Lab Session 6

1. Given a vector $x \in \mathbb{R}^n$, write a MATLAB function program $[\mathtt{u}, \gamma, \tau] = \mathtt{reflect(x)}$ to compute $u \in \mathbb{R}^n$, and $\gamma \in \mathbb{R}$ so that $Qx = [-\tau, 0, \ldots, 0]^T$ where $\tau = \pm\|x\|_2$ and the sign is chosen so that it is the same as that of the first entry of x.

2. Write another function program $\mathtt{B} = \mathtt{applreflect(u, gamma, A)}$ to *efficiently* perform the multiplication QA where $Q = I - \gamma uu^T$.

3. Use the programs written above to write another function program $\mathtt{R} = \mathtt{reflectqr(A)}$ that computes the R of a QR decomposition of $A \in \mathbb{R}^{n \times n}$ via reflectors. The program should be such that the lower triangular part of A contains the vectors u (apart from the leading 1 entry) required to construct the reflectors used at each stage and the values of γ corresponding to each reflector are stored in a separate vector.