%————————Problem1————————%

A=magic(8)

u=[4; 6; 3; 1; 2; 0; 3; 1]

v=[2; 1; 4; 0; 3; 2; 1; 1]

A =

```
64     2     3    61    60     6     7    57
 9    55    54    12    13    51    50    16
17    47    46    20    21    43    42    24
40    26    27    37    36    30    31    33
32    34    35    29    28    38    39    25
41    23    22    44    45    19    18    48
49    15    14    52    53    11    10    56
 8    58    59     5     4    62    63     1
```

u =

```
 4
 6
 3
 1
 2
 0
 3
 1
```

v =

```
 2
 1
 4
 0
 3
 2
 1
 1
```

%a) if returns 0 then not in nullspace, if 1 then in null

isequal(A*u, [0; 0; 0; 0; 0; 0; 0; 0])

ans =

logical

0

%b) if 0 then not in null if 1 then in null

isequal(A*u, [0; 0; 0; 0; 0; 0; 0; 0])

ans =

logical

0

%————————Problem2————————%

%dim Col A

rank(A)

ans =

3

%dim Nul A

(size(A, 2)) - (rank(A))

ans =

5

%————————Problem3————————%

%a) Basis for Null A

B = null(A, 'r')

B =

-1	-1	0	0	-1
-3	-4	3	4	-7
3	4	-4	-5	7
1	0	0	0	0
0	1	0	0	0
0	0	1	0	0
0	0	0	1	0
0	0	0	0	1

%b) Basis for col A

[R, piv] = rref(A)

R =

1	0	0	1	1	0	0	1
0	1	0	3	4	-3	-4	7
0	0	1	-3	-4	4	5	-7
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

piv =

```
 1     2     3
```

C = A(:, piv)

C =

```
64     2     3
 9    55    54
17    47    46
40    26    27
32    34    35
41    23    22
49    15    14
 8    58    59
```

%————————Problem4————————%

%RowA = Col(Aˆt)

AT = A.'

AT =

```
64     9    17    40    32    41    49     8
 2    55    47    26    34    23    15    58
 3    54    46    27    35    22    14    59
61    12    20    37    29    44    52     5
60    13    21    36    28    45    53     4
 6    51    43    30    38    19    11    62
 7    50    42    31    39    18    10    63
57    16    24    33    25    48    56     1
```

[R, piv] = rref(AT)

R =

```
 1     0     0     1     1     0     0     1
 0     1     0     3     4    -3    -4     7
 0     0     1    -3    -4     4     5    -7
 0     0     0     0     0     0     0     0
 0     0     0     0     0     0     0     0
 0     0     0     0     0     0     0     0
 0     0     0     0     0     0     0     0
 0     0     0     0     0     0     0     0
```

piv =

```
 1     2     3
```

C = AT(:, piv)

C =

```
64     9    17
 2    55    47
 3    54    46
61    12    20
60    13    21
 6    51    43
 7    50    42
57    16    24
```

%——————Problem5——————%

D = magic(9)

F = magic(10)

D =

```
47    58    69    80     1    12    23    34    45
57    68    79     9    11    22    33    44    46
67    78     8    10    21    32    43    54    56
77     7    18    20    31    42    53    55    66
 6    17    19    30    41    52    63    65    76
16    27    29    40    51    62    64    75     5
26    28    39    50    61    72    74     4    15
36    38    49    60    71    73     3    14    25
37    48    59    70    81     2    13    24    35
```

F =

```
92    99     1     8    15    67    74    51    58    40
98    80     7    14    16    73    55    57    64    41
 4    81    88    20    22    54    56    63    70    47
85    87    19    21     3    60    62    69    71    28
86    93    25     2     9    61    68    75    52    34
17    24    76    83    90    42    49    26    33    65
23     5    82    89    91    48    30    32    39    66
79     6    13    95    97    29    31    38    45    72
10    12    94    96    78    35    37    44    46    53
11    18   100    77    84    36    43    50    27    59
```

%if col of D and Row of D == rank of D then matrix is invertable

%1 is invertable 0 is not

isequal(size(D, 1), size(D, 2), rank(D))

ans =

logical

1

isequal(size(F, 1), size(F, 2), rank(F))

ans =

logical

0