P5.1.3

① G_1, G_2 are the givens matrix of x and y, and in that x, y are unit 2-norm.

$$G_1^T x = \begin{pmatrix}1\\0\end{pmatrix} \qquad G_1 \cdot \begin{pmatrix}1\\0\end{pmatrix} = x \qquad\qquad G^T x = y$$

$$\Rightarrow \qquad G^T G_1\begin{pmatrix}1\\0\end{pmatrix} = G_2\begin{pmatrix}1\\0\end{pmatrix}$$

$$G_2^T y = \begin{pmatrix}1\\0\end{pmatrix} \qquad G_2 \begin{pmatrix}1\\0\end{pmatrix} = y \qquad\qquad G = G_1 \cdot G_2'$$

② when $x, y \in \mathbb{R}^n$. $\quad G^T x = y$

We need more givens matrix to turn x, y into $\begin{bmatrix}1\\0\\0\\\vdots\\0\end{bmatrix}$.

Every time we need the first one and ith one to get G_{1i}.

And we got something like $\underbrace{G_{1n}^T G_{1n-1}^T G^T \cdots G_{11}^T}_{G_1^T} x = \begin{bmatrix}1\\0\\0\\\vdots\\0\end{bmatrix}$

$\underbrace{G_{2n}^T G_{2n-1}^T G_{2n-2}^T \cdots G_{21}^T}_{G_2^T} y = \begin{bmatrix}1\\0\\0\\0\\0\end{bmatrix}$

$$G_1^T = G_{1n}^T G_{1n-1}^T \cdots G_{11}^T = (G_{11} \cdot G_{12} \cdots G_{1n-1} G_{1n})^T$$

$$G_2^T = G_{2n}^T G_{2n-1}^T \cdots G_{21}^T = (G_{21} \cdot G_{22} \cdots G_{2n-1} G_{2n})^T$$

$$G = G_1 \cdot G_2^T = (G_{11} \cdot G_{12} \cdots G_{1n-1} G_{1n}) \cdot (G_{21} \cdot G_{22} \cdots G_{2n-1} G_{2n})^T$$

So in MATLAB,

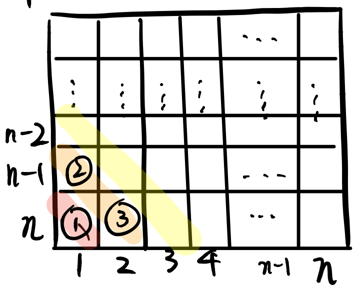
```
function [Q] = givn(x, y)
m= size(x, 1);    Gx= eye(m) ; Gy= eye(m);


for i= 2:m
        yy = [y(1)  y(i)]';
        G2 = givens (yy);
        for j= 1:m
                e1 = Gy(1,j);
                e2 = Gy(i,j);
```

```
        c = G2(1,1);
        s = G2(1,2);
        Gy(1,j)= c*e1 - s*e2;
        Gy(i,j)= s*e1 + c*e2;
    end
    y(1)= sqrt(y(1)* y(1) + y(i)* y(i)); % modify y(1) for next
                                          iteration
end

for i= 2:m
    xx= [x(1) x(i)]';
    G1= givens(xx);
    for j=1:m
        e1=  Gx(1,j);
        e2 = Gx(i,j);
        c =  G1(1,1);
        s =  G1(1,2);
        Gx(1,j)= c*e1- s*e2;
        Gx(i,j)= s*e1+ c*e2;
    end
    x(1)= sqrt(x(1)* x(1)+ x(i)*x(i));
end
Q= Gx' * Gy;
end
```

P5.2.3



We need to zero out (n-1) diagonals.
The rest part is the same as Alg 5.2.4.

In MATLAB,

i,j represent the entry we want to zero out each iteration. →

```
function[A] = mygivensqr(A)
n=size(A,1);
for z = n+1:-1:3          % this loop iterates (n-1) diagonals.
    j=1;                  % Each diag we start from col 1.
    for i= z-1:n          % row start from (z-1).
        G = givens([A(i-1,j)  A(i,j)]');
        A(i-1:i, j:n)= G'*A(i-1:i,j:n);
        j= j+1;
    end
end
end
```