

1.

```
> A := RandomLeslieMatrix(5, 3);
eigenvals(A);
```

$$A := \begin{bmatrix} 0. & 0.1100000000 & 0.2300000000 & 1.690000000 & 1.280000000 & 0.5800000000 \\ 0.6700000000 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.8100000000 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.6500000000 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.6900000000 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.0200000000 & 0 \end{bmatrix}$$

1.02600414852415, 0.0834046536832035 + 0.884284415426605 I, 0.0834046536832035 - 0.884284415426605 I, -0.591794213991960 + 0.167040736254135 I, -0.591794213991960 - 0.167040736254135 I, -0.00922502790663310

Growing

```
> A := RandomLeslieMatrix(5, 3);
eigenvals(A);
```

$$A := \begin{bmatrix} 0. & 0.3600000000 & 1.890000000 & 0.8400000000 & 2.240000000 & 2.090000000 \\ 0.3100000000 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.5400000000 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.6700000000 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.5900000000 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.6600000000 & 0 \end{bmatrix}$$

0.930596197322113, -0.437472162595363 + 0.569113261354715 I, -0.437472162595363 - 0.569113261354715 I, 0.212882416392482 + 0.591689593559507 I, 0.212882416392482 - 0.591689593559507 I, -0.481416704916351

Declining

```
> A := RandomLeslieMatrix(5, 4);
eigenvals(A);
```

$$A := \begin{bmatrix} 0. & 1.400000000 & 1.770000000 & 3.570000000 & 0.9000000000 & 0.3500000000 \\ 0.1500000000 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.2600000000 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.2400000000 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.0800000000 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.6300000000 & 0 \end{bmatrix}$$

0.636162650158558, -0.462381772419285, -0.0817466936106040 + 0.317428868146281 I, -0.0817466936106040 - 0.317428868146281 I, -0.00514374525903293 + 0.0720957984913575 I, -0.00514374525903293 - 0.0720957984913575 I

Declining

```

> A := RandomLeslieMatrix(5, 4);
eigenvals(A);

```

$$A := \begin{bmatrix} 0. & 3.340000000 & 1.510000000 & 0.7300000000 & 1.500000000 & 1.600000000 \\ 0.9800000000 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.09000000000 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.5300000000 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.03000000000 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.9800000000 & 0 \end{bmatrix}$$

```

-1.79146250539820, 1.83210185639137, -0.112174526640558 + 0.119794125930403 I, -0.112174526640558 - 0.119794125930403 I,
0.0918548511439717 + 0.128208290365490 I, 0.0918548511439717 - 0.128208290365490 I

```

##arvveina

Growing

```

> A := RandomLeslieMatrix(5, 5);
eigenvals(A);

```

$$A := \begin{bmatrix} 0. & 0.6900000000 & 3.810000000 & 1.310000000 & 0.7300000000 & 2.160000000 \\ 0.3700000000 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.6000000000 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.9400000000 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.5200000000 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.1600000000 & 0 \end{bmatrix}$$

```

1.13536160335772, -0.417592072454402 + 0.723633364189220 I, -0.417592072454402 - 0.723633364189220 I, -0.391630352764666,
0.0457264471578766 + 0.344585189715738 I, 0.0457264471578766 - 0.344585189715738 I

```

Growing

```

example PageRank(RandomMC),
> P := matrix([ [0.5, 0.2, 0.7/3, 0.8/3], [1/6, 0.4, 0.7/3, 0.8/3], [1/6, 0.2, 0.3, 0.8/3], [1/6, 0.2, 0.7/3, 0.2]]);

```

$$P := \begin{bmatrix} 0.5 & 0.2 & 0.2333333333 & 0.2666666667 \\ \frac{1}{6} & 0.4 & 0.2333333333 & 0.2666666667 \\ \frac{1}{6} & 0.2 & 0.3 & 0.2666666667 \\ \frac{1}{6} & 0.2 & 0.2333333333 & 0.2 \end{bmatrix}$$

```

> PageRank(P, 4);
[0.3151969894, 0.3151969895, 0.3151969895, 0.3151969895]

```

2.