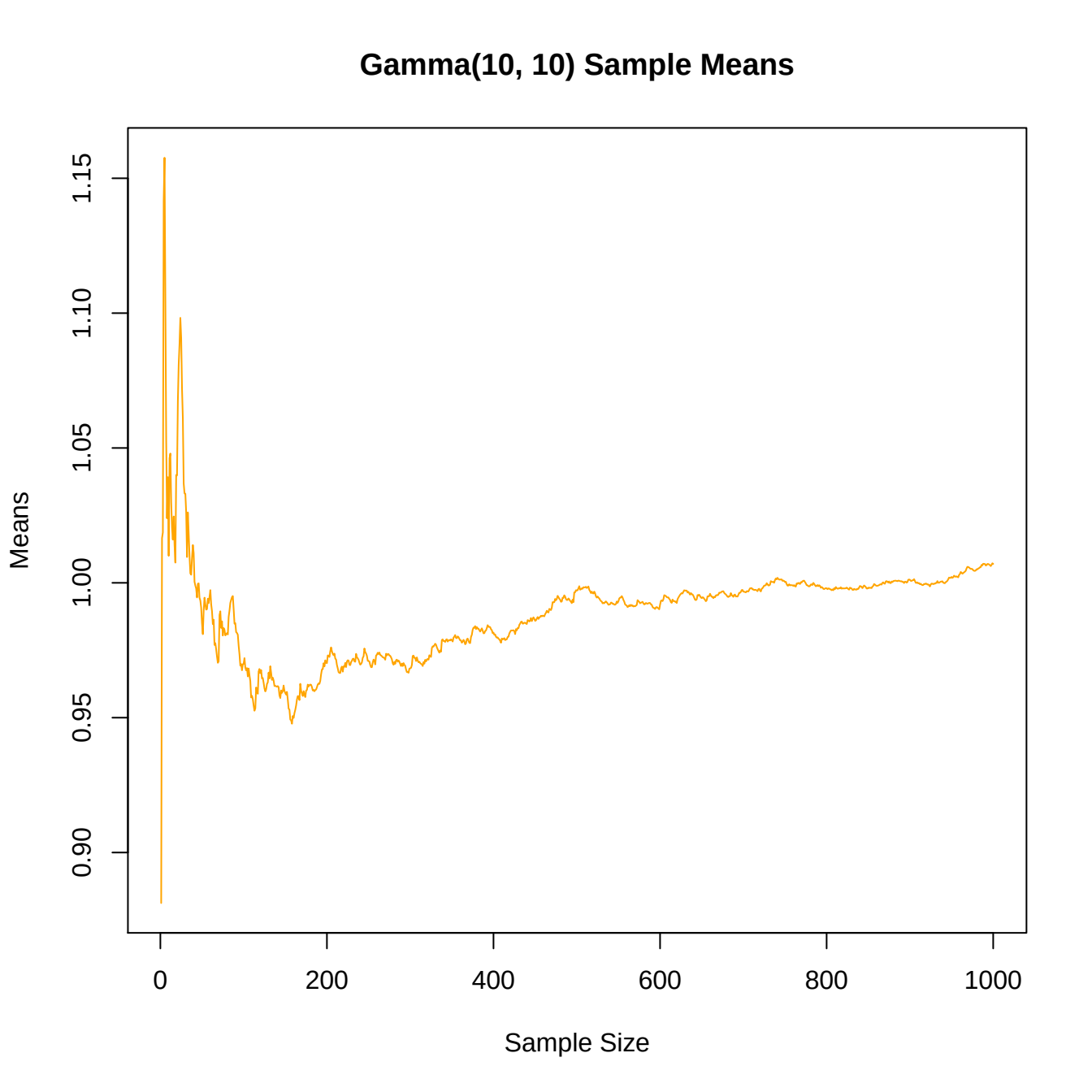

Gamma(10, 0.1) Sample Means
Means
80
85
90
95
100
105
110
0
200
400
600
800
1000
Sample Size

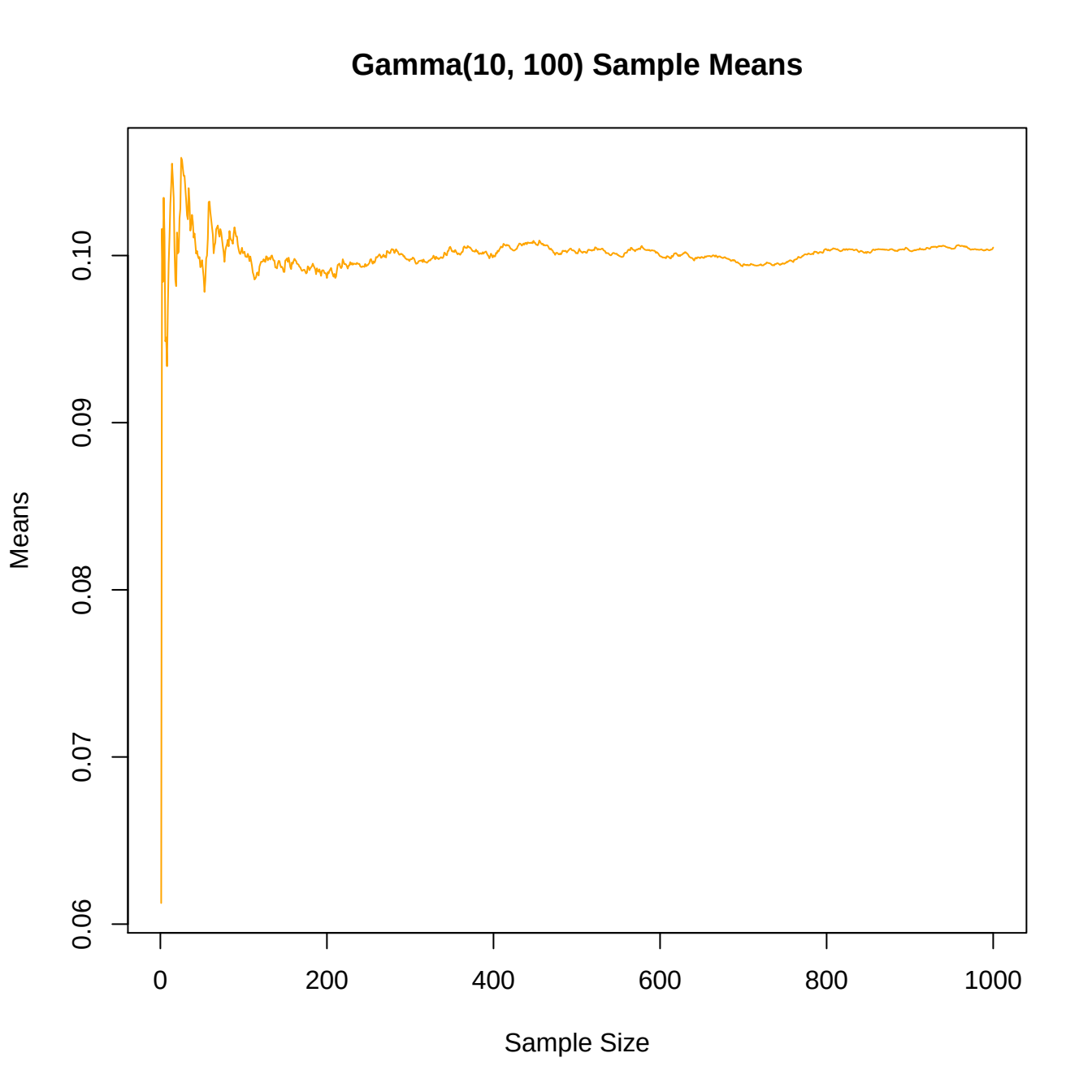

Gamma(10, 0.5) Sample Means
Means
20
18
16
14
0
200
400
600
800
1000
Sample Size

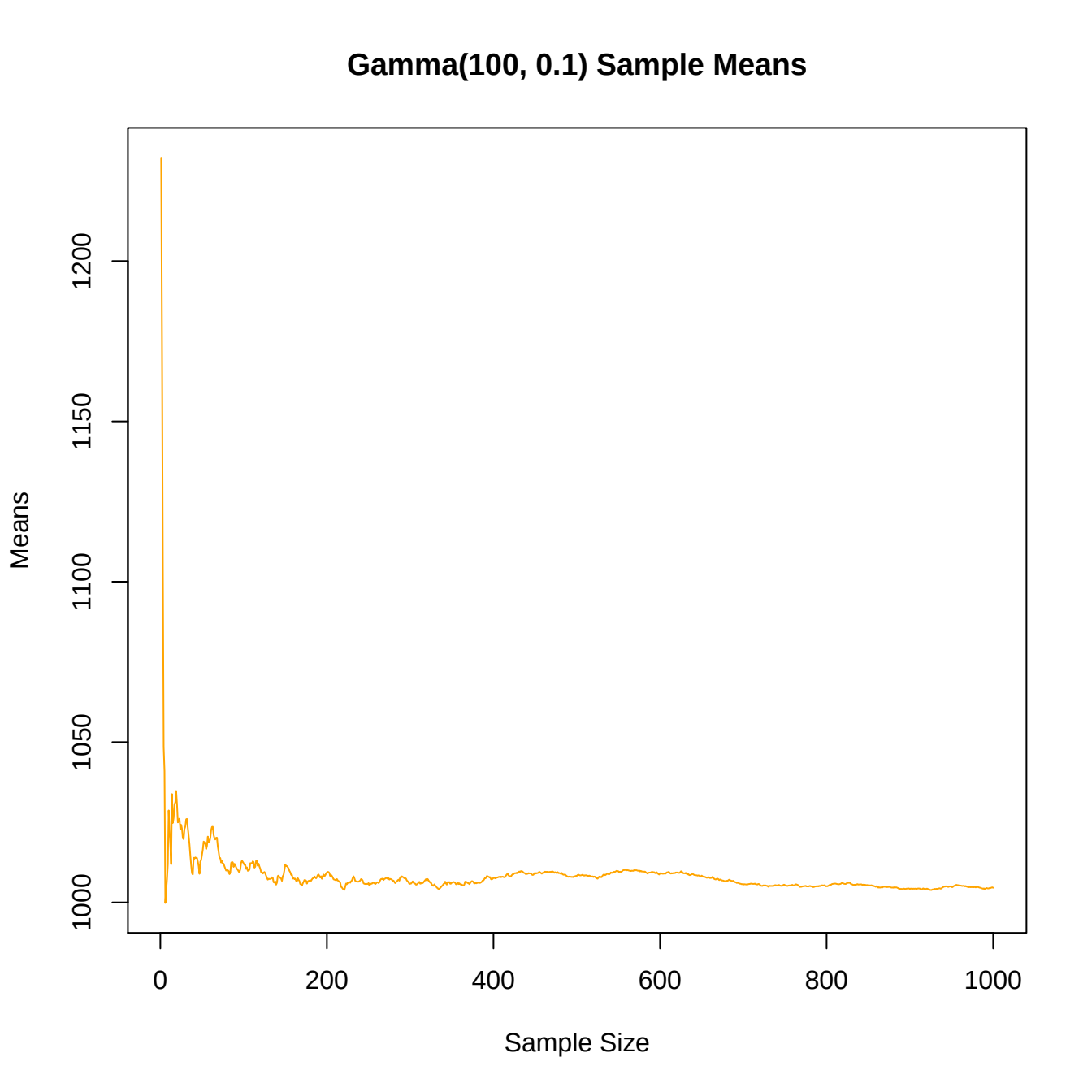

Gamma(10, 1) Sample Means
Means
10.5
10.0
9.5
9.0
8.5
0
200
400
600
800
1000
Sample Size

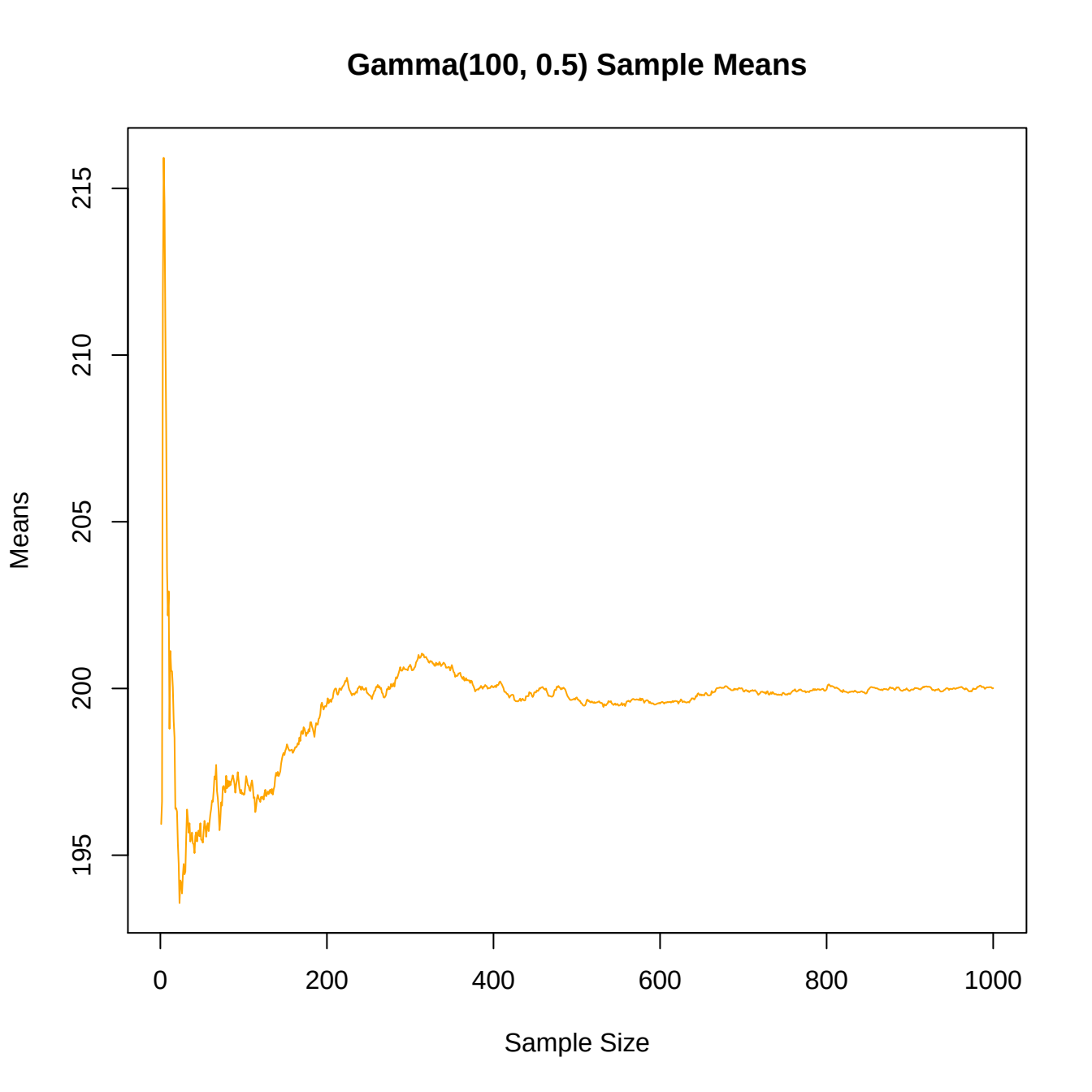

Gamma(10, 2) Sample Means
Means
5.2
5.0
4.8
4.6
4.4
0
200
400
600
800
1000
Sample Size

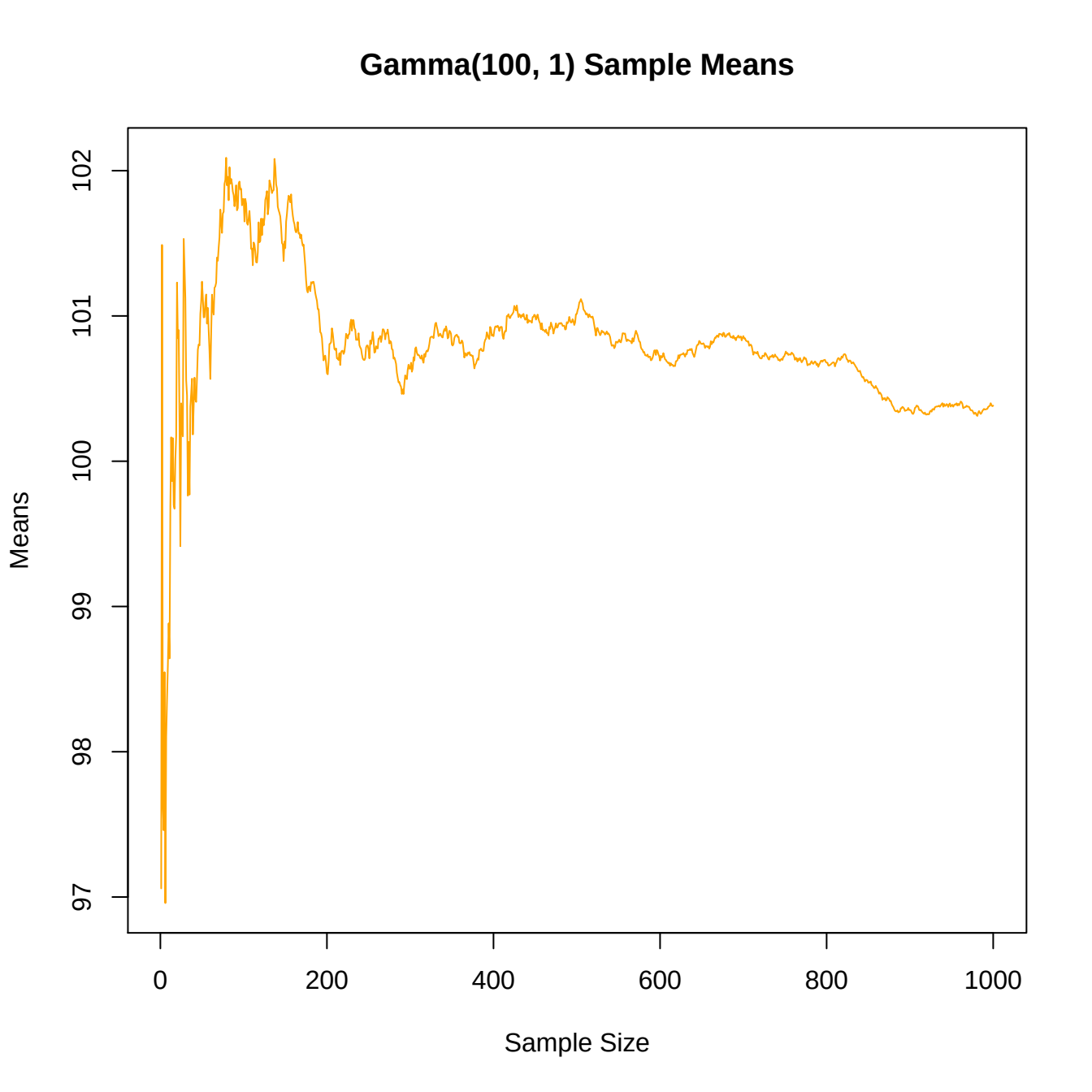

Gamma(10, 5) Sample Means
Means
2.0
2.1
2.2
2.3
2.4
2.5
2.6
2.7
0
200
400
600
800
1000
Sample Size

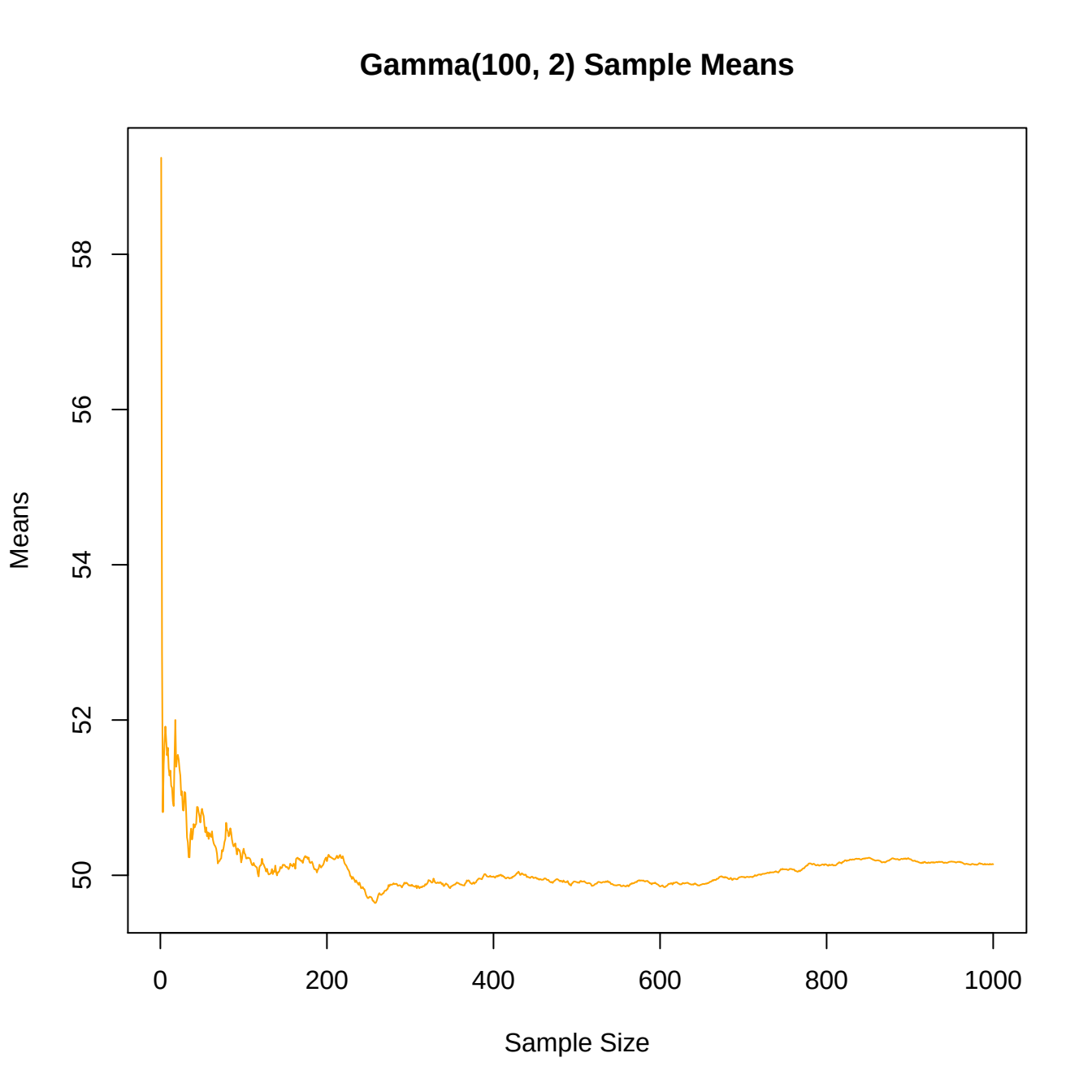

Gamma(10, 10) Sample Means
Means
0.90
0.95
1.00
1.05
1.10
1.15
0
200
400
600
800
1000
Sample Size

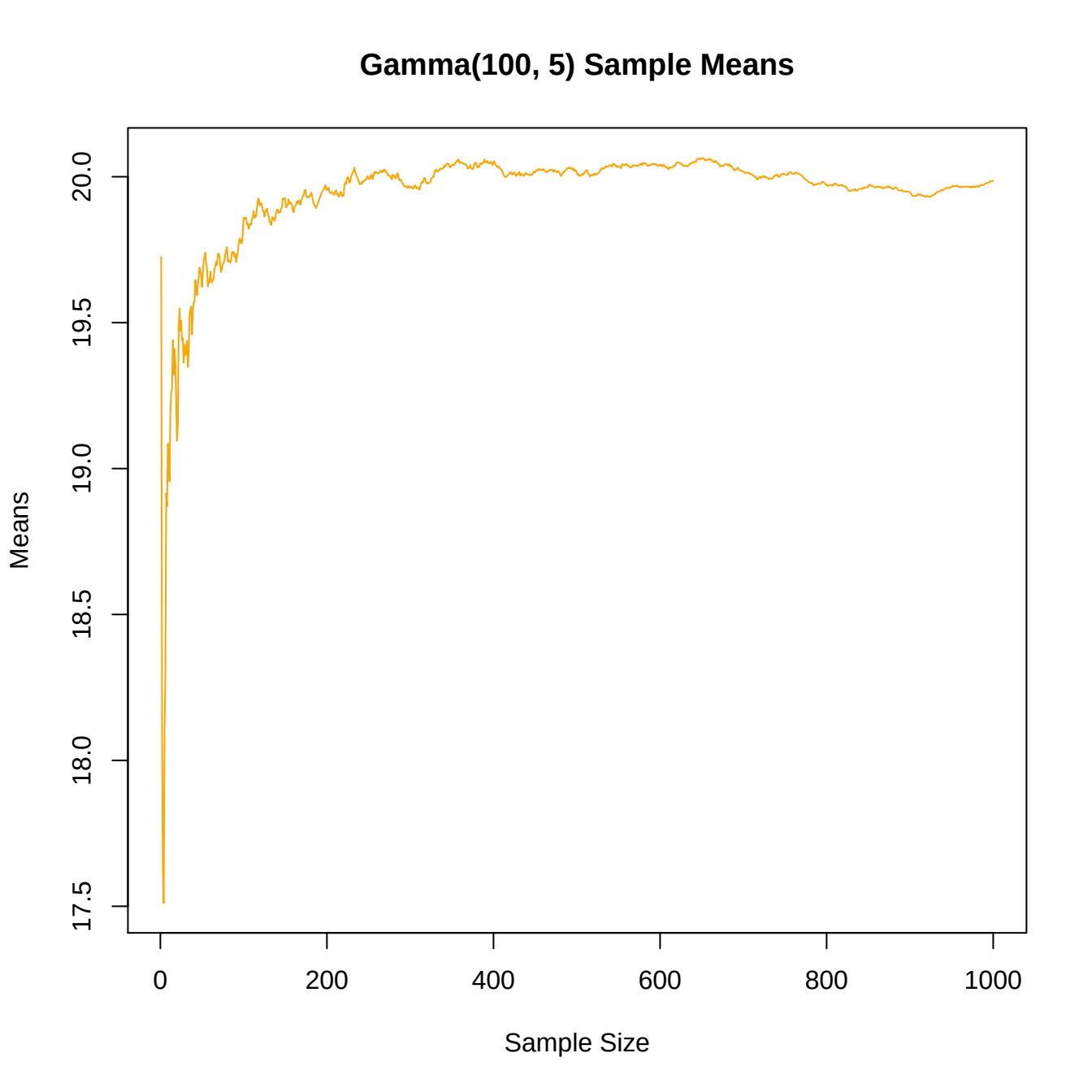

Gamma(10, 100) Sample Means
Means
0.06
0.07
0.08
0.09
0.10
0
200
400
600
800
1000
Sample Size

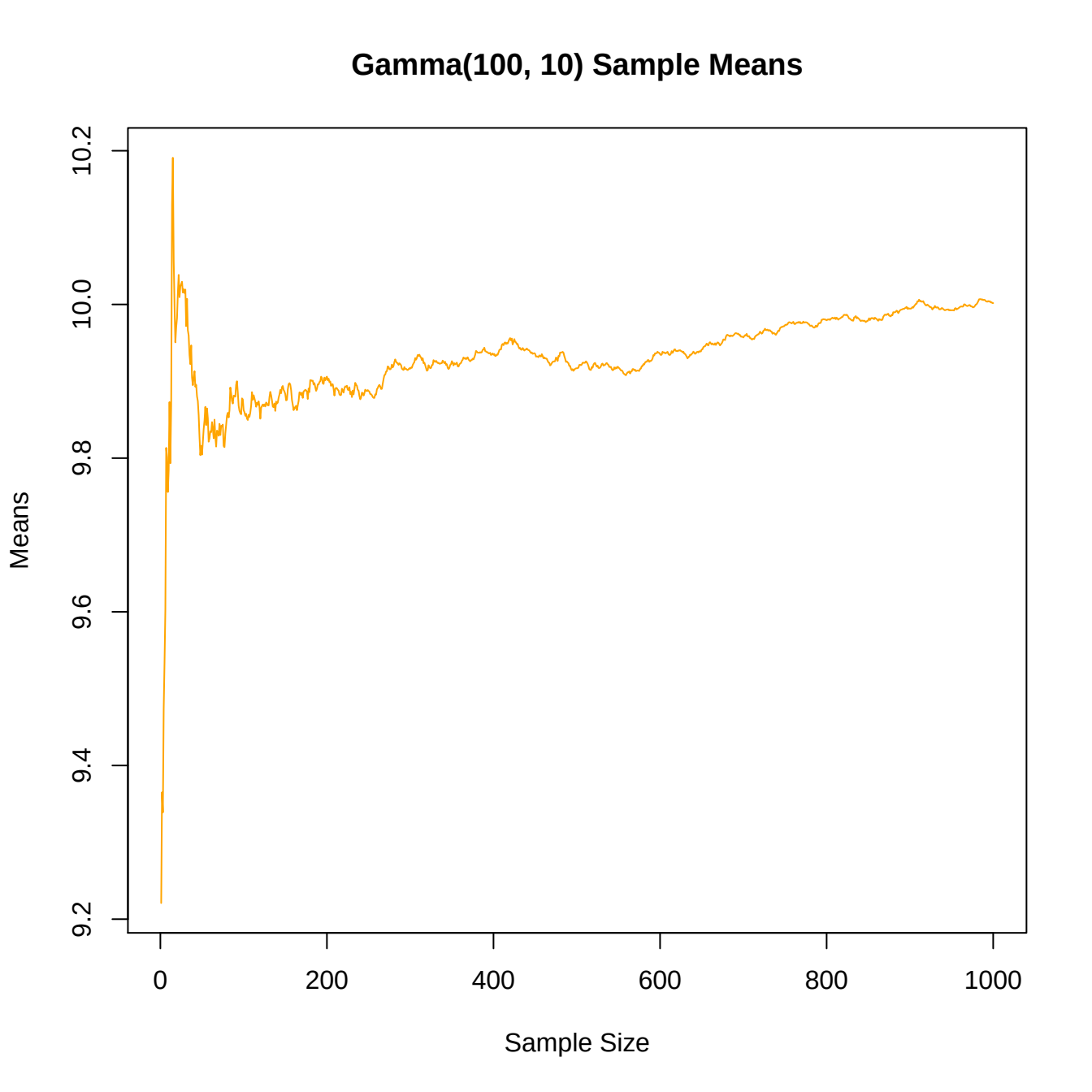

Gamma(100, 0.1) Sample Means
Means
1000
1050
1100
1150
1200
0
200
400
600
800
1000
Sample Size

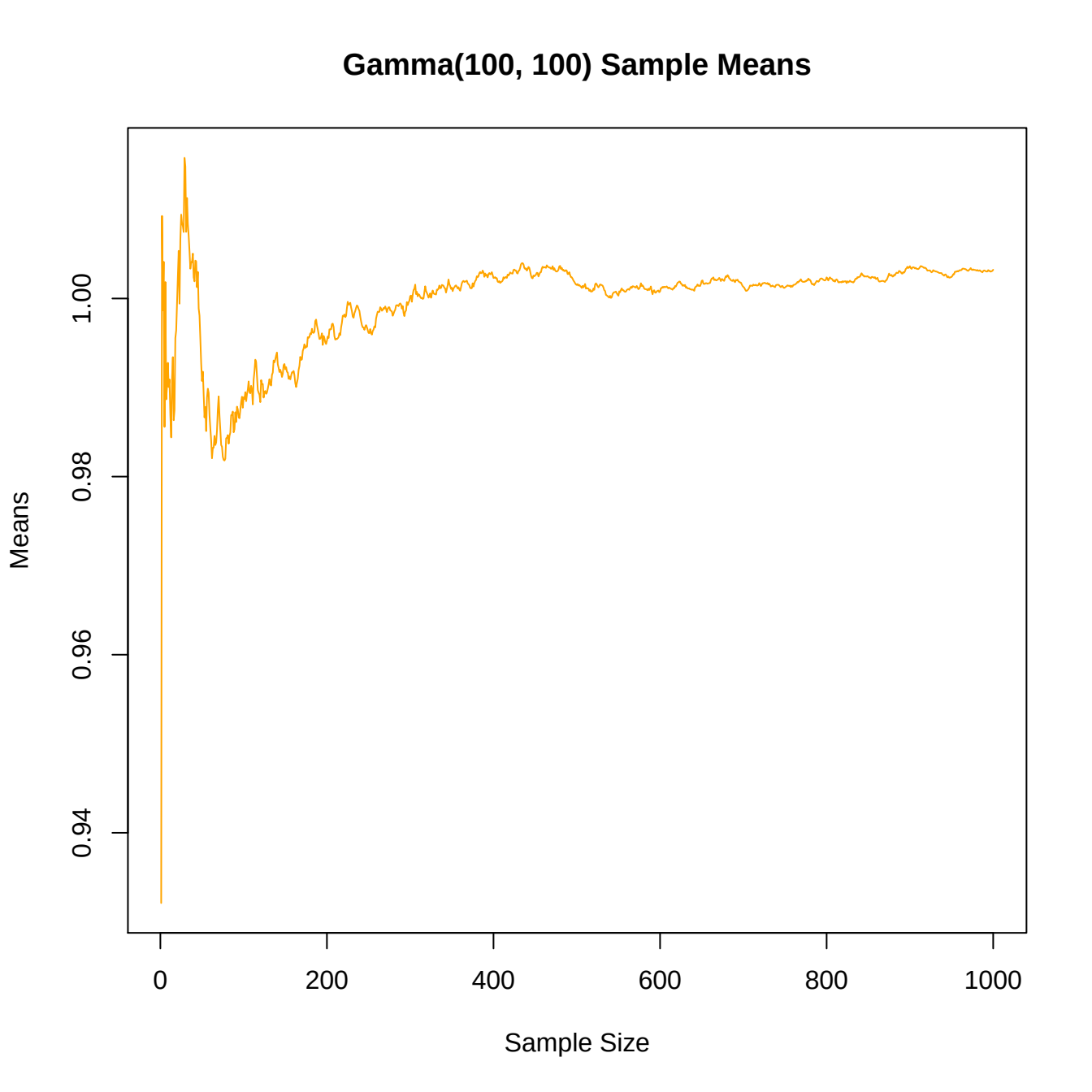

Gamma(100, 0.5) Sample Means
Means
215
210
205
200
195
0
200
400
600
800
1000
Sample Size


Gamma(100, 1) Sample Means
Means
97
98
99
100
101
102
0
200
400
600
800
1000
Sample Size


Gamma(100, 2) Sample Means
Means
50
52
54
56
58
0
200
400
600
800
1000
Sample Size


Gamma(100, 5) Sample Means
Means
17.5
18.0
18.5
19.0
19.5
20.0
0
200
400
600
800
1000
Sample Size


Gamma(100, 10) Sample Means
Means
10.2
10.0
9.8
9.6
9.4
9.2
0
200
400
600
800
1000
Sample Size


Gamma(100, 100) Sample Means
Means
1.00
0.98
0.96
0.94
0
200
400
600
800
1000
Sample Size

Question 2:

In question 1 the 49 vectors which I generated in question were used to produce 49 histograms. The distribution of these datasets can be remarkably modeled by the chi squared distribution. Alpha and Lambda represent the Shape and Rate respectively. As alpha and lambda increase the distribution move from an exponential distribution toward a normal distribution.

Question 3:

The task required a table with 49 rows which compared the theoretical expected value and variance of each Gamma distribution with the sample mean and variance. What became clearly apparent immediately when testing various sample sizes was that as the sample size increased the sample mean and variance tended toward the theoretical expected value and variance. The sample sizes I compared were 100, 1000 and 10000.

Question 4:

The problem asked to plot a line graph for each of the 49 datasets. For each case it compared the sample size n with the running sample mean, where n is between 1 and 1000. As the sample size n increased the sample mean tended toward its theoretical mean.