網通 HW1

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#1

$$G=[P\mid I] \Rightarrow H=[I\mid P^T]=\begin{bmatrix}1&0&0&1&0&1&1\\0&1&0&1&1&1&0\\0&0&1&0&1&1&1\end{bmatrix}$$

Code word:

$$C=[C_p\mid M] \Rightarrow \begin{cases} c_1=[1010]\begin{bmatrix}1&1&0&1&0&0&0\\0&1&1&0&1&0&0\\1&1&1&0&0&1&0\\1&0&1&0&0&0&1\end{bmatrix}=[0011010] \\ c_2=[1110]\begin{bmatrix}1&1&0&1&0&0&0\\0&1&1&0&1&0&0\\1&1&1&0&0&1&0\\1&0&1&0&0&0&1\end{bmatrix}=[0101110] \end{cases} \rightarrow [0011010\,0101110]$$

Received code: $x_1=[0011110]$

$x_2=[0001110]$

Error pattern

$$S=x\cdot H^T \begin{cases} x_1\cdot H^T=[0011110]\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\\1&1&0\\0&1&1\\1&1&1\\1&0&1\end{bmatrix}=[0\,1\,1] \rightarrow 0000100 \\ x_2\cdot H^T=[0001110]\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\\1&1&0\\0&1&1\\1&1&1\\1&0&1\end{bmatrix}=[0\,1\,0] \rightarrow 0100000 \end{cases}$$

```
G=[ ]; % Generator matrix
P=[1 1 0; 0 1 1;1 1 1; 1 0 1];
G=[P eye(4)];
x=[1 0 1 0];
V1=G(1,:);
V2=G(2,:);
V3=G(3,:);
V4=G(4,:);
var1=x(1) & V1 ;
var2=x(2) & V2 ;
var3=x(3) & V3 ;
var4=x(4) & V4 ;
y1=bitxor(var1,var2);
y2=bitxor(y1,var3);
y=bitxor(y2,var4);
```

```
>> y

y =

  1×7 logical array

   0   0   1   1   0   1   0
```

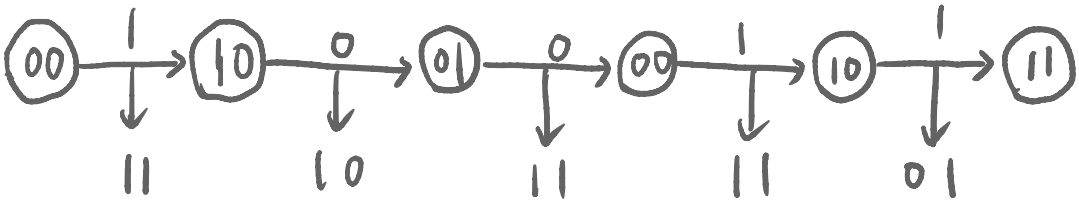
```
>> y

y =

  1×7 logical array

   0   1   0   1   1   1   0
```

```
H=[ ];

x=[0 0 1 1 1 1 0];
P=[1 1 0; 0 1 1;1 1 1; 1 0 1]; % P is parity
H=[eye(3) P'];
Ht=H';

S=zeros(1,3); %syndrome
for i=1:3
    S(i)=x(1) & Ht(1,i);

    for j=2:7

        S(i)=bitxor(S(i), (x(j) & Ht(j,i)));
    end
end
```

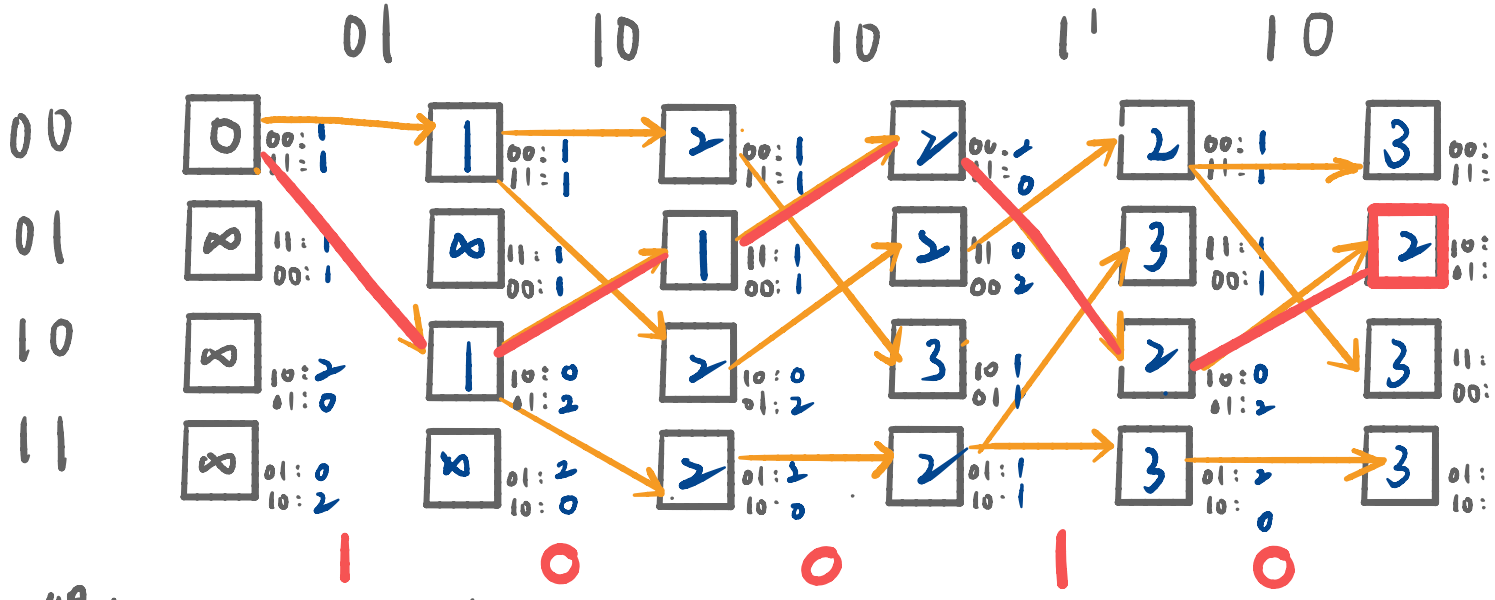
```
>> S

S =

     0     1     1
```

```
>> S

S =

     0     1     0
```

#2 ...11001→



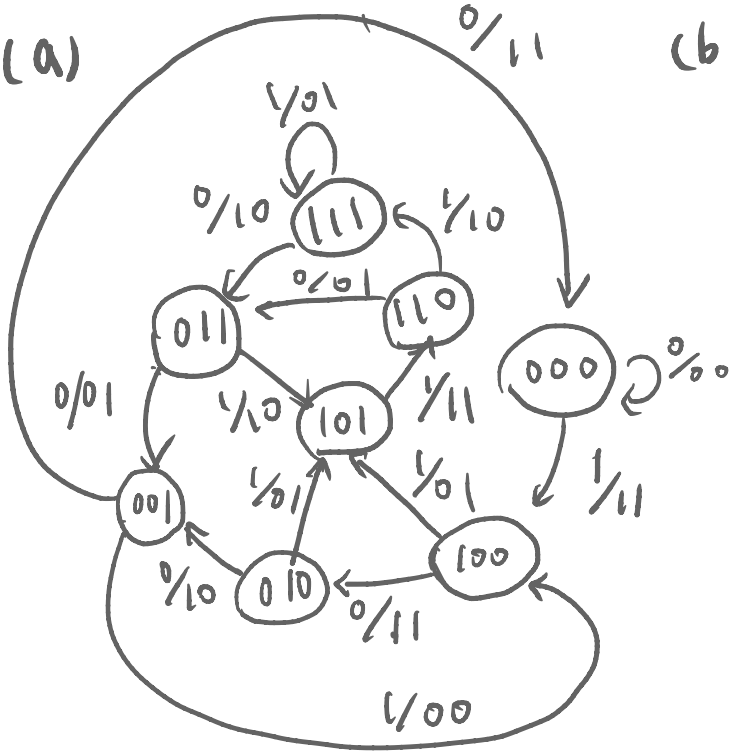
encode seq → 11 10 11 11 01 #



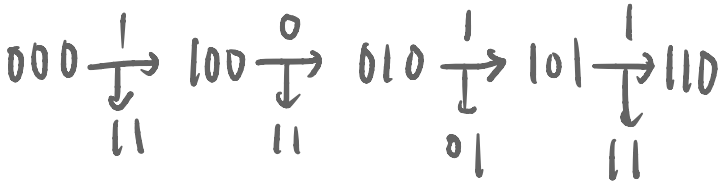
得10010，和original data (10011) 比較，error rate = $\frac{1}{5} = 20\%$ #

#3

(a)



(b) 1101



encode → 11 11 01 11 #

#4

$$T_{GBN} = 1 \times P_{ACK} + (N+1) \times P_{ACK}(1-P_{ACK}) + (2N+1) \times P_{ACK}(1-P_{ACK})^2 + ..$$

$$T_{SR} = 1 \times P_{ACK} + 2 \times P_{ACK}(1-P_{ACK}) + 3 \times P_{ACK}(1-P_{ACK})^2 + ..$$

Assume that GBN is faster than SR : $T_{GBN} < T_{SR}$

$T_{GBN} - T_{SR} = 0 + (N-1)P_{ACK}(1-P_{ACK}) + (2N-2) \times P_{ACK}(1-P_{ACK})^2 + \cdots < 0$

if $N < 1$, but $N \geq 1$ ↯

by contradiction, $T_{GBN} \geq T_{SR}$

that is, it's impossible that GBN is faster than SR

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