MAT3008 - Homework 7

박준영

1 How to build

다음의 명령어를 수행한다.

```
cd nr
make
cd ..
make
```

2 Example

프로그램을 실행하면 랜덤하게 11×11 크기의 행렬이 생성되고, 다음 화면과 같이 eigenvalue와 eigenvector가 구해진다.

```
[Matrix]
[[ -0.84,  -0.17,   1.62,  -0.55,   1.53,   0.71,  -0.32,   0.29,   1.17,   0.77,   0.22],
 [ -0.17,   0.19,  -0.18,   0.19,  -1.36,   0.87,  -0.30,   0.30,  -1.05,   0.01,   2.40],
 [  1.62,  -0.18,   0.65,   0.93,   0.05,  -0.79,   0.52,   1.10,   0.82,  -0.89,   1.91],
 [ -0.55,   0.19,   0.93,   1.20,   1.02,   0.33,  -2.23,   0.74,  -1.41,  -0.65,   1.70],
 [  1.53,  -1.36,   0.05,   1.02,  -1.23,   0.21,   0.26,  -0.16,   0.52,  -0.01,   0.81],
 [  0.71,   0.87,  -0.79,   0.33,   0.21,  -0.17,  -0.09,  -0.60,  -0.73,   1.88,   2.79],
 [ -0.32,  -0.30,   0.52,  -2.23,   0.26,  -0.09,  -1.65,   0.66,   0.33,  -2.48,   0.03],
 [  0.29,   0.30,   1.10,   0.74,  -0.16,  -0.60,   0.66,  -0.03,  -0.04,  -1.68,   0.10],
 [  1.17,  -1.05,   0.82,  -1.41,   0.52,  -0.73,   0.33,  -0.04,  -0.87,  -0.76,   1.78],
 [  0.77,   0.01,  -0.89,  -0.65,  -0.01,   1.88,  -2.48,  -1.68,  -0.76,   0.15,   0.30],
 [  0.22,   2.40,   1.91,   1.70,   0.81,   2.79,   0.03,   0.10,   1.78,   0.30,   0.47]]

[Eigenvalues]
5.68    4.75    2.90    2.13    -0.11   -0.65   -1.58   -1.87   -3.18   -4.85   -5.35

[Eigenvectors]
[[  0.14,  -0.13,   0.42,  -0.24,  -0.29,  -0.37,   0.14,  -0.40,  -0.44,   0.24,  -0.25],
 [  0.32,   0.08,  -0.21,   0.57,  -0.26,   0.01,   0.24,  -0.53,   0.09,  -0.03,   0.33],
 [  0.23,  -0.52,   0.11,  -0.12,  -0.49,   0.16,  -0.52,   0.08,   0.12,  -0.21,   0.22],
 [  0.40,  -0.09,  -0.58,  -0.46,   0.16,   0.10,   0.01,  -0.03,  -0.21,   0.39,   0.22],
 [  0.11,  -0.11,   0.19,  -0.39,   0.42,  -0.23,   0.07,  -0.41,   0.52,  -0.28,   0.18],
 [  0.42,   0.27,   0.18,   0.16,   0.27,  -0.40,  -0.27,   0.28,  -0.37,  -0.27,   0.31],
 [ -0.19,  -0.28,   0.14,   0.35,   0.31,  -0.20,  -0.38,  -0.07,   0.13,   0.65,   0.17],
 [  0.01,  -0.39,  -0.25,   0.08,  -0.17,  -0.61,   0.41,   0.42,   0.20,  -0.02,   0.01],
 [  0.02,  -0.28,   0.44,   0.00,   0.14,   0.40,   0.51,   0.22,  -0.17,   0.08,   0.45],
 [  0.19,   0.53,   0.26,  -0.20,  -0.36,  -0.05,   0.04,   0.24,   0.44,   0.40,   0.16],
 [  0.63,  -0.16,   0.14,   0.23,   0.23,   0.21,   0.06,   0.13,   0.21,   0.08,  -0.58]]
```

위 결과를 해석하면 다음과 같다. 11×11 행렬

$$A = \begin{pmatrix}
-0.84 & -0.17 & 1.62 & -0.55 & 1.53 & 0.71 & -0.32 & 0.29 & 1.17 & 0.77 & 0.22 \\
-0.17 & 0.19 & -0.18 & 0.19 & -1.36 & 0.87 & -0.30 & 0.30 & -1.05 & 0.01 & 2.40 \\
1.62 & -0.18 & 0.65 & 0.93 & 0.05 & -0.79 & 0.52 & 1.10 & 0.82 & -0.89 & 1.91 \\
-0.55 & 0.19 & 0.93 & 1.20 & 1.02 & 0.33 & -2.23 & 0.74 & -1.41 & -0.65 & 1.70 \\
1.53 & -1.36 & 0.05 & 1.02 & -1.23 & 0.21 & 0.26 & -0.16 & 0.52 & -0.01 & 0.81 \\
0.71 & 0.87 & -0.79 & 0.33 & 0.21 & -0.17 & -0.09 & -0.60 & -0.73 & 1.88 & 2.79 \\
-0.32 & -0.30 & 0.52 & -2.23 & 0.26 & -0.09 & -1.65 & 0.66 & 0.33 & -2.48 & 0.03 \\
0.29 & 0.30 & 1.10 & 0.74 & -0.16 & -0.60 & 0.66 & -0.03 & -0.04 & -1.68 & 0.10 \\
1.17 & -1.05 & 0.82 & -1.41 & 0.52 & -0.73 & 0.33 & -0.04 & -0.87 & -0.76 & 1.78 \\
0.77 & 0.01 & -0.89 & -0.65 & -0.01 & 1.88 & -2.48 & -1.68 & -0.76 & 0.15 & 0.30 \\
0.22 & 2.40 & 1.91 & 1.70 & 0.81 & 2.79 & 0.03 & 0.10 & 1.78 & 0.30 & 0.47
\end{pmatrix}$$

에 대하여 첫 번째 eigenvalue는 5.68이고, 그에 대응하는 eigenvector는

$$\begin{pmatrix} 0.14 \\ 0.32 \\ 0.23 \\ 0.40 \\ 0.11 \\ 0.42 \\ -0.19 \\ 0.01 \\ 0.02 \\ 0.19 \\ 0.63 \end{pmatrix}$$

이다.