PROJECT 1

ECE-519

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LDPC ENCODING

An 'N' bit LDPC can be defined by using 'M' parity check equations

Where M – Number of parity check equations.

N – Number of code word bits.

These M parity check equations are represented with the help of a MxN matrix called the parity check matrix H.

Let us understand the above with the help of an example,

Consider a 6 bit long code word Cn = { C1,C2,C3,C4,C5,C6} with corresponding H matrix. The parity check equations are given as:-

$C1 \oplus C2 \oplus C5 = 0$;

$C1 \oplus C4 \oplus C6 = 0$;

$C1 \oplus C2 \oplus C3 \oplus C6 = 0$

If the number of weights that is the number of ones in the rows and columns of the parity check matrix are same, then the matrix is called regular parity check matric if not it is referred to as a non- regular check matrix.

Next step is to get the H matrix in the systematic form so as to get the generator matrix to construct the code word dictionary so now to get the H matrix in the systematic form we need to use the usual matrix manipulation techniques to get the matrix in the form H(systematic)= [IM|Pmxk] where K = N-M for a (N,M) LDPC code. This systematic form is then used to form the generator matrix 'G' which is of the form G = [PTkxm|Ik]. This generator matrix can be used to generate the code and thereby generate the code dictionary which will have to be transmitted. This generator matrix can be cross verified by using the relation G*H'=0.

LDPC DECODING

We cannot use conventional maximum likelihood detector due to the non-deterministic nature of the polynomial. Therefore it fails with maximum likelihood, other decoding methods such as belief propagation which is a sub optimal decoding algorithm, works well because each of the parity check bits of the LDPC can be treated as a separate entity and can be decoded.

In belief propagation, the nodes values are constantly sent back and forth from the check nodes to the bit nodes repeatedly for every iteration and finally they arrive at the constant value. The fact that we use soft decoding instead of hard decoding means that the values are computed after many successive iterations.

```
clc;
clear;
C=input('Enter the received codeword'); % receive the code word from the user
H=input('Enter the H matrix'); %get the H matrix from the user
variance=input('Enter the variance of the channel'); %input the variance
[nk,n]=size(H);[w,t]=size(variance);
q1=zeros(n,nk);q0=zeros(n,nk);
r1=zeros(nk,n);r0=zeros(nk,n);
w=1;
while(w<t+1)
%computing the initial q value
for j=1:nk
    for i=1:n
        p(1,i)=1/(1+exp(2*C(1,i)/variance(1,w)));
        if(H(j,i)==1)
            q0(i,j)=p(1,i);
            q1(i,j)=1-p(1,i);
        end
    end
end
iteration=1;
display(p);
while(iteration<8)
    fprintf('Iteration number %d\n',iteration);
    fprintf('Variance %d',variance(1,w));
    %computing the values of r
    for i=1:n
        for j=1:nk
            if(H(j,i)==1)
                iprime=1;z=1;
                while(iprime<n+1)
                    if((iprime~=i))
                        z=z*(1-2*q0(iprime,j));
                    end
                    iprime=iprime+1;
                end
                r1(j,i)=0.5+0.5*z;
                r0(j,i)=1-r1(j,i);
            end
        end
    end
    display(q0);
    display(q1);
    display(r1);
    display(r0);
    %computing the new value of q for the next iteration
    for i=1:n
        for j=1:nk
            if(H(j,i)==1)
                jprime=1;z1=1;z2=1;
                while(jprime<nk+1)
                    if((jprime~=j)&&H(jprime,i)==1)
                        z1=z1*r1(jprime,i);
                        z2=z2*r0(jprime,i);
                    end
                    jprime=jprime+1;
                end
                qtemp1(i,j)=(1-p(1,i))*z1;
                qtemp0(i,j)=p(1,i)*z2;
```

```
                sum=qtemp1(i,j)+qtemp0(i,j);
                q1(i,j)=qtemp1(i,j)/(sum);
                q0(i,j)=qtemp0(i,j)/(sum);
            end
        end
    end
%computing Q value and the code word.
    for i=1:n
        z1=1;z2=1;
        for j=1:nk
            if(H(j,i)==1)
                z1=z1*r1(j,i);
                z2=z2*r0(j,i);
            end
            Q0(1,i)=(1-p(1,i))*z1;
            Q1(1,i)=p(1,i)*z2;
            sum=Q1(1,i)+Q0(1,i);
            Q1(1,i)=Q1(1,i)/sum;
            Q0(1,i)=Q0(1,i)/sum;
        end
        if(Q1(1,i)>Q0(1,i))
            output(1,i)=1;
        elseif(Q1(1,i)<Q0(1,i))
            output(1,i)=0;
        end
    end
    ans(iteration,:)=output;
    display(Q0);display(Q1);display(output); %displaying the output code word
    %outputsize=size(ans);
    if(iteration>2)
            if(ans(iteration,:)==ans(iteration-1,:))
                fprintf('It took %d number of iterations',iteration);
                %iteration=9;
                break;
            end
    end
    if((output*(H'))==0)
            break;
    else
            iteration=iteration+1;
    end
end
w=w+1;
end
```

Published with MATLAB® R2014b

```
Enter the received codeword[-0.4 -0.2 -1.1 0.6 -0.5 0.5 -0.4 -1.2 0.5 -0.2 -1 0.5]
Enter the H matrix[1 1 1 0 0 0 0 0 0 0 0 0; 0 0 0 1 1 1 0 0 0 0 0 0; 1 0 0 1 0 0 1 0 0 ↙
0 0 0; 0 1 0 0 1 0 0 1 0 0 0 0]
Enter the variance of the channel[0.10 0.15 0.20 0.25]

p =

    0.9997    0.9820    1.0000    0.0000    1.0000    0.0000    0.9997    1.0000 ↙
0.0000    0.9820    1.0000    0.0000

Iteration number 1
Variance 1.000000e-01
q0 =

    0.9997         0    0.9997         0
    0.9820         0         0    0.9820
    1.0000         0         0         0
         0    0.0000    0.0000         0
         0    1.0000         0    1.0000
         0    0.0000         0         0
         0         0    0.9997         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0003         0    0.0003         0
    0.0180         0         0    0.0180
    0.0000         0         0         0
         0    1.0000    1.0000         0
         0    0.0000         0    0.0000
         0    1.0000         0         0
         0         0    0.0003         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.9820    0.9997    0.9817         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0001    0.9999    0.0001         0         0 ↙
0         0         0         0
    0.0003         0         0    0.9993         0         0    0.0003         0 ↙
0         0         0         0
         0    1.0000         0         0    0.9820         0         0    0.9820 ↙
0         0         0         0
```

```
r0 =

    0.0180    0.0003    0.0183         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9999    0.0001    0.9999         0         0 ↙
0         0         0         0
    0.9997         0         0    0.0007         0         0    0.9997         0 ↙
0         0         0         0
         0    0.0000         0         0    0.0180         0         0    0.0180 ↙
0         0         0         0


Q0 =

    0.0000    1.0000    0.0000    1.0000    0.9796    0.5317    0.0000    0.0000 ↙
1.0000    0.0180    0.0000    1.0000


Q1 =

    1.0000    0.0000    1.0000    0.0000    0.0204    0.4683    1.0000    1.0000 ↙
0.0000    0.9820    1.0000    0.0000


output =

     1     0     1     0     0     0     1     1     0     1     1     0

Iteration number 2
Variance 1.000000e-01
q0 =

    1.0000         0    0.9820         0
    0.0025         0         0    0.0180
    1.0000         0         0         0
         0    0.0000    0.0634         0
         0    0.9975         0    0.5317
         0    0.0000         0         0
         0         0    0.9997         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0000         0    0.0180         0
    0.9975         0         0    0.9820
    0.0000         0         0         0
         0    1.0000    0.9366         0
         0    0.0025         0    0.4683
         0    1.0000         0         0
```

```
         0         0    0.0003         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.0025    1.0000    0.0025         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0025    1.0000    0.0025         0         0 ↙
0         0         0         0
    0.0637         0         0    0.9817         0         0    0.0791         0 ↙
0         0         0         0
         0    0.5317         0         0    0.0180         0         0    0.4695 ↙
0         0         0         0


r0 =

    0.9975    0.0000    0.9975         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9975    0.0000    0.9975         0         0 ↙
0         0         0         0
    0.9363         0         0    0.0183         0         0    0.9209         0 ↙
0         0         0         0
         0    0.4683         0         0    0.9820         0         0    0.5305 ↙
0         0         0         0


Q0 =

    0.0000    1.0000    0.0000    1.0000    0.0180    0.9820    0.0000    0.0000 ↙
1.0000    0.0180    0.0000    1.0000


Q1 =

    1.0000    0.0000    1.0000    0.0000    0.9820    0.0180    1.0000    1.0000 ↙
0.0000    0.9820    1.0000    0.0000


output =

     1     0     1     0     1     0     1     1     0     1     1     0

Iteration number 3
Variance 1.000000e-01
q0 =

    1.0000         0    1.0000         0
    0.9796         0         0    0.0000
    1.0000         0         0         0
```

```
         0    0.0000    0.0024         0
         0    1.0000         0    0.5000
         0    0.0000         0         0
         0         0    0.9997         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

```
q1 =

    0.0000         0    0.0000         0
    0.0204         0         0    1.0000
    0.0000         0         0         0
         0    1.0000    0.9976         0
         0    0.0000         0    0.5000
         0    1.0000         0         0
         0         0    0.0003         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

```
r1 =

    0.9796    1.0000    0.9796         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0000    1.0000    0.0000         0         0 ↙
0         0         0         0
    0.0028         0         0    0.9997         0         0    0.0024         0 ↙
0         0         0         0
         0    0.5000         0         0    0.0000         0         0    0.5000 ↙
0         0         0         0
```

```
r0 =

    0.0204    0.0000    0.0204         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    1.0000    0.0000    1.0000         0         0 ↙
0         0         0         0
    0.9972         0         0    0.0003         0         0    0.9976         0 ↙
0         0         0         0
         0    0.5000         0         0    1.0000         0         0    0.5000 ↙
0         0         0         0
```

```
Q0 =

    0.0000    0.9988    0.0000    1.0000    0.0000    0.0204    0.0000    0.0000 ↙
1.0000    0.0180    0.0000    1.0000
```

```
Q1 =

    1.0000    0.0012    1.0000    0.0000    1.0000    0.9796    1.0000    1.0000 ↙
0.0000    0.9820    1.0000    0.0000


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 4
Variance 1.000000e-01
q0 =

    1.0000         0    0.9841         0
    0.9820         0         0    0.0012
    1.0000         0         0         0
         0    0.0000    0.1173         0
         0    1.0000         0    0.5006
         0    0.0000         0         0
         0         0    0.9997         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0000         0    0.0159         0
    0.0180         0         0    0.9988
    0.0000         0         0         0
         0    1.0000    0.8827         0
         0    0.0000         0    0.4994
         0    1.0000         0         0
         0         0    0.0003         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.9820    1.0000    0.9820         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0000    1.0000    0.0000         0         0 ↙
0         0         0         0
    0.1176         0         0    0.9838         0         0    0.1295         0 ↙
0         0         0         0
         0    0.5006         0         0    0.0012         0         0    0.4994 ↙
```

```
0         0         0         0


r0 =

    0.0180    0.0000    0.0180         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    1.0000    0.0000    1.0000         0         0 ↙
0         0         0         0
    0.8824         0         0    0.0162         0         0    0.8705         0 ↙
0         0         0         0
         0    0.4994         0         0    0.9988         0         0    0.5006 ↙
0         0         0         0


Q0 =

    0.0024    0.9999    0.0000    0.9978    0.0012    0.0001    0.0000    0.0000 ↙
1.0000    0.0180    0.0000    1.0000


Q1 =

    0.9976    0.0001    1.0000    0.0022    0.9988    0.9999    1.0000    1.0000 ↙
0.0000    0.9820    1.0000    0.0000


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 5
Variance 1.000000e-01
q0 =

    1.0000         0    0.9820         0
    0.9820         0         0    0.0001
    1.0000         0         0         0
         0    0.0000    0.1192         0
         0    1.0000         0    0.5000
         0    0.0000         0         0
         0         0    0.9997         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0000         0    0.0180         0
    0.0180         0         0    0.9999
    0.0000         0         0         0
         0    1.0000    0.8808         0
```

```
         0    0.0000         0    0.5000
         0    1.0000         0         0
         0         0    0.0003         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.9820    1.0000    0.9819         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0000    1.0000    0.0000         0         0 ↙
0         0         0         0
    0.1195         0         0    0.9817         0         0    0.1329         0 ↙
0         0         0         0
         0    0.5000         0         0    0.0001         0         0    0.5000 ↙
0         0         0         0


r0 =

    0.0180    0.0000    0.0181         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    1.0000    0.0000    1.0000         0         0 ↙
0         0         0         0
    0.8805         0         0    0.0183         0         0    0.8671         0 ↙
0         0         0         0
         0    0.5000         0         0    0.9999         0         0    0.5000 ↙
0         0         0         0


Q0 =

    0.0025    0.9976    0.0000    0.9975    0.0001    0.0035    0.0001    0.0000 ↙
1.0000    0.0180    0.0000    1.0000


Q1 =

    0.9975    0.0024    1.0000    0.0025    0.9999    0.9965    0.9999    1.0000 ↙
0.0000    0.9820    1.0000    0.0000


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 6
Variance 1.000000e-01
q0 =

    1.0000         0    0.9821         0
```

```
    0.9820         0         0    0.0024
    1.0000         0         0         0
         0    0.0000    0.1191         0
         0    1.0000         0    0.5006
         0    0.0000         0         0
         0         0    0.9997         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

q1 =

```
    0.0000         0    0.0179         0
    0.0180         0         0    0.9976
    0.0000         0         0         0
         0    1.0000    0.8809         0
         0    0.0000         0    0.4994
         0    1.0000         0         0
         0         0    0.0003         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

r1 =

```
    0.9820    1.0000    0.9820         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0000    1.0000    0.0000         0         0 ↙
0         0         0         0
    0.1193         0         0    0.9817         0         0    0.1327         0 ↙
0         0         0         0
         0    0.5006         0         0    0.0024         0         0    0.4994 ↙
0         0         0         0
```

r0 =

```
    0.0180    0.0000    0.0180         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    1.0000    0.0000    1.0000         0         0 ↙
0         0         0         0
    0.8807         0         0    0.0183         0         0    0.8673         0 ↙
0         0         0         0
         0    0.4994         0         0    0.9976         0         0    0.5006 ↙
0         0         0         0
```

Q0 =

```
    0.0025    0.9975    0.0000    0.9975    0.0024    0.0026    0.0001    0.0000 ↙
1.0000    0.0180    0.0000    1.0000


Q1 =

    0.9975    0.0025    1.0000    0.0025    0.9976    0.9974    0.9999    1.0000 ↙
0.0000    0.9820    1.0000    0.0000


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 7
Variance 1.000000e-01
q0 =

    1.0000         0    0.9820         0
    0.9820         0         0    0.0025
    1.0000         0         0         0
         0    0.0000    0.1192         0
         0    1.0000         0    0.5006
         0    0.0000         0         0
         0         0    0.9997         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0000         0    0.0180         0
    0.0180         0         0    0.9975
    0.0000         0         0         0
         0    1.0000    0.8808         0
         0    0.0000         0    0.4994
         0    1.0000         0         0
         0         0    0.0003         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.9820    1.0000    0.9819         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0000    1.0000    0.0000         0         0 ↙
0         0         0         0
    0.1195         0         0    0.9817         0         0    0.1329         0 ↙
```

```
0         0         0         0
         0    0.5006         0         0    0.0025         0         0    0.4994 ↙
0         0         0         0


r0 =

    0.0180    0.0000    0.0181         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    1.0000    0.0000    1.0000         0         0 ↙
0         0         0         0
    0.8805         0         0    0.0183         0         0    0.8671         0 ↙
0         0         0         0
         0    0.4994         0         0    0.9975         0         0    0.5006 ↙
0         0         0         0


Q0 =

    0.0025    0.9975    0.0000    0.9975    0.0025    0.0049    0.0001    0.0000 ↙
1.0000    0.0180    0.0000    1.0000


Q1 =

    0.9975    0.0025    1.0000    0.0025    0.9975    0.9951    0.9999    1.0000 ↙
0.0000    0.9820    1.0000    0.0000


output =

     1     0     1     0     1     1     1     1     0     1     1     0


p =

    0.9952    0.9350    1.0000    0.0003    0.9987    0.0013    0.9952    1.0000 ↙
0.0013    0.9350    1.0000    0.0013

Iteration number 1
Variance 1.500000e-01
q0 =

    0.9952         0    0.9952         0
    0.9350         0         0    0.9350
    1.0000         0         0         0
         0    0.0003    0.0003         0
         0    0.9987         0    0.9987
         0    0.0013         0         0
         0         0    0.9952         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

```
q1 =

    0.0048         0    0.0048         0
    0.0650         0         0    0.0650
    0.0000         0         0         0
         0    0.9997    0.9997         0
         0    0.0013         0    0.0013
         0    0.9987         0         0
         0         0    0.0048         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0

r1 =

    0.9350    0.9952    0.9309         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0025    0.9984    0.0016         0         0 ↙
0         0         0         0
    0.0051         0         0    0.9904         0         0    0.0051         0 ↙
0         0         0         0
         0    0.9987         0         0    0.9350         0         0    0.9339 ↙
0         0         0         0

r0 =

    0.0650    0.0048    0.0691         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9975    0.0016    0.9984         0         0 ↙
0         0         0         0
    0.9949         0         0    0.0096         0         0    0.9949         0 ↙
0         0         0         0
         0    0.0013         0         0    0.0650         0         0    0.0661 ↙
0         0         0         0

Q0 =

    0.0004    0.9999    0.0000    0.9987    0.9193    0.5582    0.0000    0.0000 ↙
0.9987    0.0650    0.0000    0.9987

Q1 =

    0.9996    0.0001    1.0000    0.0013    0.0807    0.4418    1.0000    1.0000 ↙
0.0013    0.9350    1.0000    0.0013

output =
```

```
     1     0     1     0     0     0     1     1     0     1     1     0

Iteration number 2
Variance 1.500000e-01
q0 =

    1.0000         0    0.9350         0
    0.0180         0         0    0.0650
    1.0000         0         0         0
         0    0.0000    0.1165         0
         0    0.9820         0    0.5582
         0    0.0013         0         0
         0         0    0.9952         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0000         0    0.0650         0
    0.9820         0         0    0.9350
    0.0000         0         0         0
         0    1.0000    0.8835         0
         0    0.0180         0    0.4418
         0    0.9987         0         0
         0         0    0.0048         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.0180    1.0000    0.0180         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0192    0.9987    0.0180         0         0 ↙
0         0         0         0
    0.1201         0         0    0.9309         0         0    0.1663         0 ↙
0         0         0         0
         0    0.5582         0         0    0.0650         0         0    0.4493 ↙
0         0         0         0


r0 =

    0.9820    0.0000    0.9820         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9808    0.0013    0.9820         0         0 ↙
0         0         0         0
```

```
    0.8799         0         0    0.0691         0         0    0.8337         0 ↙
0         0         0         0
         0    0.4418         0         0    0.9350         0         0    0.5507 ↙
0         0         0         0


Q0 =

    0.0000    0.9997    0.0000    0.9987    0.0648    0.9350    0.0010    0.0000 ↙
0.9987    0.0650    0.0000    0.9987


Q1 =

    1.0000    0.0003    1.0000    0.0013    0.9352    0.0650    0.9990    1.0000 ↙
0.0013    0.9350    1.0000    0.0013


output =

     1     0     1     0     1     0     1     1     0     1     1     0

Iteration number 3
Variance 1.500000e-01
q0 =

    0.9993         0    0.9999         0
    0.9193         0         0    0.0004
    1.0000         0         0         0
         0    0.0000    0.0168         0
         0    0.9999         0    0.5006
         0    0.0013         0         0
         0         0    0.9952         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0007         0    0.0001         0
    0.0807         0         0    0.9996
    0.0000         0         0         0
         0    1.0000    0.9832         0
         0    0.0001         0    0.4994
         0    0.9987         0         0
         0         0    0.0048         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

```
r1 =

    0.9193    0.9993    0.9187         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0014    0.9987    0.0001         0         0 ↙
0         0         0         0
    0.0215         0         0    0.9951         0         0    0.0169         0 ↙
0         0         0         0
         0    0.5006         0         0    0.0004         0         0    0.4994 ↙
0         0         0         0


r0 =

    0.0807    0.0007    0.0813         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9986    0.0013    0.9999         0         0 ↙
0         0         0         0
    0.9785         0         0    0.0049         0         0    0.9831         0 ↙
0         0         0         0
         0    0.4994         0         0    0.9996         0         0    0.5006 ↙
0         0         0         0


Q0 =

    0.0012    0.9906    0.0000    0.9988    0.0004    0.0818    0.0001    0.0000 ↙
0.9987    0.0650    0.0000    0.9987


Q1 =

    0.9988    0.0094    1.0000    0.0012    0.9996    0.9182    0.9999    1.0000 ↙
0.0013    0.9350    1.0000    0.0013


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 4
Variance 1.500000e-01
q0 =

    0.9999         0    0.9479         0
    0.9349         0         0    0.0094
    1.0000         0         0         0
         0    0.0000    0.1977         0
         0    1.0000         0    0.5048
         0    0.0013         0         0
         0         0    0.9952         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
```

```
         0         0         0         0
         0         0         0         0


q1 =

    0.0001         0    0.0521         0
    0.0651         0         0    0.9906
    0.0000         0         0         0
         0    1.0000    0.8023         0
         0    0.0000         0    0.4952
         0    0.9987         0         0
         0         0    0.0048         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.9349    0.9999    0.9348         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0013    0.9987    0.0000         0         0 ↙
0         0         0         0
    0.2006         0         0    0.9436         0         0    0.2292         0 ↙
0         0         0         0
         0    0.5048         0         0    0.0094         0         0    0.4952 ↙
0         0         0         0


r0 =

    0.0651    0.0001    0.0652         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9987    0.0013    1.0000         0         0 ↙
0         0         0         0
    0.7994         0         0    0.0564         0         0    0.7708         0 ↙
0         0         0         0
         0    0.4952         0         0    0.9906         0         0    0.5048 ↙
0         0         0         0


Q0 =

    0.0171    0.9985    0.0000    0.9845    0.0094    0.0017    0.0014    0.0000 ↙
0.9987    0.0650    0.0000    0.9987


Q1 =

    0.9829    0.0015    1.0000    0.0155    0.9906    0.9983    0.9986    1.0000 ↙
0.0013    0.9350    1.0000    0.0013
```

```
output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 5
Variance 1.500000e-01
q0 =

    0.9988         0    0.9352         0
    0.9338         0         0    0.0015
    1.0000         0         0         0
         0    0.0000    0.2085         0
         0    1.0000         0    0.5003
         0    0.0013         0         0
         0         0    0.9952         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0012         0    0.0648         0
    0.0662         0         0    0.9985
    0.0000         0         0         0
         0    1.0000    0.7915         0
         0    0.0000         0    0.4997
         0    0.9987         0         0
         0         0    0.0048         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.9338    0.9988    0.9328         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0013    0.9987    0.0000         0         0 ↙
0         0         0         0
    0.2113         0         0    0.9310         0         0    0.2463         0 ↙
0         0         0         0
         0    0.5003         0         0    0.0015         0         0    0.4997 ↙
0         0         0         0


r0 =

    0.0662    0.0012    0.0672         0         0         0         0         0 ↙
0         0         0         0
```

```
         0         0         0    0.9987    0.0013    1.0000         0         0 ↙
0         0         0         0
    0.7887         0         0    0.0690         0         0    0.7537         0 ↙
0         0         0         0
         0    0.4997         0         0    0.9985         0         0    0.5003 ↙
0         0         0         0


Q0 =

    0.0179    0.9829    0.0000    0.9810    0.0015    0.0246    0.0016    0.0000 ↙
0.9987    0.0650    0.0000    0.9987


Q1 =

    0.9821    0.0171    1.0000    0.0190    0.9985    0.9754    0.9984    1.0000 ↙
0.0013    0.9350    1.0000    0.0013


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 6
Variance 1.500000e-01
q0 =

    0.9987         0    0.9362         0
    0.9350         0         0    0.0171
    1.0000         0         0         0
         0    0.0000    0.2071         0
         0    1.0000         0    0.5039
         0    0.0013         0         0
         0         0    0.9952         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0013         0    0.0638         0
    0.0650         0         0    0.9829
    0.0000         0         0         0
         0    1.0000    0.7929         0
         0    0.0000         0    0.4961
         0    0.9987         0         0
         0         0    0.0048         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

```
         0         0         0         0


r1 =

    0.9350    0.9987    0.9338         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0013    0.9987    0.0000         0         0 ↙
0         0         0         0
    0.2099         0         0    0.9320         0         0    0.2444         0 ↙
0         0         0         0
         0    0.5039         0         0    0.0171         0         0    0.4962 ↙
0         0         0         0


r0 =

    0.0650    0.0013    0.0662         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9987    0.0013    1.0000         0         0 ↙
0         0         0         0
    0.7901         0         0    0.0680         0         0    0.7556         0 ↙
0         0         0         0
         0    0.4961         0         0    0.9829         0         0    0.5038 ↙
0         0         0         0


Q0 =

    0.0181    0.9820    0.0000    0.9812    0.0168    0.0206    0.0016    0.0000 ↙
0.9987    0.0650    0.0000    0.9987


Q1 =

    0.9819    0.0180    1.0000    0.0188    0.9832    0.9794    0.9984    1.0000 ↙
0.0013    0.9350    1.0000    0.0013


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 7
Variance 1.500000e-01
q0 =

    0.9987         0    0.9351         0
    0.9341         0         0    0.0183
    1.0000         0         0         0
         0    0.0000    0.2084         0
         0    1.0000         0    0.5048
         0    0.0013         0         0
         0         0    0.9952         0
         0         0         0    1.0000
```

```
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0013         0    0.0649         0
    0.0659         0         0    0.9817
    0.0000         0         0         0
         0    1.0000    0.7916         0
         0    0.0000         0    0.4952
         0    0.9987         0         0
         0         0    0.0048         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.9341    0.9987    0.9330         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0013    0.9987    0.0000         0         0 ↙
0         0         0         0
    0.2112         0         0    0.9309         0         0    0.2462         0 ↙
0         0         0         0
         0    0.5048         0         0    0.0183         0         0    0.4953 ↙
0         0         0         0


r0 =

    0.0659    0.0013    0.0670         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9987    0.0013    1.0000         0         0 ↙
0         0         0         0
    0.7888         0         0    0.0691         0         0    0.7538         0 ↙
0         0         0         0
         0    0.4952         0         0    0.9817         0         0    0.5047 ↙
0         0         0         0


Q0 =

    0.0180    0.9822    0.0000    0.9811    0.0179    0.0354    0.0016    0.0000 ↙
0.9987    0.0650    0.0000    0.9987


Q1 =

    0.9820    0.0178    1.0000    0.0189    0.9821    0.9646    0.9984    1.0000 ↙
```

```
0.0013    0.9350    1.0000    0.0013


output =

     1     0     1     0     1     1     1     1     0     1     1     0


p =

    0.9820    0.8808    1.0000    0.0025    0.9933    0.0067    0.9820    1.0000 ↙
0.0067    0.8808    1.0000    0.0067

Iteration number 1
Variance 2.000000e-01
q0 =

    0.9820         0    0.9820         0
    0.8808         0         0    0.8808
    1.0000         0         0         0
         0    0.0025    0.0025         0
         0    0.9933         0    0.9933
         0    0.0067         0         0
         0         0    0.9820         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0180         0    0.0180         0
    0.1192         0         0    0.1192
    0.0000         0         0         0
         0    0.9975    0.9975         0
         0    0.0067         0    0.0067
         0    0.9933         0         0
         0         0    0.0180         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.8808    0.9820    0.8671         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0133    0.9909    0.0091         0         0 ↙
0         0         0         0
    0.0204         0         0    0.9647         0         0    0.0204         0 ↙
0         0         0         0
```

```
         0    0.9933         0         0    0.8808         0         0    0.8757 ↙
0         0         0         0


r0 =

    0.1192    0.0180    0.1329         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9867    0.0091    0.9909         0         0 ↙
0         0         0         0
    0.9796         0         0    0.0353         0         0    0.9796         0 ↙
0         0         0         0
         0    0.0067         0         0    0.1192         0         0    0.1243 ↙
0         0         0         0


Q0 =

    0.0028    0.9991    0.0001    0.9933    0.8438    0.5777    0.0004    0.0000 ↙
0.9933    0.1192    0.0000    0.9933


Q1 =

    0.9972    0.0009    0.9999    0.0067    0.1562    0.4223    0.9996    1.0000 ↙
0.0067    0.8808    1.0000    0.0067


output =

     1     0     1     0     0     0     1     1     0     1     1     0

Iteration number 2
Variance 2.000000e-01
q0 =

    0.9996         0    0.8808         0
    0.0475         0         0    0.1193
    1.0000         0         0         0
         0    0.0001    0.1554         0
         0    0.9526         0    0.5777
         0    0.0067         0         0
         0         0    0.9820         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0004         0    0.1192         0
    0.9525         0         0    0.8807
    0.0000         0         0         0
```

```
         0    0.9999    0.8446         0
         0    0.0474         0    0.4223
         0    0.9933         0         0
         0         0    0.0180         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.0475    0.9996    0.0478         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0535    0.9932    0.0475         0         0 ↙
0         0         0         0
    0.1678         0         0    0.8671         0         0    0.2375         0 ↙
0         0         0         0
         0    0.5777         0         0    0.1193         0         0    0.4409 ↙
0         0         0         0


r0 =

    0.9525    0.0004    0.9522         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9465    0.0068    0.9525         0         0 ↙
0         0         0         0
    0.8322         0         0    0.1329         0         0    0.7625         0 ↙
0         0         0         0
         0    0.4223         0         0    0.8807         0         0    0.5591 ↙
0         0         0         0


Q0 =

    0.0002    0.9979    0.0000    0.9933    0.1179    0.8810    0.0057    0.0000 ↙
0.9933    0.1192    0.0000    0.9933


Q1 =

    0.9998    0.0021    1.0000    0.0067    0.8821    0.1190    0.9943    1.0000 ↙
0.0067    0.8808    1.0000    0.0067


output =

     1     0     1     0     1     0     1     1     0     1     1     0

Iteration number 3
Variance 2.000000e-01
q0 =
```

```
    0.9963         0    0.9991         0
    0.8438         0         0    0.0029
    1.0000         0         0         0
         0    0.0004    0.0420         0
         0    0.9991         0    0.5033
         0    0.0067         0         0
         0         0    0.9820         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

q1 =

```
    0.0037         0    0.0009         0
    0.1562         0         0    0.9971
    0.0000         0         0         0
         0    0.9996    0.9580         0
         0    0.0009         0    0.4967
         0    0.9933         0         0
         0         0    0.0180         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

r1 =

```
    0.8438    0.9963    0.8413         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0076    0.9929    0.0013         0         0 ↙
0         0         0         0
    0.0585         0         0    0.9811         0         0    0.0429         0 ↙
0         0         0         0
         0    0.5033         0         0    0.0029         0         0    0.4967 ↙
0         0         0         0
```

r0 =

```
    0.1562    0.0037    0.1587         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9924    0.0071    0.9987         0         0 ↙
0         0         0         0
    0.9415         0         0    0.0189         0         0    0.9571         0 ↙
0         0         0         0
         0    0.4967         0         0    0.9971         0         0    0.5033 ↙
0         0         0         0
```

Q0 =

```
    0.0061    0.9737    0.0001    0.9938    0.0028    0.1610    0.0008    0.0000 ↙
0.9933    0.1192    0.0000    0.9933


Q1 =

    0.9939    0.0263    0.9999    0.0062    0.9972    0.8390    0.9992    1.0000 ↙
0.0067    0.8808    1.0000    0.0067


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 4
Variance 2.000000e-01
q0 =

    0.9989         0    0.9100         0
    0.8794         0         0    0.0267
    1.0000         0         0         0
         0    0.0000    0.2447         0
         0    1.0000         0    0.5137
         0    0.0067         0         0
         0         0    0.9820         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0011         0    0.0900         0
    0.1206         0         0    0.9733
    0.0000         0         0         0
         0    1.0000    0.7553         0
         0    0.0000         0    0.4863
         0    0.9933         0         0
         0         0    0.0180         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.8794    0.9988    0.8785         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0067    0.9933    0.0001         0         0 ↙
0         0         0         0
```

```
    0.2539         0         0    0.8952         0         0    0.2907         0 ↙
0         0         0         0
         0    0.5137         0         0    0.0267         0         0    0.4870 ↙
0         0         0         0


r0 =

    0.1206    0.0012    0.1215         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9933    0.0067    0.9999         0         0 ↙
0         0         0         0
    0.7461         0         0    0.1048         0         0    0.7093         0 ↙
0         0         0         0
         0    0.4863         0         0    0.9733         0         0    0.5130 ↙
0         0         0         0


Q0 =

    0.0435    0.9920    0.0001    0.9588    0.0265    0.0099    0.0074    0.0000 ↙
0.9933    0.1192    0.0000    0.9933


Q1 =

    0.9565    0.0080    0.9999    0.0412    0.9735    0.9901    0.9926    1.0000 ↙
0.0067    0.8808    1.0000    0.0067


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 5
Variance 2.000000e-01
q0 =

    0.9938         0    0.8822         0
    0.8749         0         0    0.0085
    1.0000         0         0         0
         0    0.0003    0.2684         0
         0    0.9998         0    0.5018
         0    0.0067         0         0
         0         0    0.9820         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0062         0    0.1178         0
```

```
    0.1251         0         0    0.9915
    0.0000         0         0         0
         0    0.9997    0.7316         0
         0    0.0002         0    0.4982
         0    0.9933         0         0
         0         0    0.0180         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0
```

```
r1 =

    0.8749    0.9938    0.8703         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0069    0.9930    0.0005         0         0 ↙
0         0         0         0
    0.2767         0         0    0.8685         0         0    0.3229         0 ↙
0         0         0         0
         0    0.5018         0         0    0.0085         0         0    0.4983 ↙
0         0         0         0
```

```
r0 =

    0.1251    0.0062    0.1297         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9931    0.0070    0.9995         0         0 ↙
0         0         0         0
    0.7233         0         0    0.1315         0         0    0.6771         0 ↙
0         0         0         0
         0    0.4982         0         0    0.9915         0         0    0.5017 ↙
0         0         0         0
```

```
Q0 =

    0.0467    0.9562    0.0001    0.9486    0.0081    0.0658    0.0087    0.0000 ↙
0.9933    0.1192    0.0000    0.9933
```

```
Q1 =

    0.9533    0.0438    0.9999    0.0514    0.9919    0.9342    0.9913    1.0000 ↙
0.0067    0.8808    1.0000    0.0067
```

```
output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 6
Variance 2.000000e-01
```

```
q0 =

    0.9930         0    0.8864         0
    0.8801         0         0    0.0441
    1.0000         0         0         0
         0    0.0004    0.2637         0
         0    0.9999         0    0.5105
         0    0.0067         0         0
         0         0    0.9820         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0

q1 =

    0.0070         0    0.1136         0
    0.1199         0         0    0.9559
    0.0000         0         0         0
         0    0.9996    0.7363         0
         0    0.0001         0    0.4895
         0    0.9933         0         0
         0         0    0.0180         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0

r1 =

    0.8800    0.9930    0.8748         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0067    0.9929    0.0004         0         0 ↙
0         0         0         0
    0.2722         0         0    0.8725         0         0    0.3173         0 ↙
0         0         0         0
         0    0.5105         0         0    0.0441         0         0    0.4904 ↙
0         0         0         0

r0 =

    0.1200    0.0070    0.1252         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9933    0.0071    0.9996         0         0 ↙
0         0         0         0
    0.7278         0         0    0.1275         0         0    0.6827         0 ↙
0         0         0         0
         0    0.4895         0         0    0.9559         0         0    0.5096 ↙
0         0         0         0
```

```
Q0 =

    0.0478    0.9526    0.0001    0.9494    0.0419    0.0604    0.0084    0.0000 ↙
0.9933    0.1192    0.0000    0.9933


Q1 =

    0.9522    0.0474    0.9999    0.0506    0.9581    0.9396    0.9916    1.0000 ↙
0.0067    0.8808    1.0000    0.0067


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 7
Variance 2.000000e-01
q0 =

    0.9932         0    0.8815         0
    0.8763         0         0    0.0493
    1.0000         0         0         0
         0    0.0004    0.2673         0
         0    0.9997         0    0.5136
         0    0.0067         0         0
         0         0    0.9820         0
         0         0         0    1.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0068         0    0.1185         0
    0.1237         0         0    0.9507
    0.0000         0         0         0
         0    0.9996    0.7327         0
         0    0.0003         0    0.4864
         0    0.9933         0         0
         0         0    0.0180         0
         0         0         0    0.0000
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.8763    0.9932    0.8712         0         0         0         0         0 ↙
0         0         0         0
```

```
         0         0         0    0.0070    0.9930    0.0007         0         0 ↙
0         0         0         0
    0.2756         0         0    0.8678         0         0    0.3224         0 ↙
0         0         0         0
         0    0.5136         0         0    0.0493         0         0    0.4878 ↙
0         0         0         0


r0 =

    0.1237    0.0068    0.1288         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9930    0.0070    0.9993         0         0 ↙
0         0         0         0
    0.7244         0         0    0.1322         0         0    0.6776         0 ↙
0         0         0         0
         0    0.4864         0         0    0.9507         0         0    0.5122 ↙
0         0         0         0


Q0 =

    0.0470    0.9542    0.0001    0.9492    0.0469    0.0908    0.0086    0.0000 ↙
0.9933    0.1192    0.0000    0.9933


Q1 =

    0.9530    0.0458    0.9999    0.0508    0.9531    0.9092    0.9914    1.0000 ↙
0.0067    0.8808    1.0000    0.0067


output =

     1     0     1     0     1     1     1     1     0     1     1     0


p =

    0.9608    0.8320    0.9998    0.0082    0.9820    0.0180    0.9608    0.9999 ↙
0.0180    0.8320    0.9997    0.0180

Iteration number 1
Variance 2.500000e-01
q0 =

    0.9608         0    0.9608         0
    0.8320         0         0    0.8320
    0.9998         0         0         0
         0    0.0082    0.0082         0
         0    0.9820         0    0.9820
         0    0.0180         0         0
         0         0    0.9608         0
         0         0         0    0.9999
         0         0         0         0
```

```
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0392         0    0.0392         0
    0.1680         0         0    0.1680
    0.0002         0         0         0
         0    0.9918    0.9918         0
         0    0.0180         0    0.0180
         0    0.9820         0         0
         0         0    0.0392         0
         0         0         0    0.0001
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.8319    0.9607    0.8060         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0353    0.9741    0.0259         0         0 ↙
0         0         0         0
    0.0467         0         0    0.9247         0         0    0.0467         0 ↙
0         0         0         0
         0    0.9819         0         0    0.8320         0         0    0.8201 ↙
0         0         0         0


r0 =

    0.1681    0.0393    0.1940         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9647    0.0259    0.9741         0         0 ↙
0         0         0         0
    0.9533         0         0    0.0753         0         0    0.9533         0 ↙
0         0         0         0
         0    0.0181         0         0    0.1680         0         0    0.1799 ↙
0         0         0         0


Q0 =

    0.0098    0.9963    0.0006    0.9820    0.7736    0.5917    0.0020    0.0003 ↙
0.9820    0.1680    0.0003    0.9820


Q1 =

    0.9902    0.0037    0.9994    0.0180    0.2264    0.4083    0.9980    0.9997 ↙
0.0180    0.8320    0.9997    0.0180
```

```
output =

     1     0     1     0     0     0     1     1     0     1     1     0

Iteration number 2
Variance 2.500000e-01
q0 =

    0.9980         0    0.8321         0
    0.0835         0         0    0.1685
    0.9998         0         0         0
         0    0.0007    0.1835         0
         0    0.9169         0    0.5917
         0    0.0180         0         0
         0         0    0.9608         0
         0         0         0    0.9999
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0020         0    0.1679         0
    0.9165         0         0    0.8315
    0.0002         0         0         0
         0    0.9993    0.8165         0
         0    0.0831         0    0.4083
         0    0.9820         0         0
         0         0    0.0392         0
         0         0         0    0.0001
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.0836    0.9979    0.0851         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0981    0.9814    0.0837         0         0 ↙
0         0         0         0
    0.2083         0         0    0.8061         0         0    0.2898         0 ↙
0         0         0         0
         0    0.5917         0         0    0.1685         0         0    0.4392 ↙
0         0         0         0


r0 =

    0.9164    0.0021    0.9149         0         0         0         0         0 ↙
```

```
0         0         0         0
         0         0         0    0.9019    0.0186    0.9163         0         0 ↙
0         0         0         0
    0.7917         0         0    0.1939         0         0    0.7102         0 ↙
0         0         0         0
         0    0.4083         0         0    0.8315         0         0    0.5608 ↙
0         0         0         0


Q0 =

    0.0010    0.9927    0.0000    0.9821    0.1636    0.8330    0.0164    0.0001 ↙
0.9820    0.1680    0.0003    0.9820


Q1 =

    0.9990    0.0073    1.0000    0.0179    0.8364    0.1670    0.9836    0.9999 ↙
0.0180    0.8320    0.9997    0.0180


output =

     1     0     1     0     1     0     1     1     0     1     1     0

Iteration number 3
Variance 2.500000e-01
q0 =

    0.9894         0    0.9963         0
    0.7737         0         0    0.0105
    0.9998         0         0         0
         0    0.0020    0.0703         0
         0    0.9963         0    0.5090
         0    0.0180         0         0
         0         0    0.9608         0
         0         0         0    0.9999
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0106         0    0.0037         0
    0.2263         0         0    0.9895
    0.0002         0         0         0
         0    0.9980    0.9297         0
         0    0.0037         0    0.4910
         0    0.9820         0         0
         0         0    0.0392         0
         0         0         0    0.0001
         0         0         0         0
         0         0         0         0
```

```
         0         0         0         0
         0         0         0         0


r1 =

    0.7736    0.9892    0.7679         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0216    0.9801    0.0057         0         0 ↙
0         0         0         0
    0.1040         0         0    0.9574         0         0    0.0735         0 ↙
0         0         0         0
         0    0.5090         0         0    0.0106         0         0    0.4912 ↙
0         0         0         0


r0 =

    0.2264    0.0108    0.2321         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9784    0.0199    0.9943         0         0 ↙
0         0         0         0
    0.8960         0         0    0.0426         0         0    0.9265         0 ↙
0         0         0         0
         0    0.4910         0         0    0.9894         0         0    0.5088 ↙
0         0         0         0


Q0 =

    0.0159    0.9506    0.0005    0.9837    0.0096    0.2371    0.0032    0.0001 ↙
0.9820    0.1680    0.0003    0.9820


Q1 =

    0.9841    0.0494    0.9995    0.0163    0.9904    0.7629    0.9968    0.9999 ↙
0.0180    0.8320    0.9997    0.0180


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 4
Variance 2.500000e-01
q0 =

    0.9953         0    0.8778         0
    0.8269         0         0    0.0511
    0.9998         0         0         0
         0    0.0004    0.2720         0
         0    0.9998         0    0.5256
         0    0.0180         0         0
         0         0    0.9608         0
```

```
         0         0         0    0.9999
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0047         0    0.1222         0
    0.1731         0         0    0.9489
    0.0002         0         0         0
         0    0.9996    0.7280         0
         0    0.0002         0    0.4744
         0    0.9820         0         0
         0         0    0.0392         0
         0         0         0    0.0001
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.8268    0.9951    0.8239         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0182    0.9817    0.0006         0         0 ↙
0         0         0         0
    0.2899         0         0    0.8482         0         0    0.3277         0 ↙
0         0         0         0
         0    0.5256         0         0    0.0512         0         0    0.4770 ↙
0         0         0         0


r0 =

    0.1732    0.0049    0.1761         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9818    0.0183    0.9994         0         0 ↙
0         0         0         0
    0.7101         0         0    0.1518         0         0    0.6723         0 ↙
0         0         0         0
         0    0.4744         0         0    0.9488         0         0    0.5230 ↙
0         0         0         0


Q0 =

    0.0736    0.9786    0.0007    0.9263    0.0502    0.0298    0.0195    0.0001 ↙
0.9820    0.1680    0.0003    0.9820


Q1 =
```

```
    0.9264    0.0214    0.9993    0.0737    0.9498    0.9702    0.9805    0.9999 ↙
0.0180    0.8320    0.9997    0.0180


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 5
Variance 2.500000e-01
q0 =

    0.9836         0    0.8371         0
    0.8172         0         0    0.0236
    0.9998         0         0         0
         0    0.0015    0.3078         0
         0    0.9990         0    0.5049
         0    0.0180         0         0
         0         0    0.9608         0
         0         0         0    0.9999
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0164         0    0.1629         0
    0.1828         0         0    0.9764
    0.0002         0         0         0
         0    0.9985    0.6922         0
         0    0.0010         0    0.4951
         0    0.9820         0         0
         0         0    0.0392         0
         0         0         0    0.0001
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.8171    0.9835    0.8068         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0189    0.9806    0.0025         0         0 ↙
0         0         0         0
    0.3228         0         0    0.8107         0         0    0.3704         0 ↙
0         0         0         0
         0    0.5049         0         0    0.0237         0         0    0.4953 ↙
0         0         0         0


r0 =
```

```
    0.1829    0.0165    0.1932         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9811    0.0194    0.9975         0         0 ↙
0         0         0         0
    0.6772         0         0    0.1893         0         0    0.6296         0 ↙
0         0         0         0
         0    0.4951         0         0    0.9763         0         0    0.5047 ↙
0         0         0         0


Q0 =

    0.0799    0.9246    0.0006    0.9094    0.0219    0.1185    0.0234    0.0001 ↙
0.9820    0.1680    0.0003    0.9820


Q1 =

    0.9201    0.0754    0.9994    0.0906    0.9781    0.8815    0.9766    0.9999 ↙
0.0180    0.8320    0.9997    0.0180


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 6
Variance 2.500000e-01
q0 =

    0.9809         0    0.8460         0
    0.8292         0         0    0.0768
    0.9998         0         0         0
         0    0.0019    0.2989         0
         0    0.9996         0    0.5193
         0    0.0180         0         0
         0         0    0.9608         0
         0         0         0    0.9999
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0191         0    0.1540         0
    0.1708         0         0    0.9232
    0.0002         0         0         0
         0    0.9981    0.7011         0
         0    0.0004         0    0.4807
         0    0.9820         0         0
         0         0    0.0392         0
         0         0         0    0.0001
```

```
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.8291    0.9808    0.8167         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0184    0.9802    0.0024         0         0 ↙
0         0         0         0
    0.3147         0         0    0.8189         0         0    0.3609         0 ↙
0         0         0         0
         0    0.5193         0         0    0.0768         0         0    0.4836 ↙
0         0         0         0


r0 =

    0.1709    0.0192    0.1833         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9816    0.0198    0.9976         0         0 ↙
0         0         0         0
    0.6853         0         0    0.1811         0         0    0.6391         0 ↙
0         0         0         0
         0    0.4807         0         0    0.9232         0         0    0.5164 ↙
0         0         0         0


Q0 =

    0.0833    0.9176    0.0007    0.9115    0.0700    0.1144    0.0225    0.0001 ↙
0.9820    0.1680    0.0003    0.9820


Q1 =

    0.9167    0.0824    0.9993    0.0885    0.9300    0.8856    0.9775    0.9999 ↙
0.0180    0.8320    0.9997    0.0180


output =

     1     0     1     0     1     1     1     1     0     1     1     0

Iteration number 7
Variance 2.500000e-01
q0 =

    0.9816         0    0.8349         0
    0.8209         0         0    0.0884
    0.9998         0         0         0
         0    0.0018    0.3049         0
         0    0.9985         0    0.5249
```

```
         0    0.0180         0         0
         0         0    0.9608         0
         0         0         0    0.9999
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


q1 =

    0.0184         0    0.1651         0
    0.1791         0         0    0.9116
    0.0002         0         0         0
         0    0.9982    0.6951         0
         0    0.0015         0    0.4751
         0    0.9820         0         0
         0         0    0.0392         0
         0         0         0    0.0001
         0         0         0         0
         0         0         0         0
         0         0         0         0
         0         0         0         0


r1 =

    0.8208    0.9815    0.8091         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.0195    0.9803    0.0033         0         0 ↙
0         0         0         0
    0.3202         0         0    0.8086         0         0    0.3694         0 ↙
0         0         0         0
         0    0.5249         0         0    0.0885         0         0    0.4795 ↙
0         0         0         0


r0 =

    0.1792    0.0185    0.1909         0         0         0         0         0 ↙
0         0         0         0
         0         0         0    0.9805    0.0197    0.9967         0         0 ↙
0         0         0         0
    0.6798         0         0    0.1914         0         0    0.6306         0 ↙
0         0         0         0
         0    0.4751         0         0    0.9115         0         0    0.5205 ↙
0         0         0         0


Q0 =

    0.0809    0.9220    0.0006    0.9106    0.0811    0.1544    0.0233    0.0001 ↙
0.9820    0.1680    0.0003    0.9820
```

```
Q1 =

    0.9191    0.0780    0.9994    0.0894    0.9189    0.8456    0.9767    0.9999 ↙
0.0180    0.8320    0.9997    0.0180


output =

     1     0     1     0     1     1     1     1     0     1     1     0

>>
```

```
LDPC2
Enter the received codeword[1.1368 -0.0733 -1.3096 0.909 -0.6375 -1.3766
0.624 1.0119 -0.0165 0.0448 0.859 -0.0705 -0.814 0.3096 1.0431 -1.036
0.0627 -1.0187 1.0302 -0.7368]
Enter the H matrix[1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0;0 0 0 0 1 1 1
1 0 0 0 0 0 0 0 0 0 0 0 0;0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0;0 0 0 0
0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0;0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1;1
0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0;0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 1 0
0 0;0 0 1 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 1 0 0;0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 1
0 0 0 1 0;0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1;1 0 0 0 0 0 1 0 0 0 0 0 1
0 0 0 0 0 1 0 0;0 1 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0;0 0 1 0 0 0 0 1 0
0 0 0 1 0 0 0 0 0 1 0 ;0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 1 0 0 0 ;0 0 0 0 1
0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 ]
Enter the variance of the channel[0.3 0.4 0.5 0.6 0.7]

p =

  Columns 1 through 7

    0.0005    0.6198    0.9998    0.0023    0.9859    0.9999    0.0154

  Columns 8 through 14

    0.0012    0.5275    0.4259    0.0032    0.6154    0.9956    0.1126

  Columns 15 through 20

    0.0010    0.9990    0.3970    0.9989    0.0010    0.9927

Iteration number 1
Variance 3.000000e-01
q0 =

  Columns 1 through 7

    0.0005         0         0         0         0    0.0005         0
    0.6198         0         0         0         0         0    0.6198
    0.9998         0         0         0         0         0         0
    0.0023         0         0         0         0         0         0
         0    0.9859         0         0         0    0.9859         0
         0    0.9999         0         0         0         0    0.9999
         0    0.0154         0         0         0         0         0
         0    0.0012         0         0         0         0         0
         0         0    0.5275         0         0    0.5275         0
         0         0    0.4259         0         0         0    0.4259
         0         0    0.0032         0         0         0         0
         0         0    0.6154         0         0         0         0
         0         0         0    0.9956         0    0.9956         0
         0         0         0    0.1126         0         0         0
         0         0         0    0.0010         0         0         0
         0         0         0    0.9990         0         0         0
         0         0         0         0    0.3970         0    0.3970
         0         0         0         0    0.9989         0         0
         0         0         0         0    0.0010         0         0
         0         0         0         0    0.9927         0         0

  Columns 8 through 14

         0         0         0    0.0005         0         0         0
         0         0         0         0    0.6198         0         0
```

```
    0.9998         0         0         0         0    0.9998         0
         0    0.0023         0         0         0         0    0.0023
         0         0         0         0         0         0         0
         0         0         0    0.9999         0         0         0
    0.0154         0         0         0    0.0154         0         0
         0         0    0.0012         0         0    0.0012         0
         0         0         0         0         0         0    0.5275
         0         0         0         0         0         0         0
         0    0.0032         0         0    0.0032         0         0
         0         0    0.6154    0.6154         0         0         0
         0         0         0         0         0    0.9956         0
    0.1126         0         0         0         0         0    0.1126
         0    0.0010         0         0         0         0         0
         0         0    0.9990         0    0.9990         0         0
         0         0         0         0         0         0    0.3970
    0.9989         0         0    0.9989         0         0         0
         0    0.0010         0         0         0    0.0010         0
         0         0    0.9927         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9859
         0
         0
         0
         0
    0.4259
         0
         0
         0
         0
    0.0010
         0
         0
         0
         0
    0.9927


q1 =

  Columns 1 through 7

    0.9995         0         0         0         0    0.9995         0
    0.3802         0         0         0         0         0    0.3802
    0.0002         0         0         0         0         0         0
    0.9977         0         0         0         0         0         0
         0    0.0141         0         0         0    0.0141         0
         0    0.0001         0         0         0         0    0.0001
         0    0.9846         0         0         0         0         0
         0    0.9988         0         0         0         0         0
         0         0    0.4725         0         0    0.4725         0
         0         0    0.5741         0         0         0    0.5741
         0         0    0.9968         0         0         0         0
         0         0    0.3846         0         0         0         0
         0         0         0    0.0044         0    0.0044         0
```

```
         0         0         0    0.8874         0         0         0
         0         0         0    0.9990         0         0         0
         0         0         0    0.0010         0         0         0
         0         0         0         0    0.6030         0    0.6030
         0         0         0         0    0.0011         0         0
         0         0         0         0    0.9990         0         0
         0         0         0         0    0.0073         0         0

  Columns 8 through 14

         0         0         0    0.9995         0         0         0
         0         0         0         0    0.3802         0         0
    0.0002         0         0         0         0    0.0002         0
         0    0.9977         0         0         0         0    0.9977
         0         0         0         0         0         0         0
         0         0         0    0.0001         0         0         0
    0.9846         0         0         0    0.9846         0         0
         0         0    0.9988         0         0    0.9988         0
         0         0         0         0         0         0    0.4725
         0         0         0         0         0         0         0
         0    0.9968         0         0    0.9968         0         0
         0         0    0.3846    0.3846         0         0         0
         0         0         0         0         0    0.0044         0
    0.8874         0         0         0         0         0    0.8874
         0    0.9990         0         0         0         0         0
         0         0    0.0010         0    0.0010         0         0
         0         0         0         0         0         0    0.6030
    0.0011         0         0    0.0011         0         0         0
         0    0.9990         0         0         0    0.9990         0
         0         0    0.0073         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0141
         0
         0
         0
         0
    0.5741
         0
         0
         0
         0
    0.9990
         0
         0
         0
         0
    0.0073


r1 =

  Columns 1 through 7

    0.6192    0.0030    0.3809    0.6196         0         0         0
```

```
         0         0         0         0    0.0166    0.0301    0.9847
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.4735         0         0         0    0.5272         0         0
         0    0.4847         0         0         0    0.4963         0
         0         0    0.1254         0         0         0    0.8864
         0         0         0    0.9948         0         0         0
         0         0         0         0         0         0         0
    0.3849         0         0         0         0    0.6150         0
         0    0.0195         0         0         0         0    0.6188
         0         0    0.0066         0         0         0         0
         0         0         0    0.4956         0         0         0
         0         0         0         0    0.4271         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.9709         0         0         0         0         0         0
         0    0.4830    0.5063    0.5009    0.4960         0         0
         0         0         0         0         0    0.1142    0.9937
         0         0         0         0         0         0         0
         0    0.9812         0         0         0    0.5267         0
         0         0    0.5247         0         0         0         0
         0         0         0         0         0         0    0.9834
         0         0         0    0.9957         0         0         0
    0.3865         0         0         0    0.9906         0         0
         0         0         0         0    0.9983         0         0
         0         0         0    0.6159         0         0         0
    0.9944         0         0         0         0    0.0024         0
         0    0.5794         0         0         0         0    0.4944
         0         0    0.9779         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.8832    0.1168         0         0         0         0
         0         0    0.9906    0.3987    0.6013    0.3974
         0         0         0         0         0         0
         0         0    0.5178         0         0         0
         0         0         0    0.1247         0         0
    0.9934         0         0         0    0.9935         0
         0    0.6134         0         0         0    0.6149
         0         0         0    0.6152         0         0
         0    0.3846         0         0         0         0
         0         0         0         0    0.9943         0
         0         0    0.4788         0         0         0
    0.5710         0         0         0         0    0.4281


r0 =

  Columns 1 through 7

    0.3808    0.9970    0.6191    0.3804         0         0         0
         0         0         0         0    0.9834    0.9699    0.0153
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
```

```
         0         0         0         0         0         0         0
    0.5265         0         0         0    0.4728         0         0
         0    0.5153         0         0         0    0.5037         0
         0         0    0.8746         0         0         0    0.1136
         0         0         0    0.0052         0         0         0
         0         0         0         0         0         0         0
    0.6151         0         0         0         0    0.3850         0
         0    0.9805         0         0         0         0    0.3812
         0         0    0.9934         0         0         0         0
         0         0         0    0.5044         0         0         0
         0         0         0         0    0.5729         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.0291         0         0         0         0         0         0
         0    0.5170    0.4937    0.4991    0.5040         0         0
         0         0         0         0         0    0.8858    0.0063
         0         0         0         0         0         0         0
         0    0.0188         0         0         0    0.4733         0
         0         0    0.4753         0         0         0         0
         0         0         0         0         0         0    0.0166
         0         0         0    0.0043         0         0         0
    0.6135         0         0         0    0.0094         0         0
         0         0         0         0    0.0017         0         0
         0         0         0    0.3841         0         0         0
    0.0056         0         0         0         0    0.9976         0
         0    0.4206         0         0         0         0    0.5056
         0         0    0.0221         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.1168    0.8832         0         0         0         0
         0         0    0.0094    0.6013    0.3987    0.6026
         0         0         0         0         0         0
         0         0    0.4822         0         0         0
         0         0         0    0.8753         0         0
    0.0066         0         0         0    0.0065         0
         0    0.3866         0         0         0    0.3851
         0         0         0    0.3848         0         0
         0    0.6154         0         0         0         0
         0         0         0         0    0.0057         0
         0         0    0.5212         0         0         0
    0.4290         0         0         0         0    0.5719


Q0 =

  Columns 1 through 7

    0.9994    0.0000    0.0000    1.0000    0.0002    0.0000    1.0000

  Columns 8 through 14

    1.0000    0.9836    0.9854    1.0000    1.0000    0.0000    1.0000

  Columns 15 through 20
```

```
    1.0000    0.0001    0.9937    0.0002    1.0000    0.0058


Q1 =

  Columns 1 through 7

    0.0006    1.0000    1.0000    0.0000    0.9998    1.0000    0.0000

  Columns 8 through 14

    0.0000    0.0164    0.0146    0.0000    0.0000    1.0000    0.0000

  Columns 15 through 20

    0.0000    0.9999    0.0063    0.9998    0.0000    0.9942


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

Iteration number 2
Variance 3.000000e-01
q0 =

  Columns 1 through 7

    0.0009         0         0         0         0    0.0005         0
    0.9887         0         0         0         0         0    1.0000
    1.0000         0         0         0         0         0         0
    0.0000         0         0         0         0         0         0
         0    0.9883         0         0         0    0.9998         0
         0    0.9998         0         0         0         0    1.0000
         0    0.0012         0         0         0         0         0
         0    0.0000         0         0         0         0         0
         0         0    0.0153         0         0    0.4645         0
         0         0    0.0149         0         0         0    0.0161
         0         0    0.0000         0         0         0         0
         0         0    0.0000         0         0         0         0
         0         0         0    1.0000         0    1.0000         0
         0         0         0    0.0022         0         0         0
         0         0         0    0.0000         0         0         0
         0         0         0    0.9990         0         0         0
         0         0         0         0    0.4003         0    0.0068
         0         0         0         0    0.9997         0         0
         0         0         0         0    0.0000         0         0
         0         0         0         0    0.9913         0         0

  Columns 8 through 14

         0         0         0    0.0003         0         0         0
         0         0         0         0    0.9983         0         0
```

```
    1.0000         0         0         0         0    1.0000         0
         0    0.0015         0         0         0         0    0.0000
         0         0         0         0         0         0         0
         0         0         0    1.0000         0         0         0
    0.0001         0         0         0    0.0000         0         0
         0         0    0.0000         0         0    0.0001         0
         0         0         0         0         0         0    0.0224
         0         0         0         0         0         0         0
         0    0.0020         0         0    0.0000         0         0
         0         0    0.0028    0.0153         0         0         0
         0         0         0         0         0    0.9994         0
    0.0008         0         0         0         0         0    0.0000
         0    0.0001         0         0         0         0         0
         0         0    0.9999         0    0.9998         0         0
         0         0         0         0         0         0    0.0058
    0.9988         0         0    0.9999         0         0         0
         0    0.0000         0         0         0    0.0000         0
         0         0    0.9964         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9997
         0
         0
         0
         0
    0.3959
         0
         0
         0
         0
    0.0000
         0
         0
         0
         0
    0.9923


q1 =

  Columns 1 through 7

    0.9991         0         0         0         0    0.9995         0
    0.0113         0         0         0         0         0    0.0000
    0.0000         0         0         0         0         0         0
    1.0000         0         0         0         0         0         0
         0    0.0117         0         0         0    0.0002         0
         0    0.0002         0         0         0         0    0.0000
         0    0.9988         0         0         0         0         0
         0    1.0000         0         0         0         0         0
         0         0    0.9847         0         0    0.5355         0
         0         0    0.9851         0         0         0    0.9839
         0         0    1.0000         0         0         0         0
         0         0    1.0000         0         0         0         0
         0         0         0    0.0000         0    0.0000         0
```

```
         0         0         0    0.9978         0         0         0
         0         0         0    1.0000         0         0         0
         0         0         0    0.0010         0         0         0
         0         0         0         0    0.5997         0    0.9932
         0         0         0         0    0.0003         0         0
         0         0         0         0    1.0000         0         0
         0         0         0         0    0.0087         0         0

  Columns 8 through 14

         0         0         0    0.9997         0         0         0
         0         0         0         0    0.0017         0         0
    0.0000         0         0         0         0    0.0000         0
         0    0.9985         0         0         0         0    1.0000
         0         0         0         0         0         0         0
         0         0         0    0.0000         0         0         0
    0.9999         0         0         0    1.0000         0         0
         0         0    1.0000         0         0    0.9999         0
         0         0         0         0         0         0    0.9776
         0         0         0         0         0         0         0
         0    0.9980         0         0    1.0000         0         0
         0         0    0.9972    0.9847         0         0         0
         0         0         0         0         0    0.0006         0
    0.9992         0         0         0         0         0    1.0000
         0    0.9999         0         0         0         0         0
         0         0    0.0001         0    0.0002         0         0
         0         0         0         0         0         0    0.9942
    0.0012         0         0    0.0001         0         0         0
         0    1.0000         0         0         0    1.0000         0
         0         0    0.0036         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0003
         0
         0
         0
         0
    0.6041
         0
         0
         0
         0
    1.0000
         0
         0
         0
         0
    0.0077


r1 =

  Columns 1 through 7

    0.9887    0.0009    0.0122    0.9878         0         0         0
```

```
         0         0         0         0    0.0014    0.0129    0.9881
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.5355         0         0         0    0.4645         0         0
         0    0.0226         0         0         0    0.0227         0
         0         0    0.0022         0         0         0    0.9980
         0         0         0    0.9979         0         0         0
         0         0         0         0         0         0         0
    0.9846         0         0         0         0    0.0157         0
         0    0.0003         0         0         0         0    0.9980
         0         0    0.0007         0         0         0         0
         0         0         0    0.9720         0         0         0
         0         0         0         0    0.3975         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.9869         0         0         0         0         0         0
         0    0.9850    0.9847    0.9702    0.9702         0         0
         0         0         0         0         0    0.0032    0.9990
         0         0         0         0         0         0         0
         0    0.9993         0         0         0    0.4645         0
         0         0    0.9932         0         0         0         0
         0         0         0         0         0         0    0.9987
         0         0         0    0.9984         0         0         0
    0.9935         0         0         0    0.9963         0         0
         0         0         0         0    0.9995         0         0
         0         0         0    0.9980         0         0         0
    0.9994         0         0         0         0    0.0001         0
         0    0.9942         0         0         0         0    0.9721
         0         0    0.9920         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.9968    0.0022         0         0         0         0
         0         0    0.9910    0.4020    0.5979    0.4003
         0         0         0         0         0         0
         0         0    0.9839         0         0         0
         0         0         0    0.0010         0         0
    0.9965         0         0         0    0.9964         0
         0    0.0064         0         0         0    0.0029
         0         0         0    0.0156         0         0
         0    0.0018         0         0         0         0
         0         0         0         0    0.9993         0
         0         0    0.9776         0         0         0
    0.6025         0         0         0         0    0.3959


r0 =

  Columns 1 through 7

    0.0113    0.9991    0.9878    0.0122         0         0         0
         0         0         0         0    0.9986    0.9871    0.0119
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
```

```
         0         0         0         0         0         0         0
    0.4645         0         0         0    0.5355         0         0
         0    0.9774         0         0         0    0.9773         0
         0         0    0.9978         0         0         0    0.0020
         0         0         0    0.0021         0         0         0
         0         0         0         0         0         0         0
    0.0154         0         0         0         0    0.9843         0
         0    0.9997         0         0         0         0    0.0020
         0         0    0.9993         0         0         0         0
         0         0         0    0.0280         0         0         0
         0         0         0         0    0.6025         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.0131         0         0         0         0         0         0
         0    0.0150    0.0153    0.0298    0.0298         0         0
         0         0         0         0         0    0.9968    0.0010
         0         0         0         0         0         0         0
         0    0.0007         0         0         0    0.5355         0
         0         0    0.0068         0         0         0         0
         0         0         0         0         0         0    0.0013
         0         0         0    0.0016         0         0         0
    0.0065         0         0         0    0.0037         0         0
         0         0         0         0    0.0005         0         0
         0         0         0    0.0020         0         0         0
    0.0006         0         0         0         0    0.9999         0
         0    0.0058         0         0         0         0    0.0279
         0         0    0.0080         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.0032    0.9978         0         0         0         0
         0         0    0.0090    0.5980    0.4021    0.5997
         0         0         0         0         0         0
         0         0    0.0161         0         0         0
         0         0         0    0.9990         0         0
    0.0035         0         0         0    0.0036         0
         0    0.9936         0         0         0    0.9971
         0         0         0    0.9844         0         0
         0    0.9982         0         0         0         0
         0         0         0         0    0.0007         0
         0         0    0.0224         0         0         0
    0.3975         0         0         0         0    0.6041


Q0 =

  Columns 1 through 7

    1.0000    0.0000    0.0000    1.0000    0.0000    0.0000    1.0000

  Columns 8 through 14

    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    1.0000

  Columns 15 through 20
```

```
    1.0000    0.0000    1.0000    0.0000    1.0000    0.0000


Q1 =

  Columns 1 through 7

    0.0000    1.0000    1.0000    0.0000    1.0000    1.0000    0.0000

  Columns 8 through 14

    0.0000    0.0000    0.0000    0.0000    0.0000    1.0000    0.0000

  Columns 15 through 20

    0.0000    1.0000    0.0000    1.0000    0.0000    1.0000


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

Iteration number 3
Variance 3.000000e-01
q0 =

  Columns 1 through 7

    0.0000         0         0         0         0    0.0000         0
    1.0000         0         0         0         0         0    1.0000
    1.0000         0         0         0         0         0         0
    0.0000         0         0         0         0         0         0
         0    0.9919         0         0         0    1.0000         0
         0    1.0000         0         0         0         0    1.0000
         0    0.0000         0         0         0         0         0
         0    0.0000         0         0         0         0         0
         0         0    0.0000         0         0    0.0001         0
         0         0    0.0000         0         0         0    0.0001
         0         0    0.0000         0         0         0         0
         0         0    0.0000         0         0         0         0
         0         0         0    1.0000         0    1.0000         0
         0         0         0    0.0000         0         0         0
         0         0         0    0.0000         0         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0    0.0002         0    0.0001
         0         0         0         0    1.0000         0         0
         0         0         0         0    0.0000         0         0
         0         0         0         0    1.0000         0         0

  Columns 8 through 14

         0         0         0    0.0000         0         0         0
         0         0         0         0    1.0000         0         0
```

```
    1.0000         0         0         0         0    1.0000         0
         0    0.0000         0         0         0         0    0.0000
         0         0         0         0         0         0         0
         0         0         0    1.0000         0         0         0
    0.0000         0         0         0    0.0000         0         0
         0         0    0.0000         0         0    0.0000         0
         0         0         0         0         0         0    0.0000
         0         0         0         0         0         0         0
         0    0.0000         0         0    0.0000         0         0
         0         0    0.0000    0.0002         0         0         0
         0         0         0         0         0    1.0000         0
    0.0000         0         0         0         0         0    0.0000
         0    0.0000         0         0         0         0         0
         0         0    1.0000         0    1.0000         0         0
         0         0         0         0         0         0    0.0001
    1.0000         0         0    1.0000         0         0         0
         0    0.0000         0         0         0    0.0000         0
         0         0    0.9968         0         0         0         0

  Column 15

         0
         0
         0
         0
    1.0000
         0
         0
         0
         0
    0.0001
         0
         0
         0
         0
    0.0000
         0
         0
         0
         0
    1.0000


q1 =

  Columns 1 through 7

    1.0000         0         0         0         0    1.0000         0
    0.0000         0         0         0         0         0    0.0000
    0.0000         0         0         0         0         0         0
    1.0000         0         0         0         0         0         0
         0    0.0081         0         0         0    0.0000         0
         0    0.0000         0         0         0         0    0.0000
         0    1.0000         0         0         0         0         0
         0    1.0000         0         0         0         0         0
         0         0    1.0000         0         0    0.9999         0
         0         0    1.0000         0         0         0    0.9999
         0         0    1.0000         0         0         0         0
         0         0    1.0000         0         0         0         0
         0         0         0    0.0000         0    0.0000         0
```

```
         0         0         0    1.0000         0         0         0
         0         0         0    1.0000         0         0         0
         0         0         0    0.0000         0         0         0
         0         0         0         0    0.9998         0    0.9999
         0         0         0         0    0.0000         0         0
         0         0         0         0    1.0000         0         0
         0         0         0         0    0.0000         0         0

  Columns 8 through 14

         0         0         0    1.0000         0         0         0
         0         0         0         0    0.0000         0         0
    0.0000         0         0         0         0    0.0000         0
         0    1.0000         0         0         0         0    1.0000
         0         0         0         0         0         0         0
         0         0         0    0.0000         0         0         0
    1.0000         0         0         0    1.0000         0         0
         0         0    1.0000         0         0    1.0000         0
         0         0         0         0         0         0    1.0000
         0         0         0         0         0         0         0
         0    1.0000         0         0    1.0000         0         0
         0         0    1.0000    0.9998         0         0         0
         0         0         0         0         0    0.0000         0
    1.0000         0         0         0         0         0    1.0000
         0    1.0000         0         0         0         0         0
         0         0    0.0000         0    0.0000         0         0
         0         0         0         0         0         0    0.9999
    0.0000         0         0    0.0000         0         0         0
         0    1.0000         0         0         0    1.0000         0
         0         0    0.0032         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0000
         0
         0
         0
         0
    0.9999
         0
         0
         0
         0
    1.0000
         0
         0
         0
         0
    0.0000

r1 =

  Columns 1 through 7

    1.0000    0.0000    0.0000    1.0000         0         0         0
```

```
         0         0         0         0    0.0000    0.0081    0.9919
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.9999         0         0         0    0.0001         0         0
         0    0.0002         0         0         0    0.0002         0
         0         0    0.0000         0         0         0    1.0000
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0         0
    0.9998         0         0         0         0    0.0002         0
         0    0.0000         0         0         0         0    1.0000
         0         0    0.0000         0         0         0         0
         0         0         0    0.9999         0         0         0
         0         0         0         0    0.0001         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.9919         0         0         0         0         0         0
         0    1.0000    1.0000    1.0000    1.0000         0         0
         0         0         0         0         0    0.0000    1.0000
         0         0         0         0         0         0         0
         0    1.0000         0         0         0    0.0001         0
         0         0    0.9999         0         0         0         0
         0         0         0         0         0         0    1.0000
         0         0         0    1.0000         0         0         0
    0.9968         0         0         0    0.9968         0         0
         0         0         0         0    1.0000         0         0
         0         0         0    1.0000         0         0         0
    1.0000         0         0         0         0    0.0000         0
         0    0.9999         0         0         0         0    0.9999
         0         0    1.0000         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    1.0000    0.0000         0         0         0         0
         0         0    1.0000    0.0003    0.9997    0.0002
         0         0         0         0         0         0
         0         0    0.9999         0         0         0
         0         0         0    0.0000         0         0
    1.0000         0         0         0    1.0000         0
         0    0.0032         0         0         0    0.0000
         0         0         0    0.0002         0         0
         0    0.0000         0         0         0         0
         0         0         0         0    1.0000         0
         0         0    1.0000         0         0         0
    0.9999         0         0         0         0    0.0001


r0 =

  Columns 1 through 7

    0.0000    1.0000    1.0000    0.0000         0         0         0
         0         0         0         0    1.0000    0.9919    0.0081
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
```

```
         0         0         0         0         0         0         0
    0.0001         0         0         0    0.9999         0         0
         0    0.9998         0         0         0    0.9998         0
         0         0    1.0000         0         0         0    0.0000
         0         0         0    0.0000         0         0         0
         0         0         0         0         0         0         0
    0.0002         0         0         0         0    0.9998         0
         0    1.0000         0         0         0         0    0.0000
         0         0    1.0000         0         0         0         0
         0         0         0    0.0001         0         0         0
         0         0         0         0    0.9999         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.0081         0         0         0         0         0         0
         0    0.0000    0.0000    0.0000    0.0000         0         0
         0         0         0         0         0    1.0000    0.0000
         0         0         0         0         0         0         0
         0    0.0000         0         0         0    0.9999         0
         0         0    0.0001         0         0         0         0
         0         0         0         0         0         0    0.0000
         0         0         0    0.0000         0         0         0
    0.0032         0         0         0    0.0032         0         0
         0         0         0         0    0.0000         0         0
         0         0         0    0.0000         0         0         0
    0.0000         0         0         0         0    1.0000         0
         0    0.0001         0         0         0         0    0.0001
         0         0    0.0000         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.0000    1.0000         0         0         0         0
         0         0    0.0000    0.9997    0.0003    0.9998
         0         0         0         0         0         0
         0         0    0.0001         0         0         0
         0         0         0    1.0000         0         0
    0.0000         0         0         0    0.0000         0
         0    0.9968         0         0         0    1.0000
         0         0         0    0.9998         0         0
         0    1.0000         0         0         0         0
         0         0         0         0    0.0000         0
         0         0    0.0000         0         0         0
    0.0001         0         0         0         0    0.9999


Q0 =

  Columns 1 through 7

    1.0000    0.0000    0.0000    1.0000    0.0000    0.0000    1.0000

  Columns 8 through 14

    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    1.0000

  Columns 15 through 20
```

```
    1.0000    0.0000    1.0000    0.0000    1.0000    0.0000

Q1 =

  Columns 1 through 7

    0.0000    1.0000    1.0000    0.0000    1.0000    1.0000    0.0000

  Columns 8 through 14

    0.0000    0.0000    0.0000    0.0000    0.0000    1.0000    0.0000

  Columns 15 through 20

    0.0000    1.0000    0.0000    1.0000    0.0000    1.0000

output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

It took 3 number of iterations

p =

  Columns 1 through 7

    0.0034    0.5906    0.9986    0.0105    0.9604    0.9990    0.0423

  Columns 8 through 14

    0.0063    0.5206    0.4442    0.0135    0.5872    0.9832    0.1754

  Columns 15 through 20

    0.0054    0.9944    0.4223    0.9939    0.0058    0.9755

Iteration number 1
Variance 4.000000e-01
q0 =

  Columns 1 through 7

    0.0034         0         0         0         0    0.0034         0
    0.5906         0         0         0         0         0    0.5906
    0.9986         0         0         0         0         0         0
    0.0105         0         0         0         0         0         0
         0    0.9604         0         0         0    0.9604         0
         0    0.9990         0         0         0         0    0.9990
         0    0.0423         0         0         0         0         0
         0    0.0063         0         0         0         0         0
         0         0    0.5206         0         0    0.5206         0
```

```
         0         0    0.4442         0         0         0    0.4442
         0         0    0.0135         0         0         0         0
         0         0    0.5872         0         0         0         0
         0         0         0    0.9832         0    0.9832         0
         0         0         0    0.1754         0         0         0
         0         0         0    0.0054         0         0         0
         0         0         0    0.9944         0         0         0
         0         0         0         0    0.4223         0    0.4223
         0         0         0         0    0.9939         0         0
         0         0         0         0    0.0058         0         0
         0         0         0         0    0.9755         0         0

  Columns 8 through 14

         0         0         0    0.0034         0         0         0
         0         0         0         0    0.5906         0         0
    0.9986         0         0         0         0    0.9986         0
         0    0.0105         0         0         0         0    0.0105
         0         0         0         0         0         0         0
         0         0         0    0.9990         0         0         0
    0.0423         0         0         0    0.0423         0         0
         0         0    0.0063         0         0    0.0063         0
         0         0         0         0         0         0    0.5206
         0         0         0         0         0         0         0
         0    0.0135         0         0    0.0135         0         0
         0         0    0.5872    0.5872         0         0         0
         0         0         0         0         0    0.9832         0
    0.1754         0         0         0         0         0    0.1754
         0    0.0054         0         0         0         0         0
         0         0    0.9944         0    0.9944         0         0
         0         0         0         0         0         0    0.4223
    0.9939         0         0    0.9939         0         0         0
         0    0.0058         0         0         0    0.0058         0
         0         0    0.9755         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9604
         0
         0
         0
         0
    0.4442
         0
         0
         0
         0
    0.0054
         0
         0
         0
         0
    0.9755


q1 =
```

Columns 1 through 7

0.9966	0	0	0	0	0.9966	0
0.4094	0	0	0	0	0	0.4094
0.0014	0	0	0	0	0	0
0.9895	0	0	0	0	0	0
0	0.0396	0	0	0	0.0396	0
0	0.0010	0	0	0	0	0.0010
0	0.9577	0	0	0	0	0
0	0.9937	0	0	0	0	0
0	0	0.4794	0	0	0.4794	0
0	0	0.5558	0	0	0	0.5558
0	0	0.9865	0	0	0	0
0	0	0.4128	0	0	0	0
0	0	0	0.0168	0	0.0168	0
0	0	0	0.8246	0	0	0
0	0	0	0.9946	0	0	0
0	0	0	0.0056	0	0	0
0	0	0	0	0.5777	0	0.5777
0	0	0	0	0.0061	0	0
0	0	0	0	0.9942	0	0
0	0	0	0	0.0245	0	0

Columns 8 through 14

0	0	0	0.9966	0	0	0
0	0	0	0	0.4094	0	0
0.0014	0	0	0	0	0.0014	0
0	0.9895	0	0	0	0	0.9895
0	0	0	0	0	0	0
0	0	0	0.0010	0	0	0
0.9577	0	0	0	0.9577	0	0
0	0	0.9937	0	0	0.9937	0
0	0	0	0	0	0	0.4794
0	0	0	0	0	0	0
0	0.9865	0	0	0.9865	0	0
0	0	0.4128	0.4128	0	0	0
0	0	0	0	0	0.0168	0
0.8246	0	0	0	0	0	0.8246
0	0.9946	0	0	0	0	0
0	0	0.0056	0	0.0056	0	0
0	0	0	0	0	0	0.5777
0.0061	0	0	0.0061	0	0	0
0	0.9942	0	0	0	0.9942	0
0	0	0.0245	0	0	0	0

Column 15

0
0
0
0
0.0396
0
0
0
0
0.5558
0

```
         0
         0
         0
    0.9946
         0
         0
         0
         0
    0.0245
```

```
r1 =

  Columns 1 through 7

    0.5885    0.0152    0.4119    0.5897         0         0         0
         0         0         0         0    0.0490    0.0839    0.9536
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.4817         0         0         0    0.5198         0         0
         0    0.4913         0         0         0    0.4984         0
         0         0    0.2065         0         0         0    0.8197
         0         0         0    0.9757         0         0         0
         0         0         0         0         0         0         0
    0.4140         0         0         0         0    0.5856         0
         0    0.0596         0         0         0         0    0.5872
         0         0    0.0284         0         0         0         0
         0         0         0    0.4979         0         0         0
         0         0         0         0    0.4475         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.9206         0         0         0         0         0         0
         0    0.4905    0.5035    0.5004    0.4978         0         0
         0         0         0         0         0    0.1825    0.9726
         0         0         0         0         0         0         0
         0    0.9419         0         0         0    0.5189         0
         0         0    0.5141         0         0         0         0
         0         0         0         0         0         0    0.9508
         0         0         0    0.9786         0         0         0
    0.4180         0         0         0    0.9642         0         0
         0         0         0         0    0.9895         0         0
         0         0         0    0.5820         0         0         0
    0.9763         0         0         0         0    0.0134         0
         0    0.5494         0         0         0         0    0.4969
         0         0    0.9331         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.8102    0.1897         0         0         0         0
         0         0    0.9643    0.4269    0.5730    0.4241
         0         0         0         0         0         0
         0         0    0.5101         0         0         0
         0         0         0    0.2037         0         0
    0.9708         0         0         0    0.9712         0
```

```
         0    0.5819         0         0         0    0.5852
         0         0         0    0.5865         0         0
         0    0.4193         0         0         0         0
         0         0         0         0    0.9757         0
         0         0    0.4869         0         0         0
    0.5488         0         0         0         0    0.4492


r0 =

  Columns 1 through 7

    0.4115    0.9848    0.5881    0.4103         0         0         0
         0         0         0         0    0.9510    0.9161    0.0464
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.5183         0         0         0    0.4802         0         0
         0    0.5087         0         0         0    0.5016         0
         0         0    0.7935         0         0         0    0.1803
         0         0         0    0.0243         0         0         0
         0         0         0         0         0         0         0
    0.5860         0         0         0         0    0.4144         0
         0    0.9404         0         0         0         0    0.4128
         0         0    0.9716         0         0         0         0
         0         0         0    0.5021         0         0         0
         0         0         0         0    0.5525         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.0794         0         0         0         0         0         0
         0    0.5095    0.4965    0.4996    0.5022         0         0
         0         0         0         0         0    0.8175    0.0274
         0         0         0         0         0         0         0
         0    0.0581         0         0         0    0.4811         0
         0         0    0.4859         0         0         0         0
         0         0         0         0         0         0    0.0492
         0         0         0    0.0214         0         0         0
    0.5820         0         0         0    0.0358         0         0
         0         0         0         0    0.0105         0         0
         0         0         0    0.4180         0         0         0
    0.0237         0         0         0         0    0.9866         0
         0    0.4506         0         0         0         0    0.5031
         0         0    0.0669         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.1898    0.8103         0         0         0         0
         0         0    0.0357    0.5731    0.4270    0.5759
         0         0         0         0         0         0
         0         0    0.4899         0         0         0
         0         0         0    0.7963         0         0
    0.0292         0         0         0    0.0288         0
         0    0.4181         0         0         0    0.4148
         0         0         0    0.4135         0         0
         0    0.5807         0         0         0         0
```

```
         0         0         0         0    0.0243         0
         0         0    0.5131         0         0         0
    0.4512         0         0         0         0    0.5508


Q0 =

  Columns 1 through 7

    0.9964    0.0007    0.0000    0.9998    0.0019    0.0001    0.9997

  Columns 8 through 14

    1.0000    0.9460    0.9493    0.9998    0.9994    0.0001    0.9997

  Columns 15 through 20

    1.0000    0.0013    0.9733    0.0017    1.0000    0.0208


Q1 =

  Columns 1 through 7

    0.0036    0.9993    1.0000    0.0002    0.9981    0.9999    0.0003

  Columns 8 through 14

    0.0000    0.0540    0.0507    0.0002    0.0006    0.9999    0.0003

  Columns 15 through 20

    0.0000    0.9987    0.0267    0.9983    0.0000    0.9792


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

Iteration number 2
Variance 4.000000e-01
q0 =

  Columns 1 through 7

    0.0052         0         0         0         0    0.0034         0
    0.9593         0         0         0         0         0    0.9993
    1.0000         0         0         0         0         0         0
    0.0003         0         0         0         0         0         0
         0    0.9651         0         0         0    0.9983         0
         0    0.9986         0         0         0         0    0.9999
         0    0.0068         0         0         0         0         0
         0    0.0002         0         0         0         0         0
         0         0    0.0521         0         0    0.4805         0
```

```
         0         0    0.0514         0         0         0    0.0535
         0         0    0.0002         0         0         0         0
         0         0    0.0006         0         0         0         0
         0         0         0    0.9998         0    0.9999         0
         0         0         0    0.0110         0         0         0
         0         0         0    0.0001         0         0         0
         0         0         0    0.9944         0         0         0
         0         0         0         0    0.4252         0    0.0277
         0         0         0         0    0.9978         0         0
         0         0         0         0    0.0000         0         0
         0         0         0         0    0.9719         0         0

  Columns 8 through 14

         0         0         0    0.0026         0         0         0
         0         0         0         0    0.9898         0         0
    1.0000         0         0         0         0    0.9997         0
         0    0.0074         0         0         0         0    0.0002
         0         0         0         0         0         0         0
         0         0         0    0.9999         0         0         0
    0.0015         0         0         0    0.0005         0         0
         0         0    0.0000         0         0    0.0008         0
         0         0         0         0         0         0    0.0651
         0         0         0         0         0         0         0
         0    0.0097         0         0    0.0003         0         0
         0         0    0.0149    0.0505         0         0         0
         0         0         0         0         0    0.9959         0
    0.0060         0         0         0         0         0    0.0003
         0    0.0010         0         0         0         0         0
         0         0    0.9990         0    0.9982         0         0
         0         0         0         0         0         0    0.0253
    0.9936         0         0    0.9988         0         0         0
         0    0.0001         0         0         0    0.0001         0
         0         0    0.9851         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9977
         0
         0
         0
         0
    0.4270
         0
         0
         0
         0
    0.0000
         0
         0
         0
         0
    0.9746


q1 =
```

Columns 1 through 7

0.9948	0	0	0	0	0.9966	0
0.0407	0	0	0	0	0	0.0007
0.0000	0	0	0	0	0	0
0.9997	0	0	0	0	0	0
0	0.0349	0	0	0	0.0017	0
0	0.0014	0	0	0	0	0.0001
0	0.9932	0	0	0	0	0
0	0.9998	0	0	0	0	0
0	0	0.9479	0	0	0.5195	0
0	0	0.9486	0	0	0	0.9465
0	0	0.9998	0	0	0	0
0	0	0.9994	0	0	0	0
0	0	0	0.0002	0	0.0001	0
0	0	0	0.9890	0	0	0
0	0	0	0.9999	0	0	0
0	0	0	0.0056	0	0	0
0	0	0	0	0.5748	0	0.9723
0	0	0	0	0.0022	0	0
0	0	0	0	1.0000	0	0
0	0	0	0	0.0281	0	0

Columns 8 through 14

0	0	0	0.9974	0	0	0
0	0	0	0	0.0102	0	0
0.0000	0	0	0	0	0.0003	0
0	0.9926	0	0	0	0	0.9998
0	0	0	0	0	0	0
0	0	0	0.0001	0	0	0
0.9985	0	0	0	0.9995	0	0
0	0	1.0000	0	0	0.9992	0
0	0	0	0	0	0	0.9349
0	0	0	0	0	0	0
0	0.9903	0	0	0.9997	0	0
0	0	0.9851	0.9495	0	0	0
0	0	0	0	0	0.0041	0
0.9940	0	0	0	0	0	0.9997
0	0.9990	0	0	0	0	0
0	0	0.0010	0	0.0018	0	0
0	0	0	0	0	0	0.9747
0.0064	0	0	0.0012	0	0	0
0	0.9999	0	0	0	0.9999	0
0	0	0.0149	0	0	0	0

Column 15

0
0
0
0
0.0023
0
0
0
0
0.5730
0

```
         0
         0
         0
    1.0000
         0
         0
         0
         0
    0.0254
```

r1 =

Columns 1 through 7

0.9590	0.0054	0.0457	0.9546	0	0	0
0	0	0	0	0.0084	0.0414	0.9635
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0.5194	0	0	0	0.4807	0	0
0	0.0784	0	0	0	0.0789	0
0	0	0.0139	0	0	0	0.9876
0	0	0	0.9892	0	0	0
0	0	0	0	0	0	0
0.9483	0	0	0	0	0.0539	0
0	0.0026	0	0	0	0	0.9877
0	0	0.0050	0	0	0	0
0	0	0	0.9126	0	0	0
0	0	0	0	0.4307	0	0

Columns 8 through 14

0	0	0	0	0	0	0
0.9574	0	0	0	0	0	0
0	0.9479	0.9472	0.9014	0.9017	0	0
0	0	0	0	0	0.0166	0.9940
0	0	0	0	0	0	0
0	0.9949	0	0	0	0.4807	0
0	0	0.9715	0	0	0	0
0	0	0	0	0	0	0.9920
0	0	0	0.9915	0	0	0
0.9698	0	0	0	0.9842	0	0
0	0	0	0	0.9962	0	0
0	0	0	0.9875	0	0	0
0.9955	0	0	0	0	0.0012	0
0	0.9742	0	0	0	0	0.9127
0	0	0.9724	0	0	0	0

Columns 15 through 20

0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0.9832	0.0114	0	0	0	0
0	0	0.9698	0.4294	0.5703	0.4255
0	0	0	0	0	0
0	0	0.9458	0	0	0
0	0	0	0.0075	0	0
0.9830	0	0	0	0.9821	0

```
         0    0.0294         0         0         0    0.0159
         0         0         0    0.0529         0         0
         0    0.0110         0         0         0         0
         0         0         0         0    0.9949         0
         0         0    0.9345         0         0         0
    0.5690         0         0         0         0    0.4273


r0 =

  Columns 1 through 7

    0.0410    0.9946    0.9543    0.0454         0         0         0
         0         0         0         0    0.9916    0.9586    0.0365
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.4806         0         0         0    0.5193         0         0
         0    0.9216         0         0         0    0.9211         0
         0         0    0.9861         0         0         0    0.0124
         0         0         0    0.0108         0         0         0
         0         0         0         0         0         0         0
    0.0517         0         0         0         0    0.9461         0
         0    0.9974         0         0         0         0    0.0123
         0         0    0.9950         0         0         0         0
         0         0         0    0.0874         0         0         0
         0         0         0         0    0.5693         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.0426         0         0         0         0         0         0
         0    0.0521    0.0528    0.0986    0.0983         0         0
         0         0         0         0         0    0.9834    0.0060
         0         0         0         0         0         0         0
         0    0.0051         0         0         0    0.5193         0
         0         0    0.0285         0         0         0         0
         0         0         0         0         0         0    0.0080
         0         0         0    0.0085         0         0         0
    0.0302         0         0         0    0.0158         0         0
         0         0         0         0    0.0038         0         0
         0         0         0    0.0125         0         0         0
    0.0045         0         0         0         0    0.9988         0
         0    0.0258         0         0         0         0    0.0873
         0         0    0.0276         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.0168    0.9886         0         0         0         0
         0         0    0.0302    0.5706    0.4297    0.5745
         0         0         0         0         0         0
         0         0    0.0542         0         0         0
         0         0         0    0.9925         0         0
    0.0170         0         0         0    0.0179         0
         0    0.9706         0         0         0    0.9841
         0         0         0    0.9471         0         0
         0    0.9890         0         0         0         0
```

```
         0         0         0         0    0.0051         0
         0         0    0.0655         0         0         0
    0.4310         0         0         0         0    0.5727


Q0 =

  Columns 1 through 7

    1.0000    0.0000    0.0000    1.0000    0.0002    0.0000    1.0000

  Columns 8 through 14

    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    1.0000

  Columns 15 through 20

    1.0000    0.0000    0.9999    0.0000    1.0000    0.0002


Q1 =

  Columns 1 through 7

    0.0000    1.0000    1.0000    0.0000    0.9998    1.0000    0.0000

  Columns 8 through 14

    0.0000    0.0000    0.0000    0.0000    0.0000    1.0000    0.0000

  Columns 15 through 20

    0.0000    1.0000    0.0001    1.0000    0.0000    0.9998


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

Iteration number 3
Variance 4.000000e-01
q0 =

  Columns 1 through 7

    0.0002         0         0         0         0    0.0000         0
    0.9998         0         0         0         0         0    1.0000
    1.0000         0         0         0         0         0         0
    0.0000         0         0         0         0         0         0
         0    0.9719         0         0         0    0.9997         0
         0    1.0000         0         0         0         0    1.0000
         0    0.0000         0         0         0         0         0
         0    0.0000         0         0         0         0         0
         0         0    0.0001         0         0    0.0016         0
```

```
         0         0    0.0007         0         0         0    0.0013
         0         0    0.0000         0         0         0         0
         0         0    0.0001         0         0         0         0
         0         0         0    1.0000         0    1.0000         0
         0         0         0    0.0002         0         0         0
         0         0         0    0.0001         0         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0    0.0029         0    0.0016
         0         0         0         0    1.0000         0         0
         0         0         0         0    0.0000         0         0
         0         0         0         0    0.9997         0         0

  Columns 8 through 14

         0         0         0    0.0001         0         0         0
         0         0         0         0    0.9997         0         0
    1.0000         0         0         0         0    1.0000         0
         0    0.0000         0         0         0         0    0.0000
         0         0         0         0         0         0         0
         0         0         0    1.0000         0         0         0
    0.0000         0         0         0    0.0000         0         0
         0         0    0.0000         0         0    0.0000         0
         0         0         0         0         0         0    0.0003
         0         0         0         0         0         0         0
         0    0.0000         0         0    0.0000         0         0
         0         0    0.0006    0.0025         0         0         0
         0         0         0         0         0    0.9997         0
    0.0001         0         0         0         0         0    0.0000
         0    0.0001         0         0         0         0         0
         0         0    1.0000         0    1.0000         0         0
         0         0         0         0         0         0    0.0013
    0.9997         0         0    1.0000         0         0         0
         0    0.0000         0         0         0    0.0001         0
         0         0    0.9863         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9997
         0
         0
         0
         0
    0.0013
         0
         0
         0
         0
    0.0000
         0
         0
         0
         0
    0.9997


q1 =
```

Columns 1 through 7

0.9998	0	0	0	0	1.0000	0
0.0002	0	0	0	0	0	0.0000
0.0000	0	0	0	0	0	0
1.0000	0	0	0	0	0	0
0	0.0281	0	0	0	0.0003	0
0	0.0000	0	0	0	0	0.0000
0	1.0000	0	0	0	0	0
0	1.0000	0	0	0	0	0
0	0	0.9999	0	0	0.9984	0
0	0	0.9993	0	0	0	0.9987
0	0	1.0000	0	0	0	0
0	0	0.9999	0	0	0	0
0	0	0	0.0000	0	0.0000	0
0	0	0	0.9998	0	0	0
0	0	0	0.9999	0	0	0
0	0	0	0.0000	0	0	0
0	0	0	0	0.9971	0	0.9984
0	0	0	0	0.0000	0	0
0	0	0	0	1.0000	0	0
0	0	0	0	0.0003	0	0

Columns 8 through 14

0	0	0	0.9999	0	0	0
0	0	0	0	0.0003	0	0
0.0000	0	0	0	0	0.0000	0
0	1.0000	0	0	0	0	1.0000
0	0	0	0	0	0	0
0	0	0	0.0000	0	0	0
1.0000	0	0	0	1.0000	0	0
0	0	1.0000	0	0	1.0000	0
0	0	0	0	0	0	0.9997
0	0	0	0	0	0	0
0	1.0000	0	0	1.0000	0	0
0	0	0.9994	0.9975	0	0	0
0	0	0	0	0	0.0003	0
0.9999	0	0	0	0	0	1.0000
0	0.9999	0	0	0	0	0
0	0	0.0000	0	0.0000	0	0
0	0	0	0	0	0	0.9987
0.0003	0	0	0.0000	0	0	0
0	1.0000	0	0	0	0.9999	0
0	0	0.0137	0	0	0	0

Column 15

0
0
0
0
0.0003
0
0
0
0
0.9987
0

```
         0
         0
         0
    1.0000
         0
         0
         0
         0
    0.0003
```

r1 =

Columns 1 through 7

0.9998	0.0002	0.0003	0.9997	0	0	0
0	0	0	0	0.0000	0.0281	0.9719
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0.9982	0	0	0	0.0016	0	0
0	0.0029	0	0	0	0.0029	0
0	0	0.0004	0	0	0	0.9996
0	0	0	0.9999	0	0	0
0	0	0	0	0	0	0
0.9975	0	0	0	0	0.0027	0
0	0.0000	0	0	0	0	0.9997
0	0	0.0004	0	0	0	0
0	0	0	0.9984	0	0	0
0	0	0	0	0.0016	0	0

Columns 8 through 14

0	0	0	0	0	0	0
0.9719	0	0	0	0	0	0
0	0.9992	0.9998	0.9991	0.9992	0	0
0	0	0	0	0	0.0002	0.9999
0	0	0	0	0	0	0
0	0.9997	0	0	0	0.0019	0
0	0	0.9984	0	0	0	0
0	0	0	0	0	0	0.9997
0	0	0	0.9999	0	0	0
0.9857	0	0	0	0.9863	0	0
0	0	0	0	0.9998	0	0
0	0	0	0.9997	0	0	0
0.9997	0	0	0	0	0.0001	0
0	0.9987	0	0	0	0	0.9984
0	0	0.9994	0	0	0	0

Columns 15 through 20

0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0.9998	0.0003	0	0	0	0
0	0	0.9997	0.0032	0.9968	0.0029
0	0	0	0	0	0
0	0	0.9987	0	0	0
0	0	0	0.0001	0	0
0.9999	0	0	0	0.9999	0

```
         0    0.0143         0         0         0    0.0006
         0         0         0    0.0026         0         0
         0    0.0004         0         0         0         0
         0         0         0         0    0.9997         0
         0         0    0.9997         0         0         0
    0.9981         0         0         0         0    0.0016


r0 =

  Columns 1 through 7

    0.0002    0.9998    0.9997    0.0003         0         0         0
         0         0         0         0    1.0000    0.9719    0.0281
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.0018         0         0         0    0.9984         0         0
         0    0.9971         0         0         0    0.9971         0
         0         0    0.9996         0         0         0    0.0004
         0         0         0    0.0001         0         0         0
         0         0         0         0         0         0         0
    0.0025         0         0         0         0    0.9973         0
         0    1.0000         0         0         0         0    0.0003
         0         0    0.9996         0         0         0         0
         0         0         0    0.0016         0         0         0
         0         0         0         0    0.9984         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.0281         0         0         0         0         0         0
         0    0.0008    0.0002    0.0009    0.0008         0         0
         0         0         0         0         0    0.9998    0.0001
         0         0         0         0         0         0         0
         0    0.0003         0         0         0    0.9981         0
         0         0    0.0016         0         0         0         0
         0         0         0         0         0         0    0.0003
         0         0         0    0.0001         0         0         0
    0.0143         0         0         0    0.0137         0         0
         0         0         0         0    0.0002         0         0
         0         0         0    0.0003         0         0         0
    0.0003         0         0         0         0    0.9999         0
         0    0.0013         0         0         0         0    0.0016
         0         0    0.0006         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.0002    0.9997         0         0         0         0
         0         0    0.0003    0.9968    0.0032    0.9971
         0         0         0         0         0         0
         0         0    0.0013         0         0         0
         0         0         0    0.9999         0         0
    0.0001         0         0         0    0.0001         0
         0    0.9857         0         0         0    0.9994
         0         0         0    0.9974         0         0
         0    0.9996         0         0         0         0
```

```
         0         0         0         0    0.0003         0
         0         0    0.0003         0         0         0
    0.0019         0         0         0         0    0.9984

Q0 =

  Columns 1 through 7

    1.0000    0.0000    0.0000    1.0000    0.0000    0.0000    1.0000

  Columns 8 through 14

    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    1.0000

  Columns 15 through 20

    1.0000    0.0000    1.0000    0.0000    1.0000    0.0000

Q1 =

  Columns 1 through 7

    0.0000    1.0000    1.0000    0.0000    1.0000    1.0000    0.0000

  Columns 8 through 14

    0.0000    0.0000    0.0000    0.0000    0.0000    1.0000    0.0000

  Columns 15 through 20

    0.0000    1.0000    0.0000    1.0000    0.0000    1.0000

output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

It took 3 number of iterations

p =

  Columns 1 through 7

    0.0105    0.5728    0.9947    0.0257    0.9276    0.9960    0.0761

  Columns 8 through 14

    0.0172    0.5165    0.4553    0.0312    0.5700    0.9629    0.2247

  Columns 15 through 20

    0.0152    0.9844    0.4376    0.9833    0.0160    0.9501
```

```
Iteration number 1
Variance 5.000000e-01
q0 =

  Columns 1 through 7

    0.0105         0         0         0         0    0.0105         0
    0.5728         0         0         0         0         0    0.5728
    0.9947         0         0         0         0         0         0
    0.0257         0         0         0         0         0         0
         0    0.9276         0         0         0    0.9276         0
         0    0.9960         0         0         0         0    0.9960
         0    0.0761         0         0         0         0         0
         0    0.0172         0         0         0         0         0
         0         0    0.5165         0         0    0.5165         0
         0         0    0.4553         0         0         0    0.4553
         0         0    0.0312         0         0         0         0
         0         0    0.5700         0         0         0         0
         0         0         0    0.9629         0    0.9629         0
         0         0         0    0.2247         0         0         0
         0         0         0    0.0152         0         0         0
         0         0         0    0.9844         0         0         0
         0         0         0         0    0.4376         0    0.4376
         0         0         0         0    0.9833         0         0
         0         0         0         0    0.0160         0         0
         0         0         0         0    0.9501         0         0

  Columns 8 through 14

         0         0         0    0.0105         0         0         0
         0         0         0         0    0.5728         0         0
    0.9947         0         0         0         0    0.9947         0
         0    0.0257         0         0         0         0    0.0257
         0         0         0         0         0         0         0
         0         0         0    0.9960         0         0         0
    0.0761         0         0         0    0.0761         0         0
         0         0    0.0172         0         0    0.0172         0
         0         0         0         0         0         0    0.5165
         0         0         0         0         0         0         0
         0    0.0312         0         0    0.0312         0         0
         0         0    0.5700    0.5700         0         0         0
         0         0         0         0         0    0.9629         0
    0.2247         0         0         0         0         0    0.2247
         0    0.0152         0         0         0         0         0
         0         0    0.9844         0    0.9844         0         0
         0         0         0         0         0         0    0.4376
    0.9833         0         0    0.9833         0         0         0
         0    0.0160         0         0         0    0.0160         0
         0         0    0.9501         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9276
         0
         0
```

```
     0
     0
0.4553
     0
     0
     0
     0
0.0152
     0
     0
     0
     0
0.9501
```

q1 =

Columns 1 through 7

0.9895	0	0	0	0	0.9895	0
0.4272	0	0	0	0	0	0.4272
0.0053	0	0	0	0	0	0
0.9743	0	0	0	0	0	0
0	0.0724	0	0	0	0.0724	0
0	0.0040	0	0	0	0	0.0040
0	0.9239	0	0	0	0	0
0	0.9828	0	0	0	0	0
0	0	0.4835	0	0	0.4835	0
0	0	0.5447	0	0	0	0.5447
0	0	0.9688	0	0	0	0
0	0	0.4300	0	0	0	0
0	0	0	0.0371	0	0.0371	0
0	0	0	0.7753	0	0	0
0	0	0	0.9848	0	0	0
0	0	0	0.0156	0	0	0
0	0	0	0	0.5624	0	0.5624
0	0	0	0	0.0167	0	0
0	0	0	0	0.9840	0	0
0	0	0	0	0.0499	0	0

Columns 8 through 14

0	0	0	0.9895	0	0	0
0	0	0	0	0.4272	0	0
0.0053	0	0	0	0	0.0053	0
0	0.9743	0	0	0	0	0.9743
0	0	0	0	0	0	0
0	0	0	0.0040	0	0	0
0.9239	0	0	0	0.9239	0	0
0	0	0.9828	0	0	0.9828	0
0	0	0	0	0	0	0.4835
0	0	0	0	0	0	0
0	0.9688	0	0	0.9688	0	0
0	0	0.4300	0.4300	0	0	0
0	0	0	0	0	0.0371	0
0.7753	0	0	0	0	0	0.7753
0	0.9848	0	0	0	0	0
0	0	0.0156	0	0.0156	0	0
0	0	0	0	0	0	0.5624
0.0167	0	0	0.0167	0	0	0

```
         0    0.9840         0         0         0    0.9840         0
         0         0    0.0499         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0724
         0
         0
         0
         0
    0.5447
         0
         0
         0
         0
    0.9848
         0
         0
         0
         0
    0.0499


r1 =

  Columns 1 through 7

    0.5683    0.0405    0.4324    0.5705         0         0         0
         0         0         0         0    0.0940    0.1500    0.9096
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.4869         0         0         0    0.5149         0         0
         0    0.4945         0         0         0    0.4992         0
         0         0    0.2744         0         0         0    0.7633
         0         0         0    0.9401         0         0         0
         0         0         0         0         0         0         0
    0.4329         0         0         0         0    0.5663         0
         0    0.1150         0         0         0         0    0.5661
         0         0    0.0673         0         0         0         0
         0         0         0    0.4989         0         0         0
         0         0         0         0    0.4610         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.8595         0         0         0         0         0         0
         0    0.4941    0.5022    0.5002    0.4986         0         0
         0         0         0         0         0    0.2414    0.9348
         0         0         0         0         0         0         0
         0    0.8875         0         0         0    0.5138         0
         0         0    0.5090         0         0         0         0
         0         0         0         0         0         0    0.9054
         0         0         0    0.9452         0         0         0
    0.4389         0         0         0    0.9211         0         0
         0         0         0         0    0.9693         0         0
```

```
         0         0         0    0.5598         0         0         0
    0.9434         0         0         0         0    0.0375         0
         0    0.5326         0         0         0         0    0.4980
         0         0    0.8732         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.7469    0.2529         0         0         0         0
         0         0    0.9212    0.4456    0.5543    0.4416
         0         0         0         0         0         0
         0         0    0.5065         0         0         0
         0         0         0    0.2691         0         0
    0.9305         0         0         0    0.9312         0
         0    0.5609         0         0         0    0.5655
         0         0         0    0.5680         0         0
         0    0.4422         0         0         0         0
         0         0         0         0    0.9423         0
         0         0    0.4914         0         0         0
    0.5344         0         0         0         0    0.4630


r0 =

  Columns 1 through 7

    0.4317    0.9595    0.5676    0.4295         0         0         0
         0         0         0         0    0.9060    0.8500    0.0904
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.5131         0         0         0    0.4851         0         0
         0    0.5055         0         0         0    0.5008         0
         0         0    0.7256         0         0         0    0.2367
         0         0         0    0.0599         0         0         0
         0         0         0         0         0         0         0
    0.5671         0         0         0         0    0.4337         0
         0    0.8850         0         0         0         0    0.4339
         0         0    0.9327         0         0         0         0
         0         0         0    0.5011         0         0         0
         0         0         0         0    0.5390         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.1405         0         0         0         0         0         0
         0    0.5059    0.4978    0.4998    0.5014         0         0
         0         0         0         0         0    0.7586    0.0652
         0         0         0         0         0         0         0
         0    0.1125         0         0         0    0.4862         0
         0         0    0.4910         0         0         0         0
         0         0         0         0         0         0    0.0946
         0         0         0    0.0548         0         0         0
    0.5611         0         0         0    0.0789         0         0
         0         0         0         0    0.0307         0         0
         0         0         0    0.4402         0         0         0
    0.0566         0         0         0         0    0.9625         0
         0    0.4674         0         0         0         0    0.5020
```

```
         0         0    0.1268         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.2531    0.7471         0         0         0         0
         0         0    0.0788    0.5544    0.4457    0.5584
         0         0         0         0         0         0
         0         0    0.4935         0         0         0
         0         0         0    0.7309         0         0
    0.0695         0         0         0    0.0688         0
         0    0.4391         0         0         0    0.4345
         0         0         0    0.4320         0         0
         0    0.5578         0         0         0         0
         0         0         0         0    0.0577         0
         0         0    0.5086         0         0         0
    0.4656         0         0         0         0    0.5370


Q0 =

  Columns 1 through 7

    0.9890    0.0040    0.0001    0.9987    0.0073    0.0009    0.9981

  Columns 8 through 14

    0.9998    0.8916    0.8960    0.9985    0.9964    0.0005    0.9979

  Columns 15 through 20

    0.9997    0.0054    0.9371    0.0066    0.9999    0.0445


Q1 =

  Columns 1 through 7

    0.0110    0.9960    0.9999    0.0013    0.9927    0.9991    0.0019

  Columns 8 through 14

    0.0002    0.1084    0.1040    0.0015    0.0036    0.9995    0.0021

  Columns 15 through 20

    0.0003    0.9946    0.0629    0.9934    0.0001    0.9555


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1
```

```
Iteration number 2
Variance 5.000000e-01
q0 =

  Columns 1 through 7

    0.0144         0         0         0         0    0.0104         0
    0.9134         0         0         0         0         0    0.9959
    0.9999         0         0         0         0         0         0
    0.0017         0         0         0         0         0         0
         0    0.9338         0         0         0    0.9931         0
         0    0.9947         0         0         0         0    0.9991
         0    0.0192         0         0         0         0         0
         0    0.0013         0         0         0         0         0
         0         0    0.1062         0         0    0.4897         0
         0         0    0.1048         0         0         0    0.1074
         0         0    0.0015         0         0         0         0
         0         0    0.0036         0         0         0         0
         0         0         0    0.9984         0    0.9995         0
         0         0         0    0.0296         0         0         0
         0         0         0    0.0010         0         0         0
         0         0         0    0.9842         0         0         0
         0         0         0         0    0.4398         0    0.0645
         0         0         0         0    0.9918         0         0
         0         0         0         0    0.0001         0         0
         0         0         0         0    0.9444         0         0

  Columns 8 through 14

         0         0         0    0.0084         0         0         0
         0         0         0         0    0.9701         0         0
    0.9997         0         0         0         0    0.9985         0
         0    0.0195         0         0         0         0    0.0013
         0         0         0         0         0         0         0
         0         0         0    0.9993         0         0         0
    0.0062         0         0         0    0.0025         0         0
         0         0    0.0002         0         0    0.0036         0
         0         0         0         0         0         0    0.1217
         0         0         0         0         0         0         0
         0    0.0247         0         0    0.0019         0         0
         0         0    0.0405    0.1025         0         0         0
         0         0         0         0         0    0.9872         0
    0.0200         0         0         0         0         0    0.0021
         0    0.0045         0         0         0         0         0
         0         0    0.9958         0    0.9932         0         0
         0         0         0         0         0         0    0.0609
    0.9824         0         0    0.9950         0         0         0
         0    0.0008         0         0         0    0.0010         0
         0         0    0.9654         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9915
         0
         0
```

```
         0
         0
    0.4443
         0
         0
         0
         0
         0
    0.0004
         0
         0
         0
         0
    0.9487
```

q1 =

Columns 1 through 7

0.9856	0	0	0	0	0.9896	0
0.0866	0	0	0	0	0	0.0041
0.0001	0	0	0	0	0	0
0.9983	0	0	0	0	0	0
0	0.0662	0	0	0	0.0069	0
0	0.0053	0	0	0	0	0.0009
0	0.9808	0	0	0	0	0
0	0.9987	0	0	0	0	0
0	0	0.8938	0	0	0.5103	0
0	0	0.8952	0	0	0	0.8926
0	0	0.9985	0	0	0	0
0	0	0.9964	0	0	0	0
0	0	0	0.0016	0	0.0005	0
0	0	0	0.9704	0	0	0
0	0	0	0.9990	0	0	0
0	0	0	0.0158	0	0	0
0	0	0	0	0.5602	0	0.9355
0	0	0	0	0.0082	0	0
0	0	0	0	0.9999	0	0
0	0	0	0	0.0556	0	0

Columns 8 through 14

0	0	0	0.9916	0	0	0
0	0	0	0	0.0299	0	0
0.0003	0	0	0	0	0.0015	0
0	0.9805	0	0	0	0	0.9987
0	0	0	0	0	0	0
0	0	0	0.0007	0	0	0
0.9938	0	0	0	0.9975	0	0
0	0	0.9998	0	0	0.9964	0
0	0	0	0	0	0	0.8783
0	0	0	0	0	0	0
0	0.9753	0	0	0.9981	0	0
0	0	0.9595	0.8975	0	0	0
0	0	0	0	0	0.0128	0
0.9800	0	0	0	0	0	0.9979
0	0.9955	0	0	0	0	0
0	0	0.0042	0	0.0068	0	0
0	0	0	0	0	0	0.9391
0.0176	0	0	0.0050	0	0	0

```
         0    0.9992         0         0         0    0.9990         0
         0         0    0.0346         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0085
         0
         0
         0
         0
    0.5557
         0
         0
         0
         0
    0.9996
         0
         0
         0
         0
    0.0513


r1 =

  Columns 1 through 7

    0.9119    0.0162    0.0999    0.9014         0         0         0
         0         0         0         0    0.0255    0.0840    0.9281
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.5101         0         0         0    0.4900         0         0
         0    0.1586         0         0         0    0.1608         0
         0         0    0.0427         0         0         0    0.9628
         0         0         0    0.9703         0         0         0
         0         0         0         0         0         0         0
    0.8930         0         0         0         0    0.1131         0
         0    0.0111         0         0         0         0    0.9620
         0         0    0.0173         0         0         0         0
         0         0         0    0.8308         0         0         0
         0         0         0         0    0.4500         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.9127         0         0         0         0         0         0
         0    0.8912    0.8898    0.8091    0.8104         0         0
         0         0         0         0         0    0.0454    0.9817
         0         0         0         0         0         0         0
         0    0.9824         0         0         0    0.4901         0
         0         0    0.9312         0         0         0         0
         0         0         0         0         0         0    0.9761
         0         0         0    0.9753         0         0         0
    0.9241         0         0         0    0.9613         0         0
         0         0         0         0    0.9860         0         0
```

```
         0         0         0    0.9613         0         0         0
    0.9848         0         0         0         0    0.0061         0
         0    0.9361         0         0         0         0    0.8314
         0         0    0.9407         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.9541    0.0321         0         0         0         0
         0         0    0.9371    0.4465    0.5527    0.4408
         0         0         0         0         0         0
         0         0    0.8887         0         0         0
         0         0         0    0.0262         0         0
    0.9560         0         0         0    0.9526         0
         0    0.0724         0         0         0    0.0445
         0         0         0    0.1097         0         0
         0    0.0340         0         0         0         0
         0         0         0         0    0.9822         0
         0         0    0.8757         0         0         0
    0.5492         0         0         0         0    0.4453


r0 =

  Columns 1 through 7

    0.0881    0.9838    0.9001    0.0986         0         0         0
         0         0         0         0    0.9745    0.9160    0.0719
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.4899         0         0         0    0.5100         0         0
         0    0.8414         0         0         0    0.8392         0
         0         0    0.9573         0         0         0    0.0372
         0         0         0    0.0297         0         0         0
         0         0         0         0         0         0         0
    0.1070         0         0         0         0    0.8869         0
         0    0.9889         0         0         0         0    0.0380
         0         0    0.9827         0         0         0         0
         0         0         0    0.1692         0         0         0
         0         0         0         0    0.5500         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.0873         0         0         0         0         0         0
         0    0.1088    0.1102    0.1909    0.1896         0         0
         0         0         0         0         0    0.9546    0.0183
         0         0         0         0         0         0         0
         0    0.0176         0         0         0    0.5099         0
         0         0    0.0688         0         0         0         0
         0         0         0         0         0         0    0.0239
         0         0         0    0.0247         0         0         0
    0.0759         0         0         0    0.0387         0         0
         0         0         0         0    0.0140         0         0
         0         0         0    0.0387         0         0         0
    0.0152         0         0         0         0    0.9939         0
         0    0.0639         0         0         0         0    0.1686
```

```
         0         0    0.0593         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.0459    0.9679         0         0         0         0
         0         0    0.0629    0.5535    0.4473    0.5592
         0         0         0         0         0         0
         0         0    0.1113         0         0         0
         0         0         0    0.9738         0         0
    0.0440         0         0         0    0.0474         0
         0    0.9276         0         0         0    0.9555
         0         0         0    0.8903         0         0
         0    0.9660         0         0         0         0
         0         0         0         0    0.0178         0
         0         0    0.1243         0         0         0
    0.4508         0         0         0         0    0.5547


Q0 =

  Columns 1 through 7

    0.9999    0.0000    0.0000    1.0000    0.0016    0.0000    1.0000

  Columns 8 through 14

    1.0000    0.9998    0.9995    1.0000    0.9998    0.0000    1.0000

  Columns 15 through 20

    1.0000    0.0000    0.9991    0.0000    1.0000    0.0015


Q1 =

  Columns 1 through 7

    0.0001    1.0000    1.0000    0.0000    0.9984    1.0000    0.0000

  Columns 8 through 14

    0.0000    0.0002    0.0005    0.0000    0.0002    1.0000    0.0000

  Columns 15 through 20

    0.0000    1.0000    0.0009    1.0000    0.0000    0.9985


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1
```

```
Iteration number 3
Variance 5.000000e-01
q0 =

  Columns 1 through 7

    0.0012         0         0         0         0    0.0001         0
    0.9984         0         0         0         0         0    0.9999
    1.0000         0         0         0         0         0         0
    0.0002         0         0         0         0         0         0
         0    0.9422         0         0         0    0.9983         0
         0    0.9999         0         0         0         0    1.0000
         0    0.0001         0         0         0         0         0
         0    0.0000         0         0         0         0         0
         0         0    0.0013         0         0    0.0088         0
         0         0    0.0039         0         0         0    0.0065
         0         0    0.0000         0         0         0         0
         0         0    0.0008         0         0         0         0
         0         0         0    0.9998         0    1.0000         0
         0         0         0    0.0014         0         0         0
         0         0         0    0.0006         0         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0    0.0136         0    0.0074
         0         0         0         0    0.9999         0         0
         0         0         0         0    0.0000         0         0
         0         0         0         0    0.9980         0         0

  Columns 8 through 14

         0         0         0    0.0010         0         0         0
         0         0         0         0    0.9977         0         0
    1.0000         0         0         0         0    1.0000         0
         0    0.0006         0         0         0         0    0.0001
         0         0         0         0         0         0         0
         0         0         0    0.9999         0         0         0
    0.0003         0         0         0    0.0002         0         0
         0         0    0.0000         0         0    0.0001         0
         0         0         0         0         0         0    0.0023
         0         0         0         0         0         0         0
         0    0.0003         0         0    0.0002         0         0
         0         0    0.0044    0.0123         0         0         0
         0         0         0         0         0    0.9982         0
    0.0011         0         0         0         0         0    0.0001
         0    0.0006         0         0         0         0         0
         0         0    1.0000         0    1.0000         0         0
         0         0         0         0         0         0    0.0065
    0.9983         0         0    0.9996         0         0         0
         0    0.0002         0         0         0    0.0007         0
         0         0    0.9679         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9980
         0
         0
```

```
         0
         0
    0.0076
         0
         0
         0
         0
         0
    0.0000
         0
         0
         0
         0
    0.9981
```

q1 =

Columns 1 through 7

0.9988	0	0	0	0	0.9999	0
0.0016	0	0	0	0	0	0.0001
0.0000	0	0	0	0	0	0
0.9998	0	0	0	0	0	0
0	0.0578	0	0	0	0.0017	0
0	0.0001	0	0	0	0	0.0000
0	0.9999	0	0	0	0	0
0	1.0000	0	0	0	0	0
0	0	0.9987	0	0	0.9912	0
0	0	0.9961	0	0	0	0.9935
0	0	1.0000	0	0	0	0
0	0	0.9992	0	0	0	0
0	0	0	0.0002	0	0.0000	0
0	0	0	0.9986	0	0	0
0	0	0	0.9994	0	0	0
0	0	0	0.0000	0	0	0
0	0	0	0	0.9864	0	0.9926
0	0	0	0	0.0001	0	0
0	0	0	0	1.0000	0	0
0	0	0	0	0.0020	0	0

Columns 8 through 14

0	0	0	0.9990	0	0	0
0	0	0	0	0.0023	0	0
0.0000	0	0	0	0	0.0000	0
0	0.9994	0	0	0	0	0.9999
0	0	0	0	0	0	0
0	0	0	0.0001	0	0	0
0.9997	0	0	0	0.9998	0	0
0	0	1.0000	0	0	0.9999	0
0	0	0	0	0	0	0.9977
0	0	0	0	0	0	0
0	0.9997	0	0	0.9998	0	0
0	0	0.9956	0.9877	0	0	0
0	0	0	0	0	0.0018	0
0.9989	0	0	0	0	0	0.9999
0	0.9994	0	0	0	0	0
0	0	0.0000	0	0.0000	0	0
0	0	0	0	0	0	0.9935
0.0017	0	0	0.0004	0	0	0

```
         0    0.9998         0         0         0    0.9993         0
         0         0    0.0321         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0020
         0
         0
         0
         0
    0.9924
         0
         0
         0
         0
    1.0000
         0
         0
         0
         0
    0.0019


r1 =

  Columns 1 through 7

    0.9983    0.0014    0.0030    0.9972         0         0         0
         0         0         0         0    0.0002    0.0580    0.9421
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.9895         0         0         0    0.0089         0         0
         0    0.0138         0         0         0    0.0139         0
         0         0    0.0030         0         0         0    0.9972
         0         0         0    0.9988         0         0         0
         0         0         0         0         0         0         0
    0.9873         0         0         0         0    0.0136         0
         0    0.0005         0         0         0         0    0.9975
         0         0    0.0025         0         0         0         0
         0         0         0    0.9911         0         0         0
         0         0         0         0    0.0095         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.9420         0         0         0         0         0         0
         0    0.9953    0.9979    0.9941    0.9948         0         0
         0         0         0         0         0    0.0021    0.9991
         0         0         0         0         0         0         0
         0    0.9982         0         0         0    0.0106         0
         0         0    0.9925         0         0         0         0
         0         0         0         0         0         0    0.9981
         0         0         0    0.9986         0         0         0
    0.9637         0         0         0    0.9678         0         0
         0         0         0         0    0.9986         0         0
```

```
         0         0         0    0.9974         0         0         0
    0.9976         0         0         0         0    0.0008         0
         0    0.9933         0         0         0         0    0.9911
         0         0    0.9961         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.9983    0.0022         0         0         0         0
         0         0    0.9980    0.0156    0.9844    0.0137
         0         0         0         0         0         0
         0         0    0.9933         0         0         0
         0         0         0    0.0014         0         0
    0.9989         0         0         0    0.9985         0
         0    0.0363         0         0         0    0.0044
         0         0         0    0.0133         0         0
         0    0.0027         0         0         0         0
         0         0         0         0    0.9981         0
         0         0    0.9974         0         0         0
    0.9886         0         0         0         0    0.0096


r0 =

  Columns 1 through 7

    0.0017    0.9986    0.9970    0.0028         0         0         0
         0         0         0         0    0.9998    0.9420    0.0579
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.0105         0         0         0    0.9911         0         0
         0    0.9862         0         0         0    0.9861         0
         0         0    0.9970         0         0         0    0.0028
         0         0         0    0.0012         0         0         0
         0         0         0         0         0         0         0
    0.0127         0         0         0         0    0.9864         0
         0    0.9995         0         0         0         0    0.0025
         0         0    0.9975         0         0         0         0
         0         0         0    0.0089         0         0         0
         0         0         0         0    0.9905         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.0580         0         0         0         0         0         0
         0    0.0047    0.0021    0.0059    0.0052         0         0
         0         0         0         0         0    0.9979    0.0009
         0         0         0         0         0         0         0
         0    0.0018         0         0         0    0.9894         0
         0         0    0.0075         0         0         0         0
         0         0         0         0         0         0    0.0019
         0         0         0    0.0014         0         0         0
    0.0363         0         0         0    0.0322         0         0
         0         0         0         0    0.0014         0         0
         0         0         0    0.0026         0         0         0
    0.0024         0         0         0         0    0.9992         0
         0    0.0067         0         0         0         0    0.0089
```

```
         0         0    0.0039         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.0017    0.9978         0         0         0         0
         0         0    0.0020    0.9844    0.0156    0.9863
         0         0         0         0         0         0
         0         0    0.0067         0         0         0
         0         0         0    0.9986         0         0
    0.0011         0         0         0    0.0015         0
         0    0.9637         0         0         0    0.9956
         0         0         0    0.9867         0         0
         0    0.9973         0         0         0         0
         0         0         0         0    0.0019         0
         0         0    0.0026         0         0         0
    0.0114         0         0         0         0    0.9904


Q0 =

  Columns 1 through 7

    1.0000    0.0000    0.0000    1.0000    0.0000    0.0000    1.0000

  Columns 8 through 14

    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    1.0000

  Columns 15 through 20

    1.0000    0.0000    1.0000    0.0000    1.0000    0.0000


Q1 =

  Columns 1 through 7

    0.0000    1.0000    1.0000    0.0000    1.0000    1.0000    0.0000

  Columns 8 through 14

    0.0000    0.0000    0.0000    0.0000    0.0000    1.0000    0.0000

  Columns 15 through 20

    0.0000    1.0000    0.0000    1.0000    0.0000    1.0000


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1
```

```
It took 3 number of iterations

p =

  Columns 1 through 7

    0.0221    0.5608    0.9874    0.0461    0.8933    0.9899    0.1111

  Columns 8 through 14

    0.0332    0.5137    0.4627    0.0540    0.5585    0.9378    0.2627

  Columns 15 through 20

    0.0300    0.9693    0.4479    0.9676    0.0312    0.9210

Iteration number 1
Variance 6.000000e-01
q0 =

  Columns 1 through 7

    0.0221         0         0         0         0    0.0221         0
    0.5608         0         0         0         0         0    0.5608
    0.9874         0         0         0         0         0         0
    0.0461         0         0         0         0         0         0
         0    0.8933         0         0         0    0.8933         0
         0    0.9899         0         0         0         0    0.9899
         0    0.1111         0         0         0         0         0
         0    0.0332         0         0         0         0         0
         0         0    0.5137         0         0    0.5137         0
         0         0    0.4627         0         0         0    0.4627
         0         0    0.0540         0         0         0         0
         0         0    0.5585         0         0         0         0
         0         0         0    0.9378         0    0.9378         0
         0         0         0    0.2627         0         0         0
         0         0         0    0.0300         0         0         0
         0         0         0    0.9693         0         0         0
         0         0         0         0    0.4479         0    0.4479
         0         0         0         0    0.9676         0         0
         0         0         0         0    0.0312         0         0
         0         0         0         0    0.9210         0         0

  Columns 8 through 14

         0         0         0    0.0221         0         0         0
         0         0         0         0    0.5608         0         0
    0.9874         0         0         0         0    0.9874         0
         0    0.0461         0         0         0         0    0.0461
         0         0         0         0         0         0         0
         0         0         0    0.9899         0         0         0
    0.1111         0         0         0    0.1111         0         0
         0         0    0.0332         0         0    0.0332         0
         0         0         0         0         0         0    0.5137
         0         0         0         0         0         0         0
         0    0.0540         0         0    0.0540         0         0
         0         0    0.5585    0.5585         0         0         0
         0         0         0         0         0    0.9378         0
    0.2627         0         0         0         0         0    0.2627
```

```
         0    0.0300         0         0         0         0         0
         0         0    0.9693         0    0.9693         0         0
         0         0         0         0         0         0    0.4479
    0.9676         0         0    0.9676         0         0         0
         0    0.0312         0         0         0    0.0312         0
         0         0    0.9210         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.8933
         0
         0
         0
         0
    0.4627
         0
         0
         0
         0
    0.0300
         0
         0
         0
         0
    0.9210


q1 =

  Columns 1 through 7

    0.9779         0         0         0         0    0.9779         0
    0.4392         0         0         0         0         0    0.4392
    0.0126         0         0         0         0         0         0
    0.9539         0         0         0         0         0         0
         0    0.1067         0         0         0    0.1067         0
         0    0.0101         0         0         0         0    0.0101
         0    0.8889         0         0         0         0         0
         0    0.9668         0         0         0         0         0
         0         0    0.4863         0         0    0.4863         0
         0         0    0.5373         0         0         0    0.5373
         0         0    0.9460         0         0         0         0
         0         0    0.4415         0         0         0         0
         0         0         0    0.0622         0    0.0622         0
         0         0         0    0.7373         0         0         0
         0         0         0    0.9700         0         0         0
         0         0         0    0.0307         0         0         0
         0         0         0         0    0.5521         0    0.5521
         0         0         0         0    0.0324         0         0
         0         0         0         0    0.9688         0         0
         0         0         0         0    0.0790         0         0

  Columns 8 through 14

         0         0         0    0.9779         0         0         0
         0         0         0         0    0.4392         0         0
```

```
    0.0126         0         0         0         0    0.0126         0
         0    0.9539         0         0         0         0    0.9539
         0         0         0         0         0         0         0
         0         0         0    0.0101         0         0         0
    0.8889         0         0         0    0.8889         0         0
         0         0    0.9668         0         0    0.9668         0
         0         0         0         0         0         0    0.4863
         0         0         0         0         0         0         0
         0    0.9460         0         0    0.9460         0         0
         0         0    0.4415    0.4415         0         0         0
         0         0         0         0         0    0.0622         0
    0.7373         0         0         0         0         0    0.7373
         0    0.9700         0         0         0         0         0
         0         0    0.0307         0    0.0307         0         0
         0         0         0         0         0         0    0.5521
    0.0324         0         0    0.0324         0         0         0
         0    0.9688         0         0         0    0.9688         0
         0         0    0.0790         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.1067
         0
         0
         0
         0
    0.5373
         0
         0
         0
         0
    0.9700
         0
         0
         0
         0
    0.0790


r1 =

  Columns 1 through 7

    0.5538    0.0771    0.4473    0.5566         0         0         0
         0         0         0         0    0.1442    0.2143    0.8598
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.4905         0         0         0    0.5115         0         0
         0    0.4962         0         0         0    0.4995         0
         0         0    0.3274         0         0         0    0.7163
         0         0         0    0.8931         0         0         0
         0         0         0         0         0         0         0
    0.4464         0         0         0         0    0.5523         0
         0    0.1743         0         0         0         0    0.5509
         0         0    0.1168         0         0         0         0
```

```
         0         0         0    0.4993         0         0         0
         0         0         0         0    0.4705         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.7998         0         0         0         0         0         0
         0    0.4961    0.5014    0.5001    0.4991         0         0
         0         0         0         0         0    0.2906    0.8863
         0         0         0         0         0         0         0
         0    0.8292         0         0         0    0.5103         0
         0         0    0.5062         0         0         0         0
         0         0         0         0         0         0    0.8546
         0         0         0    0.9000         0         0         0
    0.4538         0         0         0    0.8690         0         0
         0         0         0         0    0.9379         0         0
         0         0         0    0.5444         0         0         0
    0.9001         0         0         0         0    0.0733         0
         0    0.5224         0         0         0         0    0.4987
         0         0    0.8113         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.6950    0.3047         0         0         0         0
         0         0    0.8691    0.4589    0.5410    0.4544
         0         0         0         0         0         0
         0         0    0.5044         0         0         0
         0         0         0    0.3200         0         0
    0.8796         0         0         0    0.8806         0
         0    0.5460         0         0         0    0.5513
         0         0         0    0.5548         0         0
         0    0.4578         0         0         0         0
         0         0         0         0    0.8985         0
         0         0    0.4941         0         0         0
    0.5247         0         0         0         0    0.4724


r0 =

  Columns 1 through 7

    0.4462    0.9229    0.5527    0.4434         0         0         0
         0         0         0         0    0.8558    0.7857    0.1402
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.5095         0         0         0    0.4885         0         0
         0    0.5038         0         0         0    0.5005         0
         0         0    0.6726         0         0         0    0.2837
         0         0         0    0.1069         0         0         0
         0         0         0         0         0         0         0
    0.5536         0         0         0         0    0.4477         0
         0    0.8257         0         0         0         0    0.4491
         0         0    0.8832         0         0         0         0
         0         0         0    0.5007         0         0         0
         0         0         0         0    0.5295         0         0
```

Columns 8 through 14

```
         0         0         0         0         0         0         0
    0.2002         0         0         0         0         0         0
         0    0.5039    0.4986    0.4999    0.5009         0         0
         0         0         0         0         0    0.7094    0.1137
         0         0         0         0         0         0         0
         0    0.1708         0         0         0    0.4897         0
         0         0    0.4938         0         0         0         0
         0         0         0         0         0         0    0.1454
         0         0         0    0.1000         0         0         0
    0.5462         0         0         0    0.1310         0         0
         0         0         0         0    0.0621         0         0
         0         0         0    0.4556         0         0         0
    0.0999         0         0         0         0    0.9267         0
         0    0.4776         0         0         0         0    0.5013
         0         0    0.1887         0         0         0         0
```

Columns 15 through 20

```
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.3050    0.6953         0         0         0         0
         0         0    0.1309    0.5411    0.4590    0.5456
         0         0         0         0         0         0
         0         0    0.4956         0         0         0
         0         0         0    0.6800         0         0
    0.1204         0         0         0    0.1194         0
         0    0.4540         0         0         0    0.4487
         0         0         0    0.4452         0         0
         0    0.5422         0         0         0         0
         0         0         0         0    0.1015         0
         0         0    0.5059         0         0         0
    0.4753         0         0         0         0    0.5276
```

Q0 =

Columns 1 through 7

```
    0.9771    0.0134    0.0007    0.9954    0.0184    0.0034    0.9935
```

Columns 8 through 14

```
    0.9989    0.8319    0.8373    0.9947    0.9875    0.0022    0.9922
```

Columns 15 through 20

```
    0.9983    0.0139    0.8905    0.0164    0.9996    0.0729
```

Q1 =

Columns 1 through 7

```
    0.0229    0.9866    0.9993    0.0046    0.9816    0.9966    0.0065
```

Columns 8 through 14

```
    0.0011    0.1681    0.1627    0.0053    0.0125    0.9978    0.0078

  Columns 15 through 20

    0.0017    0.9861    0.1095    0.9836    0.0004    0.9271


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

Iteration number 2
Variance 6.000000e-01
q0 =

  Columns 1 through 7

    0.0283         0         0         0         0    0.0221         0
    0.8599         0         0         0         0         0    0.9864
    0.9992         0         0         0         0         0         0
    0.0058         0         0         0         0         0         0
         0    0.9000         0         0         0    0.9824         0
         0    0.9876         0         0         0         0    0.9966
         0    0.0388         0         0         0         0         0
         0    0.0046         0         0         0         0         0
         0         0    0.1660         0         0    0.4952         0
         0         0    0.1635         0         0         0    0.1661
         0         0    0.0053         0         0         0         0
         0         0    0.0125         0         0         0         0
         0         0         0    0.9946         0    0.9979         0
         0         0         0    0.0574         0         0         0
         0         0         0    0.0038         0         0         0
         0         0         0    0.9689         0         0         0
         0         0         0         0    0.4494         0    0.1112
         0         0         0         0    0.9807         0         0
         0         0         0         0    0.0005         0         0
         0         0         0         0    0.9138         0         0

  Columns 8 through 14

         0         0         0    0.0186         0         0         0
         0         0         0         0    0.9395         0         0
    0.9986         0         0         0         0    0.9950         0
         0    0.0372         0         0         0         0    0.0046
         0         0         0         0         0         0         0
         0         0         0    0.9972         0         0         0
    0.0163         0         0         0    0.0080         0         0
         0         0    0.0010         0         0    0.0102         0
         0         0         0         0         0         0    0.1811
         0         0         0         0         0         0         0
         0    0.0456         0         0    0.0063         0         0
         0         0    0.0775    0.1607         0         0         0
         0         0         0         0         0    0.9725         0
    0.0439         0         0         0         0         0    0.0077
```

```
         0    0.0121         0         0         0         0         0
         0         0    0.9884         0    0.9836         0         0
         0         0         0         0         0         0    0.1072
    0.9658         0         0    0.9868         0         0         0
         0    0.0031         0         0         0    0.0037         0
         0         0    0.9399         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9794
         0
         0
         0
         0
    0.4552
         0
         0
         0
         0
    0.0019
         0
         0
         0
         0
    0.9193


q1 =

  Columns 1 through 7

    0.9717         0         0         0         0    0.9779         0
    0.1401         0         0         0         0         0    0.0136
    0.0008         0         0         0         0         0         0
    0.9942         0         0         0         0         0         0
         0    0.1000         0         0         0    0.0176         0
         0    0.0124         0         0         0         0    0.0034
         0    0.9612         0         0         0         0         0
         0    0.9954         0         0         0         0         0
         0         0    0.8340         0         0    0.5048         0
         0         0    0.8365         0         0         0    0.8339
         0         0    0.9947         0         0         0         0
         0         0    0.9875         0         0         0         0
         0         0         0    0.0054         0    0.0021         0
         0         0         0    0.9426         0         0         0
         0         0         0    0.9962         0         0         0
         0         0         0    0.0311         0         0         0
         0         0         0         0    0.5506         0    0.8888
         0         0         0         0    0.0193         0         0
         0         0         0         0    0.9995         0         0
         0         0         0         0    0.0862         0         0

  Columns 8 through 14

         0         0         0    0.9814         0         0         0
         0         0         0         0    0.0605         0         0
```

```
    0.0014         0         0         0         0    0.0050         0
         0    0.9628         0         0         0         0    0.9954
         0         0         0         0         0         0         0
         0         0         0    0.0028         0         0         0
    0.9837         0         0         0    0.9920         0         0
         0         0    0.9990         0         0    0.9898         0
         0         0         0         0         0         0    0.8189
         0         0         0         0         0         0         0
         0    0.9544         0         0    0.9937         0         0
         0         0    0.9225    0.8393         0         0         0
         0         0         0         0         0    0.0275         0
    0.9561         0         0         0         0         0    0.9923
         0    0.9879         0         0         0         0         0
         0         0    0.0116         0    0.0164         0         0
         0         0         0         0         0         0    0.8928
    0.0342         0         0    0.0132         0         0         0
         0    0.9969         0         0         0    0.9963         0
         0         0    0.0601         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0206
         0
         0
         0
         0
    0.5448
         0
         0
         0
         0
    0.9981
         0
         0
         0
         0
    0.0807


r1 =

  Columns 1 through 7

    0.8552    0.0345    0.1644    0.8390         0         0         0
         0         0         0         0    0.0543    0.1344    0.8865
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.5046         0         0         0    0.4954         0         0
         0    0.2421         0         0         0    0.2474         0
         0         0    0.0890         0         0         0    0.9237
         0         0         0    0.9407         0         0         0
         0         0         0         0         0         0         0
    0.8285         0         0         0         0    0.1819         0
         0    0.0301         0         0         0         0    0.9197
         0         0    0.0406         0         0         0         0
```

```
         0         0         0    0.7467         0         0         0
         0         0         0         0    0.4625         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.8599         0         0         0         0         0         0
         0    0.8247    0.8223    0.7192    0.7225         0         0
         0         0         0         0         0    0.0882    0.9602
         0         0         0         0         0         0         0
         0    0.9591         0         0         0    0.4956         0
         0         0    0.8756         0         0         0         0
         0         0         0         0         0         0    0.9494
         0         0         0    0.9488         0         0         0
    0.8631         0         0         0    0.9289         0         0
         0         0         0         0    0.9661         0         0
         0         0         0    0.9183         0         0         0
    0.9643         0         0         0         0    0.0187         0
         0    0.8832         0         0         0         0    0.7483
         0         0    0.9005         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.9105    0.0656         0         0         0         0
         0         0    0.8974    0.4582    0.5403    0.4514
         0         0         0         0         0         0
         0         0    0.8226         0         0         0
         0         0         0    0.0600         0         0
    0.9181         0         0         0    0.9105         0
         0    0.1290         0         0         0    0.0881
         0         0         0    0.1751         0         0
         0    0.0730         0         0         0         0
         0         0         0         0    0.9582         0
         0         0    0.8111         0         0         0
    0.5361         0         0         0         0    0.4572


r0 =

  Columns 1 through 7

    0.1448    0.9655    0.8356    0.1610         0         0         0
         0         0         0         0    0.9457    0.8656    0.1135
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.4954         0         0         0    0.5046         0         0
         0    0.7579         0         0         0    0.7526         0
         0         0    0.9110         0         0         0    0.0763
         0         0         0    0.0593         0         0         0
         0         0         0         0         0         0         0
    0.1715         0         0         0         0    0.8181         0
         0    0.9699         0         0         0         0    0.0803
         0         0    0.9594         0         0         0         0
         0         0         0    0.2533         0         0         0
         0         0         0         0    0.5375         0         0
```

Columns 8 through 14

```
         0         0         0         0         0         0         0
    0.1401         0         0         0         0         0         0
         0    0.1753    0.1777    0.2808    0.2775         0         0
         0         0         0         0         0    0.9118    0.0398
         0         0         0         0         0         0         0
         0    0.0409         0         0         0    0.5044         0
         0         0    0.1244         0         0         0         0
         0         0         0         0         0         0    0.0506
         0         0         0    0.0512         0         0         0
    0.1369         0         0         0    0.0711         0         0
         0         0         0         0    0.0339         0         0
         0         0         0    0.0817         0         0         0
    0.0357         0         0         0         0    0.9813         0
         0    0.1168         0         0         0         0    0.2517
         0         0    0.0995         0         0         0         0
```

Columns 15 through 20

```
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.0895    0.9344         0         0         0         0
         0         0    0.1026    0.5418    0.4597    0.5486
         0         0         0         0         0         0
         0         0    0.1774         0         0         0
         0         0         0    0.9400         0         0
    0.0819         0         0         0    0.0895         0
         0    0.8710         0         0         0    0.9119
         0         0         0    0.8249         0         0
         0    0.9270         0         0         0         0
         0         0         0         0    0.0418         0
         0         0    0.1889         0         0         0
    0.4639         0         0         0         0    0.5428
```

Q0 =

Columns 1 through 7

```
    0.9992    0.0003    0.0000    0.9998    0.0058    0.0001    0.9999
```

Columns 8 through 14

```
    1.0000    0.9987    0.9971    0.9999    0.9987    0.0001    0.9997
```

Columns 15 through 20

```
    0.9998    0.0000    0.9954    0.0004    0.9999    0.0057
```

Q1 =

Columns 1 through 7

```
    0.0008    0.9997    1.0000    0.0002    0.9942    0.9999    0.0001
```

Columns 8 through 14

```
    0.0000    0.0013    0.0029    0.0001    0.0013    0.9999    0.0003

  Columns 15 through 20

    0.0002    1.0000    0.0046    0.9996    0.0001    0.9943


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

Iteration number 3
Variance 6.000000e-01
q0 =

  Columns 1 through 7

    0.0046         0         0         0         0    0.0008         0
    0.9923         0         0         0         0         0    0.9991
    0.9999         0         0         0         0         0         0
    0.0010         0         0         0         0         0         0
         0    0.9083         0         0         0    0.9941         0
         0    0.9993         0         0         0         0    0.9996
         0    0.0009         0         0         0         0         0
         0    0.0002         0         0         0         0         0
         0         0    0.0059         0         0    0.0288         0
         0         0    0.0133         0         0         0    0.0201
         0         0    0.0003         0         0         0         0
         0         0    0.0034         0         0         0         0
         0         0         0    0.9988         0    0.9999         0
         0         0         0    0.0064         0         0         0
         0         0         0    0.0024         0         0         0
         0         0         0    0.9996         0         0         0
         0         0         0         0    0.0391         0    0.0211
         0         0         0         0    0.9995         0         0
         0         0         0         0    0.0001         0         0
         0         0         0         0    0.9931         0         0

  Columns 8 through 14

         0         0         0    0.0037         0         0         0
         0         0         0         0    0.9911         0         0
    0.9999         0         0         0         0    0.9998         0
         0    0.0031         0         0         0         0    0.0006
         0         0         0         0         0         0         0
         0         0         0    0.9995         0         0         0
    0.0014         0         0         0    0.0013         0         0
         0         0    0.0002         0         0    0.0009         0
         0         0         0         0         0         0    0.0095
         0         0         0         0         0         0         0
         0    0.0020         0         0    0.0012         0         0
         0         0    0.0168    0.0359         0         0         0
         0         0         0         0         0    0.9937         0
    0.0049         0         0         0         0         0    0.0008
```

```
         0    0.0026         0         0         0         0         0
         0         0    0.9998         0    0.9997         0         0
         0         0         0         0         0         0    0.0196
    0.9940         0         0    0.9982         0         0         0
         0    0.0012         0         0         0    0.0027         0
         0         0    0.9439         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9933
         0
         0
         0
         0
    0.0258
         0
         0
         0
         0
    0.0003
         0
         0
         0
         0
    0.9932


q1 =

  Columns 1 through 7

    0.9954         0         0         0         0    0.9992         0
    0.0077         0         0         0         0         0    0.0009
    0.0001         0         0         0         0         0         0
    0.9990         0         0         0         0         0         0
         0    0.0917         0         0         0    0.0059         0
         0    0.0007         0         0         0         0    0.0004
         0    0.9991         0         0         0         0         0
         0    0.9998         0         0         0         0         0
         0         0    0.9941         0         0    0.9712         0
         0         0    0.9867         0         0         0    0.9799
         0         0    0.9997         0         0         0         0
         0         0    0.9966         0         0         0         0
         0         0         0    0.0012         0    0.0001         0
         0         0         0    0.9936         0         0         0
         0         0         0    0.9976         0         0         0
         0         0         0    0.0004         0         0         0
         0         0         0         0    0.9609         0    0.9789
         0         0         0         0    0.0005         0         0
         0         0         0         0    0.9999         0         0
         0         0         0         0    0.0069         0         0

  Columns 8 through 14

         0         0         0    0.9963         0         0         0
         0         0         0         0    0.0089         0         0
```

```
    0.0001         0         0         0         0    0.0002         0
         0    0.9969         0         0         0         0    0.9994
         0         0         0         0         0         0         0
         0         0         0    0.0005         0         0         0
    0.9986         0         0         0    0.9987         0         0
         0         0    0.9998         0         0    0.9991         0
         0         0         0         0         0         0    0.9905
         0         0         0         0         0         0         0
         0    0.9980         0         0    0.9988         0         0
         0         0    0.9832    0.9641         0         0         0
         0         0         0         0         0    0.0063         0
    0.9951         0         0         0         0         0    0.9992
         0    0.9974         0         0         0         0         0
         0         0    0.0002         0    0.0003         0         0
         0         0         0         0         0         0    0.9804
    0.0060         0         0    0.0018         0         0         0
         0    0.9988         0         0         0    0.9973         0
         0         0    0.0561         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0067
         0
         0
         0
         0
    0.9742
         0
         0
         0
         0
    0.9997
         0
         0
         0
         0
    0.0068


r1 =

  Columns 1 through 7

    0.9912    0.0056    0.0132    0.9877         0         0         0
         0         0         0         0    0.0018    0.0926    0.9076
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.9655         0         0         0    0.0297         0         0
         0    0.0408         0         0         0    0.0412         0
         0         0    0.0122         0         0         0    0.9890
         0         0         0    0.9942         0         0         0
         0         0         0         0         0         0         0
    0.9620         0         0         0         0    0.0410         0
         0    0.0028         0         0         0         0    0.9896
         0         0    0.0098         0         0         0         0
```

```
         0         0         0    0.9705         0         0         0
         0         0         0         0    0.0324         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.9070         0         0         0         0         0         0
         0    0.9831    0.9905    0.9777    0.9806         0         0
         0         0         0         0         0    0.0091    0.9960
         0         0         0         0         0         0         0
         0    0.9932         0         0         0    0.0351         0
         0         0    0.9777         0         0         0         0
         0         0         0         0         0         0    0.9925
         0         0         0    0.9931         0         0         0
    0.9289         0         0         0    0.9436         0         0
         0         0         0         0    0.9939         0         0
         0         0         0    0.9895         0         0         0
    0.9908         0         0         0         0    0.0038         0
         0    0.9791         0         0         0         0    0.9707
         0         0    0.9864         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.9921    0.0099         0         0         0         0
         0         0    0.9925    0.0457    0.9541    0.0397
         0         0         0         0         0         0
         0         0    0.9787         0         0         0
         0         0         0    0.0064         0         0
    0.9937         0         0         0    0.9923         0
         0    0.0712         0         0         0    0.0171
         0         0         0    0.0398         0         0
         0    0.0113         0         0         0         0
         0         0         0         0    0.9926         0
         0         0    0.9892         0         0         0
    0.9616         0         0         0         0    0.0324


r0 =

  Columns 1 through 7

    0.0088    0.9944    0.9868    0.0123         0         0         0
         0         0         0         0    0.9982    0.9074    0.0924
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.0345         0         0         0    0.9703         0         0
         0    0.9592         0         0         0    0.9588         0
         0         0    0.9878         0         0         0    0.0110
         0         0         0    0.0058         0         0         0
         0         0         0         0         0         0         0
    0.0380         0         0         0         0    0.9590         0
         0    0.9972         0         0         0         0    0.0104
         0         0    0.9902         0         0         0         0
         0         0         0    0.0295         0         0         0
         0         0         0         0    0.9676         0         0
```

```
  Columns 8 through 14

         0         0         0         0         0         0         0
    0.0930         0         0         0         0         0         0
         0    0.0169    0.0095    0.0223    0.0194         0         0
         0         0         0         0         0    0.9909    0.0040
         0         0         0         0         0         0         0
         0    0.0068         0         0         0    0.9649         0
         0         0    0.0223         0         0         0         0
         0         0         0         0         0         0    0.0075
         0         0         0    0.0069         0         0         0
    0.0711         0         0         0    0.0564         0         0
         0         0         0         0    0.0061         0         0
         0         0         0    0.0105         0         0         0
    0.0092         0         0         0         0    0.9962         0
         0    0.0209         0         0         0         0    0.0293
         0         0    0.0136         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.0079    0.9901         0         0         0         0
         0         0    0.0075    0.9543    0.0459    0.9603
         0         0         0         0         0         0
         0         0    0.0213         0         0         0
         0         0         0    0.9936         0         0
    0.0063         0         0         0    0.0077         0
         0    0.9288         0         0         0    0.9829
         0         0         0    0.9602         0         0
         0    0.9887         0         0         0         0
         0         0         0         0    0.0074         0
         0         0    0.0108         0         0         0
    0.0384         0         0         0         0    0.9676


Q0 =

  Columns 1 through 7

    1.0000    0.0000    0.0000    1.0000    0.0000    0.0000    1.0000

  Columns 8 through 14

    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    1.0000

  Columns 15 through 20

    1.0000    0.0000    1.0000    0.0000    1.0000    0.0000


Q1 =

  Columns 1 through 7

    0.0000    1.0000    1.0000    0.0000    1.0000    1.0000    0.0000

  Columns 8 through 14
```

```
    0.0000    0.0000    0.0000    0.0000    0.0000    1.0000    0.0000

  Columns 15 through 20

    0.0000    1.0000    0.0000    1.0000    0.0000    1.0000


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

It took 3 number of iterations

p =

  Columns 1 through 7

    0.0374    0.5522    0.9768    0.0693    0.8607    0.9808    0.1440

  Columns 8 through 14

    0.0526    0.5118    0.4680    0.0791    0.5502    0.9110    0.2922

  Columns 15 through 20

    0.0483    0.9507    0.4553    0.9484    0.0500    0.8914

Iteration number 1
Variance 7.000000e-01
q0 =

  Columns 1 through 7

    0.0374         0         0         0         0    0.0374         0
    0.5522         0         0         0         0         0    0.5522
    0.9768         0         0         0         0         0         0
    0.0693         0         0         0         0         0         0
         0    0.8607         0         0         0    0.8607         0
         0    0.9808         0         0         0         0    0.9808
         0    0.1440         0         0         0         0         0
         0    0.0526         0         0         0         0         0
         0         0    0.5118         0         0    0.5118         0
         0         0    0.4680         0         0         0    0.4680
         0         0    0.0791         0         0         0         0
         0         0    0.5502         0         0         0         0
         0         0         0    0.9110         0    0.9110         0
         0         0         0    0.2922         0         0         0
         0         0         0    0.0483         0         0         0
         0         0         0    0.9507         0         0         0
         0         0         0         0    0.4553         0    0.4553
         0         0         0         0    0.9484         0         0
         0         0         0         0    0.0500         0         0
         0         0         0         0    0.8914         0         0
```

```
  Columns 8 through 14

         0         0         0    0.0374         0         0         0
         0         0         0         0    0.5522         0         0
    0.9768         0         0         0         0    0.9768         0
         0    0.0693         0         0         0         0    0.0693
         0         0         0         0         0         0         0
         0         0         0    0.9808         0         0         0
    0.1440         0         0         0    0.1440         0         0
         0         0    0.0526         0         0    0.0526         0
         0         0         0         0         0         0    0.5118
         0         0         0         0         0         0         0
         0    0.0791         0         0    0.0791         0         0
         0         0    0.5502    0.5502         0         0         0
         0         0         0         0         0    0.9110         0
    0.2922         0         0         0         0         0    0.2922
         0    0.0483         0         0         0         0         0
         0         0    0.9507         0    0.9507         0         0
         0         0         0         0         0         0    0.4553
    0.9484         0         0    0.9484         0         0         0
         0    0.0500         0         0         0    0.0500         0
         0         0    0.8914         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.8607
         0
         0
         0
         0
    0.4680
         0
         0
         0
         0
    0.0483
         0
         0
         0
         0
    0.8914


q1 =

  Columns 1 through 7

    0.9626         0         0         0         0    0.9626         0
    0.4478         0         0         0         0         0    0.4478
    0.0232         0         0         0         0         0         0
    0.9307         0         0         0         0         0         0
         0    0.1393         0         0         0    0.1393         0
         0    0.0192         0         0         0         0    0.0192
         0    0.8560         0         0         0         0         0
         0    0.9474         0         0         0         0         0
         0         0    0.4882         0         0    0.4882         0
```

```
         0         0    0.5320         0         0         0    0.5320
         0         0    0.9209         0         0         0         0
         0         0    0.4498         0         0         0         0
         0         0         0    0.0890         0    0.0890         0
         0         0         0    0.7078         0         0         0
         0         0         0    0.9517         0         0         0
         0         0         0    0.0493         0         0         0
         0         0         0         0    0.5447         0    0.5447
         0         0         0         0    0.0516         0         0
         0         0         0         0    0.9500         0         0
         0         0         0         0    0.1086         0         0

  Columns 8 through 14

         0         0         0    0.9626         0         0         0
         0         0         0         0    0.4478         0         0
    0.0232         0         0         0         0    0.0232         0
         0    0.9307         0         0         0         0    0.9307
         0         0         0         0         0         0         0
         0         0         0    0.0192         0         0         0
    0.8560         0         0         0    0.8560         0         0
         0         0    0.9474         0         0    0.9474         0
         0         0         0         0         0         0    0.4882
         0         0         0         0         0         0         0
         0    0.9209         0         0    0.9209         0         0
         0         0    0.4498    0.4498         0         0         0
         0         0         0         0         0    0.0890         0
    0.7078         0         0         0         0         0    0.7078
         0    0.9517         0         0         0         0         0
         0         0    0.0493         0    0.0493         0         0
         0         0         0         0         0         0    0.5447
    0.0516         0         0    0.0516         0         0         0
         0    0.9500         0         0         0    0.9500         0
         0         0    0.1086         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.1393
         0
         0
         0
         0
    0.5320
         0
         0
         0
         0
    0.9517
         0
         0
         0
         0
    0.1086


r1 =
```

```
  Columns 1 through 7

    0.5429    0.1200    0.4584    0.5460         0         0         0
         0         0         0         0    0.1936    0.2701    0.8104
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.4930         0         0         0    0.5090         0         0
         0    0.4973         0         0         0    0.4997         0
         0         0    0.3673         0         0         0    0.6777
         0         0         0    0.8421         0         0         0
         0         0         0         0         0         0         0
    0.4567         0         0         0         0    0.5416         0
         0    0.2298         0         0         0         0    0.5396
         0         0    0.1691         0         0         0         0
         0         0         0    0.4996         0         0         0
         0         0         0         0    0.4774         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.7470         0         0         0         0         0         0
         0    0.4973    0.5010    0.5001    0.4994         0         0
         0         0         0         0         0    0.3308    0.8347
         0         0         0         0         0         0         0
         0    0.7743         0         0         0    0.5079         0
         0         0    0.5045         0         0         0         0
         0         0         0         0         0         0    0.8045
         0         0         0    0.8501         0         0         0
    0.4646         0         0         0    0.8157         0         0
         0         0         0         0    0.8989         0         0
         0         0         0    0.5335         0         0         0
    0.8527         0         0         0         0    0.1160         0
         0    0.5160         0         0         0         0    0.4991
         0         0    0.7551         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.6540    0.3457         0         0         0         0
         0         0    0.8159    0.4685    0.5314    0.4640
         0         0         0         0         0         0
         0         0    0.5032         0         0         0
         0         0         0    0.3589         0         0
    0.8262         0         0         0    0.8275         0
         0    0.5352         0         0         0    0.5405
         0         0         0    0.5447         0         0
         0    0.4687         0         0         0         0
         0         0         0         0    0.8507         0
         0         0    0.4958         0         0         0
    0.5180         0         0         0         0    0.4792


r0 =

  Columns 1 through 7
```

```
    0.4571    0.8800    0.5416    0.4540         0         0         0
         0         0         0         0    0.8064    0.7299    0.1896
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.5070         0         0         0    0.4910         0         0
         0    0.5027         0         0         0    0.5003         0
         0         0    0.6327         0         0         0    0.3223
         0         0         0    0.1579         0         0         0
         0         0         0         0         0         0         0
    0.5433         0         0         0         0    0.4584         0
         0    0.7702         0         0         0         0    0.4604
         0         0    0.8309         0         0         0         0
         0         0         0    0.5004         0         0         0
         0         0         0         0    0.5226         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.2530         0         0         0         0         0         0
         0    0.5027    0.4990    0.4999    0.5006         0         0
         0         0         0         0         0    0.6692    0.1653
         0         0         0         0         0         0         0
         0    0.2257         0         0         0    0.4921         0
         0         0    0.4955         0         0         0         0
         0         0         0         0         0         0    0.1955
         0         0         0    0.1499         0         0         0
    0.5354         0         0         0    0.1843         0         0
         0         0         0         0    0.1011         0         0
         0         0         0    0.4665         0         0         0
    0.1473         0         0         0         0    0.8840         0
         0    0.4840         0         0         0         0    0.5009
         0         0    0.2449         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.3460    0.6543         0         0         0         0
         0         0    0.1841    0.5315    0.4686    0.5360
         0         0         0         0         0         0
         0         0    0.4968         0         0         0
         0         0         0    0.6411         0         0
    0.1738         0         0         0    0.1725         0
         0    0.4648         0         0         0    0.4595
         0         0         0    0.4553         0         0
         0    0.5313         0         0         0         0
         0         0         0         0    0.1493         0
         0         0    0.5042         0         0         0
    0.4820         0         0         0         0    0.5208


Q0 =

  Columns 1 through 7

    0.9615    0.0316    0.0024    0.9885    0.0355    0.0085    0.9843

  Columns 8 through 14
```

```
    0.9963    0.7754    0.7817    0.9869    0.9698    0.0065    0.9804

  Columns 15 through 20

    0.9948    0.0271    0.8407    0.0311    0.9983    0.1024


Q1 =

  Columns 1 through 7

    0.0385    0.9684    0.9976    0.0115    0.9645    0.9915    0.0157

  Columns 8 through 14

    0.0037    0.2246    0.2183    0.0131    0.0302    0.9935    0.0196

  Columns 15 through 20

    0.0052    0.9729    0.1593    0.9689    0.0017    0.8976


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

Iteration number 2
Variance 7.000000e-01
q0 =

  Columns 1 through 7

    0.0454         0         0         0         0    0.0375         0
    0.8069         0         0         0         0         0    0.9681
    0.9972         0         0         0         0         0         0
    0.0138         0         0         0         0         0         0
         0    0.8672         0         0         0    0.9657         0
         0    0.9774         0         0         0         0    0.9915
         0    0.0639         0         0         0         0         0
         0    0.0109         0         0         0         0         0
         0         0    0.2227         0         0    0.4985         0
         0         0    0.2189         0         0         0    0.2213
         0         0    0.0131         0         0         0         0
         0         0    0.0301         0         0         0         0
         0         0         0    0.9869         0    0.9937         0
         0         0         0    0.0915         0         0         0
         0         0         0    0.0098         0         0         0
         0         0         0    0.9500         0         0         0
         0         0         0         0    0.4563         0    0.1610
         0         0         0         0    0.9648         0         0
         0         0         0         0    0.0019         0         0
         0         0         0         0    0.8835         0         0
```

```
  Columns 8 through 14

         0         0         0    0.0326         0         0         0
         0         0         0         0    0.9014         0         0
    0.9959         0         0         0         0    0.9885         0
         0    0.0584         0         0         0         0    0.0115
         0         0         0         0         0         0         0
         0         0         0    0.9928         0         0         0
    0.0325         0         0         0    0.0184         0         0
         0         0    0.0032         0         0    0.0212         0
         0         0         0         0         0         0    0.2359
         0         0         0         0         0         0         0
         0    0.0699         0         0    0.0149         0         0
         0         0    0.1212    0.2169         0         0         0
         0         0         0         0         0    0.9525         0
    0.0758         0         0         0         0         0    0.0195
         0    0.0244         0         0         0         0         0
         0         0    0.9764         0    0.9694         0         0
         0         0         0         0         0         0    0.1570
    0.9457         0         0    0.9738         0         0         0
         0    0.0081         0         0         0    0.0096         0
         0         0    0.9116         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.9613
         0
         0
         0
         0
    0.4626
         0
         0
         0
         0
    0.0056
         0
         0
         0
         0
    0.8897


q1 =

  Columns 1 through 7

    0.9546         0         0         0         0    0.9625         0
    0.1931         0         0         0         0         0    0.0319
    0.0028         0         0         0         0         0         0
    0.9862         0         0         0         0         0         0
         0    0.1328         0         0         0    0.0343         0
         0    0.0226         0         0         0         0    0.0085
         0    0.9361         0         0         0         0         0
         0    0.9891         0         0         0         0         0
         0         0    0.7773         0         0    0.5015         0
```

```
         0         0    0.7811         0         0         0    0.7787
         0         0    0.9869         0         0         0         0
         0         0    0.9699         0         0         0         0
         0         0         0    0.0131         0    0.0063         0
         0         0         0    0.9085         0         0         0
         0         0         0    0.9902         0         0         0
         0         0         0    0.0500         0         0         0
         0         0         0         0    0.5437         0    0.8390
         0         0         0         0    0.0352         0         0
         0         0         0         0    0.9981         0         0
         0         0         0         0    0.1165         0         0

  Columns 8 through 14

         0         0         0    0.9674         0         0         0
         0         0         0         0    0.0986         0         0
    0.0041         0         0         0         0    0.0115         0
         0    0.9416         0         0         0         0    0.9885
         0         0         0         0         0         0         0
         0         0         0    0.0072         0         0         0
    0.9675         0         0         0    0.9816         0         0
         0         0    0.9968         0         0    0.9788         0
         0         0         0         0         0         0    0.7641
         0         0         0         0         0         0         0
         0    0.9301         0         0    0.9851         0         0
         0         0    0.8788    0.7831         0         0         0
         0         0         0         0         0    0.0475         0
    0.9242         0         0         0         0         0    0.9805
         0    0.9756         0         0         0         0         0
         0         0    0.0236         0    0.0306         0         0
         0         0         0         0         0         0    0.8430
    0.0543         0         0    0.0262         0         0         0
         0    0.9919         0         0         0    0.9904         0
         0         0    0.0884         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0387
         0
         0
         0
         0
    0.5374
         0
         0
         0
         0
    0.9944
         0
         0
         0
         0
    0.1103


r1 =
```

Columns 1 through 7

0.7967	0.0604	0.2287	0.7775	0	0	0
0	0	0	0	0.0927	0.1868	0.8429
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0.5014	0	0	0	0.4986	0	0
0	0.3143	0	0	0	0.3231	0
0	0	0.1465	0	0	0	0.8750
0	0	0	0.9025	0	0	0
0	0	0	0	0	0	0
0.7644	0	0	0	0	0.2492	0
0	0.0613	0	0	0	0	0.8656
0	0	0.0750	0	0	0	0
0	0	0	0.6741	0	0	0
0	0	0	0	0.4712	0	0

Columns 8 through 14

0	0	0	0	0	0	0
0.8058	0	0	0	0	0	0
0	0.7572	0.7537	0.6465	0.6518	0	0
0	0	0	0	0	0.1396	0.9296
0	0	0	0	0	0	0
0	0.9254	0	0	0	0.4987	0
0	0	0.8119	0	0	0	0
0	0	0	0	0	0	0.9134
0	0	0	0.9133	0	0	0
0.7971	0	0	0	0.8896	0	0
0	0	0	0	0.9366	0	0
0	0	0	0.8630	0	0	0
0.9336	0	0	0	0	0.0412	0
0	0.8220	0	0	0	0	0.6770
0	0	0.8555	0	0	0	0

Columns 15 through 20

0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0.8580	0.1100	0	0	0	0
0	0	0.8552	0.4666	0.5311	0.4596
0	0	0	0	0	0
0	0	0.7564	0	0	0
0	0	0	0.1066	0	0
0.8737	0	0	0	0.8614	0
0	0.1902	0	0	0	0.1414
0	0	0	0.2392	0	0
0	0.1249	0	0	0	0
0	0	0	0	0.9233	0
0	0	0.7479	0	0	0
0.5269	0	0	0	0	0.4659

r0 =

Columns 1 through 7

```
    0.2033    0.9396    0.7713    0.2225         0         0         0
         0         0         0         0    0.9073    0.8132    0.1571
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.4986         0         0         0    0.5014         0         0
         0    0.6857         0         0         0    0.6769         0
         0         0    0.8535         0         0         0    0.1250
         0         0         0    0.0975         0         0         0
         0         0         0         0         0         0         0
    0.2356         0         0         0         0    0.7508         0
         0    0.9387         0         0         0         0    0.1344
         0         0    0.9250         0         0         0         0
         0         0         0    0.3259         0         0         0
         0         0         0         0    0.5288         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.1942         0         0         0         0         0         0
         0    0.2428    0.2463    0.3535    0.3482         0         0
         0         0         0         0         0    0.8604    0.0704
         0         0         0         0         0         0         0
         0    0.0746         0         0         0    0.5013         0
         0         0    0.1881         0         0         0         0
         0         0         0         0         0         0    0.0866
         0         0         0    0.0867         0         0         0
    0.2029         0         0         0    0.1104         0         0
         0         0         0         0    0.0634         0         0
         0         0         0    0.1370         0         0         0
    0.0664         0         0         0         0    0.9588         0
         0    0.1780         0         0         0         0    0.3230
         0         0    0.1445         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.1420    0.8900         0         0         0         0
         0         0    0.1448    0.5334    0.4689    0.5404
         0         0         0         0         0         0
         0         0    0.2436         0         0         0
         0         0         0    0.8934         0         0
    0.1263         0         0         0    0.1386         0
         0    0.8098         0         0         0    0.8586
         0         0         0    0.7608         0         0
         0    0.8751         0         0         0         0
         0         0         0         0    0.0767         0
         0         0    0.2521         0         0         0
    0.4731         0         0         0         0    0.5341


Q0 =

  Columns 1 through 7

    0.9970    0.0016    0.0001    0.9989    0.0144    0.0007    0.9993

  Columns 8 through 14
```

```
    0.9998    0.9942    0.9889    0.9993    0.9945    0.0007    0.9986

  Columns 15 through 20

    0.9989    0.0002    0.9849    0.0018    0.9994    0.0147


Q1 =

  Columns 1 through 7

    0.0030    0.9984    0.9999    0.0011    0.9856    0.9993    0.0007

  Columns 8 through 14

    0.0002    0.0058    0.0111    0.0007    0.0055    0.9993    0.0014

  Columns 15 through 20

    0.0011    0.9998    0.0151    0.9982    0.0006    0.9853


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

Iteration number 3
Variance 7.000000e-01
q0 =

  Columns 1 through 7

    0.0118         0         0         0         0    0.0030         0
    0.9763         0         0         0         0         0    0.9966
    0.9997         0         0         0         0         0         0
    0.0039         0         0         0         0         0         0
         0    0.8746         0         0         0    0.9855         0
         0    0.9969         0         0         0         0    0.9985
         0    0.0037         0         0         0         0         0
         0    0.0010         0         0         0         0         0
         0         0    0.0180         0         0    0.0678         0
         0         0    0.0333         0         0         0    0.0463
         0         0    0.0013         0         0         0         0
         0         0    0.0102         0         0         0         0
         0         0         0    0.9958         0    0.9993         0
         0         0         0    0.0183         0         0         0
         0         0         0    0.0065         0         0         0
         0         0         0    0.9983         0         0         0
         0         0         0         0    0.0832         0    0.0455
         0         0         0         0    0.9980         0         0
         0         0         0         0    0.0007         0         0
         0         0         0         0    0.9828         0         0
```

Columns 8 through 14

```
         0         0         0    0.0098         0         0         0
         0         0         0         0    0.9767         0         0
    0.9994         0         0         0         0    0.9988         0
         0    0.0102         0         0         0         0    0.0023
         0         0         0         0         0         0         0
         0         0         0    0.9979         0         0         0
    0.0048         0         0         0    0.0045         0         0
         0         0    0.0010         0         0    0.0034         0
         0         0         0         0         0         0    0.0264
         0         0         0         0         0         0         0
         0    0.0074         0         0    0.0044         0         0
         0         0    0.0423    0.0750         0         0         0
         0         0         0         0         0    0.9845         0
    0.0147         0         0         0         0         0    0.0030
         0    0.0075         0         0         0         0         0
         0         0    0.9991         0    0.9985         0         0
         0         0         0         0         0         0    0.0436
    0.9852         0         0    0.9943         0         0         0
         0    0.0038         0         0         0    0.0074         0
         0         0    0.9171         0         0         0         0
```

Column 15

```
         0
         0
         0
         0
    0.9838
         0
         0
         0
         0
    0.0624
         0
         0
         0
         0
    0.0012
         0
         0
         0
         0
    0.9832
```

q1 =

Columns 1 through 7

```
    0.9882         0         0         0         0    0.9970         0
    0.0237         0         0         0         0         0    0.0034
    0.0003         0         0         0         0         0         0
    0.9961         0         0         0         0         0         0
         0    0.1254         0         0         0    0.0145         0
         0    0.0031         0         0         0         0    0.0015
         0    0.9963         0         0         0         0         0
         0    0.9990         0         0         0         0         0
         0         0    0.9820         0         0    0.9322         0
```

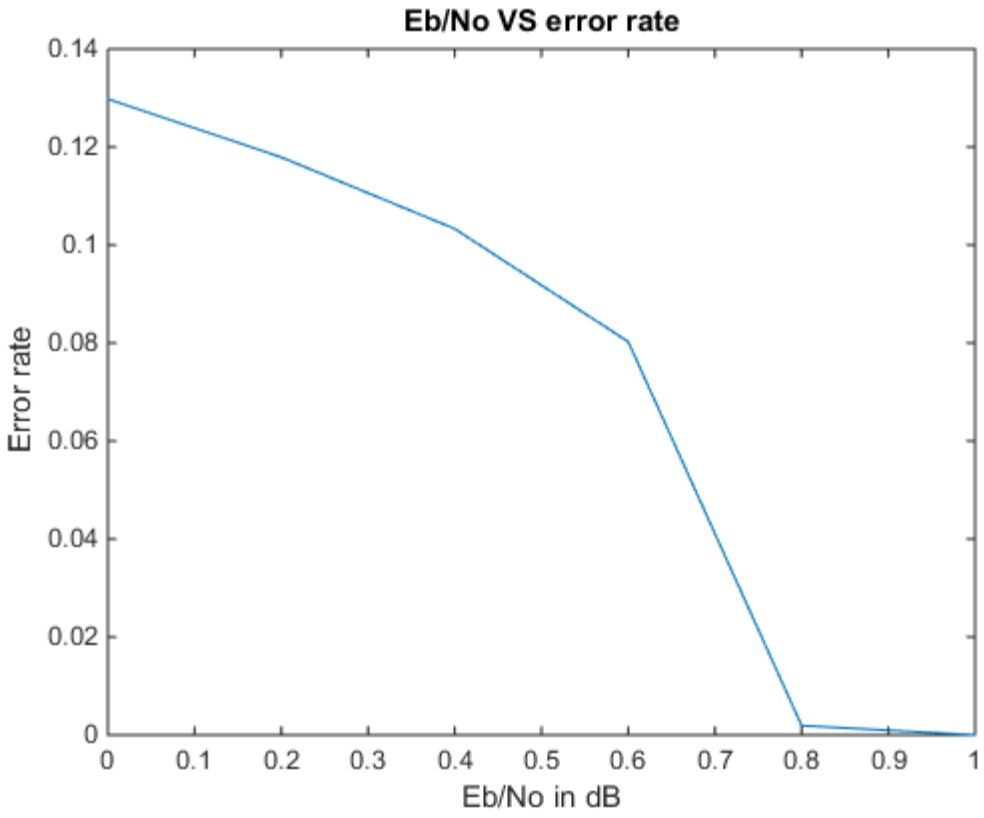
```
         0         0    0.9667         0         0         0    0.9537
         0         0    0.9987         0         0         0         0
         0         0    0.9898         0         0         0         0
         0         0         0    0.0042         0    0.0007         0
         0         0         0    0.9817         0         0         0
         0         0         0    0.9935         0         0         0
         0         0         0    0.0017         0         0         0
         0         0         0         0    0.9168         0    0.9545
         0         0         0         0    0.0020         0         0
         0         0         0         0    0.9993         0         0
         0         0         0         0    0.0172         0         0

  Columns 8 through 14

         0         0         0    0.9902         0         0         0
         0         0         0         0    0.0233         0         0
    0.0006         0         0         0         0    0.0012         0
         0    0.9898         0         0         0         0    0.9977
         0         0         0         0         0         0         0
         0         0         0    0.0021         0         0         0
    0.9952         0         0         0    0.9955         0         0
         0         0    0.9990         0         0    0.9966         0
         0         0         0         0         0         0    0.9736
         0         0         0         0         0         0         0
         0    0.9926         0         0    0.9956         0         0
         0         0    0.9577    0.9250         0         0         0
         0         0         0         0         0    0.0155         0
    0.9853         0         0         0         0         0    0.9970
         0    0.9925         0         0         0         0         0
         0         0    0.0009         0    0.0015         0         0
         0         0         0         0         0         0    0.9564
    0.0148         0         0    0.0057         0         0         0
         0    0.9962         0         0         0    0.9926         0
         0         0    0.0829         0         0         0         0

  Column 15

         0
         0
         0
         0
    0.0162
         0
         0
         0
         0
    0.9376
         0
         0
         0
         0
    0.9988
         0
         0
         0
         0
    0.0168


r1 =
```

```
  Columns 1 through 7

    0.9723    0.0159    0.0385    0.9648         0         0         0
         0         0         0         0    0.0078    0.1289    0.8715
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.9191         0         0         0    0.0710         0         0
         0    0.0889         0         0         0    0.0904         0
         0         0    0.0336         0         0         0    0.9704
         0         0         0    0.9815         0         0         0
         0         0         0         0         0         0         0
    0.9184         0         0         0         0    0.0880         0
         0    0.0103         0         0         0         0    0.9710
         0         0    0.0260         0         0         0         0
         0         0         0    0.9298         0         0         0
         0         0         0         0    0.0781         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.8695         0         0         0         0         0         0
         0    0.9560    0.9710    0.9408    0.9488         0         0
         0         0         0         0         0    0.0263    0.9877
         0         0         0         0         0         0         0
         0    0.9819         0         0         0    0.0829         0
         0         0    0.9500         0         0         0         0
         0         0         0         0         0         0    0.9800
         0         0         0    0.9788         0         0         0
    0.8811         0         0         0    0.9156         0         0
         0         0         0         0    0.9826         0         0
         0         0         0    0.9710         0         0         0
    0.9761         0         0         0         0    0.0120         0
         0    0.9516         0         0         0         0    0.9303
         0         0    0.9665         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.9760    0.0286         0         0         0         0
         0         0    0.9802    0.0981    0.9008    0.0855
         0         0         0         0         0         0
         0         0    0.9493         0         0         0
         0         0         0    0.0199         0         0
    0.9788         0         0         0    0.9753         0
         0    0.1189         0         0         0    0.0441
         0         0         0    0.0851         0         0
         0    0.0318         0         0         0         0
         0         0         0         0    0.9800         0
         0         0    0.9687         0         0         0
    0.9092         0         0         0         0    0.0776


r0 =

  Columns 1 through 7
```

```
    0.0277    0.9841    0.9615    0.0352         0         0         0
         0         0         0         0    0.9922    0.8711    0.1285
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    0.0809         0         0         0    0.9290         0         0
         0    0.9111         0         0         0    0.9096         0
         0         0    0.9664         0         0         0    0.0296
         0         0         0    0.0185         0         0         0
         0         0         0         0         0         0         0
    0.0816         0         0         0         0    0.9120         0
         0    0.9897         0         0         0         0    0.0290
         0         0    0.9740         0         0         0         0
         0         0         0    0.0702         0         0         0
         0         0         0         0    0.9219         0         0

  Columns 8 through 14

         0         0         0         0         0         0         0
    0.1305         0         0         0         0         0         0
         0    0.0440    0.0290    0.0592    0.0512         0         0
         0         0         0         0         0    0.9737    0.0123
         0         0         0         0         0         0         0
         0    0.0181         0         0         0    0.9171         0
         0         0    0.0500         0         0         0         0
         0         0         0         0         0         0    0.0200
         0         0         0    0.0212         0         0         0
    0.1189         0         0         0    0.0844         0         0
         0         0         0         0    0.0174         0         0
         0         0         0    0.0290         0         0         0
    0.0239         0         0         0         0    0.9880         0
         0    0.0484         0         0         0         0    0.0697
         0         0    0.0335         0         0         0         0

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    0.0240    0.9714         0         0         0         0
         0         0    0.0198    0.9019    0.0992    0.9145
         0         0         0         0         0         0
         0         0    0.0507         0         0         0
         0         0         0    0.9801         0         0
    0.0212         0         0         0    0.0247         0
         0    0.8811         0         0         0    0.9559
         0         0         0    0.9149         0         0
         0    0.9682         0         0         0         0
         0         0         0         0    0.0200         0
         0         0    0.0313         0         0         0
    0.0908         0         0         0         0    0.9224


Q0 =

  Columns 1 through 7

    1.0000    0.0000    0.0000    1.0000    0.0000    0.0000    1.0000

  Columns 8 through 14
```

```
    1.0000    1.0000    1.0000    1.0000    0.9999    0.0000    1.0000

  Columns 15 through 20

    1.0000    0.0000    1.0000    0.0000    1.0000    0.0000


Q1 =

  Columns 1 through 7

    0.0000    1.0000    1.0000    0.0000    1.0000    1.0000    0.0000

  Columns 8 through 14

    0.0000    0.0000    0.0000    0.0000    0.0001    1.0000    0.0000

  Columns 15 through 20

    0.0000    1.0000    0.0000    1.0000    0.0000    1.0000


output =

  Columns 1 through 12

     0     1     1     0     1     1     0     0     0     0     0     0

  Columns 13 through 20

     1     0     0     1     0     1     0     1

It took 3 number of iterations
diary off
```

```
EbN0=[0 0.2 0.4 0.6 0.8 1];
errorrate=[0.1298 0.1179 0.1033 0.08026 0.001907 0];
plot(EbN0,errorrate);
title('Eb/No VS error rate');
xlabel('Eb/No in dB');
ylabel('Error rate');
```



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```
clc;
EbNo1=0:1:10;
EbNo=EbNo1/10;
%find the Pe values from the eqn
for i=1:11
    EbNomag(1,i)=10^EbNo(1,i);
    x=sqrt(2*EbNomag(1,i));
    %x=sqrt(2*EbNo1(i));
    q=qfunc(x);
    z(1,i)=2*q*(1-(q/2));
end
display(z);
plot(EbNo1,(z));
hold on
%qpsk coded from simulink
Error=[0.13 0 0 0 0 0 0 0 0 0 0];
plot(EbNo1,Error);
hold off
legend('uncoded','coded');
title('Eb/No VS error rate');
xlabel('Eb/No in dB');
ylabel('Error rate');
```

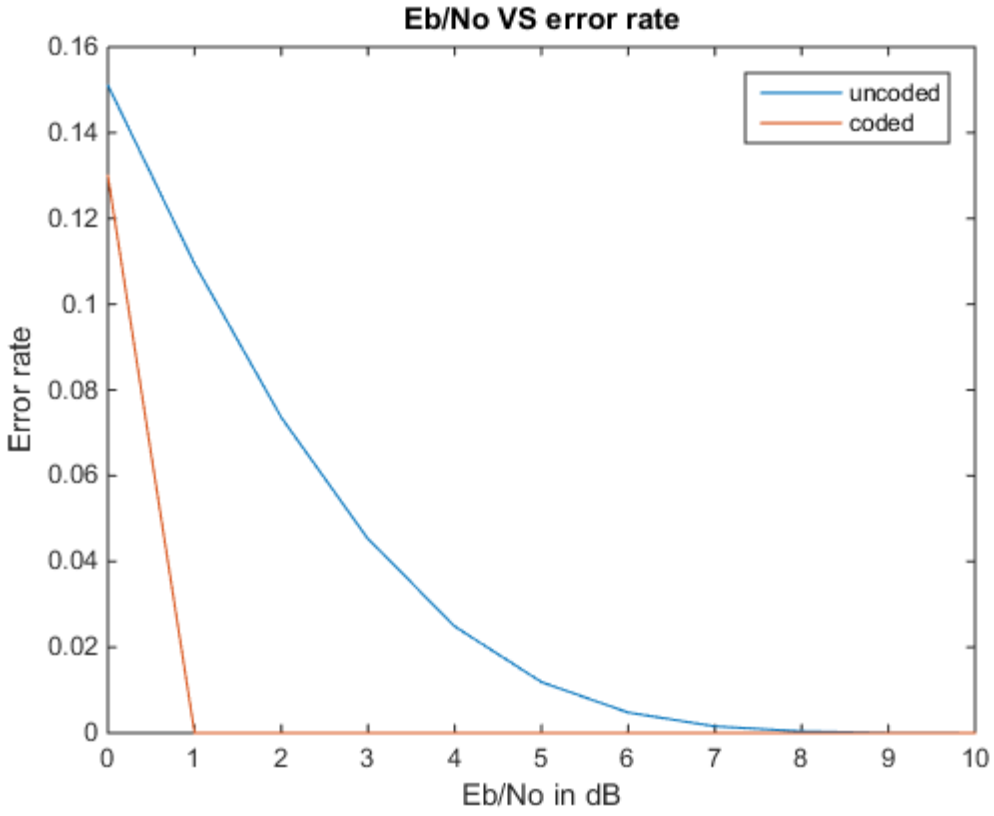
```
z =

  Columns 1 through 7

    0.1511    0.1094    0.0736    0.0452    0.0248    0.0119    0.0048

  Columns 8 through 11

    0.0015    0.0004    0.0001    0.0000
```



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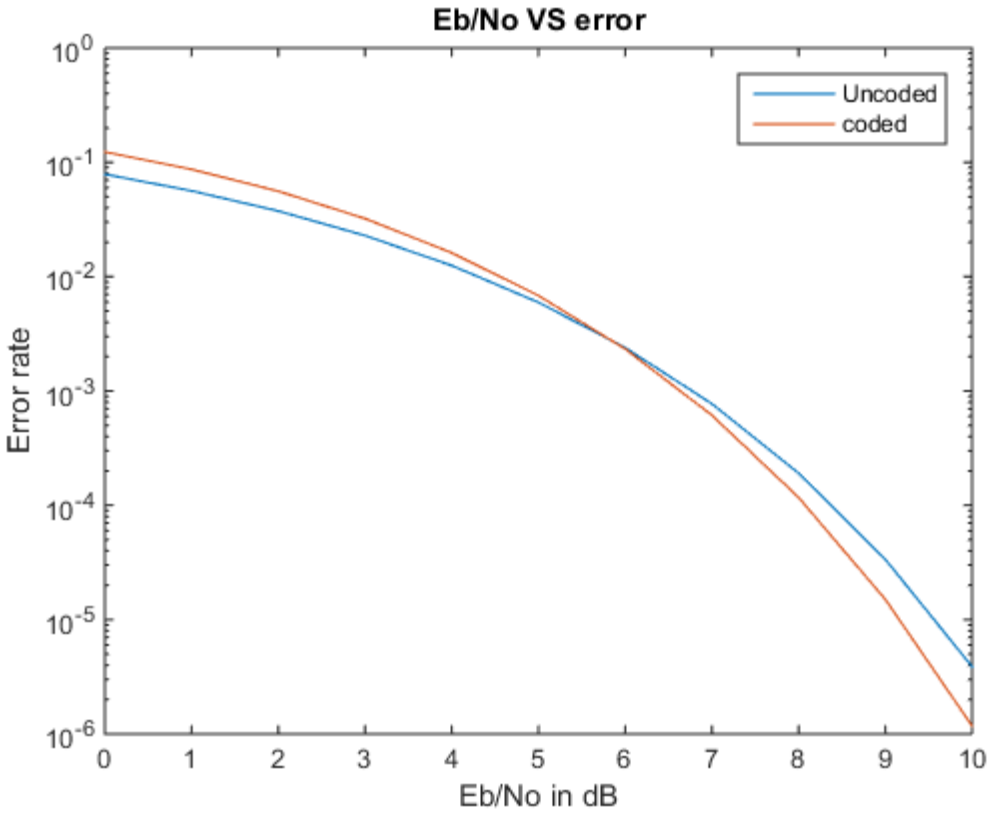
```
EbNo=(0:10)';
beruncoded=berawgn(EbNo,'psk',4,'nondiff');
bercoded=bercoding(EbNo,'block','hard',7,4,3);
semilogy(EbNo,[beruncoded,bercoded]);
title('Eb/No VS error');
xlabel('Eb/No in dB');
ylabel('Error rate');
legend('Uncoded','coded');
```



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