

DATA 605 - Homework 2

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```
library(ggplot2)
library(psych)
library(dplyr)
library(knitr)
library(tidyr)
```

Problem Set 1

1) given a 2 dim A =

$a[1,1]a[1,2]$

$a[2,1]a[2,2]$

the transpose is A^T :

$a[1,1]a[2,1]$

$a[1,2]a[2,2]$

the first cell of $ATA[1,1]$

$[a1,1] * a[1,1] + a[2,1] * a[2,1]$

while first cell of $AAT[1,1]$ is

$[a1,1] * a[1,1] + a[1,2] * a[1,2]$

clearly if $a[1,2]$ and $a[2,1]$ are different values ATA and AAT will not be the same

for example A:

1 2

3 4

$A * A^T =$

5 11

11 25

$A^T * A =$

10 14

14 20

2) Of course if A is symmetrical i.e $A^T = A$ then $ATA = AAT = AA$. However, there are also non-symmetrical matrices that fulfill $ATA = AAT$. The full class of these matrices is called **normal**.

Problem Set 2

```
LU <- function(A) {  
  
  if (dim(A)[1] != dim(A)[2]) {  
    notsquare = "not a square matrix"  
    return (notsquare)}  
  else {  
    d = dim(A)  
    L = matrix(0, d, d)  
    for (i in 1:d){  
      L[i,i]=1  
    }  
    for (r in 2:d){  
      c_end = r-1  
      for (c in 1:c_end){  
        f = - A[r,c] / A[c,c]  
        A[r,]= f * A[c,] + A[r,]  
        L[r,c] = -f  
      }  
    }  
  
    }  
  return (list(U=A,L=L))  
}
```

Test Matrix 1

```
A = matrix(c(1,4,-3,-2,8,5,3,4,7),nrow=3,ncol=3,byrow = T)  
LU_A = LU(A)  
LU_A$L
```

```
##      [,1] [,2] [,3]  
## [1,]    1  0.0    0  
## [2,]   -2  1.0    0  
## [3,]    3 -0.5    1
```

```
LU_A$U
```

```
##      [,1] [,2] [,3]  
## [1,]    1    4 -3.0  
## [2,]    0   16 -1.0  
## [3,]    0    0 15.5
```

Test Matrix 2

```
A = matrix(c(2,4,-4,1,-4,3,-6,-9,5),nrow=3,ncol=3,byrow = T)
LU_A = LU(A)
LU_A$L
```

```
##      [,1] [,2] [,3]
## [1,]  1.0  0.0   0
## [2,]  0.5  1.0   0
## [3,] -3.0 -0.5   1
```

```
LU_A$U
```

```
##      [,1] [,2] [,3]
## [1,]    2    4 -4.0
## [2,]    0   -6  5.0
## [3,]    0    0 -4.5
```

Github (both PDF and RMarkdown):

https://github.com/chilleundso/Data605_CompMath/tree/master/Homework2