

```
C:\thinkingmachines.in>py eg1.py
a
[[ 10  20  30  40]
 [ 50  60  70  80]
 [ 90 100 110 120]
 [130 140 150 160]]
b
[matrix([[ 10,   20],
          [ 50,   60],
          [ 90, 100],
          [130, 140]]), matrix([[ 30,   40],
          [ 70,   80],
          [110, 120],
          [150, 160]])]
c:\thinkingmachines.in>notepad eg1.py
```

```
[matrix([[ 130, 140]]), matrix([[ 30,   40],
          [ 70,   80],
          [110, 120],
          [150, 160]])]
c
[[ 10  20]
 [ 50  60]
 [ 90 100]
 [130 140]]
d
[[ 30  40]
 [ 70  80]
 [110 120]
 [150 160]]
g
[[[10 20]
 [50 60]]
h
[[[ 90 100]
 [130 140]]
i
[[[30 40]
 [70 80]]
j
[[[110 120]
 [150 160]]]
c:\thinkingmachines.in>
```

```
eg1 - Notepad
File Edit Format View Help
import numpy
a=numpy.matrix(((10,20,30,40),(50,60,70,80),(90,100,110,120),
(130,140,150,160)))
b=numpy.hsplit(a,2)
print('a\n',a)
print('b\n',b)
c=b[0]
d=b[1]
print('c\n',c)
print('d\n',d)
e=numpy.vsplit(c,2)
f=numpy.vsplit(d,2)
g=e[0]
h=e[1]
i=f[0]
j=f[1]
print('g\n',g)
print('h\n',h)
print('i\n',i)
print('j\n',j)
```

```
Command Prompt
Ln 1, Col 1 100% Windows (CRLF) UTF-8
c
[[ 10  20]
 [ 50  60]
 [ 90 100]
 [130 140]]
d
[[ 30  40]
 [ 70  80]
 [110 120]
 [150 160]]
g
[[10 20]
 [50 60]]
h
[[ 90 100]
 [130 140]]
i
[[30 40]
 [70 80]]
j
[[110 120]
 [150 160]]
C:\thinkingmachines.in>notepad eg1.py
C:\thinkingmachines.in>notepad eg2.py
C:\thinkingmachines.in>pip install scipy
```

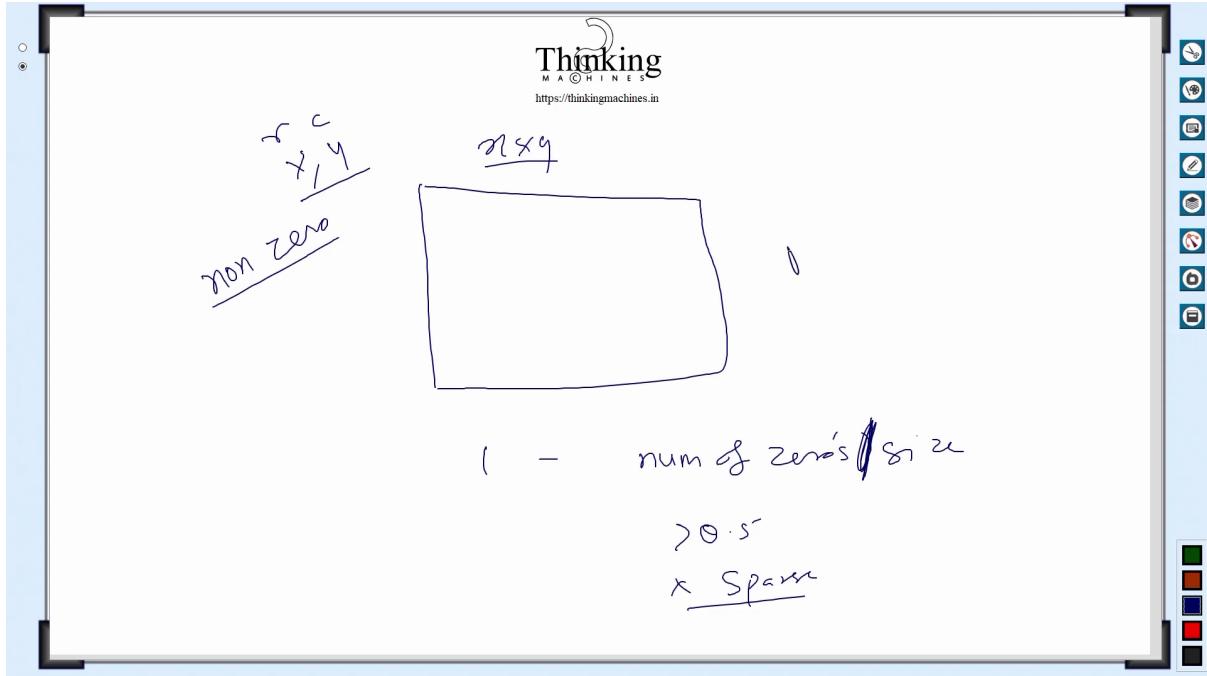
```
eg2 - Notepad
File Edit Format View Help
import numpy
import scipy.sparse
a=numpy.matrix(((24,0,0,1),(0,1,20,0),(0,0,0,1),(1,4,0,1),(0,21,0,1),
(0,0,0,1)))
print('a\n',a)
#csr -> compressed sparse column
ca=scipy.sparse.csr_matrix(a)
print('compressed form\n',ca)
```



```
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eg2 - Notepad
File Edit Format View Help
import numpy
import scipy.sparse
a=numpy.matrix(((24,20,10,1),(0,1,20,50),(60,40,0,1),(1,4,0,1),
(24,21,0,1),(0,54,0,1)))
print('a\n',a)
#csr -> compressed sparse column
ca=scipy.sparse.csr_matrix(a)
print('compressed form\n',ca)
print(scipy.sparse.issparse(a))
```

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```
[ 0  1  20 50]
[60 40  0  1]
[ 1  4  0  1]
[24 21  0  1]
[ 0 54  0  1]
18
C:\thinkingmachines.in>notepad eg2.py
C:\thinkingmachines.in>notepad eg2.py
C:\thinkingmachines.in>notepad eg2.py
C:\thinkingmachines.in>py eg2.py
a
[[24, 20, 10, 1]
 [ 0, 1, 20, 50]
 [60, 40,  0,  1]
 [ 1,  4,  0,  1]
 [24, 21,  0,  1]
 [ 0, 54,  0,  1]]
non zero count 18
shape (6, 4)
rows : 6
columns : 4
size : 24
C:\thinkingmachines.in>
```



```
eg2 - Notepad
File Edit Format View Help
import numpy
import scipy.sparse
a=numpy.matrix(((24,20,10,1),(0,1,20,50),(60,40,0,1),(1,4,0,1),
(24,21,0,1),(0,54,0,1)))
print('a\n',a)
k=numpy.count_nonzero(a)
print('non zero count',k)
print('shape ',a.shape)
rows=a.shape[0]
columns=a.shape[1]
print('rows : ',rows)
print('columns : ',columns)
sz=a.size
print('size : ',sz)
x=1-(k/sz)
if x>0.5: print("True")
else: print("False")
```

```
eg2 - Notepad
File Edit Format View Help
Ln 3, Col 13 100% Windows (CRLF) UTF-8
import numpy
a=numpy.matrix(((10,20,30,40),(50,60,70,80),(90,100,110,120)))
b=numpy.linalg.matrix_rank(a)
print(b)
```

```
Ln 1, Col 1 100% Windows (CRLF) UTF-8
```

```
[ 0  1 20 50]
[60 40  0  1]
[ 1  4  0  1]
[24 21  0  1]
[ 0 54  0  1]
non zero count 18
shape (6, 4)
rows : 6
columns : 4
size : 24
False

C:\thinkingmachines.in>notepad eg2.py
C:\thinkingmachines.in>py eg2.py
2

C:\thinkingmachines.in>notepad eg2.py
C:\thinkingmachines.in>py eg2.py
a
[[ 10  20  30  40]
 [ 50  60  70  80]
 [ 90 100 110 120]]
Rank : 2
Trace : 180

C:\thinkingmachines.in>
```

```
eg2 - Notepad
File Edit Format View Help
import numpy
a=numpy.matrix(((10,20,30,40),(50,60,70,80),(90,100,110,120)))
b=numpy.linalg.matrix_rank(a)
print('a\n',a)
print('Rank : ',b)
c=numpy.trace(a)
print('Trace : ',c)

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```

```
C:\thinkingmachines.in>py eg2.py
a
[[ 10  20  30  40]
 [ 50  60  70  80]
 [ 90 100 110 120]
 [130 140 150 160]]
a^2
[[ 9000 10000 11000 12000]
 [20200 22800 25400 28000]
 [31400 35600 39800 44000]
 [42600 48400 54200 60000]]
a*a
[[ 9000 10000 11000 12000]
 [20200 22800 25400 28000]
 [31400 35600 39800 44000]
 [42600 48400 54200 60000]]
c:\thinkingmachines.in>
```

```
eg2 - Notepad
File Edit Format View Help
import numpy
a=numpy.matrix(((10,20,30,40),(50,60,70,80),(90,100,110,120),
(130,140,150,160)))
b=numpy.linalg.matrix_power(a,2)
print('a\n',a)
print('a^2\n',b)
c=a*a
print('a*a\n',c)

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```

```
eg2 - Notepad
File Edit Format View Help
import numpy
a=numpy.matrix(((10,20,30,40),(50,60,70,80),(90,100,110,120),
(130,140,150,160)))
b=numpy.linalg.matrix_power(a,2)
print('a\n',a)
print('a^2\n',b)
c=a*a
print('a*a\n',c)
print('-'*100)
b=numpy.linalg.matrix_power(a,3)
print('a\n',a)
print('a^3\n',b)
c=a*a*a
print('a*a*3\n',c)
```



```
eg2 - Notepad
File Edit Format View Help
Ln 1, Col 1 100% Windows (CRLF) UTF-8
import numpy
a=numpy.matrix(((1,2,30,40),(20,3,40,-2),(-3,40,3,20),(50,0,4,2)))
print('a\n',a)
b,c=numpy.linalg.eig(a)
print('eigen values \n',b)
print('eigen vectors \n',c)
```



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