Take a Markov transition matrix P_k for a k period time gap. We are interested in finding the transition matrix for a j gap, with j different from k.

For any well-behaved transition matrix, we have

$$P_k = V\Lambda_k V^{-1}$$

where Λ_k is a diagonal matrix with eigenvalues on the diagonal and V is the matrix of eigenvectors.

It is easy to show that $P_j = V\Lambda_k^{j/k}V^{-1}$.

In [1]:
```
import numpy as np

# input matrix
Ptwo = np.ones((2,2))
Ptwo[0,0] = 0.8
Ptwo[0,1] = 0.2
Ptwo[1,0] = 0.1
Ptwo[1,1] = 0.9
print "two-year transition = \n",Ptwo
```

```
two-year transition =
[[ 0.8  0.2]
 [ 0.1  0.9]]
```

In [2]:
```
# get eigen values and vectors
w,v = np.linalg.eig(Ptwo)
```

In [3]:
```
print w
```

```
[ 0.7  1. ]
```

In [4]:
```
print v
```

```
[[-0.89442719 -0.70710678]
 [ 0.4472136  -0.70710678]]
```

In [5]:
```
sw = np.diag(np.sqrt(w))
```

In [6]:
```
Pone = np.dot(np.dot(v, sw) , np.linalg.inv(v))
```

In [7]:
```
print "one-year transition = \n",Pone
```

```
one-year transition =
[[ 0.89110668  0.10889332]
 [ 0.05444666  0.94555334]]
```

In [8]:
```
Ptwo_check = np.dot(Pone,Pone)
print "check for two transitions \n", Ptwo_check
```

```
check for two transitions
[[ 0.8  0.2]
 [ 0.1  0.9]]
```

In [ ]: