C2 python ver

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page 12 Method1 eigen decomposition

```
import numpy as np
import numpy.linalg as ln

P = np.array([[0.7,0.5],[0.3,0.5]])
ln.eig(P.T)
```

```
## (array([1. , 0.2]), array([[ 0.70710678, -0.51449576],
##        [ 0.70710678,  0.85749293]]))
```

```
w, x_1 = np.linalg.eig(P)
x_1 = x_1[:, 0]
x_1
```

```
## array([0.85749293, 0.51449576])
```

```
v = x_1 / sum(x_1)
v
```

```
## array([0.625, 0.375])
```

page 15 Method2 System of linear equation

```
P = np.array([[0.7,0.3],[0.5,0.5]])
n = len(P)  #n=|S|
I = np.eye(2) #identity matrix
A = np.c_[P-I,np.repeat(1,n)]
b = np.append(np.repeat(0,n),np.array([1]))
A
```

```
## array([[-0.3,  0.3,  1. ],
##        [ 0.5, -0.5,  1. ]])
```

```
b
```

```
## array([0, 0, 1])
```

```
v = np.linalg.solve(np.dot(A,A.T),np.dot(A,b.T))
v
```

```
## array([0.625, 0.375])
```

page 17 Motivation

```
from sympy import *
p = Matrix([[0.7,0.3],[0.5,0.5]])
```

```
np.dot(P,P) #matrix multiplication
```

```
## array([[0.64, 0.36],
##        [0.6 , 0.4 ]])
```

```
p**3
```

```
## Matrix([
## [0.628, 0.372],
## [ 0.62,  0.38]])
```

```
p**4
```

```
## Matrix([
## [0.6256, 0.3744],
## [ 0.624,  0.376]])
```

```
p**20
```

```
## Matrix([
## [0.625000000000003, 0.374999999999996],
## [0.624999999999993, 0.375000000000006]])
```

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```
p = Matrix([[0,1],[1,0]])
```

```
p**2
```

```
## Matrix([
## [1, 0],
## [0, 1]])
```

```
p**3
```

```
## Matrix([
## [0, 1],
## [1, 0]])
```