HW3

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Problem SET 1

Question 1:- What is the rank of the matrix A?

Ans :- The rank of a matrix is defined as
(a) the maximum number of linearly independent column vectors in the matrix or
(b) the maximum number of linearly independent row vectors in the matrix. Both definitions are quivalent.

```r
A <- matrix(c(1,-1,0,5,2,0,1,4,3,1,-2,-2,4,3,1,-3),nrow=4,ncol=4)

4
```

```
## [1] 4
```

```r
# Calculating rank of Matrix by using rankMatrix function of Matrix package.
require(Matrix)
```

```
## Loading required package: Matrix
```

```r
rankMatrix(A)[1]
```

```
## [1] 4
```

Both Answers match , hence Rank of matrix A is 4. As it is a full matrix and all 4 rows/columns are linearly independent of each other hence Rank is 4.

Question 2:- Given an mxn matrix where m > n, what can be the maximum rank? The minimum rank, assuming that the matrix is non-zero?

Answer :- a) The maximum Rank for m * n where m>n will be n if all the n columns are linerar independent.
b) Minimum Rank for m *n where m >n will be 1 as the matrix is non-zero so it will have 1 linear independent columns.

Question 3:- What is the rank of matrix B?

Answer :- The RANK of matrix B is 1, as row 2 is equal to row1 * 3 . And row 3 is equal to row 1 times 2. Hence we have only one linear independent row. Hence Rank is 1. Next step we will calculate the rank of matrix B using r function rankMatrix to prove it.

```r
B <- matrix (c(1,3,2,2,6,4,1,3,2),nrow=3, ncol=3)
rankMatrix(B)[1]
```

```
## [1] 1
```

Hence proved that Rank of B is 1.

Problem SET 2

Question :-

Answer :- Answer by hand is attached as pdf(Solution_Problem_Set_HW3.pdf to cuny hw submission site) , herein R we will try to prove the same with r functions.

```
library(pracma)
```

```
## Warning: package 'pracma' was built under R version 3.5.3
```

```
##
## Attaching package: 'pracma'
```

```
## The following objects are masked from 'package:Matrix':
##
##     expm, lu, tril, triu
```

```
A <- matrix(c(1,0,0,2,4,0,3,5,6),nrow=3,ncol=3)
A
```

```
##      [,1] [,2] [,3]
## [1,]    1    2    3
## [2,]    0    4    5
## [3,]    0    0    6
```

```
charpoly(A)
```

```
## [1]   1 -11  34 -24
```

The values prove that our Charcteristic polynomial is correct.

```
e <- eigen(A)
e$values
```

```
## [1] 6 4 1
```

This proves our eigen values are also correct

```
e$vectors
```

```
##           [,1]      [,2] [,3]
## [1,] 0.5108407 0.5547002    1
## [2,] 0.7981886 0.8320503    0
## [3,] 0.3192754 0.0000000    0
```

This proves our eigen vector values are also correct.