```
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%Lab 2

%Problem 1 focuses on sinusoidal steady-state and transient response
 of
%filters.

%Problem 2 takes a sinsuoid input with some random noise, and
 processes it
%through a bandpass filter. Further more, zero-order hold and zero-
mean
%white-noise signal sequence was investigated.

%Problem 1
clear

u = @(t) (t>=0);
w0 = 4;

% part a
t_int = linspace(0,10,1001);

syms s t
x(t) = sin(w0*t)
H(s) = (s+3)/(s^2+s+1.25)
h(t) = ilaplace(H)
p = poles(H)
t_const = double(log(100)/abs(real(p(1))))

figure;
plot(t_int,h(t_int),'b');
grid on; xlabel('t(sec)');
title('impulse response, h(t)');
set(gca, 'XTick', 0:1:10, 'XLim', [0 10]);
set(gca, 'YTick', -2:1:2, 'YLim', [-2 2]);

%part b
eval = H(w0*1i)% H(jw)
mag_of_H = abs(H(w0 * 1i)).^2
phase = angle(eval)

yst = abs(H(w0*1i))*sin(w0*t_int + phase);

%part c
num = [1 3]; den = [1 1 1.25];
term = [1 -1i*w0]; den2 = conv(den, term)
[a,b,c] = residue(num, den2)

res = a(2) * exp(b(2)*t_int) + a(3) * exp(b(3)*t_int);
y_c = eval * exp(w0*1i*t_int) + res;
y = imag(y_c);
```
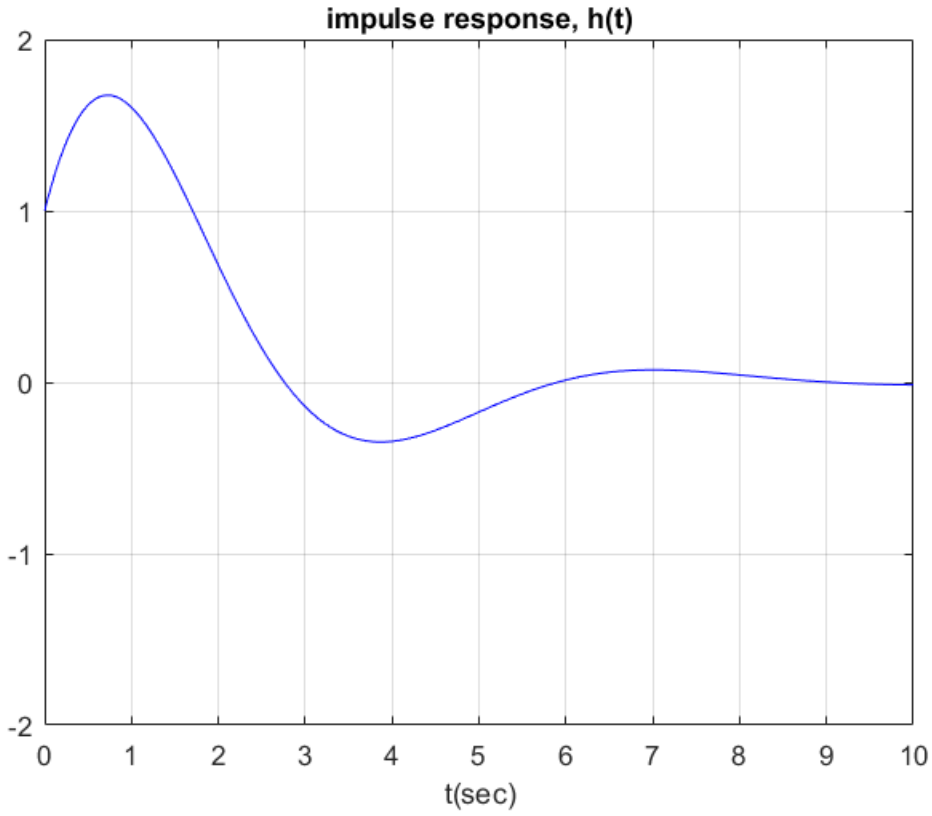
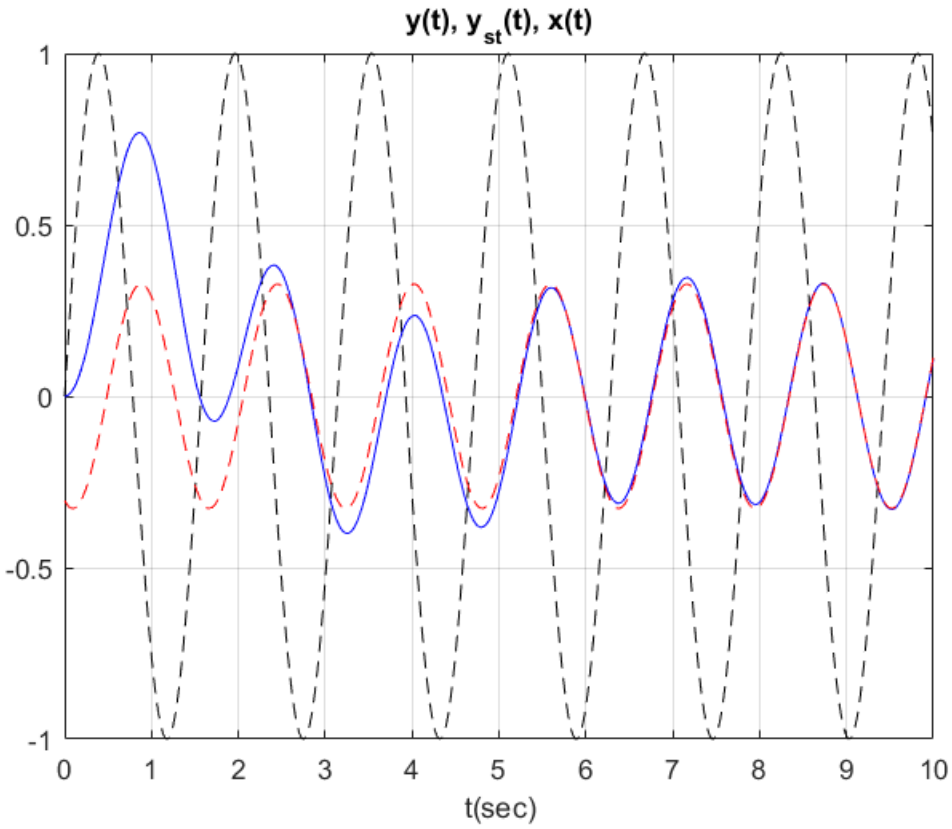

```
figure;
plot(t_int, x(t_int), 'k--', t_int, y, 'b');
grid on;
hold on; plot(t_int, yst, 'r--');
set(gca, 'XTick', 0:1:10, 'XLim', [0, 10]);
set(gca, 'YTick', -1:0.5:1, 'YLim', [-1, 1]);
title('y(t), y_{st}(t), x(t)');
xlabel('t(sec)');

%part d
tph = -phase/w0
x_val = x(t_int);
[t0, t_ind1] = max(x_val(800:900));
[t1, t_ind2] = max(y(800:900));

tmax_x = 800 + t_ind1 %x
tmax_y = 800 + t_ind2 %y
t_est = (tmax_y)/1000 - (tmax_x)/1000

%hold on; plot(tmax_x, y(tmax_x), 'r.', 'MarkerSize', 20);
%hold on; plot(tmax_y, y(tmax_y), 'r.', 'MarkerSize', 20);

%part e
ytr = y-yst;
figure; plot (t_int, ytr);
title ('transient, y_{tr}(t)');

clear all;
```

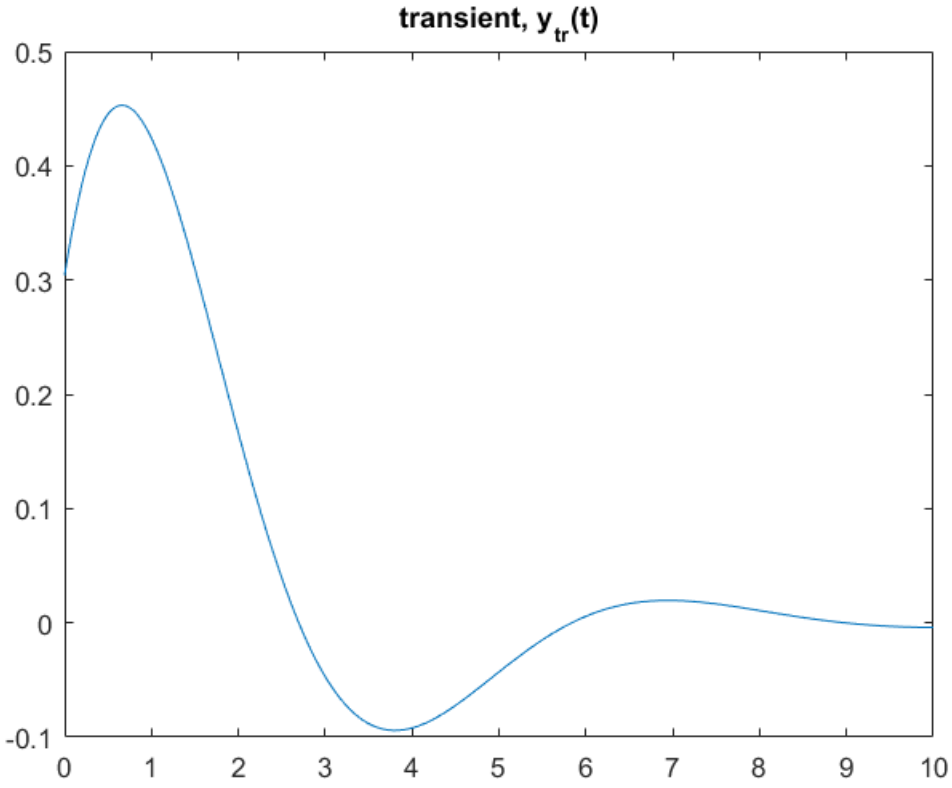
```
x(t) =

sin(4*t)


H(s) =

(s + 3)/(s^2 + s + 5/4)


h(t) =

exp(-t/2)*(cos(t) + (5*sin(t))/2)


p =

 - 1/2 + 1i
 - 1/2 - 1i


t_const =
```

```
    9.2103

eval =

- 452/3737 - 1136i/3737


mag_of_H =

400/3737


phase =

atan(284/113) - pi


den2 =

   1.0000 + 0.0000i   1.0000 - 4.0000i   1.2500 - 4.0000i   0.0000 -
 5.0000i


a =

  -0.1210 - 0.3040i
  -0.2574 + 0.0743i
   0.3784 + 0.2297i


b =

   0.0000 + 4.0000i
  -0.5000 - 1.0000i
  -0.5000 + 1.0000i


c =

     []


tph =

pi/4 - atan(284/113)/4


tmax_x =

   827


tmax_y =
```

```
    875

t_est =

    0.0480
```




y(t), y_st(t), x(t)
1
0.5
0
-0.5
-1
0
1
2
3
4
5
6
7
8
9
10
t(sec)


transient, y_tr(t)
0.5
0.4
0.3
0.2
0.1
0
-0.1
0
1
2
3
4
5
6
7
8
9
10

```
%Problem 2

%part a
w0 = 5; alpha = 0.2;
w = 0:0.05:10;

H_mag_sq = @(w)(alpha^2 * w.^2)./((w.^2-w0^2).^2 + alpha^2 .* w.^2);

figure;
plot(w, H_mag_sq(w), 'b');
title('|H(j\omega)|^{2}, \omega_{0} = 5, \alpha = 0.2');
set(gca, 'XTick', 0:1:10, 'XLim', [0 10]);
set(gca, 'YTick', 0:0.5:1, 'YLim', [0 1.1]);
xlabel('\omega');

%part b
Tmax = 40; T = Tmax/2000;
t = 0:T:Tmax;
seed = 2016; rng(seed);
v = randn(size(t));
x = sin(w0*t) + v;

num = [alpha 0]; den = [1 alpha w0^2];
y = lsim(tf(num,den), x, t, [0;0], 'zoh');

figure; plot(t, x, 'k');
grid on; title('noisy input sinusoid, x(t)');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

figure; plot(t, y);
grid on; title('filtered output, y(t), \alpha = 0.2');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

%part c
y_v = lsim(tf(num,den),v,t,[0;0],'zoh');
figure; plot(t, v, 'k');
grid on; title('input noise, v(t)');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

figure; plot(t, y_v);
grid on; title('filtered noise, y_{v}(t), \alpha = 0.2');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

%part d

clear;

%part a
w0 = 5; alpha = 0.5;
w = 0:0.05:10
```

```
H_mag_sq = @(w)(alpha^2 * w.^2)./((w.^2-w0^2).^2 + alpha^2 .* w.^2);

figure;
plot(w, H_mag_sq(w), 'b');
title('|H(j\omega)|^{2}, \omega_{0} = 5, \alpha = 0.5');
set(gca, 'XTick', 0:1:10, 'XLim', [0 10]);
set(gca, 'YTick', 0:0.5:1, 'YLim', [0 1.1]);
xlabel('\omega');

%part b
Tmax = 40; T = Tmax/2000;
t = 0:T:Tmax;
seed = 2016; rng(seed);
v = randn(size(t));
x = sin(w0*t) + v;

num = [alpha 0]; den = [1 alpha w0^2];
y = lsim(tf(num,den), x, t, [0;0], 'zoh');

figure; plot(t, x, 'k');
grid on; title('noisy input sinusoid, x(t)');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

figure; plot(t, y);
grid on; title('filtered output, y(t), \alpha = 0.5');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

%part c
y_v = lsim(tf(num,den),v,t,[0;0],'zoh');
figure; plot(t, v, 'k');
grid on; title('input noise, v(t)');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

figure; plot(t, y_v);
grid on; title('filtered noise, y_{v}(t), \alpha = 0.5');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

clear;

%alpha = 1
%part a
w0 = 5; alpha = 1;
w = 0:0.05:10

H_mag_sq = @(w)(alpha^2 * w.^2)./((w.^2-w0^2).^2 + alpha^2 .* w.^2);

figure;
plot(w, H_mag_sq(w), 'b');
title('|H(j\omega)|^{2}, \omega_{0} = 5, \alpha = 1');
```

```
set(gca, 'XTick', 0:1:10, 'XLim', [0 10]);
set(gca, 'YTick', 0:0.5:1, 'YLim', [0 1.1]);
xlabel('\omega');

%part b
Tmax = 40; T = Tmax/2000;
t = 0:T:Tmax;
seed = 2016; rng(seed);
v = randn(size(t));
x = sin(w0*t) + v;

num = [alpha 0]; den = [1 alpha w0^2];
y = lsim(tf(num,den), x, t, [0;0], 'zoh');

figure; plot(t, x, 'k');
grid on; title('noisy input sinusoid, x(t)');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

figure; plot(t, y);
grid on; title('filtered output, y(t), \alpha = 1');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

%part c
y_v = lsim(tf(num,den),v,t,[0;0],'zoh');
figure; plot(t, v, 'k');
grid on; title('input noise, v(t)');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

figure; plot(t, y_v);
grid on; title('filtered noise, y_{v}(t), \alpha = 1');
set(gca, 'XTick', 0:10:40, 'XLim', [0, 40]);
set(gca, 'YTick', -4:1:4, 'YLim', [-4, 4]);

%part e
w0 = 5; alpha = 0.2;
Tmax = 40; T = Tmax/2000; t = 0:T:Tmax;
wr = sqrt((w0^2) - ((alpha^2)/4));

G = (alpha/wr) * exp(-alpha*(T/2)) * sin(wr*T);
a1 = -2 * exp(-alpha*(T/2)) * cos(wr*T); a2 = exp(-alpha*T);
Hd = @(z)(G.*z.^(-1) .* (1-z.^(-1))./(1 + (a1.*z.^(-1)) +
 (a2.*z.^(-2)));
Hd(t);
xn = x;

ctr = 0; v1 = 0; v2 = 0; yn = 0;
while (ctr < t)
    yn = v1
    v1 = v2 + (G*xn) - (a1*yn);
    v2 = (-G*xn) - (a2*yn);
    ctr = ctr + 1;
```

```
end
disp(['yn = ' num2str(yn)]);

num = [0 G -G]; den = [1 a1 a2];
y_lsim = filter(num, den, x)
y_iter = yn;
E_lsim = norm(y_lsim - y_iter)
E_iter = norm(y_iter - y_lsim)

%part f
w0=5; alpha = 0.2; T = 0.02;
t_60dB = (log(1000)*2)/alpha;
N = (2 * t_60dB)/T;

gn0 = @(n)(alpha./wr) * exp((-alpha * n * T)./2) * sin(wr * n * T);
gn1 = @(n)(alpha./wr) * exp((-alpha * (n-1) * T)./2) * sin(wr * (n-1)*
 T);
hd = @(n)gn0(n) - gn1(n); p = exp((-alpha * T)/2) * exp(1i * wr *T);
op1 = G * exp((alpha * T)/2); op2 = (1 - exp((alpha*T)/2)) * exp(-1i *
 wr *T);
op3 = 2 * 1i * sin(wr * T); A = (op1 * op2)/op3;

NRR_exact = (2 * real((A.^2 * p.^2)./(1-(p.^2)))) + ...
            ((2 .* (abs(A).^2) * abs(p).^2)./(1-(abs(p).^2)))

ctr = 0; ans=0;
while (ctr < N-1)
    ans = (abs(hd(ctr)).^2) + ans;
    ctr = ctr + 1;
end

disp(['NRR1 = ' num2str(ans)])
NRR2 = (std(yn).^2)/(std(v).^2)
NRR3 = (T*alpha)/2


w =

  Columns 1 through 7

         0    0.0500    0.1000    0.1500    0.2000    0.2500    0.3000

  Columns 8 through 14

    0.3500    0.4000    0.4500    0.5000    0.5500    0.6000    0.6500

  Columns 15 through 21

    0.7000    0.7500    0.8000    0.8500    0.9000    0.9500    1.0000

  Columns 22 through 28

    1.0500    1.1000    1.1500    1.2000    1.2500    1.3000    1.3500
```

Columns 29 through 35

1.4000 1.4500 1.5000 1.5500 1.6000 1.6500 1.7000

Columns 36 through 42

1.7500 1.8000 1.8500 1.9000 1.9500 2.0000 2.0500

Columns 43 through 49

2.1000 2.1500 2.2000 2.2500 2.3000 2.3500 2.4000

Columns 50 through 56

2.4500 2.5000 2.5500 2.6000 2.6500 2.7000 2.7500

Columns 57 through 63

2.8000 2.8500 2.9000 2.9500 3.0000 3.0500 3.1000

Columns 64 through 70

3.1500 3.2000 3.2500 3.3000 3.3500 3.4000 3.4500

Columns 71 through 77

3.5000 3.5500 3.6000 3.6500 3.7000 3.7500 3.8000

Columns 78 through 84

3.8500 3.9000 3.9500 4.0000 4.0500 4.1000 4.1500

Columns 85 through 91

4.2000 4.2500 4.3000 4.3500 4.4000 4.4500 4.5000

Columns 92 through 98

4.5500 4.6000 4.6500 4.7000 4.7500 4.8000 4.8500

Columns 99 through 105

4.9000 4.9500 5.0000 5.0500 5.1000 5.1500 5.2000

Columns 106 through 112

5.2500 5.3000 5.3500 5.4000 5.4500 5.5000 5.5500

Columns 113 through 119

5.6000 5.6500 5.7000 5.7500 5.8000 5.8500 5.9000

Columns 120 through 126

```
    5.9500    6.0000    6.0500    6.1000    6.1500    6.2000    6.2500

  Columns 127 through 133

    6.3000    6.3500    6.4000    6.4500    6.5000    6.5500    6.6000

  Columns 134 through 140

    6.6500    6.7000    6.7500    6.8000    6.8500    6.9000    6.9500

  Columns 141 through 147

    7.0000    7.0500    7.1000    7.1500    7.2000    7.2500    7.3000

  Columns 148 through 154

    7.3500    7.4000    7.4500    7.5000    7.5500    7.6000    7.6500

  Columns 155 through 161

    7.7000    7.7500    7.8000    7.8500    7.9000    7.9500    8.0000

  Columns 162 through 168

    8.0500    8.1000    8.1500    8.2000    8.2500    8.3000    8.3500

  Columns 169 through 175

    8.4000    8.4500    8.5000    8.5500    8.6000    8.6500    8.7000

  Columns 176 through 182

    8.7500    8.8000    8.8500    8.9000    8.9500    9.0000    9.0500

  Columns 183 through 189

    9.1000    9.1500    9.2000    9.2500    9.3000    9.3500    9.4000

  Columns 190 through 196

    9.4500    9.5000    9.5500    9.6000    9.6500    9.7000    9.7500

  Columns 197 through 201

    9.8000    9.8500    9.9000    9.9500   10.0000

w =

  Columns 1 through 7

         0    0.0500    0.1000    0.1500    0.2000    0.2500    0.3000

  Columns 8 through 14
```

```
  0.3500    0.4000    0.4500    0.5000    0.5500    0.6000    0.6500

Columns 15 through 21

  0.7000    0.7500    0.8000    0.8500    0.9000    0.9500    1.0000

Columns 22 through 28

  1.0500    1.1000    1.1500    1.2000    1.2500    1.3000    1.3500

Columns 29 through 35

  1.4000    1.4500    1.5000    1.5500    1.6000    1.6500    1.7000

Columns 36 through 42

  1.7500    1.8000    1.8500    1.9000    1.9500    2.0000    2.0500

Columns 43 through 49

  2.1000    2.1500    2.2000    2.2500    2.3000    2.3500    2.4000

Columns 50 through 56

  2.4500    2.5000    2.5500    2.6000    2.6500    2.7000    2.7500

Columns 57 through 63

  2.8000    2.8500    2.9000    2.9500    3.0000    3.0500    3.1000

Columns 64 through 70

  3.1500    3.2000    3.2500    3.3000    3.3500    3.4000    3.4500

Columns 71 through 77

  3.5000    3.5500    3.6000    3.6500    3.7000    3.7500    3.8000

Columns 78 through 84

  3.8500    3.9000    3.9500    4.0000    4.0500    4.1000    4.1500

Columns 85 through 91

  4.2000    4.2500    4.3000    4.3500    4.4000    4.4500    4.5000

Columns 92 through 98

  4.5500    4.6000    4.6500    4.7000    4.7500    4.8000    4.8500

Columns 99 through 105

  4.9000    4.9500    5.0000    5.0500    5.1000    5.1500    5.2000
```

```
Columns 106 through 112

  5.2500    5.3000    5.3500    5.4000    5.4500    5.5000    5.5500

Columns 113 through 119

  5.6000    5.6500    5.7000    5.7500    5.8000    5.8500    5.9000

Columns 120 through 126

  5.9500    6.0000    6.0500    6.1000    6.1500    6.2000    6.2500

Columns 127 through 133

  6.3000    6.3500    6.4000    6.4500    6.5000    6.5500    6.6000

Columns 134 through 140

  6.6500    6.7000    6.7500    6.8000    6.8500    6.9000    6.9500

Columns 141 through 147

  7.0000    7.0500    7.1000    7.1500    7.2000    7.2500    7.3000

Columns 148 through 154

  7.3500    7.4000    7.4500    7.5000    7.5500    7.6000    7.6500

Columns 155 through 161

  7.7000    7.7500    7.8000    7.8500    7.9000    7.9500    8.0000

Columns 162 through 168

  8.0500    8.1000    8.1500    8.2000    8.2500    8.3000    8.3500

Columns 169 through 175

  8.4000    8.4500    8.5000    8.5500    8.6000    8.6500    8.7000

Columns 176 through 182

  8.7500    8.8000    8.8500    8.9000    8.9500    9.0000    9.0500

Columns 183 through 189

  9.1000    9.1500    9.2000    9.2500    9.3000    9.3500    9.4000

Columns 190 through 196

  9.4500    9.5000    9.5500    9.6000    9.6500    9.7000    9.7500

Columns 197 through 201
```

```
    9.8000    9.8500    9.9000    9.9500   10.0000

yn = 0

y_lsim =

  Columns 1 through 7

         0    0.0056    0.0080    0.0126    0.0167    0.0171    0.0209

  Columns 8 through 14

    0.0194    0.0243    0.0308    0.0329    0.0354    0.0326    0.0298

  Columns 15 through 21

    0.0256    0.0295    0.0317    0.0257    0.0328    0.0314    0.0297

  Columns 22 through 28

    0.0275    0.0148    0.0102    0.0029   -0.0014   -0.0058   -0.0119

  Columns 29 through 35

   -0.0158   -0.0124   -0.0182   -0.0258   -0.0203   -0.0204   -0.0230

  Columns 36 through 42

   -0.0281   -0.0324   -0.0375   -0.0498   -0.0506   -0.0586   -0.0650

  Columns 43 through 49

   -0.0683   -0.0754   -0.0789   -0.0816   -0.0775   -0.0793   -0.0745

  Columns 50 through 56

   -0.0748   -0.0814   -0.0843   -0.0818   -0.0783   -0.0771   -0.0670

  Columns 57 through 63

   -0.0557   -0.0428   -0.0392   -0.0291   -0.0247   -0.0102    0.0034

  Columns 64 through 70

    0.0157    0.0234    0.0316    0.0505    0.0683    0.0764    0.0888

  Columns 71 through 77

    0.1030    0.1116    0.1246    0.1295    0.1338    0.1452    0.1469

  Columns 78 through 84

    0.1471    0.1484    0.1410    0.1422    0.1412    0.1338    0.1250
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```
Columns 85 through 91

  0.1146    0.1101    0.0943    0.0814    0.0711    0.0581    0.0393

Columns 92 through 98

  0.0202   -0.0026   -0.0207   -0.0308   -0.0474   -0.0651   -0.0826

Columns 99 through 105

 -0.0998   -0.1138   -0.1263   -0.1342   -0.1454   -0.1569   -0.1626

Columns 106 through 112

 -0.1697   -0.1825   -0.1884   -0.1875   -0.1853   -0.1902   -0.1779

Columns 113 through 119

 -0.1741   -0.1674   -0.1646   -0.1562   -0.1394   -0.1227   -0.1129

Columns 120 through 126

 -0.0917   -0.0740   -0.0605   -0.0436   -0.0196    0.0022    0.0187

Columns 127 through 133

  0.0386    0.0620    0.0842    0.1013    0.1212    0.1445    0.1643

Columns 134 through 140

  0.1783    0.1943    0.2011    0.2166    0.2292    0.2353    0.2479

Columns 141 through 147

  0.2548    0.2545    0.2494    0.2473    0.2377    0.2261    0.2086

Columns 148 through 154

  0.1926    0.1773    0.1546    0.1350    0.1121    0.0921    0.0641

Columns 155 through 161

  0.0447    0.0198   -0.0089   -0.0353   -0.0603   -0.0872   -0.1126

Columns 162 through 168

 -0.1417   -0.1587   -0.1804   -0.2023   -0.2228   -0.2335   -0.2540

Columns 169 through 175

 -0.2659   -0.2793   -0.2841   -0.2958   -0.2970   -0.2978   -0.2975

Columns 176 through 182
```

```
 -0.2878   -0.2791   -0.2651   -0.2492   -0.2323   -0.2103   -0.1820

Columns 183 through 189

 -0.1509   -0.1269   -0.0967   -0.0681   -0.0456   -0.0102    0.0201

Columns 190 through 196

  0.0483    0.0748    0.1026    0.1349    0.1644    0.1893    0.2118

Columns 197 through 203

  0.2321    0.2517    0.2779    0.2925    0.3128    0.3252    0.3317

Columns 204 through 210

  0.3376    0.3360    0.3352    0.3330    0.3262    0.3107    0.3009

Columns 211 through 217

  0.2789    0.2536    0.2273    0.2001    0.1805    0.1494    0.1152

Columns 218 through 224

  0.0839    0.0510    0.0180   -0.0161   -0.0534   -0.0953   -0.1332

Columns 225 through 231

 -0.1706   -0.2007   -0.2298   -0.2578   -0.2871   -0.3031   -0.3317

Columns 232 through 238

 -0.3493   -0.3627   -0.3673   -0.3762   -0.3827   -0.3836   -0.3787

Columns 239 through 245

 -0.3679   -0.3565   -0.3327   -0.3146   -0.2918   -0.2659   -0.2323

Columns 246 through 252

 -0.2063   -0.1782   -0.1428   -0.1078   -0.0711   -0.0392    0.0053

Columns 253 through 259

  0.0474    0.0879    0.1290    0.1558    0.1896    0.2232    0.2469

Columns 260 through 266

  0.2748    0.3003    0.3239    0.3465    0.3681    0.3836    0.3895

Columns 267 through 273

  0.3969    0.4011    0.3986    0.3923    0.3834    0.3743    0.3611
```

```
Columns 274 through 280

  0.3314    0.3070    0.2844    0.2603    0.2265    0.1917    0.1569

Columns 281 through 287

  0.1168    0.0749    0.0349   -0.0049   -0.0468   -0.0911   -0.1323

Columns 288 through 294

 -0.1796   -0.2173   -0.2545   -0.2854   -0.3165   -0.3477   -0.3765

Columns 295 through 301

 -0.3980   -0.4186   -0.4307   -0.4421   -0.4400   -0.4418   -0.4420

Columns 302 through 308

 -0.4414   -0.4243   -0.4093   -0.3815   -0.3504   -0.3267   -0.2875

Columns 309 through 315

 -0.2571   -0.2158   -0.1759   -0.1363   -0.0949   -0.0471   -0.0070

Columns 316 through 322

  0.0385    0.0863    0.1309    0.1702    0.2164    0.2615    0.3010

Columns 323 through 329

  0.3438    0.3686    0.3974    0.4270    0.4487    0.4663    0.4687

Columns 330 through 336

  0.4791    0.4874    0.4875    0.4782    0.4688    0.4516    0.4294

Columns 337 through 343

  0.4034    0.3752    0.3401    0.3060    0.2638    0.2187    0.1795

Columns 344 through 350

  0.1325    0.0805    0.0222   -0.0301   -0.0713   -0.1156   -0.1646

Columns 351 through 357

 -0.2098   -0.2658   -0.3076   -0.3517   -0.3891   -0.4250   -0.4594

Columns 358 through 364

 -0.4866   -0.5085   -0.5222   -0.5390   -0.5382   -0.5397   -0.5389

Columns 365 through 371
```

```
 -0.5285   -0.5119   -0.4928   -0.4628   -0.4316   -0.3924   -0.3493

Columns 372 through 378

 -0.3037   -0.2568   -0.2104   -0.1571   -0.1015   -0.0507    0.0083

Columns 379 through 385

  0.0602    0.1152    0.1627    0.2113    0.2647    0.3109    0.3583

Columns 386 through 392

  0.3958    0.4287    0.4614    0.4867    0.5151    0.5301    0.5528

Columns 393 through 399

  0.5588    0.5585    0.5581    0.5570    0.5402    0.5192    0.4950

Columns 400 through 406

  0.4634    0.4322    0.3930    0.3490    0.3037    0.2564    0.2077

Columns 407 through 413

  0.1519    0.0980    0.0441   -0.0076   -0.0620   -0.1101   -0.1642

Columns 414 through 420

 -0.2166   -0.2686   -0.3235   -0.3764   -0.4174   -0.4615   -0.4969

Columns 421 through 427

 -0.5296   -0.5611   -0.5800   -0.5937   -0.6020   -0.6025   -0.6004

Columns 428 through 434

 -0.5907   -0.5742   -0.5524   -0.5294   -0.4943   -0.4527   -0.4098

Columns 435 through 441

 -0.3632   -0.3109   -0.2574   -0.1959   -0.1344   -0.0721   -0.0076

Columns 442 through 448

  0.0537    0.1073    0.1731    0.2341    0.2902    0.3397    0.3882

Columns 449 through 455

  0.4293    0.4716    0.5157    0.5513    0.5790    0.6002    0.6149

Columns 456 through 462

  0.6237    0.6136    0.6119    0.5982    0.5835    0.5674    0.5451
```

Columns 463 through 469

0.5173 0.4829 0.4493 0.3991 0.3547 0.3016 0.2457

Columns 470 through 476

0.1894 0.1296 0.0675 0.0067 -0.0540 -0.1266 -0.1874

Columns 477 through 483

-0.2460 -0.3065 -0.3613 -0.4134 -0.4605 -0.5028 -0.5453

Columns 484 through 490

-0.5748 -0.6009 -0.6211 -0.6346 -0.6384 -0.6444 -0.6426

Columns 491 through 497

-0.6333 -0.6177 -0.5992 -0.5706 -0.5386 -0.5027 -0.4580

Columns 498 through 504

-0.4140 -0.3524 -0.2905 -0.2238 -0.1560 -0.0945 -0.0274

Columns 505 through 511

0.0310 0.0935 0.1597 0.2202 0.2881 0.3464 0.4023

Columns 512 through 518

0.4500 0.5015 0.5506 0.5901 0.6255 0.6525 0.6679

Columns 519 through 525

0.6842 0.6887 0.6795 0.6700 0.6564 0.6299 0.6018

Columns 526 through 532

0.5742 0.5295 0.4857 0.4370 0.3812 0.3239 0.2680

Columns 533 through 539

0.1951 0.1286 0.0612 -0.0024 -0.0750 -0.1505 -0.2185

Columns 540 through 546

-0.2837 -0.3420 -0.4081 -0.4676 -0.5212 -0.5569 -0.5994

Columns 547 through 553

-0.6318 -0.6648 -0.6904 -0.7059 -0.7119 -0.7073 -0.6986

Columns 554 through 560

```
 -0.6907   -0.6731   -0.6501   -0.6136   -0.5757   -0.5254   -0.4688

Columns 561 through 567

 -0.4124   -0.3506   -0.2842   -0.2202   -0.1544   -0.0793   -0.0119

Columns 568 through 574

  0.0568    0.1322    0.2045    0.2768    0.3328    0.3945    0.4501

Columns 575 through 581

  0.5050    0.5538    0.5950    0.6340    0.6601    0.6803    0.6935

Columns 582 through 588

  0.7040    0.7162    0.7140    0.7092    0.6965    0.6756    0.6497

Columns 589 through 595

  0.6153    0.5695    0.5177    0.4618    0.3977    0.3343    0.2781

Columns 596 through 602

  0.2036    0.1268    0.0551   -0.0284   -0.0969   -0.1617   -0.2318

Columns 603 through 609

 -0.2956   -0.3664   -0.4294   -0.4907   -0.5452   -0.5967   -0.6342

Columns 610 through 616

 -0.6726   -0.7003   -0.7250   -0.7457   -0.7539   -0.7578   -0.7480

Columns 617 through 623

 -0.7380   -0.7207   -0.6889   -0.6589   -0.6185   -0.5747   -0.5155

Columns 624 through 630

 -0.4528   -0.3877   -0.3148   -0.2405   -0.1682   -0.0921   -0.0185

Columns 631 through 637

  0.0499    0.1312    0.2075    0.2825    0.3512    0.4183    0.4817

Columns 638 through 644

  0.5370    0.5938    0.6444    0.6917    0.7273    0.7550    0.7747

Columns 645 through 651

  0.7827    0.7834    0.7723    0.7567    0.7355    0.7092    0.6711
```

Columns 652 through 658

0.6326 0.5875 0.5252 0.4728 0.3984 0.3362 0.2666

Columns 659 through 665

0.1943 0.1268 0.0500 -0.0271 -0.1046 -0.1809 -0.2524

Columns 666 through 672

-0.3274 -0.3915 -0.4556 -0.5115 -0.5651 -0.6143 -0.6546

Columns 673 through 679

-0.6862 -0.7211 -0.7464 -0.7665 -0.7710 -0.7734 -0.7595

Columns 680 through 686

-0.7483 -0.7340 -0.7034 -0.6679 -0.6292 -0.5746 -0.5195

Columns 687 through 693

-0.4552 -0.3925 -0.3210 -0.2473 -0.1799 -0.1087 -0.0333

Columns 694 through 700

0.0492 0.1272 0.2102 0.2886 0.3665 0.4369 0.4988

Columns 701 through 707

0.5641 0.6204 0.6703 0.7094 0.7383 0.7650 0.7882

Columns 708 through 714

0.7986 0.8058 0.8124 0.8007 0.7923 0.7641 0.7292

Columns 715 through 721

0.6855 0.6380 0.5724 0.5158 0.4447 0.3748 0.2978

Columns 722 through 728

0.2248 0.1430 0.0659 -0.0122 -0.0963 -0.1808 -0.2607

Columns 729 through 735

-0.3322 -0.4073 -0.4821 -0.5455 -0.6030 -0.6526 -0.6972

Columns 736 through 742

-0.7345 -0.7710 -0.7987 -0.8180 -0.8351 -0.8329 -0.8266

Columns 743 through 749

```
 -0.8137   -0.7923   -0.7630   -0.7259   -0.6776   -0.6267   -0.5770

Columns 750 through 756

 -0.5097   -0.4356   -0.3540   -0.2708   -0.1919   -0.1146   -0.0305

Columns 757 through 763

  0.0577    0.1404    0.2229    0.3067    0.3833    0.4565    0.5330

Columns 764 through 770

  0.5922    0.6515    0.7031    0.7453    0.7775    0.8032    0.8234

Columns 771 through 777

  0.8428    0.8494    0.8434    0.8360    0.8160    0.7879    0.7522

Columns 778 through 784

  0.7097    0.6553    0.6041    0.5489    0.4794    0.4071    0.3298

Columns 785 through 791

  0.2471    0.1636    0.0799   -0.0096   -0.0925   -0.1796   -0.2600

Columns 792 through 798

 -0.3421   -0.4215   -0.4985   -0.5693   -0.6330   -0.6943   -0.7433

Columns 799 through 805

 -0.7881   -0.8213   -0.8495   -0.8651   -0.8796   -0.8851   -0.8809

Columns 806 through 812

 -0.8687   -0.8421   -0.8064   -0.7687   -0.7216   -0.6634   -0.5967

Columns 813 through 819

 -0.5289   -0.4498   -0.3669   -0.2891   -0.2037   -0.1161   -0.0309

Columns 820 through 826

  0.0567    0.1398    0.2296    0.3109    0.3916    0.4761    0.5534

Columns 827 through 833

  0.6188    0.6805    0.7358    0.7882    0.8334    0.8619    0.8823

Columns 834 through 840

  0.9018    0.9062    0.9087    0.8889    0.8693    0.8315    0.7879
```

Columns 841 through 847

0.7406 0.6850 0.6171 0.5494 0.4740 0.4050 0.3213

Columns 848 through 854

0.2331 0.1436 0.0523 -0.0361 -0.1234 -0.2084 -0.2978

Columns 855 through 861

-0.3789 -0.4616 -0.5428 -0.6139 -0.6757 -0.7302 -0.7828

Columns 862 through 868

-0.8300 -0.8620 -0.8887 -0.9028 -0.9108 -0.9040 -0.8923

Columns 869 through 875

-0.8706 -0.8350 -0.7981 -0.7539 -0.7033 -0.6423 -0.5716

Columns 876 through 882

-0.5035 -0.4304 -0.3508 -0.2655 -0.1775 -0.0855 -0.0015

Columns 883 through 889

0.0891 0.1792 0.2711 0.3580 0.4335 0.5096 0.5787

Columns 890 through 896

0.6441 0.7088 0.7585 0.8105 0.8450 0.8749 0.8867

Columns 897 through 903

0.8921 0.8884 0.8764 0.8661 0.8436 0.8125 0.7749

Columns 904 through 910

0.7268 0.6675 0.6047 0.5358 0.4688 0.3884 0.3114

Columns 911 through 917

0.2230 0.1334 0.0525 -0.0416 -0.1279 -0.2164 -0.2996

Columns 918 through 924

-0.3883 -0.4667 -0.5456 -0.6134 -0.6803 -0.7371 -0.7963

Columns 925 through 931

-0.8414 -0.8741 -0.8970 -0.9117 -0.9217 -0.9129 -0.9028

Columns 932 through 938

```
 -0.8942   -0.8648   -0.8261   -0.7774   -0.7219   -0.6638   -0.5963

Columns 939 through 945

 -0.5216   -0.4457   -0.3570   -0.2628   -0.1727   -0.0794    0.0195

Columns 946 through 952

  0.1150    0.2106    0.2990    0.3844    0.4717    0.5467    0.6210

Columns 953 through 959

  0.6908    0.7495    0.7986    0.8441    0.8782    0.9116    0.9281

Columns 960 through 966

  0.9450    0.9547    0.9480    0.9261    0.8973    0.8638    0.8182

Columns 967 through 973

  0.7648    0.7073    0.6393    0.5636    0.4824    0.3970    0.3075

Columns 974 through 980

  0.2127    0.1156    0.0199   -0.0751   -0.1692   -0.2579   -0.3465

Columns 981 through 987

 -0.4360   -0.5138   -0.5961   -0.6634   -0.7318   -0.7815   -0.8354

Columns 988 through 994

 -0.8745   -0.9113   -0.9388   -0.9532   -0.9595   -0.9517   -0.9392

Columns 995 through 1001

 -0.9191   -0.8853   -0.8486   -0.8008   -0.7419   -0.6773   -0.6051

Columns 1002 through 1008

 -0.5284   -0.4416   -0.3492   -0.2527   -0.1544   -0.0636    0.0338

Columns 1009 through 1015

  0.1228    0.2231    0.3197    0.4075    0.4872    0.5703    0.6416

Columns 1016 through 1022

  0.7015    0.7621    0.8136    0.8513    0.8835    0.9120    0.9324

Columns 1023 through 1029

  0.9394    0.9392    0.9326    0.9077    0.8837    0.8499    0.8079
```

Columns 1030 through 1036

0.7532 0.6934 0.6298 0.5538 0.4685 0.3800 0.2854

Columns 1037 through 1043

0.1941 0.1004 0.0001 -0.0992 -0.1815 -0.2807 -0.3608

Columns 1044 through 1050

-0.4454 -0.5256 -0.5985 -0.6670 -0.7327 -0.7873 -0.8360

Columns 1051 through 1057

-0.8701 -0.9008 -0.9229 -0.9302 -0.9302 -0.9220 -0.9052

Columns 1058 through 1064

-0.8780 -0.8386 -0.8044 -0.7560 -0.7023 -0.6352 -0.5663

Columns 1065 through 1071

-0.4869 -0.4041 -0.3145 -0.2186 -0.1203 -0.0296 0.0650

Columns 1072 through 1078

0.1499 0.2458 0.3352 0.4198 0.4985 0.5728 0.6481

Columns 1079 through 1085

0.7044 0.7568 0.8035 0.8442 0.8797 0.9054 0.9245

Columns 1086 through 1092

0.9265 0.9178 0.8955 0.8730 0.8462 0.8041 0.7505

Columns 1093 through 1099

0.6946 0.6374 0.5701 0.4965 0.4203 0.3450 0.2572

Columns 1100 through 1106

0.1617 0.0674 -0.0272 -0.1143 -0.2099 -0.2981 -0.3847

Columns 1107 through 1113

-0.4649 -0.5455 -0.6120 -0.6793 -0.7357 -0.7842 -0.8239

Columns 1114 through 1120

-0.8576 -0.8839 -0.8948 -0.9069 -0.9088 -0.9013 -0.8824

Columns 1121 through 1127

-0.8526 -0.8150 -0.7686 -0.7139 -0.6517 -0.5906 -0.5184

Columns 1128 through 1134

-0.4375 -0.3614 -0.2765 -0.1909 -0.0954 -0.0040 0.0915

Columns 1135 through 1141

0.1819 0.2670 0.3598 0.4443 0.5329 0.6013 0.6634

Columns 1142 through 1148

0.7193 0.7742 0.8185 0.8539 0.8775 0.8915 0.9023

Columns 1149 through 1155

0.9023 0.8957 0.8833 0.8666 0.8344 0.7935 0.7391

Columns 1156 through 1162

0.6829 0.6145 0.5393 0.4683 0.3838 0.3013 0.2138

Columns 1163 through 1169

0.1213 0.0241 -0.0637 -0.1572 -0.2527 -0.3431 -0.4267

Columns 1170 through 1176

-0.5100 -0.5914 -0.6578 -0.7240 -0.7843 -0.8334 -0.8690

Columns 1177 through 1183

-0.8982 -0.9184 -0.9370 -0.9371 -0.9278 -0.9108 -0.8793

Columns 1184 through 1190

-0.8477 -0.8035 -0.7566 -0.7041 -0.6418 -0.5671 -0.4835

Columns 1191 through 1197

-0.3936 -0.3065 -0.2219 -0.1380 -0.0440 0.0465 0.1353

Columns 1198 through 1204

0.2238 0.3116 0.3969 0.4746 0.5552 0.6345 0.6974

Columns 1205 through 1211

0.7596 0.8139 0.8538 0.8905 0.9173 0.9308 0.9361

Columns 1212 through 1218

0.9319 0.9195 0.8930 0.8655 0.8213 0.7748 0.7201

Columns 1219 through 1225

0.6620 0.5946 0.5221 0.4397 0.3646 0.2846 0.1942

Columns 1226 through 1232

0.0983 0.0088 -0.0909 -0.1888 -0.2861 -0.3791 -0.4661

Columns 1233 through 1239

-0.5473 -0.6242 -0.6855 -0.7454 -0.8012 -0.8529 -0.8947

Columns 1240 through 1246

-0.9262 -0.9448 -0.9568 -0.9502 -0.9375 -0.9170 -0.8868

Columns 1247 through 1253

-0.8491 -0.8142 -0.7558 -0.6938 -0.6261 -0.5475 -0.4668

Columns 1254 through 1260

-0.3806 -0.2975 -0.2041 -0.1053 -0.0155 0.0769 0.1720

Columns 1261 through 1267

0.2714 0.3618 0.4520 0.5320 0.6055 0.6750 0.7395

Columns 1268 through 1274

0.7917 0.8366 0.8782 0.9061 0.9236 0.9442 0.9483

Columns 1275 through 1281

0.9439 0.9280 0.9027 0.8731 0.8297 0.7807 0.7192

Columns 1282 through 1288

0.6559 0.5835 0.5013 0.4184 0.3367 0.2474 0.1543

Columns 1289 through 1295

0.0599 -0.0311 -0.1237 -0.2132 -0.2990 -0.3843 -0.4729

Columns 1296 through 1302

-0.5486 -0.6251 -0.6947 -0.7588 -0.8129 -0.8538 -0.8931

Columns 1303 through 1309

-0.9241 -0.9405 -0.9547 -0.9595 -0.9530 -0.9326 -0.9072

Columns 1310 through 1316

```
 -0.8761   -0.8317   -0.7778   -0.7208   -0.6489   -0.5722   -0.4915

Columns 1317 through 1323

 -0.3983   -0.3079   -0.2157   -0.1193   -0.0206    0.0731    0.1680

Columns 1324 through 1330

  0.2615    0.3590    0.4463    0.5326    0.6132    0.6839    0.7437

Columns 1331 through 1337

  0.8025    0.8545    0.8919    0.9218    0.9446    0.9566    0.9597

Columns 1338 through 1344

  0.9527    0.9433    0.9189    0.8864    0.8441    0.7966    0.7357

Columns 1345 through 1351

  0.6661    0.5941    0.5145    0.4301    0.3491    0.2502    0.1556

Columns 1352 through 1358

  0.0625   -0.0397   -0.1339   -0.2244   -0.3191   -0.4074   -0.4902

Columns 1359 through 1365

 -0.5693   -0.6377   -0.7018   -0.7641   -0.8179   -0.8666   -0.9040

Columns 1366 through 1372

 -0.9366   -0.9567   -0.9651   -0.9627   -0.9532   -0.9333   -0.8996

Columns 1373 through 1379

 -0.8638   -0.8181   -0.7640   -0.6952   -0.6327   -0.5476   -0.4673

Columns 1380 through 1386

 -0.3787   -0.2903   -0.1953   -0.0976   -0.0044    0.0995    0.1880

Columns 1387 through 1393

  0.2833    0.3714    0.4607    0.5388    0.6123    0.6906    0.7510

Columns 1394 through 1400

  0.8079    0.8616    0.9047    0.9338    0.9549    0.9684    0.9711

Columns 1401 through 1407

  0.9593    0.9400    0.9180    0.8822    0.8395    0.7897    0.7294
```

Columns 1408 through 1414

0.6594 0.5814 0.5032 0.4137 0.3220 0.2245 0.1301

Columns 1415 through 1421

0.0340 -0.0595 -0.1672 -0.2609 -0.3517 -0.4414 -0.5208

Columns 1422 through 1428

-0.6000 -0.6641 -0.7328 -0.7943 -0.8401 -0.8807 -0.9145

Columns 1429 through 1435

-0.9416 -0.9551 -0.9636 -0.9574 -0.9450 -0.9148 -0.8917

Columns 1436 through 1442

-0.8487 -0.7995 -0.7402 -0.6765 -0.6076 -0.5311 -0.4454

Columns 1443 through 1449

-0.3570 -0.2680 -0.1746 -0.0796 0.0222 0.1203 0.2145

Columns 1450 through 1456

0.3037 0.3904 0.4732 0.5561 0.6281 0.6902 0.7581

Columns 1457 through 1463

0.8112 0.8601 0.9036 0.9326 0.9458 0.9578 0.9495

Columns 1464 through 1470

0.9422 0.9236 0.8891 0.8510 0.8024 0.7513 0.6892

Columns 1471 through 1477

0.6287 0.5559 0.4734 0.3904 0.3049 0.2154 0.1286

Columns 1478 through 1484

0.0275 -0.0638 -0.1538 -0.2421 -0.3413 -0.4233 -0.5095

Columns 1485 through 1491

-0.5886 -0.6580 -0.7274 -0.7853 -0.8322 -0.8817 -0.9082

Columns 1492 through 1498

-0.9319 -0.9479 -0.9587 -0.9575 -0.9479 -0.9257 -0.8929

Columns 1499 through 1505

```
 -0.8515   -0.7963   -0.7317   -0.6638   -0.5853   -0.5094   -0.4316

Columns 1506 through 1512

 -0.3419   -0.2513   -0.1546   -0.0616    0.0438    0.1388    0.2313

Columns 1513 through 1519

  0.3253    0.4147    0.4979    0.5817    0.6547    0.7239    0.7857

Columns 1520 through 1526

  0.8398    0.8851    0.9177    0.9526    0.9646    0.9720    0.9579

Columns 1527 through 1533

  0.9523    0.9216    0.8931    0.8533    0.7998    0.7446    0.6774

Columns 1534 through 1540

  0.6080    0.5326    0.4488    0.3673    0.2768    0.1911    0.1002

Columns 1541 through 1547

  0.0076   -0.0854   -0.1799   -0.2685   -0.3485   -0.4288   -0.5167

Columns 1548 through 1554

 -0.5994   -0.6790   -0.7502   -0.8109   -0.8585   -0.9001   -0.9404

Columns 1555 through 1561

 -0.9609   -0.9779   -0.9851   -0.9878   -0.9686   -0.9400   -0.9040

Columns 1562 through 1568

 -0.8612   -0.8093   -0.7427   -0.6735   -0.6004   -0.5153   -0.4259

Columns 1569 through 1575

 -0.3334   -0.2408   -0.1522   -0.0511    0.0402    0.1364    0.2439

Columns 1576 through 1582

  0.3326    0.4236    0.5150    0.5950    0.6681    0.7348    0.7955

Columns 1583 through 1589

  0.8469    0.8871    0.9228    0.9542    0.9688    0.9765    0.9806

Columns 1590 through 1596

  0.9655    0.9488    0.9131    0.8622    0.8185    0.7660    0.7033
```

Columns 1597 through 1603

0.6295 0.5499 0.4663 0.3874 0.2956 0.1925 0.0982

Columns 1604 through 1610

-0.0028 -0.1070 -0.2006 -0.2988 -0.3896 -0.4747 -0.5607

Columns 1611 through 1617

-0.6308 -0.6988 -0.7642 -0.8246 -0.8790 -0.9190 -0.9448

Columns 1618 through 1624

-0.9697 -0.9868 -0.9864 -0.9749 -0.9511 -0.9194 -0.8814

Columns 1625 through 1631

-0.8385 -0.7801 -0.7138 -0.6431 -0.5702 -0.4898 -0.4052

Columns 1632 through 1638

-0.3162 -0.2275 -0.1311 -0.0286 0.0638 0.1548 0.2465

Columns 1639 through 1645

0.3411 0.4236 0.5089 0.5889 0.6659 0.7298 0.7808

Columns 1646 through 1652

0.8376 0.8874 0.9278 0.9555 0.9806 0.9915 0.9892

Columns 1653 through 1659

0.9705 0.9421 0.9095 0.8656 0.8174 0.7531 0.6927

Columns 1660 through 1666

0.6093 0.5303 0.4399 0.3557 0.2665 0.1693 0.0717

Columns 1667 through 1673

-0.0249 -0.1224 -0.2177 -0.3197 -0.4056 -0.4936 -0.5733

Columns 1674 through 1680

-0.6521 -0.7195 -0.7846 -0.8326 -0.8856 -0.9240 -0.9547

Columns 1681 through 1687

-0.9730 -0.9776 -0.9835 -0.9706 -0.9496 -0.9151 -0.8775

Columns 1688 through 1694

```
 -0.8336   -0.7758   -0.7100   -0.6405   -0.5587   -0.4757   -0.3887

Columns 1695 through 1701

 -0.2970   -0.2042   -0.1050   -0.0109    0.0938    0.1944    0.2930

Columns 1702 through 1708

  0.3809    0.4642    0.5447    0.6181    0.6883    0.7459    0.8027

Columns 1709 through 1715

  0.8531    0.8905    0.9263    0.9495    0.9571    0.9579    0.9521

Columns 1716 through 1722

  0.9362    0.9149    0.8842    0.8441    0.7954    0.7354    0.6721

Columns 1723 through 1729

  0.6048    0.5218    0.4371    0.3439    0.2460    0.1492    0.0493

Columns 1730 through 1736

 -0.0428   -0.1386   -0.2269   -0.3246   -0.4189   -0.5005   -0.5812

Columns 1737 through 1743

 -0.6579   -0.7264   -0.7934   -0.8393   -0.8885   -0.9288   -0.9565

Columns 1744 through 1750

 -0.9757   -0.9838   -0.9803   -0.9685   -0.9459   -0.9119   -0.8701

Columns 1751 through 1757

 -0.8174   -0.7508   -0.6856   -0.6144   -0.5338   -0.4460   -0.3578

Columns 1758 through 1764

 -0.2645   -0.1722   -0.0787    0.0167    0.1198    0.2182    0.3195

Columns 1765 through 1771

  0.4072    0.4882    0.5705    0.6501    0.7208    0.7785    0.8291

Columns 1772 through 1778

  0.8732    0.9111    0.9344    0.9462    0.9562    0.9506    0.9407

Columns 1779 through 1785

  0.9194    0.8919    0.8526    0.8032    0.7490    0.6845    0.6195
```

Columns 1786 through 1792

0.5487 0.4713 0.3899 0.2985 0.2085 0.1158 0.0197

Columns 1793 through 1799

-0.0694 -0.1653 -0.2577 -0.3492 -0.4319 -0.5169 -0.5937

Columns 1800 through 1806

-0.6670 -0.7212 -0.7767 -0.8257 -0.8721 -0.9062 -0.9271

Columns 1807 through 1813

-0.9391 -0.9484 -0.9369 -0.9210 -0.8958 -0.8662 -0.8272

Columns 1814 through 1820

-0.7705 -0.7104 -0.6450 -0.5742 -0.4924 -0.4142 -0.3250

Columns 1821 through 1827

-0.2379 -0.1488 -0.0611 0.0341 0.1248 0.2164 0.3072

Columns 1828 through 1834

0.3939 0.4780 0.5511 0.6270 0.6915 0.7539 0.8008

Columns 1835 through 1841

0.8466 0.8802 0.9033 0.9167 0.9175 0.9190 0.9087

Columns 1842 through 1848

0.8925 0.8630 0.8250 0.7763 0.7230 0.6628 0.5935

Columns 1849 through 1855

0.5208 0.4480 0.3609 0.2735 0.1982 0.1009 0.0087

Columns 1856 through 1862

-0.0833 -0.1751 -0.2658 -0.3583 -0.4361 -0.5113 -0.5822

Columns 1863 through 1869

-0.6517 -0.7111 -0.7696 -0.8175 -0.8499 -0.8793 -0.8993

Columns 1870 through 1876

-0.9114 -0.9126 -0.9066 -0.8928 -0.8673 -0.8323 -0.7879

Columns 1877 through 1883

-0.7399 -0.6788 -0.6168 -0.5487 -0.4724 -0.3935 -0.3095

Columns 1884 through 1890

-0.2227 -0.1320 -0.0408 0.0546 0.1451 0.2311 0.3172

Columns 1891 through 1897

0.4028 0.4756 0.5540 0.6252 0.6835 0.7402 0.7826

Columns 1898 through 1904

0.8187 0.8510 0.8818 0.8948 0.9030 0.8984 0.8820

Columns 1905 through 1911

0.8678 0.8409 0.8012 0.7558 0.7043 0.6473 0.5786

Columns 1912 through 1918

0.5025 0.4232 0.3467 0.2629 0.1704 0.0806 -0.0063

Columns 1919 through 1925

-0.0922 -0.1806 -0.2727 -0.3615 -0.4442 -0.5207 -0.5939

Columns 1926 through 1932

-0.6674 -0.7276 -0.7811 -0.8264 -0.8638 -0.8895 -0.9102

Columns 1933 through 1939

-0.9249 -0.9269 -0.9210 -0.9082 -0.8819 -0.8481 -0.7982

Columns 1940 through 1946

-0.7439 -0.6892 -0.6168 -0.5382 -0.4542 -0.3688 -0.2804

Columns 1947 through 1953

-0.1930 -0.1059 -0.0138 0.0746 0.1658 0.2594 0.3482

Columns 1954 through 1960

0.4335 0.5190 0.5895 0.6637 0.7256 0.7854 0.8387

Columns 1961 through 1967

0.8731 0.9029 0.9247 0.9378 0.9481 0.9410 0.9237

Columns 1968 through 1974

0.9041 0.8657 0.8231 0.7783 0.7197 0.6539 0.5725

```
  Columns 1975 through 1981

    0.4937    0.4117    0.3264    0.2346    0.1393    0.0458   -0.0471

  Columns 1982 through 1988

   -0.1438   -0.2416   -0.3362   -0.4218   -0.5051   -0.5837   -0.6486

  Columns 1989 through 1995

   -0.7183   -0.7757   -0.8317   -0.8758   -0.9096   -0.9410   -0.9507

  Columns 1996 through 2001

   -0.9535   -0.9482   -0.9319   -0.9133   -0.8845   -0.8503

E_lsim =

   25.9212

E_iter =

   25.9212

NRR_exact =

   7.9840e-07

NRR1 = 0.0020143

NRR2 =

     0

NRR3 =

    0.0020
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