In [ ]:
```
import numpy as np
```

Problem 23.1

Let A be a nonsingular square matrix and let $A = QR$ and $A^*A = U^*U$ be QR and Cholesky factorizations, respectively, with the usual normalizations $r_{jj}, u_{jj} > 0$. Is it true or false that $R = U$?

In [ ]:
```
# Define a hermetian positive definite matrix A.
b = np.random.normal(size=(5, 5))
A = b @ b.T
```

In [ ]:
```
# Check that A is hermetian
A == A.T
```

Out[ ]:
```
array([[ True,  True,  True,  True,  True],
       [ True,  True,  True,  True,  True],
       [ True,  True,  True,  True,  True],
       [ True,  True,  True,  True,  True],
       [ True,  True,  True,  True,  True]])
```

In [ ]:
```
# Check that A is positive definite
np.linalg.eig(A)[0] > 0
```

Out[ ]:
```
array([ True,  True,  True,  True,  True])
```

In [ ]:
```
# Compute the Cholesky factorization of A
U = np.linalg.cholesky(A)
```

In [ ]:
```
# Compute the QR factorization of A
Q, R = np.linalg.qr(A)
```

In [ ]:
```
# Check if the nonzero (i.e., upper diagonal) entries of R are the same as the entr
R == U.T
```

Out[ ]:
```
array([[False, False, False, False, False],
       [ True, False, False, False, False],
       [ True,  True, False, False, False],
       [ True,  True,  True, False, False],
       [ True,  True,  True,  True, False]])
```

It is not true that $R = U$, as is evidenced by the last computation.