Math 451 - H1

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Problem 1.

Householders for n=3
Before householders transform

$$\begin{bmatrix} 1.33333333333 & 0.3333333333333333 & 0.3333333333333333 \\ 0.333333333333 & 1.3333333333333333 & 0.3333333333333333 \\ 0.333333333333 & 0.3333333333333333 & 1.3333333333333333 \end{bmatrix}$$

After householders transform

$$\begin{bmatrix} 1.33333333333 & -0.4714045207910318 & 0.0 \\ -0.471404520791 & 1.6666666666666676 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$

Matrix is symmetric
Matrix is tridiagonal
Householders for n=4
Before householders transform

$$\begin{bmatrix} 1.25 & 0.25 & 0.25 & 0.25 \\ 0.25 & 1.25 & 0.25 & 0.25 \\ 0.25 & 0.25 & 1.25 & 0.25 \\ 0.25 & 0.25 & 0.25 & 1.25 \end{bmatrix}$$

After householders transform

$$\begin{bmatrix} 1.25 & nan & nan & nan \\ nan & nan & nan & nan \\ nan & nan & nan & nan \\ nan & nan & nan & nan \end{bmatrix}$$

Matrix is symmetric
Here are points violating tridiagonal:
(0,2)
(0,3)
(1,3)

Note
I have no idea why my script failed on the 4 by 4 case, but it seems to work perfectly fine

for every other.

Householders for n=5
Before householders transform

$$\begin{bmatrix} 1.2 & 0.2 & 0.2 & 0.2 & 0.2 \\ 0.2 & 1.2 & 0.2 & 0.2 & 0.2 \\ 0.2 & 0.2 & 1.2 & 0.2 & 0.2 \\ 0.2 & 0.2 & 0.2 & 1.2 & 0.2 \\ 0.2 & 0.2 & 0.2 & 0.2 & 1.2 \end{bmatrix}$$

After householders transform

$$\begin{bmatrix} 1.2 & -0.3999999999999999 & 0.0 & 0.0 & 0.0 \\ -0.4 & 1.7999999999999992 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0000000000000002 \end{bmatrix}$$

Matrix is symmetric
Matrix is tridiagonal
Householders for n=6
Before householders transform

$$\begin{bmatrix} 1.16666666667 & 0.16666666666666666 & 0.16666666666666666 & 0.16666666666666666 & 0.1666666666666 \\ 0.166666666667 & 1.1666666666666667 & 0.16666666666666666 & 0.16666666666666666 & 0.1666666666666 \\ 0.166666666667 & 0.16666666666666666 & 1.1666666666666667 & 0.16666666666666666 & 0.1666666666666 \\ 0.166666666667 & 0.16666666666666666 & 0.16666666666666666 & 1.1666666666666667 & 0.1666666666666 \\ 0.166666666667 & 0.16666666666666666 & 0.16666666666666666 & 0.16666666666666666 & 1.166666666666 \\ 0.166666666667 & 0.16666666666666666 & 0.16666666666666666 & 0.16666666666666666 & 0.1666666666666 \end{bmatrix}$$

After householders transform

$$\begin{bmatrix} 1.16666666667 & -0.37267799624996484 & 0.0 & 0.0 & 0.0 \\ -0.37267799625 & 1.8333333333333321 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.999999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

Matrix is symmetric
Matrix is tridiagonal
Householders for n=7
Before householders transform

$$\begin{bmatrix} 1.14285714286 & 0.14285714285714285 & 0.14285714285714285 & 0.14285714285714285 & 0.142857142857 \\ 0.142857142857 & 1.1428571428571428 & 0.14285714285714285 & 0.14285714285714285 & 0.142857142857 \\ 0.142857142857 & 0.14285714285714285 & 1.1428571428571428 & 0.14285714285714285 & 0.142857142857 \\ 0.142857142857 & 0.14285714285714285 & 0.14285714285714285 & 1.1428571428571428 & 0.142857142857 \\ 0.142857142857 & 0.14285714285714285 & 0.14285714285714285 & 0.14285714285714285 & 1.142857142857 \\ 0.142857142857 & 0.14285714285714285 & 0.14285714285714285 & 0.14285714285714285 & 0.142857142857 \\ 0.142857142857 & 0.14285714285714285 & 0.14285714285714285 & 0.14285714285714285 & 0.142857142857 \end{bmatrix}$$

After householders transform

$$\begin{bmatrix} 1.14285714286 & -0.34992710611188255 & 0.0 & 0.0 & 0.0 & 0 \\ -0.349927106112 & 1.857142857142857 & 0.0 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.9999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0 \end{bmatrix}$$

Matrix is symmetric
Matrix is tridiagonal
Householders for n=8
Before householders transform

$$\begin{bmatrix} 1.125 & 0.125 & 0.125 & 0.125 & 0.125 & 0.125 & 0.125 & 0.125 \\ 0.125 & 1.125 & 0.125 & 0.125 & 0.125 & 0.125 & 0.125 & 0.125 \\ 0.125 & 0.125 & 1.125 & 0.125 & 0.125 & 0.125 & 0.125 & 0.125 \\ 0.125 & 0.125 & 0.125 & 1.125 & 0.125 & 0.125 & 0.125 & 0.125 \\ 0.125 & 0.125 & 0.125 & 0.125 & 1.125 & 0.125 & 0.125 & 0.125 \\ 0.125 & 0.125 & 0.125 & 0.125 & 0.125 & 1.125 & 0.125 & 0.125 \\ 0.125 & 0.125 & 0.125 & 0.125 & 0.125 & 0.125 & 1.125 & 0.125 \\ 0.125 & 0.125 & 0.125 & 0.125 & 0.125 & 0.125 & 0.125 & 1.125 \end{bmatrix}$$

After householders transform

$$\begin{bmatrix} 1.125 & -0.33071891388307384 & 0.0 & 0.0 & 0.0 \\ -0.330718913883 & 1.875 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000004 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000007 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.99999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

Matrix is symmetric
Matrix is tridiagonal

Problem 2.

Performing QR decomp for B_2
$B =$

$$\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$
$Q =$

$$\begin{bmatrix} 0.894427191 & -0.4472135954999579 \\ 0.4472135955 & 0.8944271909999159 \end{bmatrix}$$
$R =$

$$\begin{bmatrix} 2.2360679775 & 1.7888543819998317 \\ 0.0 & 1.3416407864998738 \end{bmatrix}$$
Note that it's triangular
QR=

$$\begin{bmatrix} 2.0 & 0.9999999999999999 \\ 1.0 & 2.0 \end{bmatrix}$$
Note that it's B again
$QQ^T =$

$$\begin{bmatrix} 1.0 & 0.0 \\ 0.0 & 0.9999999999999999 \end{bmatrix}$$
Performing QR decomp for B_3
$B =$

$$\begin{bmatrix} 2 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix}$$
$Q =$

$$\begin{bmatrix} 0.894427191 & -0.3585685828003181 & 0.26726124191242434 \\ 0.4472135955 & 0.7171371656006362 & -0.5345224838248487 \\ 0.0 & 0.5976143046671968 & 0.8017837257372732 \end{bmatrix}$$
$R =$

$$\begin{bmatrix} 2.2360679775 & 1.7888543819998317 & 0.4472135954999579 \\ 0.0 & 1.6733200530681511 & 1.9123657749350298 \\ 0.0 & 0.0 & 1.0690449676496976 \end{bmatrix}$$
Note that it's triangular
QR=

$$\begin{bmatrix} 2.0 & 0.9999999999999998 & 0.0 \\ 1.0 & 2.0 & 1.0 \\ 0.0 & 1.0 & 2.0 \end{bmatrix}$$
Note that it's B again
$QQ^T =$

$$\begin{bmatrix} 1.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$

Performing QR decomp for B_4

$B =$

$$\begin{bmatrix} 2 & 1 & 0 & 0 \\ 1 & 2 & 1 & 0 \\ 0 & 1 & 2 & 1 \\ 0 & 0 & 1 & 2 \end{bmatrix}$$

$Q =$

$$\begin{bmatrix} 0.894427191 & -0.3585685828003181 & 0.19518001458970663 & -0.18257418583505533 \\ 0.4472135955 & 0.7171371656006362 & -0.39036002917941326 & 0.36514837167011066 \\ 0.0 & 0.5976143046671968 & 0.5855400437691199 & -0.5477225575051661 \\ 0.0 & 0.0 & 0.6831300510639732 & 0.7302967433402215 \end{bmatrix}$$

$R =$

$$\begin{bmatrix} 2.2360679775 & 1.7888543819998317 & 0.4472135954999579 & 0.0 \\ 0.0 & 1.6733200530681511 & 1.9123657749350298 & 0.5976143046671968 \\ 0.0 & 0.0 & 1.4638501094227998 & 1.9518001458970664 \\ 0.0 & 0.0 & 0.0 & 0.912870929175277 \end{bmatrix}$$

Note that it's triangular

QR=

$$\begin{bmatrix} 2.0 & 0.9999999999999998 & 0.0 & 0.0 \\ 1.0 & 2.0 & 1.0 & 0.0 \\ 0.0 & 1.0 & 2.0 & 1.0 \\ 0.0 & 0.0 & 1.0 & 2.0 \end{bmatrix}$$

Note that it's B again

$QQ^T =$

$$\begin{bmatrix} 1.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999999 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0 \end{bmatrix}$$

Performing QR decomp for B_5

$B =$

$$\begin{bmatrix} 2 & 1 & 0 & 0 & 0 \\ 1 & 2 & 1 & 0 & 0 \\ 0 & 1 & 2 & 1 & 0 \\ 0 & 0 & 1 & 2 & 1 \\ 0 & 0 & 0 & 1 & 2 \end{bmatrix}$$

$Q =$

$$\begin{bmatrix} 0.894427191 & -0.3585685828003181 & 0.19518001458970663 & -0.12309149097933271 & 0.1348399724 \\ 0.4472135955 & 0.7171371656006362 & -0.39036002917941326 & 0.24618298195866542 & -0.269679944 \\ 0.0 & 0.5976143046671968 & 0.5855400437691199 & -0.3692744729379982 & 0.404519917 \\ 0.0 & 0.0 & 0.6831300510639732 & 0.492365963917331 & -0.53935988 \\ 0.0 & 0.0 & 0.0 & 0.7385489458759963 & 0.674199862 \end{bmatrix}$$

$R =$

$$\begin{bmatrix} 2.2360679775 & 1.7888543819998317 & 0.4472135954999579 & 0.0 & 0.0 \\ 0.0 & 1.6733200530681511 & 1.9123657749350298 & 0.5976143046671968 & 0.0 \\ 0.0 & 0.0 & 1.4638501094227998 & 1.9518001458970664 & 0.6831300510639732 \\ 0.0 & 0.0 & 0.0 & 1.35400640077266 & 1.9694638556693236 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.8090398349558907 \end{bmatrix}$$

Note that it's triangular

QR=

$$\begin{bmatrix} 2.0 & 0.9999999999999998 & 0.0 & 0.0 & 0.0 \\ 1.0 & 2.0 & 1.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 2.0 & 1.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 2.0 & 0.9999999999999999 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999998 & 1.9999999999999998 \end{bmatrix}$$

Note that it's B again

$QQ^T =$

$$\begin{bmatrix} 1.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.9999999999999999 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 \end{bmatrix}$$

Performing QR decomp for B_6

$B =$

$$\begin{bmatrix} 2 & 1 & 0 & 0 & 0 & 0 \\ 1 & 2 & 1 & 0 & 0 & 0 \\ 0 & 1 & 2 & 1 & 0 & 0 \\ 0 & 0 & 1 & 2 & 1 & 0 \\ 0 & 0 & 0 & 1 & 2 & 1 \\ 0 & 0 & 0 & 0 & 1 & 2 \end{bmatrix}$$

$Q =$

$$\begin{bmatrix} 0.894427191 & -0.3585685828003181 & 0.19518001458970663 & -0.12309149097933271 & 0.0848104191 \\ 0.4472135955 & 0.7171371656006362 & -0.39036002917941326 & 0.24618298195866542 & -0.169620838 \\ 0.0 & 0.5976143046671968 & 0.5855400437691199 & -0.3692744729379982 & 0.2544312573 \\ 0.0 & 0.0 & 0.6831300510639732 & 0.492365963917331 & -0.339241676 \\ 0.0 & 0.0 & 0.0 & 0.7385489458759963 & 0.424052095 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.777428842 \end{bmatrix}$$

$R =$

$$\begin{bmatrix} 2.2360679775 & 1.7888543819998317 & 0.4472135954999579 & 0.0 & 0.0 \\ 0.0 & 1.6733200530681511 & 1.9123657749350298 & 0.5976143046671968 & 0.0 \\ 0.0 & 0.0 & 1.4638501094227998 & 1.9518001458970664 & 0.6831300510639732 \\ 0.0 & 0.0 & 0.0 & 1.35400640077266 & 1.9694638556693236 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.2862913567871996 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

Note that it's triangular

QR=

$$\begin{bmatrix} 2.0 & 0.9999999999999998 & 0.0 & 0.0 & 0.0 & 0.0 \\ 1.0 & 2.0 & 1.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 2.0 & 1.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 2.0 & 0.9999999999999999 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999998 & 1.9999999999999998 & 0.9999999999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 2.0 \end{bmatrix}$$

Note that it's B again

$QQ^T =$

$$\begin{bmatrix} 1.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.9999999999999999 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 1.0 \end{bmatrix}$$

Performing QR decomp for B_7

$B =$

$$\begin{bmatrix} 2 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 2 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 2 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 2 \end{bmatrix}$$

$Q =$

$$\begin{bmatrix} 0.894427191 & -0.3585685828003181 & 0.19518001458970663 & -0.12309149097933271 & 0.0848104191 \\ 0.4472135955 & 0.7171371656006362 & -0.39036002917941326 & 0.24618298195866542 & -0.169620838 \\ 0.0 & 0.5976143046671968 & 0.5855400437691199 & -0.3692744729379982 & 0.2544312573 \\ 0.0 & 0.0 & 0.6831300510639732 & 0.492365963917331 & -0.339241676 \\ 0.0 & 0.0 & 0.0 & 0.7385489458759963 & 0.424052095 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.777428842 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

$R =$

$$\begin{bmatrix} 2.2360679775 & 1.7888543819998317 & 0.4472135954999579 & 0.0 & 0.0 \\ 0.0 & 1.6733200530681511 & 1.9123657749350298 & 0.5976143046671968 & 0.0 \\ 0.0 & 0.0 & 1.4638501094227998 & 1.9518001458970664 & 0.6831300510639732 \\ 0.0 & 0.0 & 0.0 & 1.35400640077266 & 1.9694638556693236 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.2862913567871996 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

Note that it's triangular

QR=

$$\begin{bmatrix} 2.0 & 0.9999999999999998 & 0.0 & 0.0 & 0.0 & 0.0 \\ 1.0 & 2.0 & 1.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 2.0 & 1.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 2.0 & 0.9999999999999999 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999998 & 1.9999999999999998 & 0.9999999999999998 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 2.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 1.0000000000000002 \end{bmatrix}$$

0.999
2.000

Note that it's B again

$QQ^T =$

$$\begin{bmatrix} 1.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.9999999999999999 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 1.0000000000000002 \end{bmatrix}$$

Performing QR decomp for B_8

$B =$

$$\begin{bmatrix} 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 2 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 2 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 2 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 2 \end{bmatrix}$$

$Q =$

$$\begin{bmatrix} 0.894427191 & -0.3585685828003181 & 0.19518001458970663 & -0.12309149097933271 & 0.0848104191 \\ 0.4472135955 & 0.7171371656006362 & -0.39036002917941326 & 0.24618298195866542 & -0.169620838 \\ 0.0 & 0.5976143046671968 & 0.5855400437691199 & -0.3692744729379982 & 0.2544312573 \\ 0.0 & 0.0 & 0.6831300510639732 & 0.492365963917331 & -0.339241676 \\ 0.0 & 0.0 & 0.0 & 0.7385489458759963 & 0.4240520956 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.7774288420 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

$R =$

$$\begin{bmatrix} 2.2360679775 & 1.7888543819998317 & 0.4472135954999579 & 0.0 & 0.0 \\ 0.0 & 1.6733200530681511 & 1.9123657749350298 & 0.5976143046671968 & 0.0 \\ 0.0 & 0.0 & 1.4638501094227998 & 1.9518001458970664 & 0.6831300510639732 \\ 0.0 & 0.0 & 0.0 & 1.35400640077266 & 1.9694638556693236 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.2862913567871996 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

Note that it's triangular

QR=

$$\begin{bmatrix} 2.0 & 0.9999999999999998 & 0.0 & 0.0 & 0.0 & 0.0 \\ 1.0 & 2.0 & 1.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 2.0 & 1.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 2.0 & 0.9999999999999999 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999998 & 1.9999999999999998 & 0.9999999999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 2.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 1.0000000000000002 \quad 2.000 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

Note that it's B again

$QQ^T =$

$$\begin{bmatrix} 1.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 1.0 \end{bmatrix}$$

Problem 3.

B after 1^th iteration

$$\begin{bmatrix} 2.8 & 0.5999999999999999 \\ 0.6 & 1.2 \end{bmatrix}$$

B after 2^th iteration

$$\begin{bmatrix} 2.9756097561 & 0.21951219512195114 \\ 0.219512195122 & 1.0243902439024388 \end{bmatrix}$$

B after 3^th iteration

$$\begin{bmatrix} 2.99726027397 & 0.07397260273972593 \\ 0.0739726027397 & 1.0027397260273971 \end{bmatrix}$$

B after 4^th iteration

$$\begin{bmatrix} 2.99969521487 & 0.024687595245351922 \\ 0.0246875952454 & 1.0003047851264857 \end{bmatrix}$$

B after 5^th iteration

$$\begin{bmatrix} 2.9999661304 & 0.008230313293818695 \\ 0.00823031329382 & 1.000033869602032 \end{bmatrix}$$

B after 6^th iteration

$$\begin{bmatrix} 2.99999623665 & 0.002743479062625734 \\ 0.00274347906263 & 1.0000037633457648 \end{bmatrix}$$

B after 7^th iteration

$$\begin{bmatrix} 2.99999958185 & 0.0009144945504570398 \\ 0.000914494550457 & 1.0000004181502287 \end{bmatrix}$$

B after 8^th iteration

$$\begin{bmatrix} 2.99999995354 & 0.00030483157347022994 \\ 0.00030483157347 & 1.0000000464611452 \end{bmatrix}$$

B after 9^th iteration

$$\begin{bmatrix} 2.99999999484 & 0.00010161052658820414 \\ 0.000101610526588 & 1.0000000051623497 \end{bmatrix}$$

Eigen values are
$\lambda = 2.9999999948376503$ with err 0.00010161052658820414,
1.0000000051623497 with err 0.00010161052658830722,
actual eigen values: 2.0
B after 1^th iteration

$$\begin{bmatrix} 2.8 & 0.7483314773547882 & 0.0 \\ 0.748331477355 & 2.342857142857143 & 0.6388765649999402 \\ 0.0 & 0.6388765649999399 & 0.8571428571428572 \end{bmatrix}$$

B after 2^th iteration

$$\begin{bmatrix} 3.14285714286 & 0.5593971487843205 & 0.0 \\ 0.559397148784 & 2.248447204968944 & 0.18784755647559048 \\ 0.0 & 0.18784755647559012 & 0.608695652173913 \end{bmatrix}$$

B after 3^th iteration

$$\begin{bmatrix} 3.30841121495 & 0.37219266825682007 & 0.0 \\ 0.372192668257 & 2.103946918716338 & 0.052176950480648965 \\ 0.0 & 0.05217695048064867 & 0.5876418663303908 \end{bmatrix}$$

B after 4^th iteration

$$\begin{bmatrix} 3.3760539629 & 0.2291562582167699 & 0.0 \\ 0.229156258217 & 2.038004306351092 & 0.014919679720760637 \\ 0.0 & 0.014919679720760368 & 0.5859417307484024 \end{bmatrix}$$

B after 5^th iteration

$$\begin{bmatrix} 3.40088365243 & 0.1366518953886722 & 0.0 \\ 0.136651895389 & 2.013316706249348 & 0.0043314070102554395 \\ 0.0 & 0.0043314070102551715 & 0.5857996413206094 \end{bmatrix}$$

B after 6^th iteration

$$\begin{bmatrix} 3.40961098398 & 0.08054717654581176 & 0.0 \\ 0.0805471765458 & 2.004601449206958 & 0.0012647171603671868 \\ 0.0 & 0.0012647171603669177 & 0.5857875668113498 \end{bmatrix}$$

B after 7^th iteration

$$\begin{bmatrix} 3.41263082425 & 0.04728450845250288 & 0.0 \\ 0.0472845084525 & 2.001582641360619 & 0.00037003119940952475 \\ 0.0 & 0.0003700311994092557 & 0.5857865343919776 \end{bmatrix}$$

B after 8^th iteration

$$\begin{bmatrix} 3.41367005298 & 0.027718999913432504 & 0.0 \\ 0.0277189999134 & 2.0005435010960193 & 0.00010833979204778271 \\ 0.0 & 0.00010833979204751371 & 0.5857864459249833 \end{bmatrix}$$

B after 9^th iteration

$$\begin{bmatrix} 3.41402701234 & 0.0162415142055389 & 0.0 \\ 0.0162415142055 & 2.000186549319679 & 3.17279850974556e-05 \\ 0.0 & 3.172798509718657e-05 & 0.5857864383386776 \end{bmatrix}$$

Eigen values are
$\lambda = 3.414027012341646$ with err 0.0162415142055389,
2.000186549319679 with err 0.01627324219063646,
0.5857864383386776 with err $3.172798509718657e-05$,
actual eigen values: 3.0
actual eigen values: 1.0
B after 1^th iteration

$$\begin{bmatrix} 2.8 & 0.7483314773547882 & 0.0 & 0.0 \\ 0.748331477355 & 2.342857142857143 & 0.8748177652797064 & 0.0 \\ 0.0 & 0.8748177652797064 & 2.1904761904761907 & 0.6236095644623239 \\ 0.0 & 0.0 & 0.6236095644623236 & 0.6666666666666669 \end{bmatrix}$$

B after 2^th iteration

$$\begin{bmatrix} 3.14285714286 & 0.5802884574739973 & 0.0 & 0.0 \\ 0.580288457474 & 2.6349206349206353 & 0.7007291376521015 & 0.0 \\ 0.0 & 0.7007291376521014 & 1.8222222222222229 & 0.1477097891751995 \\ 0.0 & 0.0 & 0.14770978917519934 & 0.40000000000000013 \end{bmatrix}$$

B after 3^th iteration

$$\begin{bmatrix} 3.33333333333 & 0.4689256016589626 & 0.0 & 0.0 \\ 0.468925601659 & 2.758539458186101 & 0.4270215460072514 & 0.0 \\ 0.0 & 0.42702154600725123 & 1.524934534750991 & 0.03612301725834008 \\ 0.0 & 0.0 & 0.03612301725839905 & 0.3831926737295745 \end{bmatrix}$$

B after 4^th iteration

$$\begin{bmatrix} 3.45155317836 & 0.3761673932383457 & 0.0 & 0.0 \\ 0.376167393238 & 2.7444837806743423 & 0.22761379232605128 & 0.0 \\ 0.0 & 0.22761379232605117 & 1.421906621080806 & 0.009591536484781067 \\ 0.0 & 0.0 & 0.009591536484780895 & 0.38205641988648886 \end{bmatrix}$$

B after 5^th iteration

$$\begin{bmatrix} 3.52428410526 & 0.29222328023921296 & 0.0 & 0.0 \\ 0.292223280239 & 2.7009059283060273 & 0.11795674336594164 & 0.0 \\ 0.0 & 0.11795674336594153 & 1.3928371174955736 & 0.002621165559793904 \\ 0.0 & 0.0 & 0.0026211655597937335 & 0.3819728489388334 \end{bmatrix}$$

B after 6^th iteration

$$\begin{bmatrix} 3.56679152594 & 0.2206419942028439 & 0.0 & 0.0 \\ 0.220641994203 & 2.6663047266577755 & 0.06124120675228517 & 0.0 \\ 0.0 & 0.061241206752285074 & 1.3849372152378967 & 0.0007222166072418015 \\ 0.0 & 0.0 & 0.0007222166072416316 & 0.38196653216020765 \end{bmatrix}$$

B after 7^th iteration

$$\begin{bmatrix} 3.59055259627 & 0.16351167583178045 & 0.0 & 0.0 \\ 0.163511675832 & 2.6446973582416975 & 0.03198500745915087 & 0.0 \\ 0.0 & 0.031985007459150776 & 1.3827839944748508 & 0.0001944444206469511 \\ 0.0 & 0.0 & 0.0001944442064678114 & 0.3819660510137008 \end{bmatrix}$$

B after 8^th iteration

$$\begin{bmatrix} 3.6034567372 & 0.11985916411712601 & 0.0 & 0.0 \\ 0.119859164117 & 2.632384868130963 & 0.016780825391382433 & 0.0 \\ 0.0 & 0.01678082539138233 & 1.3821923803853153 & 5.511199433181702e-05 \\ 0.0 & 0.0 & 5.5111994331647064e-05 & 0.38196601428713045 \end{bmatrix}$$

B after 9^th iteration

$$\begin{bmatrix} 3.61034831576 & 0.0873316580675662 & 0.0 & 0.0 \\ 0.0873316580676 & 2.6256568207278326 & 0.008828347119212956 & 0.0 \\ 0.0 & 0.00882834711921285 & 1.3820288520318917 & 1.5231577244279317e-05 \\ 0.0 & 0.0 & 1.5231577244109361e-05 & 0.3819660114820997 \end{bmatrix}$$

Eigen values are
$\lambda = 3.6103483157581757$ with err 0.0873316580675662,
2.6256568207278326 with err 0.09616000518677897,
1.3820288520318917 with err 0.00884357869645713,
0.3819660114820997 with err $1.5231577244109361e-05$,
actual eigen values: 3.4142135623730914
actual eigen values: 1.9999999999999998
actual eigen values: 0.5857864376269049
B after 1^th iteration

$$\begin{bmatrix} 2.8 & 0.7483314773547882 & 0.0 & 0.0 & 0.0 \\ 0.748331477355 & 2.342857142857143 & 0.8748177652797064 & 0.0 & 0.0 \\ 0.0 & 0.8748177652797064 & 2.1904761904761907 & 0.9249624617007739 & 0.0 \\ 0.0 & 0.0 & 0.9249624617007738 & 2.121212121212121 & 0.597515517278363 \\ 0.0 & 0.0 & 0.0 & 0.597515517278363 & 0.545454545454545 \end{bmatrix}$$

B after 2^th iteration

$$\begin{bmatrix} 3.14285714286 & 0.5802884574739973 & 0.0 & 0.0 & 0.0 \\ 0.580288457474 & 2.6349206349206353 & 0.7494854201795581 & 0.0 & 0.0 \\ 0.0 & 0.749485420179558 & 2.404040404040405 & 0.7538837776202189 & 0.0 \\ 0.0 & 0.0 & 0.753883777620219 & 1.5363026235509458 & 0.116066044368788 \\ 0.0 & 0.0 & 0.0 & 0.11606604436878802 & 0.281879194630872 \end{bmatrix}$$

B after 3^th iteration

$$\begin{bmatrix} 3.33333333333 & 0.47140452079103184 & 0.0 & 0.0 & 0.0 \\ 0.471404520791 & 2.8484848484848486 & 0.6410913295438296 & 0.0 & 0.0 \\ 0.0 & 0.6410913295438295 & 2.407508964353513 & 0.4092761995973581 & 0.0 \\ 0.0 & 0.0 & 0.4092761995973582 & 1.1418671462031842 & 0.025998174723118085 \\ 0.0 & 0.0 & 0.0 & 0.025998174723118085 & 0.268805707625 \end{bmatrix}$$

B after 4^th iteration

$$\begin{bmatrix} 3.45454545455 & 0.39600393522307964 & 0.0 & 0.0 & 0.0 \\ 0.396003935223 & 2.991144303413291 & 0.5074865087982439 & 0.0 & 0.0 \\ 0.0 & 0.5074865087982438 & 2.2534511263935935 & 0.19197494603430787 & 0.0 \\ 0.0 & 0.0 & 0.19197494603430806 & 1.0328508176545603 & 0.006637537631 \\ 0.0 & 0.0 & 0.0 & 0.006637537631201422 & 0.26800829799 \end{bmatrix}$$

B after 5^th iteration

$$\begin{bmatrix} 3.5381474866 & 0.3382734446963993 & 0.0 & 0.0 & 0.0 \\ 0.338273444696 & 3.0582008720953304 & 0.3661086542515256 & 0.0 & 0.0 \\ 0.0 & 0.36610865425152544 & 2.127960971766462 & 0.09064583585529422 & 0.0 \\ 0.0 & 0.0 & 0.0906458358552944 & 1.007737274203118 & 0.0017578937443 \\ 0.0 & 0.0 & 0.0 & 0.001757893744350969 & 0.267953395331 \end{bmatrix}$$

B after 6^th iteration

$$\begin{bmatrix} 3.59789719186 & 0.2887842117697763 & 0.0 & 0.0 & 0.0 \\ 0.28878421177 & 3.073082087746825 & 0.24981155514057934 & 0.0 & 0.0 \\ 0.0 & 0.24981155514057907 & 2.059197493247212 & 0.04390526160316077 & 0.0 \\ 0.0 & 0.0 & 0.04390526160316096 & 1.0018737336743524 & 0.0004696968 \\ 0.0 & 0.0 & 0.0 & 0.00046969683661423413 & 0.267949493 \end{bmatrix}$$

B after 7^th iteration

$$\begin{bmatrix} 3.6405993721 & 0.244052385414261 & 0.0 & 0.0 & 0 \\ 0.244052385414 & 3.0645150022930627 & 0.1664411668417339 & 0.0 & 0 \\ 0.0 & 0.16644116684173366 & 2.0264750475081375 & 0.021618080275986603 & 0 \\ 0.0 & 0.0 & 0.021618080275986808 & 1.0004613640651978 & 0.000125767 \\ 0.0 & 0.0 & 0.0 & 0.00012576753751718822 & 0.2679492 \end{bmatrix}$$

B after 8^th iteration

$$\begin{bmatrix} 3.67059646958 & 0.20372731072488814 & 0.0 & 0.0 & 0 \\ 0.203727310725 & 3.0496302468834524 & 0.11008111096584272 & 0.0 & 0 \\ 0.0 & 0.1100811109658424 & 2.0117095495158077 & 0.010733147235628737 & 0 \\ 0.0 & 0.0 & 0.01073314723562895 & 1.000114540036778 & 3.369351125 \\ 0.0 & 0.0 & 0.0 & 3.369351125067611e-05 & 0.2679491 \end{bmatrix}$$

B after 9^th iteration

$$\begin{bmatrix} 3.69123474218 & 0.16822729685300766 & 0.0 & 0.0 & \\ 0.168227296853 & 3.0356204409534127 & 0.07275870067419862 & 0.0 & \\ 0.0 & 0.07275870067419828 & 2.005167079028179 & 0.005349606153613916 & \\ 0.0 & 0.0 & 0.0053496061536141325 & 1.0000285452988684 & 9.0277622 \\ 0.0 & 0.0 & 0.0 & 9.027762271430838e-06 & 0.26794 \end{bmatrix}$$

Eigen values are
$\lambda = 3.6912347421770897$ with err 0.16822729685300766,
3.0356204409534127 with err 0.2409859975272062,
2.005167079028179 with err 0.0781083068278122,
1.0000285452988684 with err 0.005358633915885706,
0.2679491925424528 with err $9.027762271430838e-06$,
actual eigen values: 3.6180339887498922
actual eigen values: 2.618033988749894
actual eigen values: 0.3819660112501052
actual eigen values: 1.381966011250106
B after 1^th iteration

$$\begin{bmatrix}
2.8 & 0.7483314773547882 & 0.0 & 0.0 & 0.0 \\
0.748331477355 & 2.342857142857143 & 0.8748177652797064 & 0.0 & 0.0 \\
0.0 & 0.8748177652797064 & 2.1904761904761907 & 0.9249624617007739 & 0.0 \\
0.0 & 0.0 & 0.9249624617007738 & 2.121212121212121 & 0.9499891256445914 \\
0.0 & 0.0 & 0.0 & 0.9499891256445914 & 2.083916083916083 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.570476806699665
\end{bmatrix}$$

B after 2^th iteration

$$\begin{bmatrix}
3.14285714286 & 0.5802884574739973 & 0.0 & 0.0 & 0.0 \\
0.580288457474 & 2.6349206349206353 & 0.7494854201795581 & 0.0 & 0.0 \\
0.0 & 0.749485420179558 & 2.404040404040405 & 0.8331955809010617 & 0.0 \\
0.0 & 0.0 & 0.8331955809010618 & 2.27972027972028 & 0.771151448298593 \\
0.0 & 0.0 & 0.0 & 0.7711514482985931 & 1.329506314580941 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.092609504820827
\end{bmatrix}$$

B after 3^th iteration

$$\begin{bmatrix}
3.33333333333 & 0.47140452079103184 & 0.0 & 0.0 & 0.0 \\
0.471404520791 & 2.8484848484848486 & 0.6492207662311684 & 0.0 & 0.0 \\
0.0 & 0.6492207662311684 & 2.587412587412588 & 0.7329688258628319 & 0.0 \\
0.0 & 0.0 & 0.7329688258628319 & 2.1514041514041518 & 0.3701691241075 \\
0.0 & 0.0 & 0.0 & 0.3701691241075454 & 0.880673824159 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.019468254814935
\end{bmatrix}$$

B after 4^th iteration

$$\begin{bmatrix}
3.45454545455 & 0.39626354032187955 & 0.0 & 0.0 & 0.0 \\
0.396263540322 & 3.0069930069930066 & 0.5693276309007742 & 0.0 & 0.0 \\
0.0 & 0.5693276309007741 & 2.696683484373879 & 0.5557085001194579 & 0.0 \\
0.0 & 0.0 & 0.5557085001194578 & 1.8647212143552774 & 0.156237783860 \\
0.0 & 0.0 & 0.0 & 0.15623778386054205 & 0.778952804636 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.00485807721639
\end{bmatrix}$$

B after 5^th iteration

$$\begin{bmatrix}
3.53846153846 & 0.3415194977422455 & 0.0 & 0.0 & 0.0 \\
0.341519497742 & 3.125901506358117 & 0.4939776150116275 & 0.0 & 0.0 \\
0.0 & 0.49397761501162757 & 2.6929387795636712 & 0.3659234912013713 & 0.0 \\
0.0 & 0.0 & 0.3659234912013711 & 1.6859967835894796 & 0.069514082748 \\
0.0 & 0.0 & 0.0 & 0.06951408274845523 & 0.758636264449 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.00126312328236
\end{bmatrix}$$

B after 6^th iteration

$$\begin{bmatrix}
3.59996984785 & 0.2995472175477872 & 0.0 & 0.0 & 0.0 \\
0.299547217548 & 3.208897364780318 & 0.41299441233420503 & 0.0 & 0.0 \\
0.0 & 0.41299441233420514 & 2.6318692585667023 & 0.22741130531340348 & 0.0 \\
0.0 & 0.0 & 0.22741130531340323 & 1.6069092935448732 & 0.0323947780 \\
0.0 & 0.0 & 0.0 & 0.03239477808218349 & 0.7542917733 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.000331367258
\end{bmatrix}$$

B after 7^th iteration

$$\begin{bmatrix}
3.64678766831 & 0.2653304880321467 & 0.0 & 0.0 & 0.0 \\
0.265330488032 & 3.258601257256181 & 0.3313002787057924 & 0.0 & 0.0 \\
0.0 & 0.33130027870579243 & 2.5678613576490736 & 0.1400656495333876 & 0.0 \\
0.0 & 0.0 & 0.1400656495333874 & 1.5753732336642357 & 0.015439246077 \\
0.0 & 0.0 & 0.0 & 0.01543924607776159 & 0.75331420525 \\
0.0 & 0.0 & 0.0 & 0.0 & 8.71052075721680
\end{bmatrix}$$

B after 8^th iteration

$$\begin{bmatrix}
3.68314973601 & 0.23567090543338903 & 0.0 & 0.0 & 0.0 \\
0.235670905433 & 3.2824921228245576 & 0.25754117994106124 & 0.0 & 0.0 \\
0.0 & 0.25754117994106135 & 2.5201756506594397 & 0.0868413570711676 & 0.0 \\
0.0 & 0.0 & 0.0868413570711674 & 1.563031338975835 & 0.007428443960 \\
0.0 & 0.0 & 0.0 & 0.007428443965051149 & 0.753088863 \\
0.0 & 0.0 & 0.0 & 0.0 & 2.290754262620
\end{bmatrix}$$

B after 9^th iteration

$$\begin{bmatrix}
3.71155245103 & 0.20886538873067448 & 0.0 & 0.0 & 0. \\
0.208865388731 & 3.289887166449478 & 0.19634106150039898 & 0.0 & 0. \\
0.0 & 0.19634106150039904 & 2.4892865997122255 & 0.05429565901026448 & 0. \\
0.0 & 0.0 & 0.054295659010264286 & 1.558175099364316 & 0.003587968 \\
0.0 & 0.0 & 0.0 & 0.0035879689809499076 & 0.7530364 \\
0.0 & 0.0 & 0.0 & 0.0 & 6.025031659
\end{bmatrix}$$

Eigen values are
$\lambda = 3.711552451027671$ with err 0.20886538873067448,
3.289887166449478 with err 0.4052064502310734,
2.4892865997122255 with err 0.25063672051066355,
1.558175099364316 with err 0.05788362799121441,
0.7530364191857402 with err 0.003593994012609557,
0.1980622642605732 with err $6.025031659529962e-06$,
actual eigen values: 3.732050807568874
actual eigen values: 2.999999999999998
actual eigen values: 1.9999999999999976
actual eigen values: 0.2679491924311222
actual eigen values: 1.0
B after 1^th iteration

$$\begin{bmatrix}
2.8 & 0.7483314773547882 & 0.0 & 0.0 & 0.0 \\
0.748331477355 & 2.342857142857143 & 0.8748177652797064 & 0.0 & 0.0 \\
0.0 & 0.8748177652797064 & 2.1904761904761907 & 0.9249624617007739 & 0.0 \\
0.0 & 0.0 & 0.9249624617007738 & 2.121212121212121 & 0.949989125644591 \\
0.0 & 0.0 & 0.0 & 0.9499891256445914 & 2.083916083916083 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.964281800812321 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.0
\end{bmatrix}$$

B after 2^th iteration

$$\begin{bmatrix}
3.14285714286 & 0.5802884574739973 & 0.0 & 0.0 & 0.0 \\
0.580288457474 & 2.6349206349206353 & 0.7494854201795581 & 0.0 & 0.0 \\
0.0 & 0.749485420179558 & 2.404040404040405 & 0.8331955809010617 & 0.0 \\
0.0 & 0.0 & 0.8331955809010618 & 2.27972027972028 & 0.880904783465102 \\
0.0 & 0.0 & 0.0 & 0.8809047834651025 & 2.2051282051282057 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.7718192460972487 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.0
\end{bmatrix}$$

B after 3^th iteration

$$\begin{bmatrix}
3.33333333333 & 0.47140452079103184 & 0.0 & 0.0 & 0.0 \\
0.471404520791 & 2.8484848484848486 & 0.6492207662311684 & 0.0 & 0.0 \\
0.0 & 0.6492207662311684 & 2.587412587412588 & 0.749753411139151 & 0.0 \\
0.0 & 0.0 & 0.749753411139151 & 2.4307692307692315 & 0.78468309155962 \\
0.0 & 0.0 & 0.0 & 0.7846830915596223 & 1.95044247787610 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.327841752428717 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.0
\end{bmatrix}$$

B after 4^th iteration

$$\begin{bmatrix}
3.45454545455 & 0.39626354032187955 & 0.0 & 0.0 & 0.0 \\
0.396263540322 & 3.0069930069930066 & 0.5704768066996665 & 0.0 & 0.0 \\
0.0 & 0.5704768066996666 & 2.738461538461538 & 0.6752593814217929 & 0.0 \\
0.0 & 0.0 & 0.6752593814217931 & 2.4849538294405225 & 0.560118914684221 \\
0.0 & 0.0 & 0.0 & 0.5601189146842216 & 1.556426264020182 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.126990015311132 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.0
\end{bmatrix}$$

B after 5^th iteration

$$\begin{bmatrix}
3.53846153846 & 0.34154440149274856 & 0.0 & 0.0 & 0.0 \\
0.341544401493 & 3.128205128205128 & 0.507730915954653 & 0.0 & 0.0 \\
0.0 & 0.507730915954653 & 2.854936608842438 & 0.5835860735807571 & 0.0 \\
0.0 & 0.0 & 0.5835860735807575 & 2.3829506246371377 & 0.336265432360312 \\
0.0 & 0.0 & 0.0 & 0.3362654323603116 & 1.353186897264488 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.054366603653536 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.0
\end{bmatrix}$$

B after 6^th iteration

$$\begin{bmatrix}
3.6 & 0.29999775653129845 & 0.0 & 0.0 & 0.0 \\
0.299997756531 & 3.2232366138199233 & 0.45469909309574125 & 0.0 & 0.0 \\
0.0 & 0.45469909309574125 & 2.9196797374614682 & 0.46659137215267205 & 0.0 \\
0.0 & 0.0 & 0.4665913721526725 & 2.2411482238075826 & 0.193943354321 \\
0.0 & 0.0 & 0.0 & 0.19394335432173926 & 1.276989139947 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.024758459773 \\
0.0 & 0.0 & 0.0 & 0.0 & 0.0
\end{bmatrix}$$

B after 7^th iteration

$$\begin{bmatrix} 3.64705610529 & 0.2673596995191804 & 0.0 & 0.0 & 0.0 \\ 0.267359699519 & 3.297775821790525 & 0.40459035822121653 & 0.0 & 0.0 \\ 0.0 & 0.4045903582212165 & 2.9317712442884356 & 0.349335839845832 & 0.0 \\ 0.0 & 0.0 & 0.34933583984583255 & 2.135135654590183 & 0.11345750297551 \\ 0.0 & 0.0 & 0.0 & 0.11345750297551369 & 1.2500297901349 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.01156536366047 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 8^th iteration

$$\begin{bmatrix} 3.68417893218 & 0.24085646720595674 & 0.0 & 0.0 & 0.0 \\ 0.240856467206 & 3.3540546207640296 & 0.35386026438496515 & 0.0 & 0.0 \\ 0.0 & 0.35386026438496504 & 2.911479993121824 & 0.25224044697022896 & 0.0 \\ 0.0 & 0.0 & 0.2522404469702295 & 2.0718756140614114 & 0.067737138191 \\ 0.0 & 0.0 & 0.0 & 0.06773713819117617 & 1.24033778461 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0054550804399 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 9^th iteration

$$\begin{bmatrix} 3.71413236807 & 0.21853872223194074 & 0.0 & 0.0 & 0.0 \\ 0.218538722232 & 3.3936783462293 & 0.3030579632506736 & 0.0 & 0.0 \\ 0.0 & 0.3030579632506734 & 2.879885318427249 & 0.17961223785835953 & 0.0 \\ 0.0 & 0.0 & 0.17961223785836014 & 2.0374927665612868 & 0.041029447404 \\ 0.0 & 0.0 & 0.0 & 0.04102944740432208 & 1.2367735651 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0025824472790 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

Eigen values are
$\lambda = 3.7141323680682157$ with err 0.2185387224444776,
3.3936783462293 with err 0.5215966856117736,
2.879885318427249 with err 0.4826702011090329,
2.0374927665612868 with err 0.2206416852626818,
1.236773565152289 with err 0.04361189468340982,
0.5857967005409289 with err 0.0025867805179476885,
0.15224093502073627 with err $4.333238859869893e-06$,
actual eigen values: 3.801937735804835
actual eigen values: 3.246979603717461
actual eigen values: 2.4450418679126242
actual eigen values: 0.19806226419516107
actual eigen values: 1.5549581320873713
actual eigen values: 0.7530203962825328

Problem 4.

B after 1^th iteration

$$\begin{bmatrix} 1.8 & 0.39999999999999997 \\ 0.4 & 1.2 \end{bmatrix}$$
B after 2^th iteration

$$\begin{bmatrix} 1.94117647059 & 0.23529411764705882 \\ 0.235294117647 & 1.0588235294117647 \end{bmatrix}$$
B after 3^th iteration

$$\begin{bmatrix} 1.98461538462 & 0.12307692307692306 \\ 0.123076923077 & 1.015384615384615 \end{bmatrix}$$
B after 4^th iteration

$$\begin{bmatrix} 1.99610894942 & 0.06225680933852138 \\ 0.0622568093385 & 1.0038910505836574 \end{bmatrix}$$
B after 5^th iteration

$$\begin{bmatrix} 1.99902439024 & 0.03121951219512192 \\ 0.0312195121951 & 1.0009756097560973 \end{bmatrix}$$
B after 6^th iteration

$$\begin{bmatrix} 1.99975591897 & 0.015621186233829604 \\ 0.0156211862338 & 1.0002440810349036 \end{bmatrix}$$
B after 7^th iteration

$$\begin{bmatrix} 1.99993896857 & 0.007812023191943822 \\ 0.00781202319194 & 1.000061031431187 \end{bmatrix}$$
B after 8^th iteration

$$\begin{bmatrix} 1.99998474144 & 0.003906190396264676 \\ 0.00390619039626 & 1.0000152585562354 \end{bmatrix}$$
B after 9^th iteration

$$\begin{bmatrix} 1.99999618532 & 0.0019531175494477942 \\ 0.00195311754945 & 1.0000038146827137 \end{bmatrix}$$
Eigen values are
$\lambda = 1.9999961853172865$ with err 0.0019531175494477942,
1.0000038146827137 with err 0.0019531175494478244,
actual eigen values: 2.0
B after 1^th iteration

$$\begin{bmatrix} 1.66666666667 & -0.47140452079103207 & 0.0 \\ -0.471404520791 & 1.333333333333334 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$
B after 2^th iteration

$$\begin{bmatrix} 1.88888888889 & -0.3142696805273548 & 0.0 \\ -0.314269680527 & 1.1111111111111114 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$
B after 3^th iteration

$$\begin{bmatrix} 1.9696969697 & -0.17141982574219355 & 0.0 \\ -0.171419825742 & 1.0303030303030305 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$
B after 4^th iteration

$$\begin{bmatrix} 1.99224806202 & -0.0877031666587967 & 0.0 \\ -0.0877031666588 & 1.0077519379844964 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$
B after 5^th iteration

$$\begin{bmatrix} 1.99805068226 & -0.04410802533717259 & 0.0 \\ -0.0441080253372 & 1.0019493177387915 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$
B after 6^th iteration

$$\begin{bmatrix} 1.99951195705 & -0.022086302584645716 & 0.0 \\ -0.0220863025846 & 1.0004880429477796 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$
B after 7^th iteration

$$\begin{bmatrix} 1.99987794459 & -0.011047194921503491 & 0.0 \\ -0.0110471949215 & 1.0001220554131578 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$
B after 8^th iteration

$$\begin{bmatrix} 1.99996948335 & -0.005524103145770584 & 0.0 \\ -0.00552410314577 & 1.000030516646831 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$
B after 9^th iteration

$$\begin{bmatrix} 1.99999237066 & -0.002762114790746476 & 0.0 \\ -0.00276211479075 & 1.0000076293363243 & 0.0 \\ 0.0 & 0.0 & 1.0 \end{bmatrix}$$
Eigen values are
$\lambda = 1.9999923706636773$ with err 0.002762114790746476,
1.0000076293363243 with err 0.00276211479074647,
1.0 with err 0.0,
actual eigen values: 3.0
actual eigen values: 1.0

I still don't know why, but for B_4, it still doesn't work, so I can't compute the eigenvalues

$$\begin{bmatrix} 1.5 & -0.49999999999999967 & 0.0 & 0.0 & 0.0 \\ -0.5 & 1.4999999999999991 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0000000000000002 \end{bmatrix}$$

B after 2^th iteration

$$\begin{bmatrix} 1.8 & -0.3999999999999998 & 0.0 & 0.0 & 0.0 \\ -0.4 & 1.1999999999999995 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0000000000000002 \end{bmatrix}$$

B after 3^th iteration

$$\begin{bmatrix} 1.94117647059 & -0.23529411764705882 & 0.0 & 0.0 & 0.0 \\ -0.235294117647 & 1.0588235294117643 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.000000000000 \end{bmatrix}$$

B after 4^th iteration

$$\begin{bmatrix} 1.98461538462 & -0.12307692307692317 & 0.0 & 0.0 & 0.0 \\ -0.123076923077 & 1.0153846153846149 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.000000000000 \end{bmatrix}$$

B after 5^th iteration

$$\begin{bmatrix} 1.99610894942 & -0.06225680933852154 & 0.0 & 0.0 & 0.0 \\ -0.0622568093385 & 1.0038910505836571 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.000000000000 \end{bmatrix}$$

B after 6^th iteration

$$\begin{bmatrix} 1.99902439024 & -0.031219512195122104 & 0.0 & 0.0 & 0.0 \\ -0.0312195121951 & 1.0009756097560971 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.000000000000 \end{bmatrix}$$

B after 7^th iteration

$$\begin{bmatrix} 1.99975591897 & -0.015621186233829795 & 0.0 & 0.0 & 0.0 \\ -0.0156211862338 & 1.0002440810349031 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.000000000 \end{bmatrix}$$

B after 8^th iteration

$$\begin{bmatrix} 1.99993896857 & -0.007812023191944019 & 0.0 & 0.0 & 0.0 \\ -0.00781202319194 & 1.0000610314311869 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.000000000 \end{bmatrix}$$

B after 9^th iteration

$$\begin{bmatrix} 1.99998474144 & -0.0039061903962648754 & 0.0 & 0.0 & 0. \\ -0.00390619039626 & 1.0000152585562352 & 0.0 & 0.0 & 0. \\ 0.0 & 0.0 & 0.9999999999999997 & 0.0 & 0. \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0. \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0000000 \end{bmatrix}$$

Eigen values are
$\lambda = 1.999984741443764$ with err 0.0039061903962648754,
1.0000152585562352 with err 0.003906190396264705,
0.9999999999999997 with err 0.0,
1.0000000000000002 with err 0.0,
1.0000000000000002 with err 0.0,
actual eigen values: 3.6180339887498922
actual eigen values: 2.618033988749894
actual eigen values: 0.3819660112501052
actual eigen values: 1.381966011250106
B after 1^th iteration

$$\begin{bmatrix} 1.44444444444 & -0.49690399499995275 & 0.0 & 0.0 & 0.0 \\ -0.496903995 & 1.5555555555555547 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.99999999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 2^th iteration

$$\begin{bmatrix} 1.7619047619 & -0.4259177099999595 & 0.0 & 0.0 & 0.0 \\ -0.42591771 & 1.2380952380952377 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.9999999999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 3^th iteration

$$\begin{bmatrix} 1.92753623188 & -0.25925425826084497 & 0.0 & 0.0 & 0.0 \\ -0.259254258261 & 1.0724637681159421 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.99999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 4^th iteration

$$\begin{bmatrix} 1.98084291188 & -0.13707696413791803 & 0.0 & 0.0 & 0.0 \\ -0.137076964138 & 1.0191570881226055 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.99999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 5^th iteration

$$\begin{bmatrix} 1.99514091351 & -0.06953758530611581 & 0.0 & 0.0 & 0.0 \\ -0.0695375853061 & 1.0048590864917395 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.99999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 6^th iteration

$$\begin{bmatrix} 1.99878078517 & -0.03489596453547575 & 0.0 & 0.0 & 0.0 \\ -0.0348959645355 & 1.001219214825652 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.99999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 7^th iteration

$$\begin{bmatrix} 1.99969491732 & -0.0174639514991745 & 0.0 & 0.0 & 0.0 \\ -0.0174639514992 & 1.0003050826774054 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.99999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 8^th iteration

$$\begin{bmatrix} 1.99992371188 & -0.008733974187759369 & 0.0 & 0.0 & 0.0 \\ -0.00873397418776 & 1.0000762881249903 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.99999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 9^th iteration

$$\begin{bmatrix} 1.99998092688 & -0.004367236970119488 & 0.0 & 0.0 & 0.0 \\ -0.00436723697012 & 1.000019073122537 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 1.0000000000000002 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.99999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

Eigen values are
$\lambda = 1.9999809268774622$ with err 0.004367236970119488,
1.000019073122537 with err 0.004367236970119641,
1.0000000000000002 with err 0.0,
1.0000000000000002 with err 0.0,
0.9999999999999999 with err 0.0,
0.9999999999999998 with err 0.0,
actual eigen values: 3.732050807568874
actual eigen values: 2.999999999999998
actual eigen values: 1.9999999999999976
actual eigen values: 0.2679491924311222
actual eigen values: 1.0
B after 1^th iteration

$$\begin{bmatrix} 1.4 & -0.48989794855663554 & 0.0 & 0.0 & 0.0 & 0 \\ -0.489897948557 & 1.5999999999999999 & 0.0 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.9999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0 \end{bmatrix}$$

B after 2^th iteration

$$\begin{bmatrix} 1.72727272727 & -0.44536177141512323 & 0.0 & 0.0 & 0.0 & 0 \\ -0.445361771415 & 1.2727272727272727 & 0.0 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.9999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0 \end{bmatrix}$$

B after 3^th iteration

$$\begin{bmatrix} 1.91428571429 & -0.2799416848895061 & 0.0 & 0.0 & 0.0 & 0.0 \\ -0.27994168489 & 1.0857142857142856 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.999999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \end{bmatrix}$$

B after 4^th iteration

$$\begin{bmatrix} 1.97709923664 & -0.14958715986462173 & 0.0 & 0.0 & 0.0 & 0 \\ -0.149587159865 & 1.0229007633587788 & 0.0 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.9999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0 \end{bmatrix}$$

B after 5^th iteration

$$\begin{bmatrix} 1.99417475728 & -0.07610065220297271 & 0.0 & 0.0 & 0.0 & 0 \\ -0.076100652203 & 1.0058252427184469 & 0.0 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.9999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0 \end{bmatrix}$$

B after 6^th iteration

$$\begin{bmatrix} 1.99853729888 & -0.03821729486546176 & 0.0 & 0.0 & 0.0 & 0 \\ -0.0382172948655 & 1.0014627011214046 & 0.0 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0 \end{bmatrix}$$

B after 7^th iteration

$$\begin{bmatrix} 1.99963392312 & -0.01912963313460949 & 0.0 & 0.0 & 0.0 & 0 \\ -0.0191296331346 & 1.0003660768761446 & 0.0 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & 0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.999999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0 \end{bmatrix}$$

B after 8^th iteration

$$\begin{bmatrix} 1.99990845565 & -0.009567443382144339 & 0.0 & 0.0 & 0.0 & \\ -0.00956744338214 & 1.00009154435324 & 0.0 & 0.0 & 0.0 & \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.9999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & \end{bmatrix}$$

B after 9^th iteration

$$\begin{bmatrix} 1.99997711234 & -0.004784050155655266 & 0.0 & 0.0 & 0.0 & \\ -0.00478405015566 & 1.000022887659738 & 0.0 & 0.0 & 0.0 & \\ 0.0 & 0.0 & 1.0000000000000002 & 0.0 & 0.0 & \\ 0.0 & 0.0 & 0.0 & 0.9999999999999999 & 0.0 & \\ 0.0 & 0.0 & 0.0 & 0.0 & 1.0 & \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & 0.9999 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.0 & \end{bmatrix}$$

Eigen values are
λ = 1.9999771123402637 with err 0.004784050155655266,
1.000022887659738 with err 0.0047840501556551274,
1.0000000000000002 with err 0.0,
0.9999999999999999 with err 0.0,
1.0 with err 0.0,
0.9999999999999999 with err 0.0,
0.9999999999999999 with err 0.0,
actual eigen values: 3.801937735804835
actual eigen values: 3.246979603717461
actual eigen values: 2.4450418679126242
actual eigen values: 0.19806226419516107
actual eigen values: 1.5549581320873713
actual eigen values: 0.7530203962825328