```python
"""
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"""

import numpy as np

def fB(B):
    n = len(B)
    b=0;
    for i in range(n):
        if(B[i] == 1):
            b = b + np.power(2,i)
    return b

#Z = constant, B = Matrix, alpha = noise
def PZgivenB(Z, B, alpha):
    ret = [(np.power(alpha, np.abs(Z-fB(B[i])))) * (1-alpha)/(1+alpha) for i in range(len(B))];
    return ret

#calculate the estimate for B i_val given sample size and B i's.
def calc(B, PZ_B, i_val):
    n = len(PZ_B)
    numerator = sum(PZ_B[i] for i in range(n) if B[i][i_val]==1)
    denominator = sum(PZ_B[i] for i in range(n))
    return numerator/denominator

def plotDict(d):
    lists = sorted(d.items()) # sorted by key, return a list of tuples
    x, y = zip(*lists) # unpack a list of pairs into two tuples
    for i in range(len(x)):
        print (x[i], '\t', y[i])

#generate big random observation data and iteratively add them to sample data.
def run(rows, Z_val, i_val, bits_val, alpha, begin_rows, increment, epsilon):
    sample_B = np.random.randint(2, size=(rows, bits_val))
    PZ_B = np.array(PZgivenB(Z_val, sample_B, alpha))
    curRows = begin_rows
    PB_Z = dict()
    PB_Z[begin_rows- increment] = 0
    PB_Z[begin_rows- 2*increment] = 0
    delta=1000
    while (curRows <= rows and delta > epsilon):
        subSample_B = sample_B[:curRows, :]
        subPZ_B = PZ_B[:curRows]
        PB_Z[curRows] = calc(subSample_B, subPZ_B, i_val)
        delta = np.abs(PB_Z[curRows] - PB_Z[curRows-increment]) + np.abs(PB_Z[curRows] - PB_Z[curRows-2*increment])
        curRows = curRows + increment
    plotDict(PB_Z)

#all indexes are zero reference. So from the Assignment question, if i_val is 2, put 1 here.
run(rows=1000000,Z_val=128, i_val=9,bits_val=10,alpha=0.2, begin_rows=500000, increment = 5000, epsilon = 0.001)
```

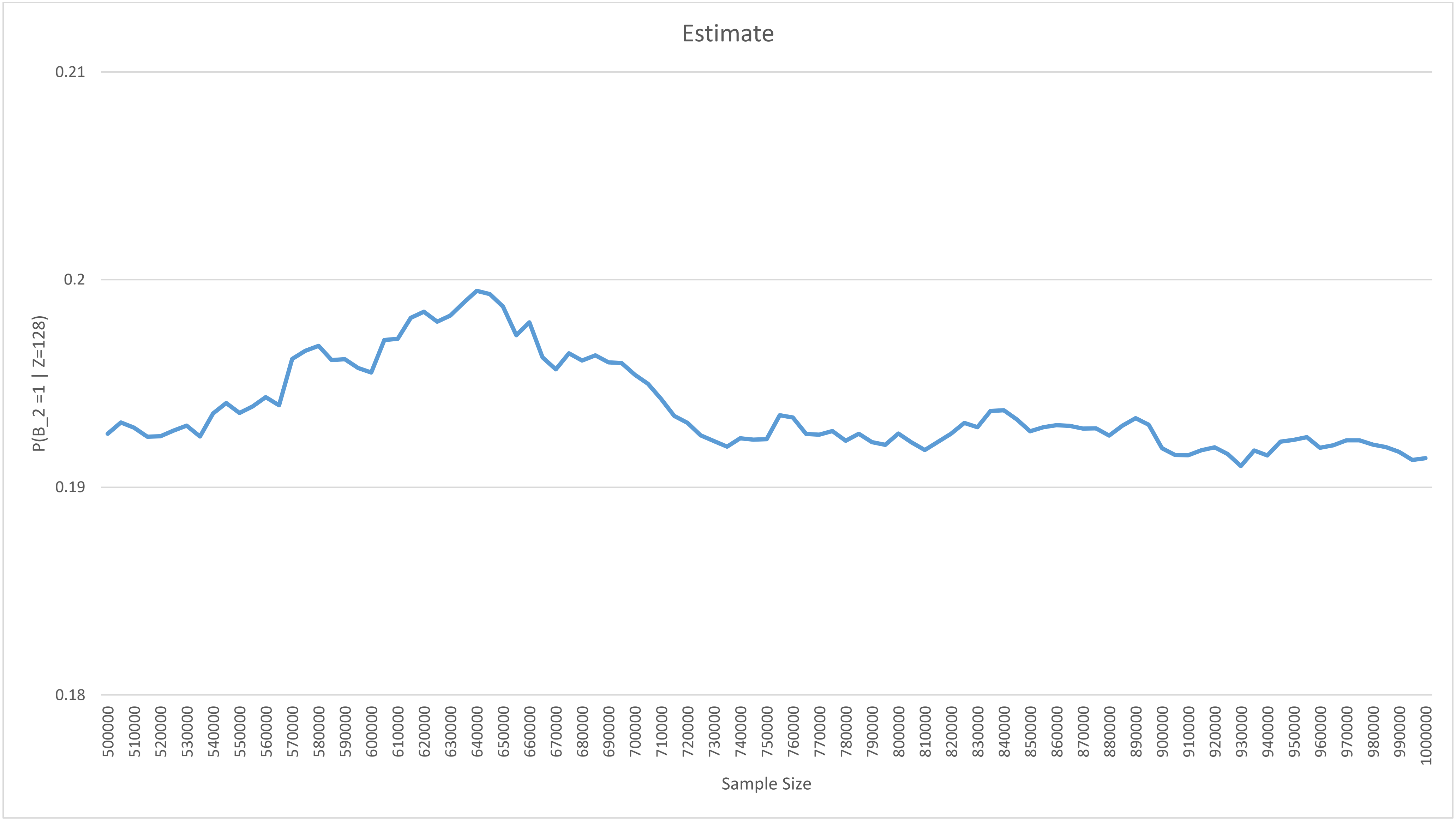
Estimate
0.21
0.2
0.19
0.18
P(B_2 =1 | Z=128)
500000
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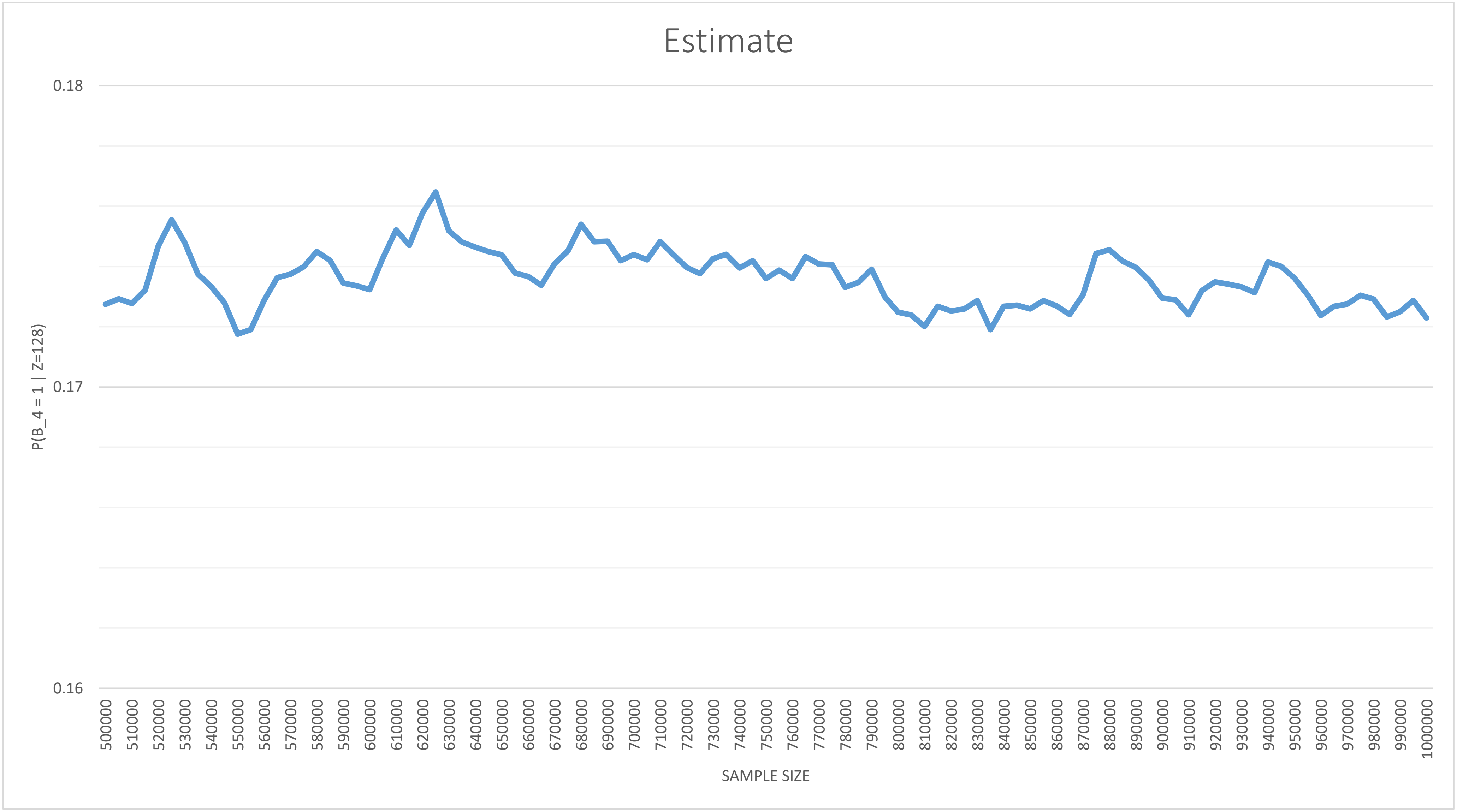
970000
980000
990000
1000000
Sample Size


Estimate
0.18
0.17
0.16
P(B_4 = 1 | Z=128)
SAMPLE SIZE
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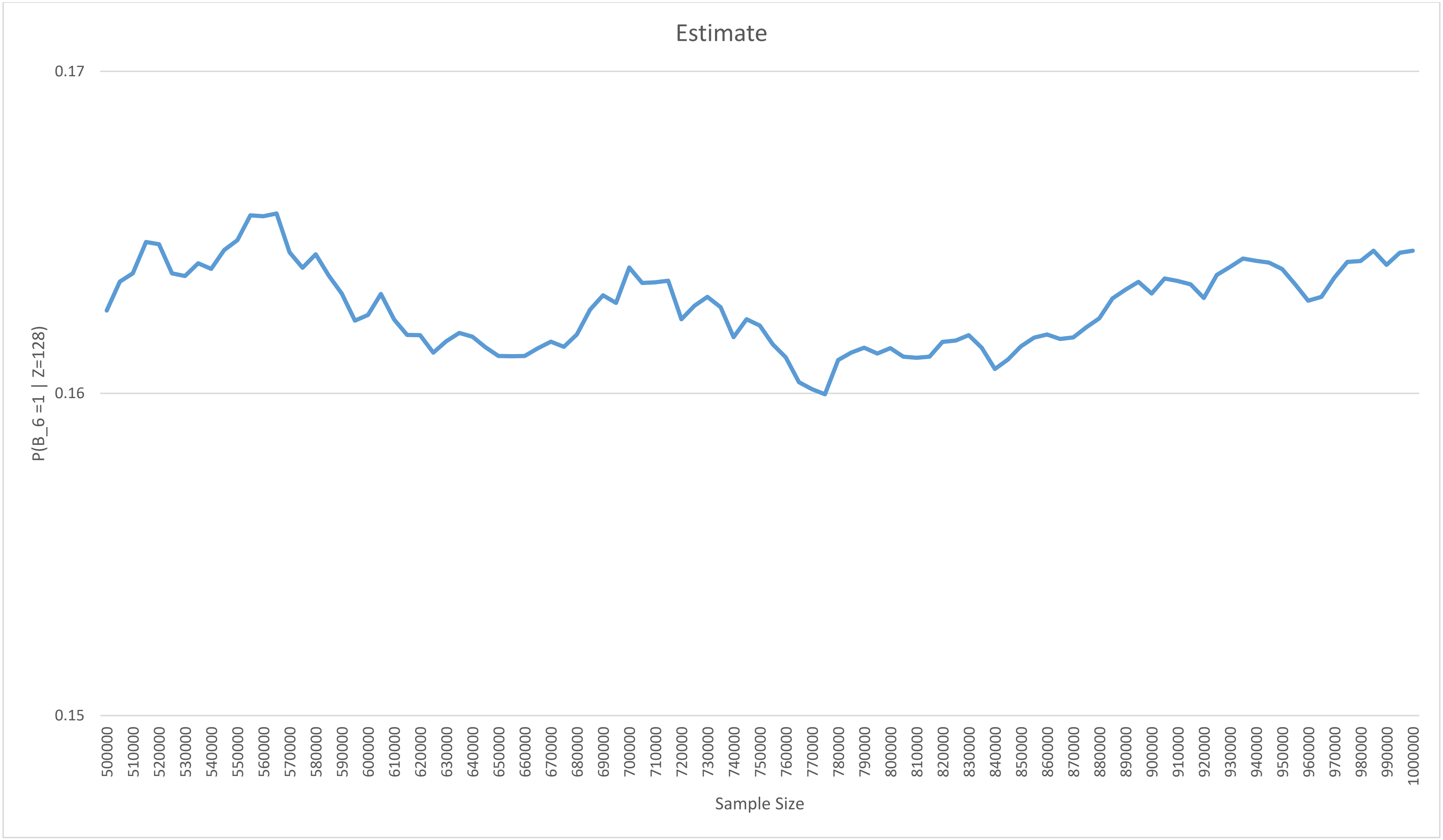
1000000


Estimate
0.17
0.16
0.15
P(B_6 =1 | Z=128)
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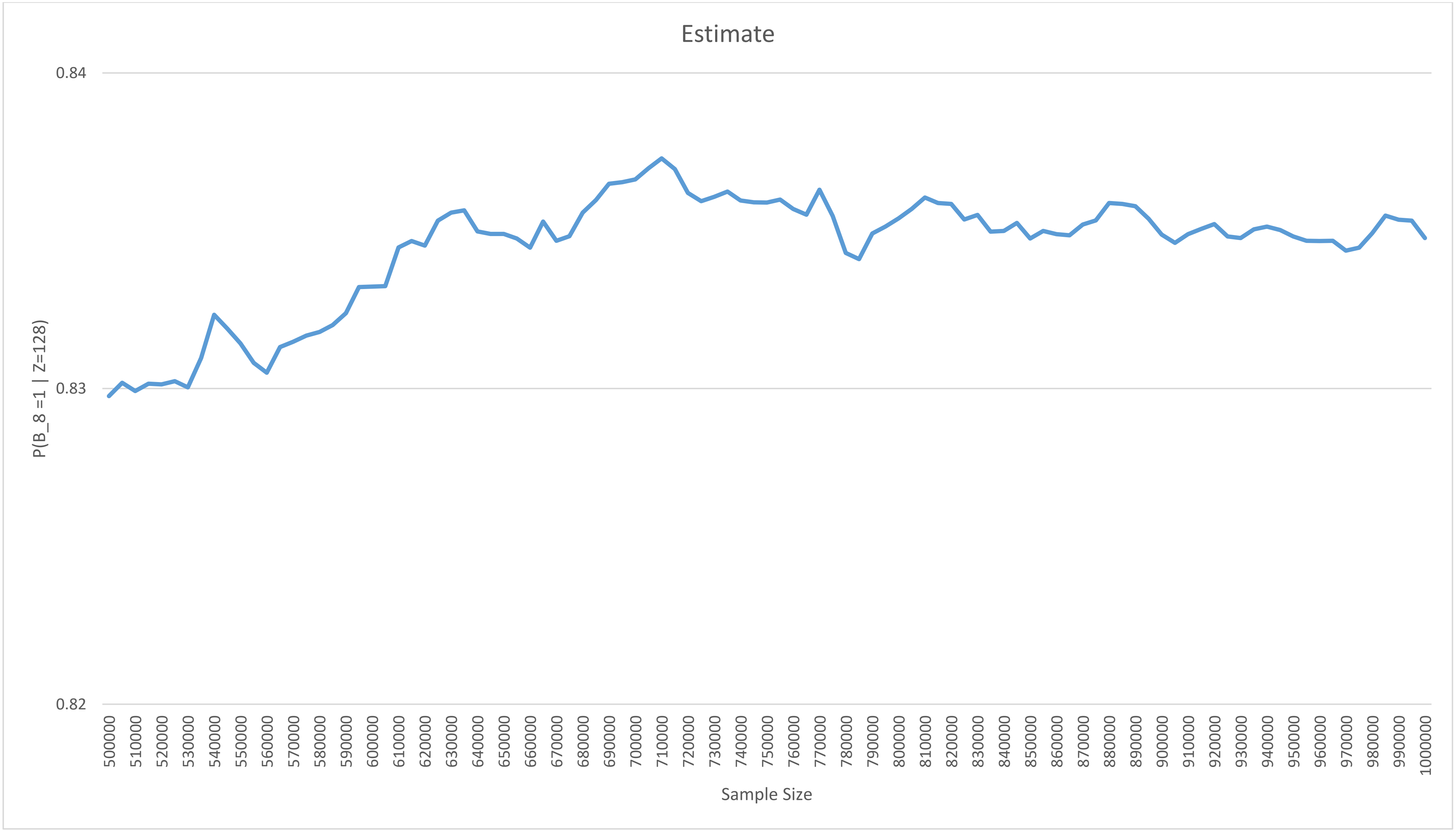
Sample Size


Estimate
0.84
0.83
0.82
P(B_8 =1 | Z=128)
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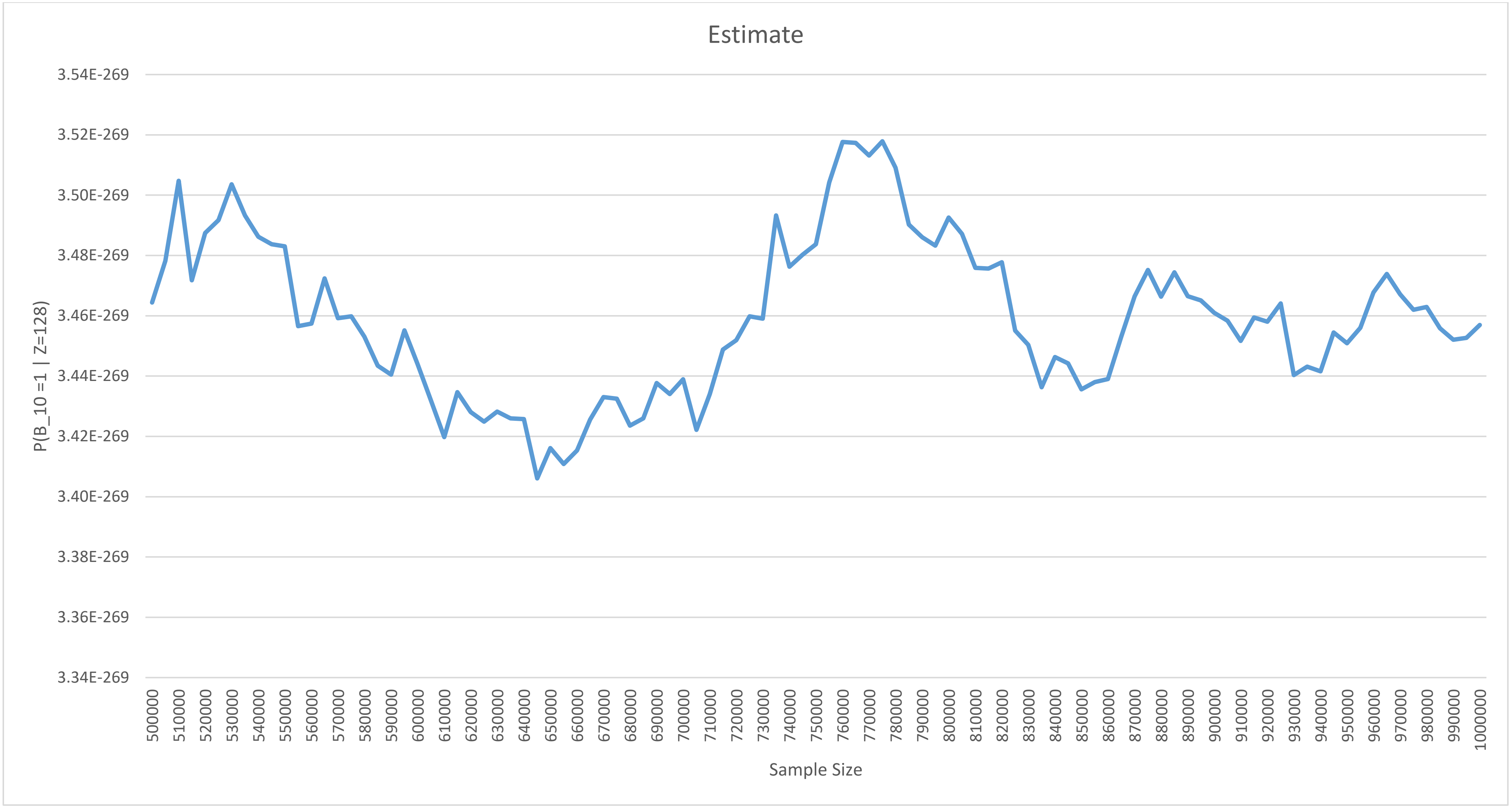
Sample Size


Estimate
3.54E-269
3.52E-269
3.50E-269
3.48E-269
3.46E-269
3.44E-269
3.42E-269
3.40E-269
3.38E-269
3.36E-269
3.34E-269
P(B_10 =1 | Z=128)
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990000
1000000
Sample Size