LINEAR ALGEBRA MINI PROJECT
ON
MARKOV CHAINS

Anup N : PES1201800283
K. Sreesh Reddy : PES1201801580

MARKOV PROCESS

$$\mathbf{x}_2 = M\mathbf{x}_1 = M(M\mathbf{x}_0) = M^2\mathbf{x}_0$$

$$\mathbf{x}_3 = M\mathbf{x}_2 = M(M^2\mathbf{x}_0) = M^3\mathbf{x}_0$$

$$\vdots$$

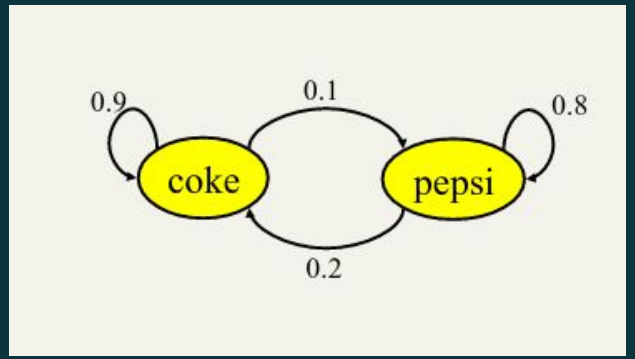
$$\mathbf{x}_k = M^k\mathbf{x}_0$$

INTRODUCTION

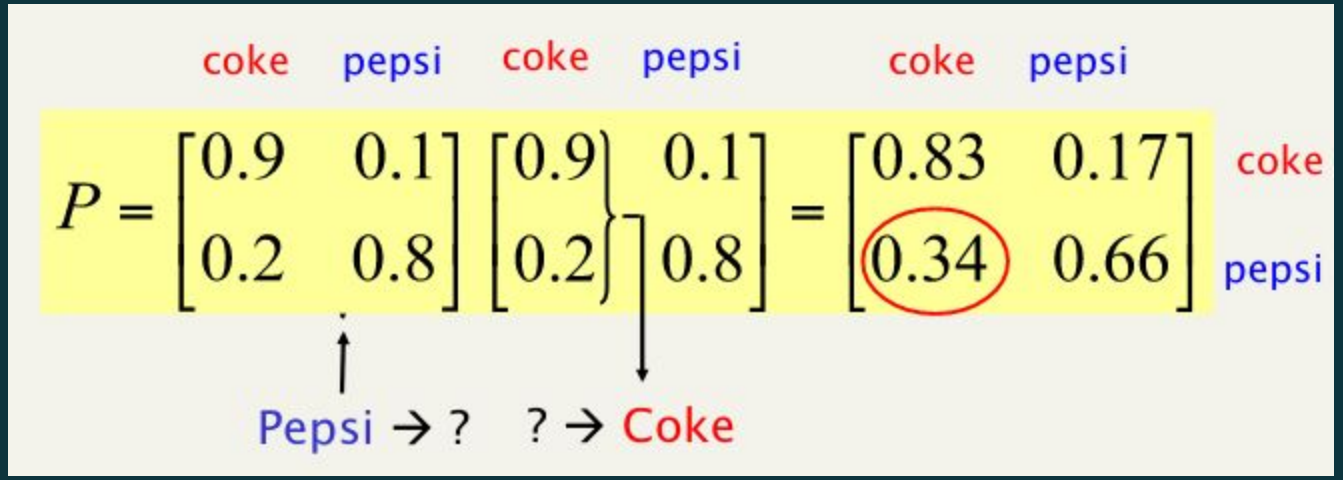
COKE VS PEPSI EXAMPLE :

- Given that a person's last purchase was Coke, there is a 90 % chance that his next cola purchase will also be a Coke.
- If a person's last cola purchase was Pepsi, there is an 80% chance that his next cola purchase will also be Pepsi.
- Transition Matrix :

	coke	pepsi
coke	0.9	0.1
pepsi	0.2	0.8



Given that a person is currently a Pepsi purchaser, what is the probability that he will purchase Coke two purchases from now ?



Given that a person is currently a Coke purchaser, what is the probability that he will purchase Pepsi three purchases from now ?

$$P^3 = \begin{matrix} \\ \text{coke} \\ \text{pepsi} \end{matrix} \begin{matrix} \begin{matrix} \text{coke} & \text{pepsi} \end{matrix} \\ \begin{bmatrix} 0.9 & 0.1 \\ 0.2 & 0.8 \end{bmatrix} \end{matrix} \begin{matrix} \begin{matrix} \text{coke} & \text{pepsi} \end{matrix} \\ \begin{bmatrix} 0.83 & 0.17 \\ 0.34 & 0.66 \end{bmatrix} \end{matrix} = \begin{matrix} \begin{matrix} \text{coke} & \text{pepsi} \end{matrix} \\ \begin{bmatrix} 0.781 & 0.219 \\ 0.438 & 0.562 \end{bmatrix} \end{matrix} \begin{matrix} \\ \text{coke} \\ \text{pepsi} \end{matrix}$$

PROBLEM

- Utilise Markov chains to predict Election Polls and help parties build strategies accordingly.

- Markov chains to predict the nature of Financial Markets.

Motivation—suppose in a given urban area, each year 5% of the city population moves to the suburbs and 3% of the suburban population moves to the city. If the current city population is 600,000 and the current suburban population is 400,000, what will the population of each be in one year?

City: .95*(city population) + .03*(suburban population)

$$.95(600,000) + .03(400,000) = 582,000$$

Suburban: .05*(city population)+.97*(suburban population)

$$.05(600,000) + .97(400,000) = 418,000$$

SCILAB

```
-> T = [ 0.7 0.1 0.3 ; 0.2 0.8 0.3 ; 0.1 0.1 0.4 ]
T  =

  0.7   0.1   0.3
  0.2   0.8   0.3
  0.1   0.1   0.4

->

-> [c,d] = spec(T);

-> disp("The Eigen-values are:",spec(T));

 "The Eigen-values are:"

  1.  + 0.i
  0.6 + 0.i
  0.3 + 0.i
```

Calculating eigenvalues of matrix

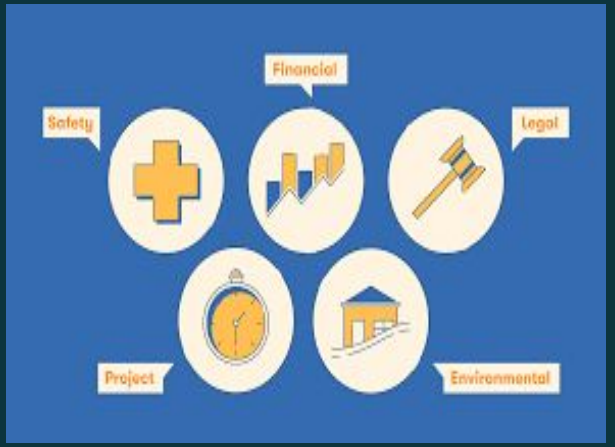
```
M  =

  0.9    0.075   0.025
  0.15   0.8     0.05
  0.25   0.25    0.5

--> H = [0 1 0]
H  =

  0.   1.   0.

--> // CALCULATING PROBABILITIES AFTER WEEK 1

--> H*M
ans  =

  0.15   0.8   0.05

--> // CALCULATING PROBABILITIES AFTER WEEK 5

--> H*(M^5)
ans  =

  0.47661   0.450515   0.072875

--> // CALCULATING PROBABILITIES AFTER WEEK 52

--> H*(M^52)
ans  =

  0.6249999   0.3125001   0.0625

--> // CALCULATING PROBABILITIES AFTER WEEK 99

--> H*(M^99)
ans  =

  0.625   0.3125   0.0625
```

Calculating future state vectors

FUTURE WORK

ANALYSING THE RISK IN CONSTRUCTION PROJECTS :

- Issues with construction projects usually affect the aspects such as cost and time.
- Diminish the risk of construction projects by utilization of data from previous works.
- Utilize Markov chain procedure to evaluate short and long term risk



THANK YOU