clc;

close all;

clear all;

n=7;k=4;

i=eye(4);

%identity matrix

for x=1:k

p(x,1)=xor(xor(i(x,1),i(x,3)),i(x,3));

p(x,2)=xor(xor(i(x,1),i(x,2)),i(x,3));

p(x,3)=xor(xor(i(x,2),i(x,3)),i(x,4));

end

disp("parity Matrix");disp(p)

%generation of generator matrix

g=[p i];

disp("generator matrix");disp(g)

%generation of codebook

%disp(['message ' ' code' ' weight of code']);

for z=0:15

msg\_str=dec2bin(z,4);

msg=[str2num(char(msg\_str(1))),str2num(char(msg\_str(2))),str2num(char(msg\_str(3))),str2num(char(msg\_str(4)))];

code=mod((msg\*g),2);

weight=sum(code);

%disp([num2str(msg)num2str(code)num2str(weight)]);

end

%syndrome generation

h=[eye(n-k) p']; %parity check matrix

ht=h'

ep=[0 0 0 0 0 0 0];

%disp(['syndrome' 'error pattern' ' ']);

ze=[0 0 0];

%disp([num2str(ze) ' ' num2str(ep)])

for f=1:7

epl=ep;

epl(f)=~epl(f);

%disp([num2str(ht(f,:)) ' ' num2str(ep)]);

end

%hamming code

m=randi([0,1],1,4);

%m= [1 0 0 1]

disp('TRANSMITTED MSG IS');disp(m);

c=mod((m\*g),2);

disp('CODEWORD IS');disp(c);

r=c;

e=randi([1,7],1);

r(e)=~r(e);

disp('RECIEVED MSG IS');disp(r);

s=mod((r\*h'),2);

disp('SYNDROME IS');disp(s);

if s==[0 0 0]

disp('NO ERROR');

cm=r;

disp(cm);

elseif s==[1 0 0]

disp('FIRST BIT ERROR');

cm=r;

cm(1)=~cm(1);

disp(cm);

elseif s==[0 1 0]

disp('SECOND BIT ERROR');

cm=r;

cm(2)=~cm(2);

disp(cm);

elseif s==[0 0 1]

disp('THIRD BIT ERROR');

cm=r;

cm(3)=~cm(3);

disp(cm);

elseif s==[1 1 0]

disp('FOURTH BIT ERROR');

cm=r;

cm(4)=~cm(4);

disp(cm);

elseif s==[0 1 1]

disp('FIFTH BIT ERROR');

cm=r;

cm(5)=~cm(5);

disp(cm);

elseif s==[1 1 1]

disp('SIXTH BIT ERROR');

cm=r;

cm(6)=~cm(6);

disp(cm);

elseif s==[1 0 1]

disp('SEVENTH BIT ERROR');

cm=r;

cm(7)=~cm(7);

disp(cm);

end

disp('CORRECTED MSG IS');disp(cm(4:7));