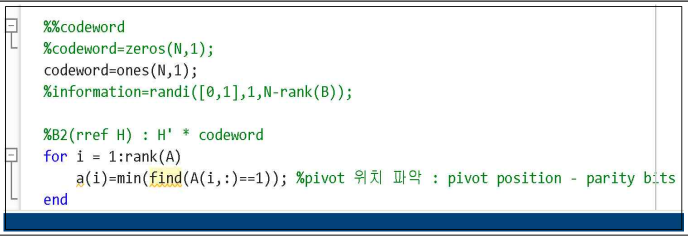
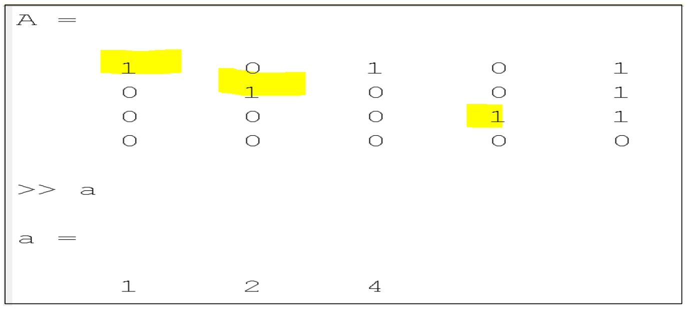


```
%%codeword
%codeword=zeros(N,1);
codeword=ones(N,1);
%information=randi([0,1],1,N-rank(B));

%B2(rref H) : H' * codeword
for i = 1:rank(A)
    a(i)=min(find(A(i,:)==1)); %pivot 위치 파악 : pivot position - parity bits
end
```



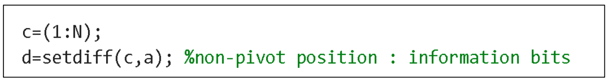
```
A =

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

>> a

a =

     1     2     4
```

해당 코드 부분에서 rank(A)를 구한 이유는
그만큼, pivot이 존재한다는 것이기에, 다음과 같이 코드 구성.

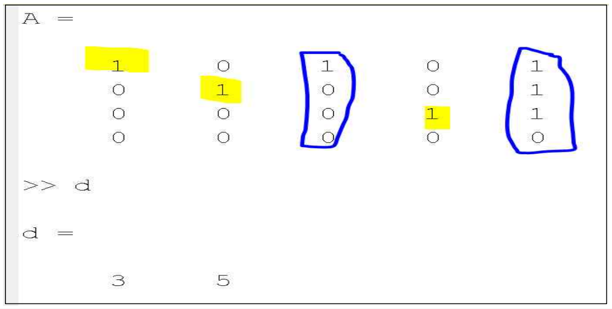
따라서 a를 통해, pivot의 위치를 열 기준으로 파악할 수 있다. A의 경우, 1,2,4번째 열에 pivot이 있기에, '1,2,4'가 출력된다.

The reason for calculating rank(A) in code is that there are pivot. rank(A)=number of pivot.

For example, matrix "A"'s rank is 3 and the position of pivot is 1st, 2nd, 4th column.



```
c=(1:N);
d=setdiff(c,a); %non-pivot position : information bits
```



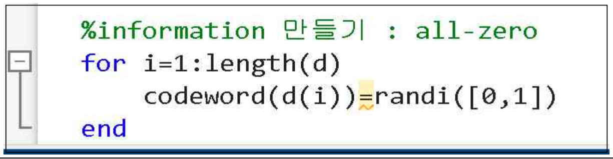
```
A =

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

>> d

d =

     3     5
```

it is position of information bits.

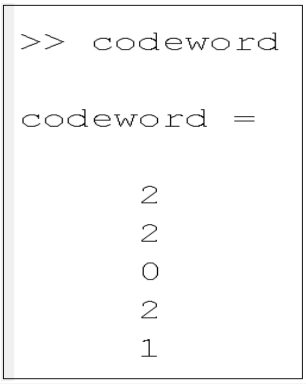
yellow : pivot(parity bit), blue : information bit.

so position of information bit is 3rd, 5th column.

function : setdiff



```
%information 만들기 : all-zero
for i=1:length(d)
    codeword(d(i))=randi([0,1])
end
```

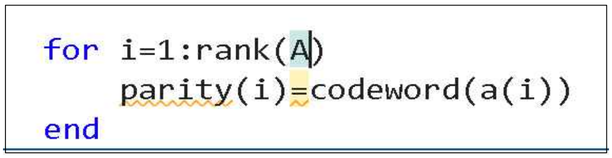


```
>> codeword

codeword =

     2
     2
     0
     2
     1
```

codeword=ones(N,1)*2;

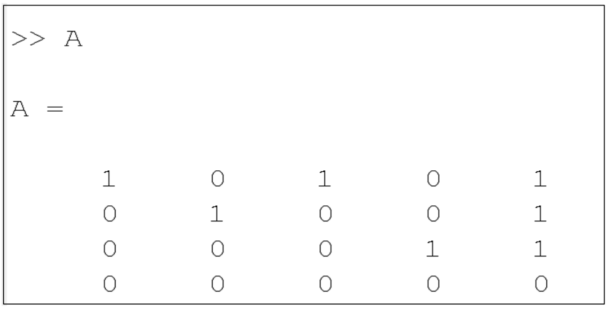
'codeword'는 우선 "n*1"의 크기로 구성했고, 2로 모두 구성한 다음에, 앞서 구한 information bit 위치에, 'randi'값을 제대로 배치하였는지 파악.

'Codeword' is all two codeword, and then determined if the 'randi value(information bit)' was correctly placed in the information bit position obtained earlier(d=setdiff(c,a)).

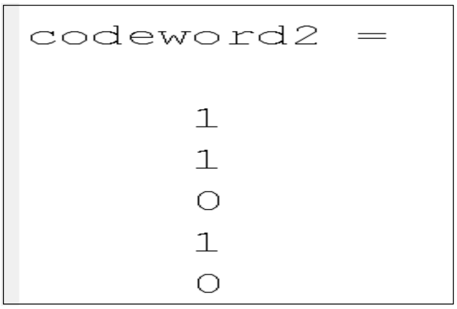


```
for i=1:rank(A)
    parity(i)=codeword(a(i))
end
```

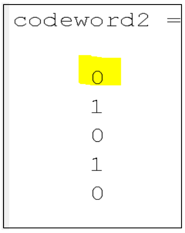
extract parity value. (2)
codeword = 2 2 0 2 1
parity value's position : 1st, 2nd, 4th.



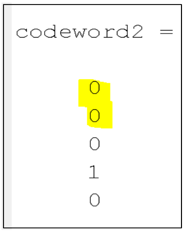
```
>> A

A =

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



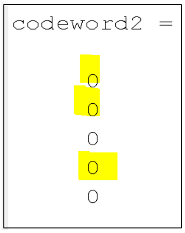
```
codeword2 =

     1
     1
     0
     1
     0
```



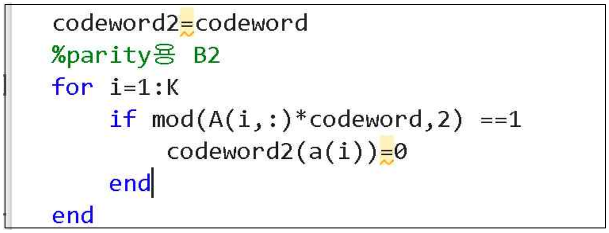
```
codeword2 =

     0
     1
     0
     1
     0
```



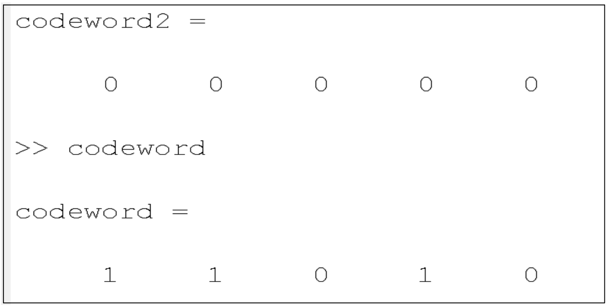
```
codeword2 =

     0
     0
     0
     1
     0
```



```
codeword2 =

     0
     0
     0
     0
     0
```



```
codeword2=codeword
%parity용 B2
for i=1:K
    if mod(A(i,:)*codeword,2) ==1
        codeword2(a(i))=0
    end
end
```

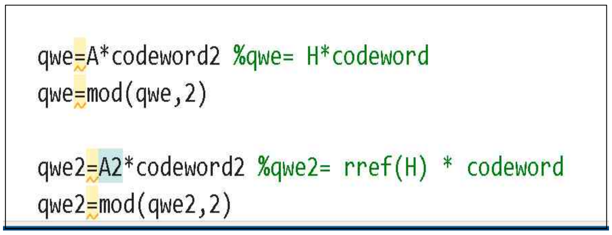


```
codeword2 =

     0     0     0     0     0

>> codeword

codeword =

     1     1     0     1     0
```

codeword vs codword2(revision)

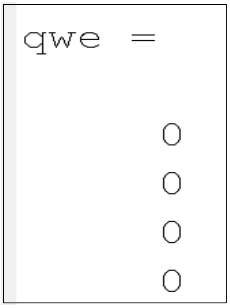
H*codeword=0. -> no error.

“if mod(A(i,:)*codeword,2)==1” : decision about error.

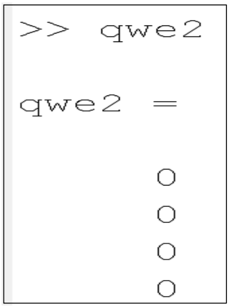


```
qwe=A*codeword2 %qwe= H*codeword
qwe=mod(qwe,2)

qwe2=A2*codeword2 %qwe2= rref(H) * codeword
qwe2=mod(qwe2,2)
```

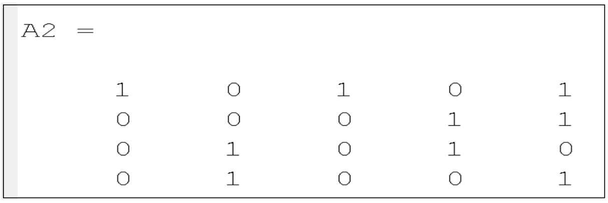
H*codeword = 0.



```
qwe =

     0
     0
     0
     0
```

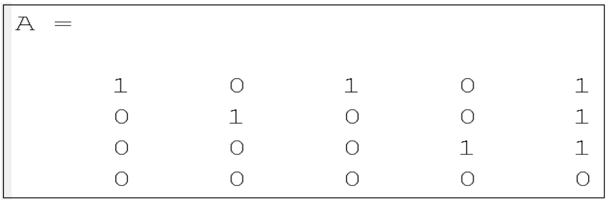


```
>> qwe2

qwe2 =

     0
     0
     0
     0
```



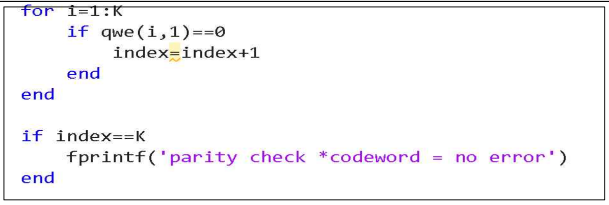
```
A2 =

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

basic matrix

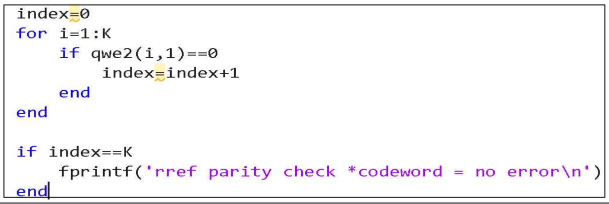


```
A =

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

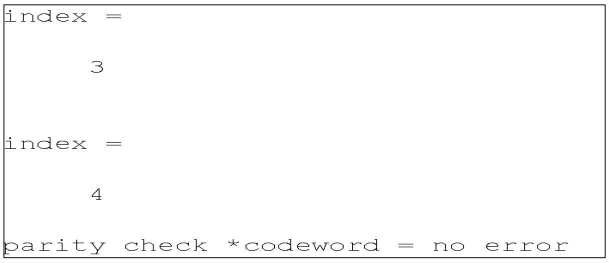
rref matrix



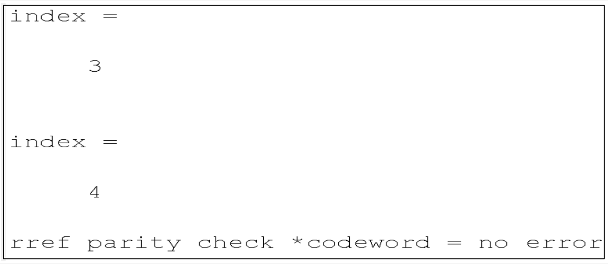
```
for i=1:K
    if qwe(i,1)==0
        index=index+1
    end
end

if index==K
    fprintf('parity check *codeword = no error')
end
```



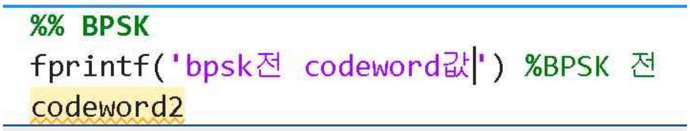
```
index=0
for i=1:K
    if qwe2(i,1)==0
        index=index+1
    end
end

if index==K
    fprintf('rref parity check *codeword = no error\n')
end
```



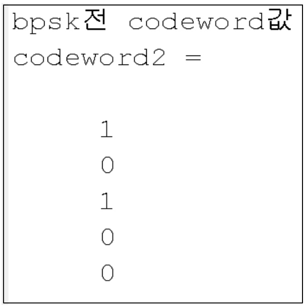
```
index =

     3


index =

     4

parity check *codeword = no error
```



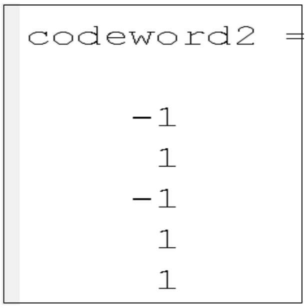
```
index =

     3


index =

     4

rref parity check *codeword = no error
```



```
%% BPSK
fprintf('bpsk전 codeword값') %BPSK 전
codeword2
```



```
bpsk전 codeword값
codeword2 =

     1
     0
     1
     0
     0
```



```
codeword2 =

    -1
     1
    -1
     1
     1
```

BPSK

- ‘1’값은 -1로, ‘0’은 1로 바꾸었다.