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ASSIGNMENT 3.6

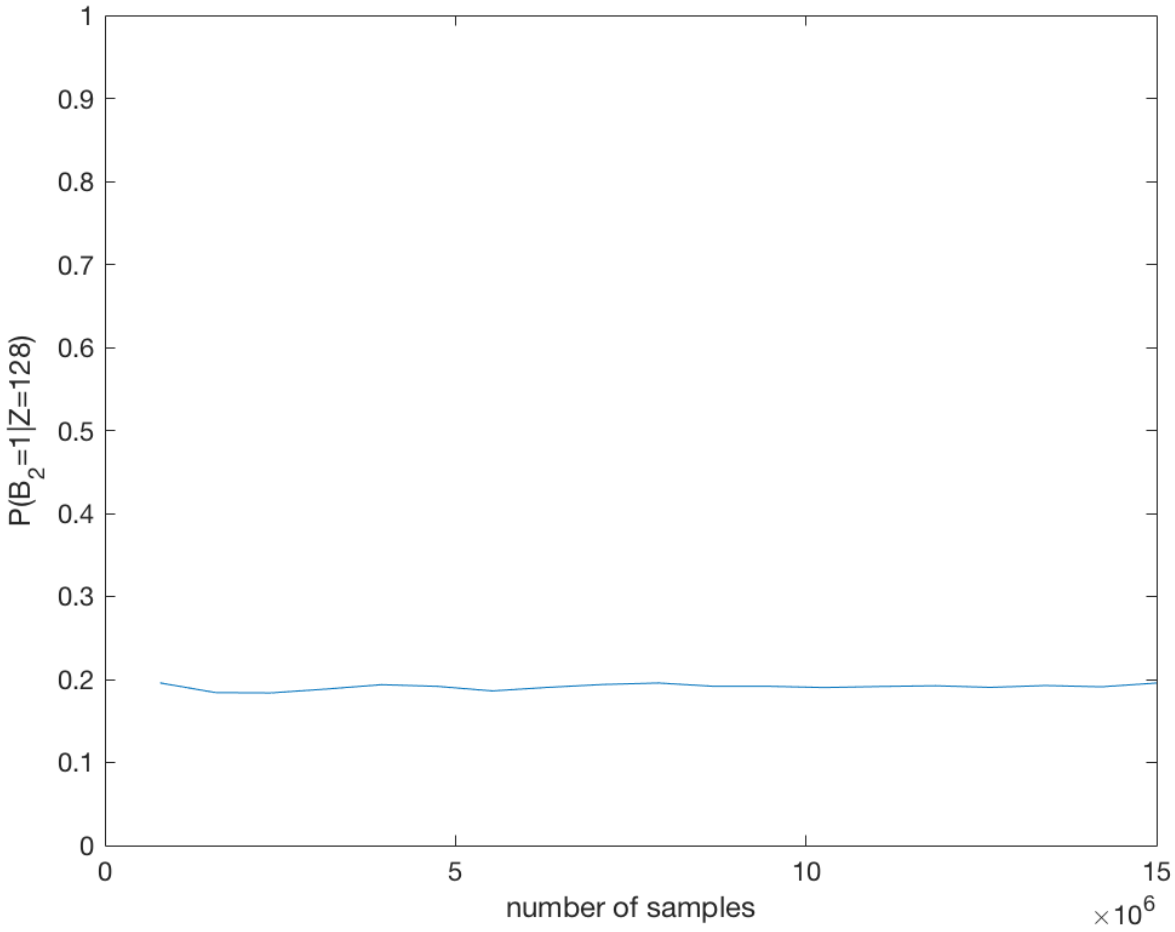

Figure 1: $i = 2,\ P(B_2|Z = 128) \approx 0.19$

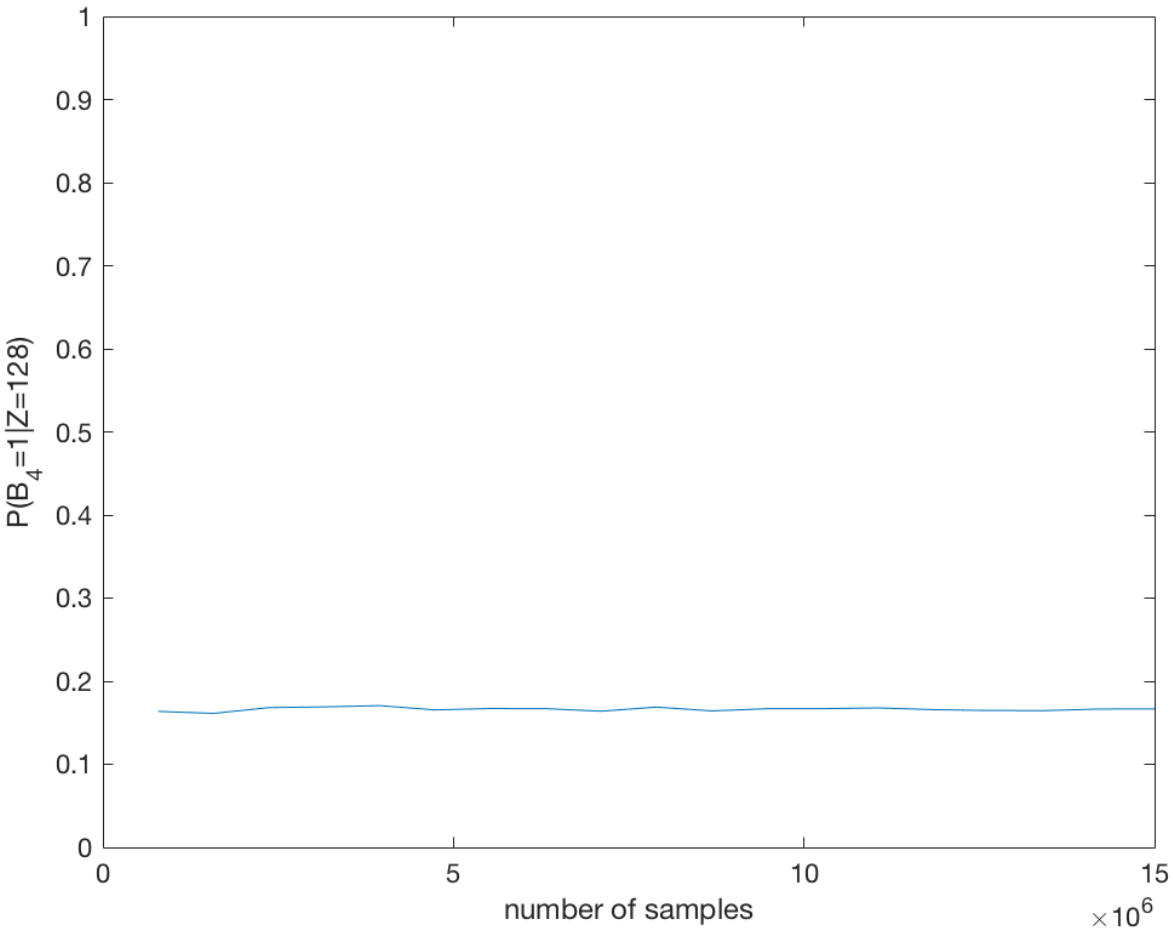

Figure 2: $i = 4,\ P(B_4|Z = 128) \approx 0.16$

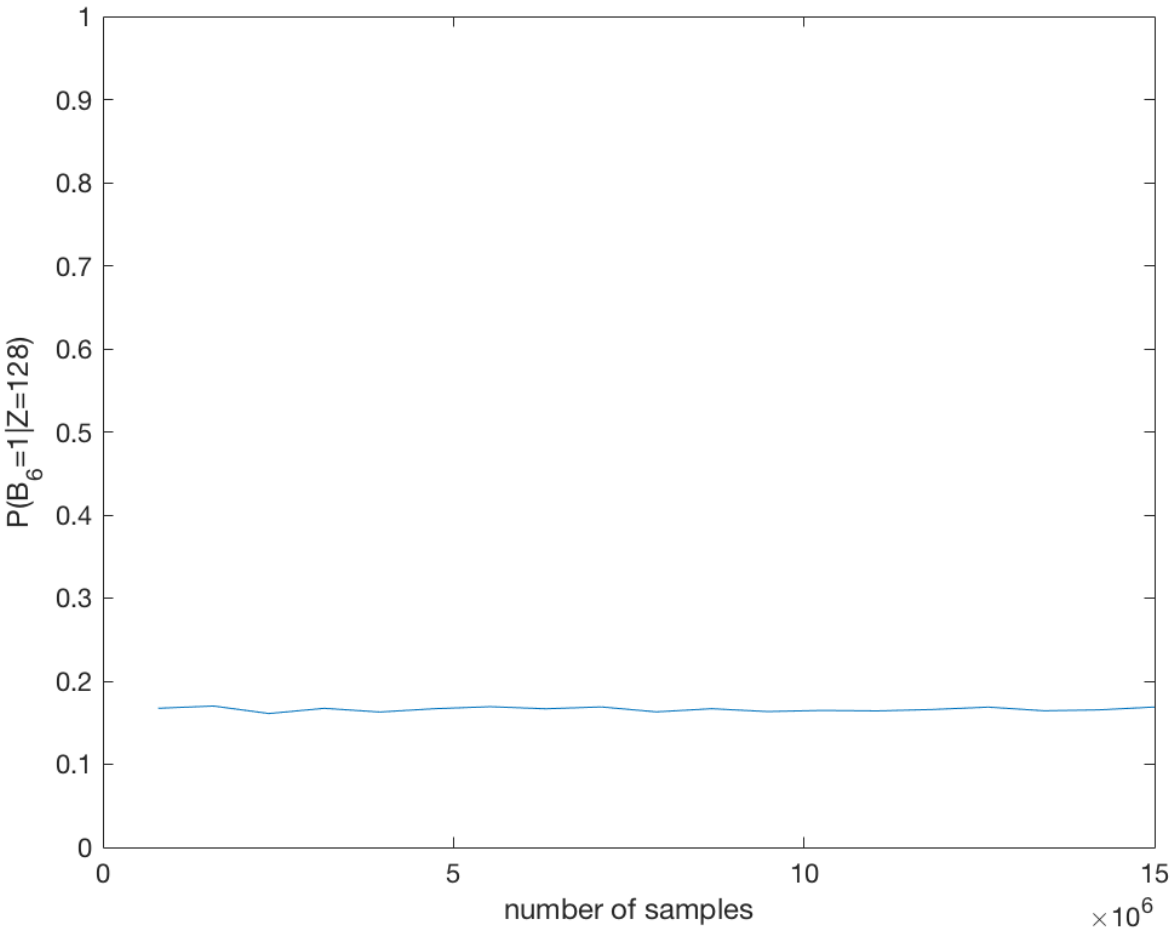

Figure 3: $i = 6,\ P(B_6|Z = 128) \approx 0.16$

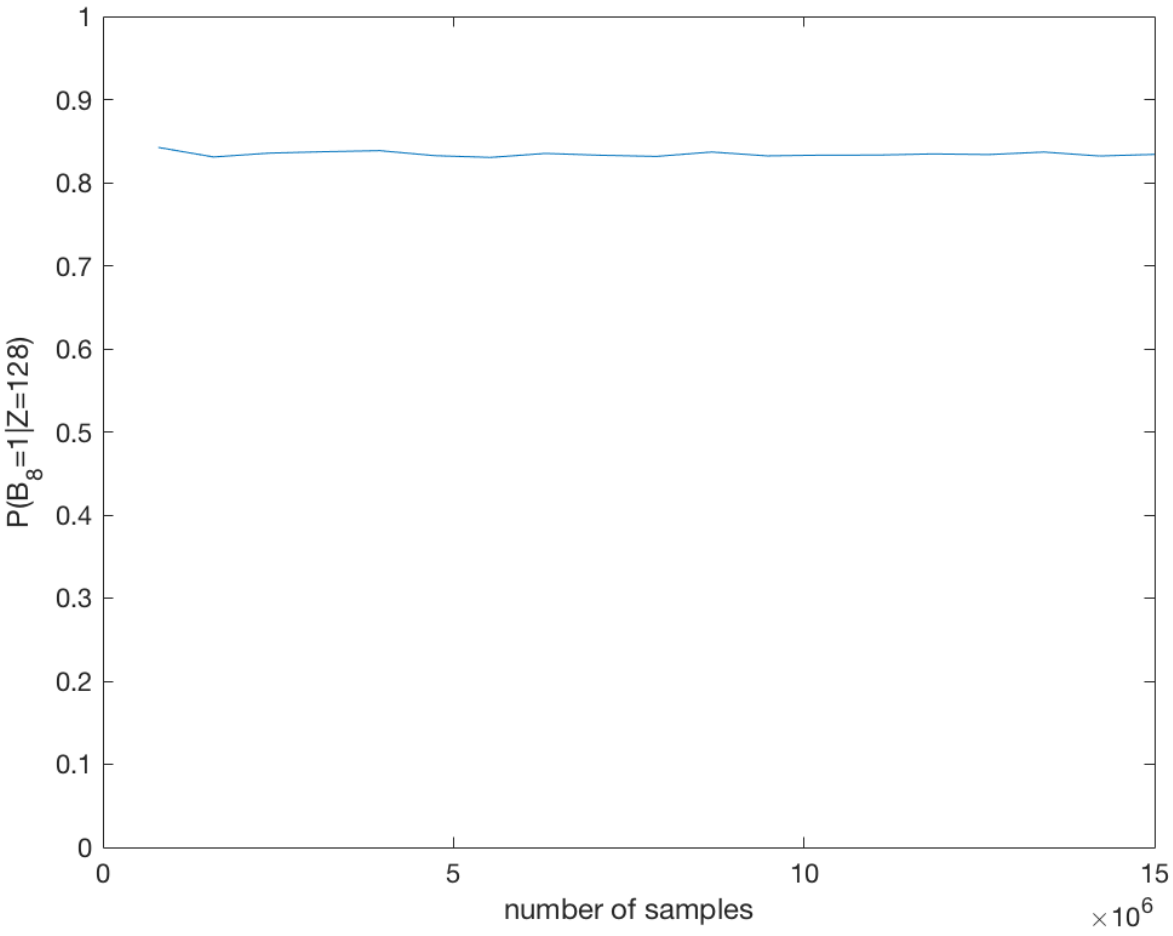

Figure 4: $i = 8,\ P(B_8|Z = 128) \approx 0.83$

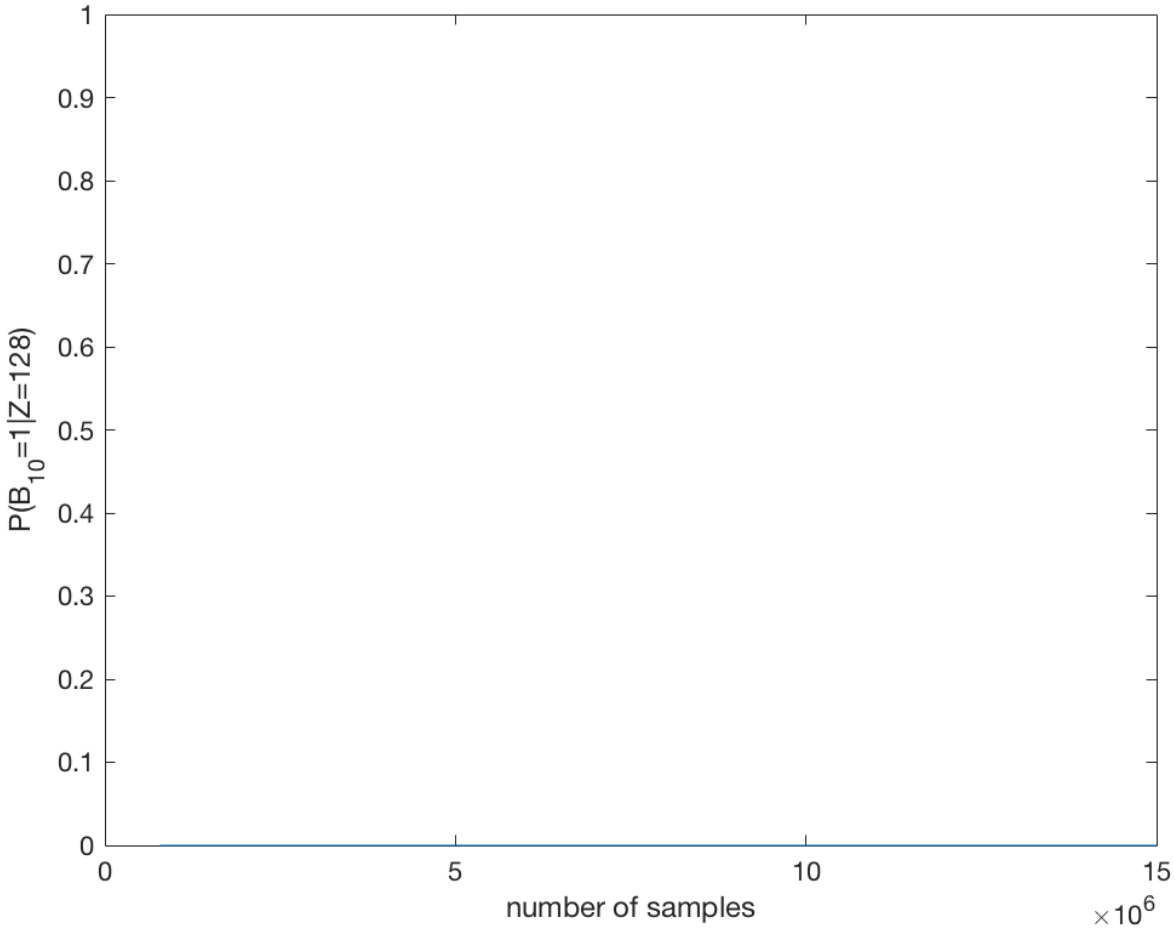

Figure 5: $i = 10,\ P(B_1 0|Z = 128) \approx 0.00$

1 Source Code

Listing 1: main.m

```
% assign i
i = 10; % i = 2,4,6,8,10

x = linspace(0, 15e6, 20);
y = zeros(1,20);
for j = 1:length(x)
    y(1,j) = LW(x(1,j), i);
end
figure;
plot(x, y);
axis([0 15e6 0 1]);
xlabel('number of samples');
ylabel('P(B_{10}=1|Z=128)');
```

Listing 2: LW.m

```
% calculate LW of P(Bi=1|Z=128) of N samples

function result = LW(N, i)

    % to generate N samples
    samples = Random(N);

    % calculate LW
    numerator = 0;
    denominator = 0;

    for row = 1:N
        sample = samples(row,:);
        numerator = numerator + Indicator(sample, i) * Probability(sample);
        denominator = denominator + Probability(sample);
    end

    result = numerator/denominator;
end
```

Listing 3: Probability.m

```
% probability P(Z|B1, B2, ..., Bn)
% sample is B1, B2, ..., Bn, 1*n

function P_Z = Probability(sample)
    Z = 128;
```

```
6       noise = 0.2;
7
8       % calculate f(B) of Bn...B1
9       f_B = 0;
10      for i = 1:length(sample)
11          f_B = f_B + 2^(10-i) * sample(1, i);
12      end
13
14      % calculate P(Z|B1, B2, ..., Bn)
15      P_Z = noise^(abs(Z - f_B)) * (1-noise) / (1+noise);
16  end
```

Listing 4: Random.m

```
1  % to generate N random samples
2
3  function samples = Random(N)
4      samples = zeros(round(N), 10);
5      for row = 1:N
6          temp = int8(rand(1,10));
7          samples(row, :) = temp;
8      end
9  end
```

Listing 5: Indicator.m

```
1  % Indicator I(q, q_i)
2
3  function I = Indicator(sample, i)
4      if sample(1, 10-i+1) == 1
5          I = 1;
6      else
7          I = 0;
8      end
9  end
```

Submitted by Xiaowen Mao on Oct 18.