Assignment 2

Max Wagner

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PS1.

$$A^T A \neq AA^T$$

$$(A^T A)^T \neq (AA^T)^T$$

$$(A^T)^T A^T \neq A^T (A^T)^T$$

They are symmetric, but not always equal. An exception to this rule is a diagonal matrix, or rather any matrix where the only non-zero elements are on the diagonal, essentially making:

$$A = A^T$$

PS2. Only works for 3x3 matrices.

```
LUDecomp <- function(matrix) {
  u <- matrix
  inv1 <- matrix(c(1,0,0,-u[2,1],1,0,0,0,1), nrow = 3, byrow = TRUE)
  u <- inv1 %*% u

  inv2 <- matrix(c(1,0,0,0,1,0,-u[3,1],0,1), nrow = 3, byrow = TRUE)
  u <- inv2 %*% u

  inv3 <- matrix(c(1,0,0,0,-u[2,2],0,0,u[3,2],1), nrow = 3, byrow = TRUE)
  u <- inv3 %*% u

  l <- solve(inv1) %*% solve(inv2) %*% solve(inv3) # not sure how to do L without solve...

  return(list(l,u))
}

matrix <- matrix(c(1,2,3,1,1,1,2,0,1), nrow = 3)
LUDecomp(matrix)
```

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

```
## [1,]    1    1    2
## [2,]    0   -1   -4
## [3,]    0    0    3
```