

- ① Class overview & expectations :
- Syllabus (rough)
 - quals
 - Matlab
 - Hws/Exams
 - Dates

- ④ Overview of Awesome : ODE examples : Fluids & FTLE
Chaos & Dynamical Systems
Applications in controls
Very large systems of equations

Entirely new language to interact w/
natural world

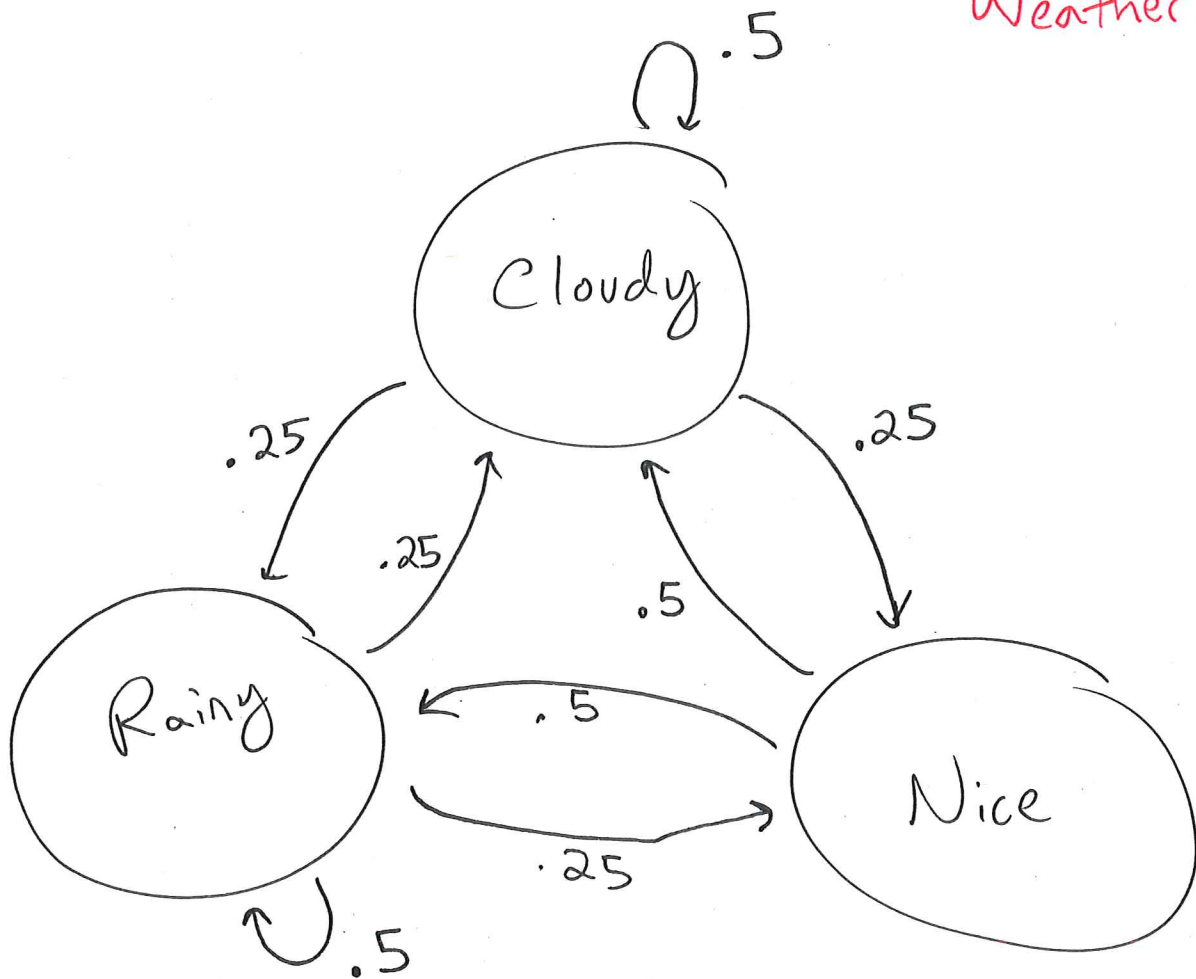
We make connections between very different
& interesting fields : fluids, energy, neuroscience
medical devices

- ② A bit about me : this is my favorite thing to do.

- ③ Poll Students about background

- ⑤ Some examples : $\dot{x} = ax$ (Next Lecture!)

Weather Model



$$X_{\text{tomorrow}} = A X_{\text{today}} = \begin{bmatrix} .5 \\ 0 \\ .5 \end{bmatrix}$$

$$X_{\text{today}} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \begin{matrix} R \\ N \\ C \end{matrix}$$

$$A = \begin{bmatrix} R_{\text{tod}} & N_{\text{tod}} & C_{\text{tod}} \\ .5 & .5 & .25 \\ .25 & 0 & .25 \\ .25 & .5 & .5 \end{bmatrix} \begin{matrix} R_{\text{tom}} \\ N_{\text{tom}} \\ C_{\text{tom}} \end{matrix}$$

x_1 x_2 x_3 ... x_N
|| ||

$\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$

Ax_1 A^2x_1 ... $A^{N-1}x_1$

Weather
today

Day 2

Day 3

...

Day N

```
clear all, close all, clc
```

```
A = [0.5 0.5 0.25;  
     0.25 0 0.25;  
     0.25 0.5 0.5];
```

```
xtoday = [1; 0; 0]; % today is rainy
```

```
for i=1:50  
    xtomorrow = A * xtoday  
    xtoday = xtomorrow;  
end
```

4/5

For next time, please remind yourself

of : - Power Law $\frac{d}{dx} x^n$

- Chain Rule $\frac{d}{dx} f(g(x))$

- $\dot{x} = ax$