

## A Householder reflector exercise

Suppose  $u \in \mathbb{R}^m$  is given, and  $H \equiv H(u) = I - (\frac{2}{u^t u})uu^t$ . Let  $A \in \mathbb{R}^{m \times n}$ .

1. Count the flops required to compute  $(\frac{-2}{u^t u})(uu^t)$ .
2. Count the flops required to compute  $((\frac{-2}{u^t u})u)u^t$ .
3. Using 2., count the flops required to form  $H$ .
4. Using 3., count the flops required to compute  $B_e = HA$ .
5. Count the flops required to compute  $B_f = A - ((\frac{-2}{u^t u})u)(u^t A)$ .
6. Show that (in exact arithmetic)  $B_f = B_e$ .