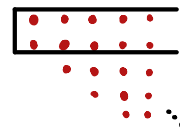


4(a) 1. Compute QR of  $\tilde{H}_n = M_n R_n \leadsto O(n^2)$  as  $\tilde{H}_n$  hessenberg

2. Compute  $M_n^T(\|b\|e_1) \leadsto O(n^2)$

3. Solve  $R_n y = M_n^T(\|b\|e_1) \leadsto O(n^2)$



2x2 to 2xn

$\leadsto 6n$  flops

$\leadsto$  total n row

$\therefore O(n^2)$ .

$$\begin{matrix} 2 \times 2 & 0 & 0 & 0 \\ & 0 & 0 & 0 \end{matrix}$$

(b) Note that  $\tilde{H}_n = \begin{bmatrix} \tilde{H}_{n-1} & x \\ \dots & x \end{bmatrix} \leadsto R_n = \begin{bmatrix} R_{n-1} & 0 \\ 0 & 1 \end{bmatrix}$

we only need to calculate this

2x2 to 2xn  $\leadsto 6$  flops

$\leadsto$  total n rows  $\therefore O(n)$

For 2, so does  $M_n = [M_{n-1} | f_n]$

so we need to compute  $\tilde{H}_n^T \cdot \|b\|e_1$  only.

Lastly, we can just add  $-\frac{r_{kn}}{r_{k1}} \cdot y_k$  to the components of previous y

$\therefore O(n)$  ■

5 Let  $x_0 = x$  be an initial guess that he/she wishes to start with.

Then, from the problem  $Ax_* = b$ ,  $A(x_* - x) = b - Ax$ .

So, if we set  $x' = (x_* - x)$ ,  $b' = b - Ax$ , thus again it can be viewed as the new problem  $Ax' = b'$  with initial guess  $x'_0 = 0$ ,  $r'_0 = b'$ . (So we can use Algorithm 35.1 normally)

Apply algorithm to  $Ax' = b'$ . We can get  $x_n$ 's by  $x_n' + x$  each step. ■

