DATA 605 HW Assignment 2

Avery Davidowitz

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1 Problem Set 1

1.1

Show that $AA^t \neq A^tA$ in general. (Proof and demonstration.) This can be easily proven through contradiction. Let us assume that $AA^t = A^tA$ for any arbitrary square matrix A. If:

$$A = \begin{pmatrix} 0 & 1 \\ 3 & 3 \end{pmatrix}$$

Then:

$$A^t = \begin{pmatrix} 0 & 3 \\ 1 & 3 \end{pmatrix}$$

Therefore $AA^t =$

```
A <- matrix(c(0,1,3,3), nrow=2, byrow=TRUE)
print(A * t(A))
```

```
##      [,1] [,2]
## [1,]    0    3
## [2,]    3    9
```

However, calculating A^tA yields:

```
print(t(A) * A)
```

```
##      [,1] [,2]
## [1,]    0    3
## [2,]    3    9
```

1.2

For a special type of square matrix A, we get $AA^t = A^tA$. Under what conditions could this be true?