

# ECE 314: Probability with Engineering Application Lab

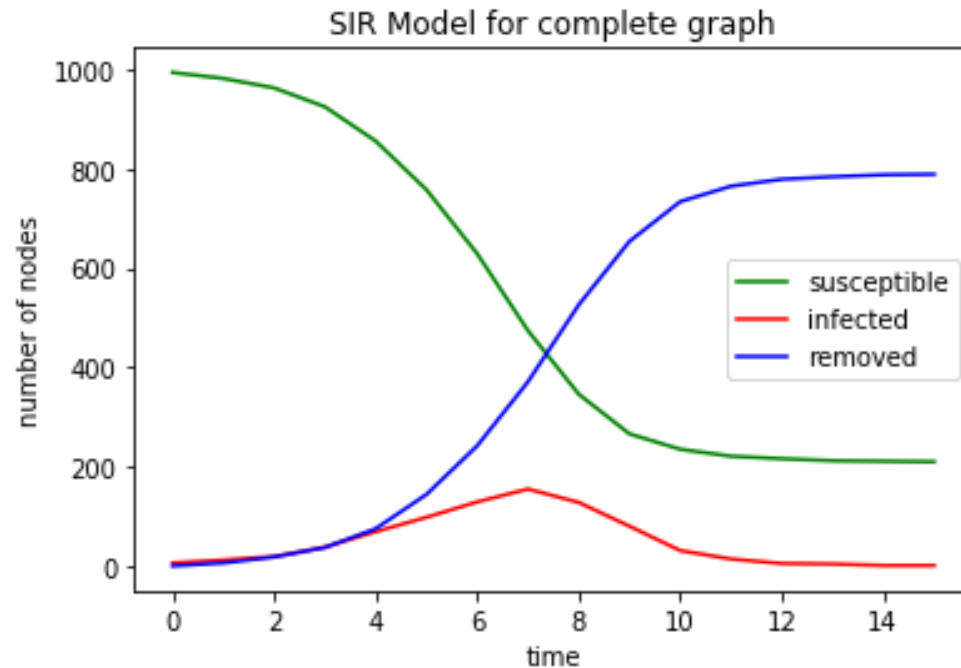
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# Course Goal

- Show students how to solve problems involving uncertainty through reasoning and computer programming.
- For example, you will be modeling the spread of a virus,
- using “SIR Model”
- Hope you enjoy the course!



# Course content

- 1 mini lecture, 1 quiz, 1 lab, every week (except the first, more on this later)
- Lecture: Refer to videos on Blackboard (no live video)
- Lab: “Content” session on Blackboard
  - Python Jupyter notebooks. Solve the problems and submit back to Blackboard.
  - Due each Tuesday midnight.
  - Lab 0 to get you familiar with Python Jupyter Notebook (which you already are).
  - Lab 1 and Lab 2 **both due** on Feb. 25<sup>th</sup>

# Course content (cont'd)

- Quiz: “Quiz” session on Blackboard
  - Test basic concepts in the last lab. No quiz for the last lab (Lab 14)
  - Available 10:00-10:10 a.m. each Tuesday
  - Time limited to 10 minutes.
  - One trial allowed. No cooperation allowed.
  - Quiz 0 at 10:00 a.m. on Feb 18<sup>th</sup>. Will not count into grades.
  - Quiz 1-2 on Feb 25<sup>th</sup>. **20** minutes.
- No makeup day on April 11<sup>th</sup>.

# Lab 1: Introduction to Python and Probability

- Random Variable
  - Definition
  - Representation
    - Table
    - pmf (probability mass function)
    - CDF (Cumulative Distribution Function)
  - In Python
    - Create as an object
    - Use its methods

# Lab 1: Introduction to Python and Probability

- Random Variable: Definition
  - A variable whose value is random
  - e.g. -tossing a die
  - -tossing a coin
  - -the temperature in your room

# Lab 1: Introduction to Python and Probability

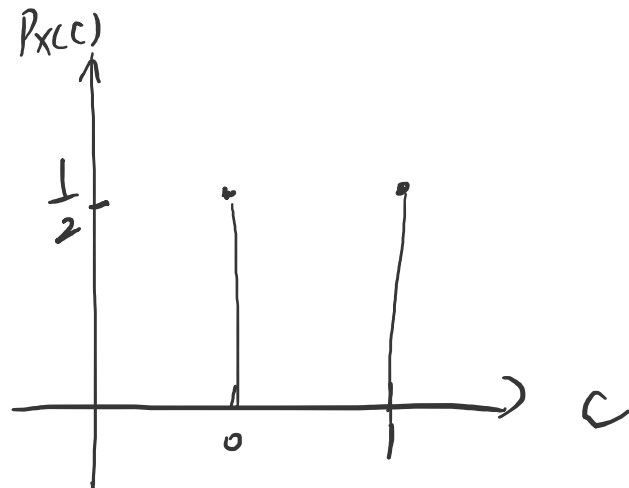
- Random Variable: Representation
  - Toss a fair coin, Head = 1, Tail = 0.
  - Table

$c$	$0$	$1$
$p$	$\frac{1}{2}$	$\frac{1}{2}$

# Lab 1: Introduction to Python and Probability

- Random Variable: Representation
  - pmf (probability mass function)

$$P_X(c) = P\{X = c\}$$





# Lab 1: Introduction to Python and Probability

- Random Variable: Representation

- CDF (Cumulative Distribution Function)

$$F_X(c) = P\{X \leq c\}$$

① Non-decreasing

②  $F(-\infty) = 0$

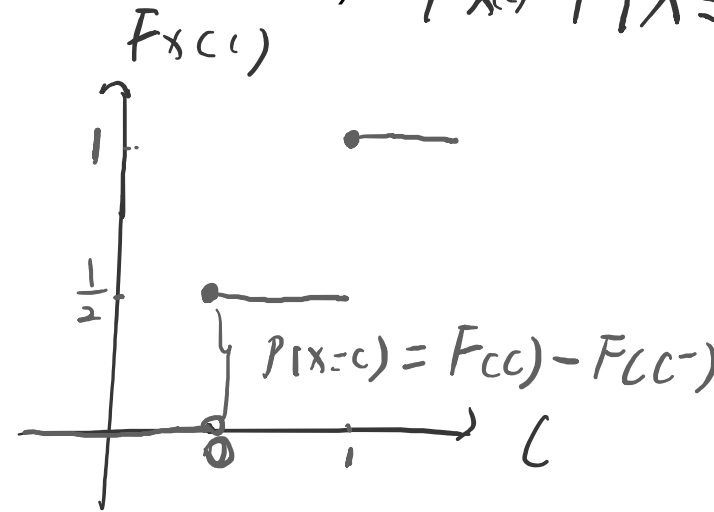
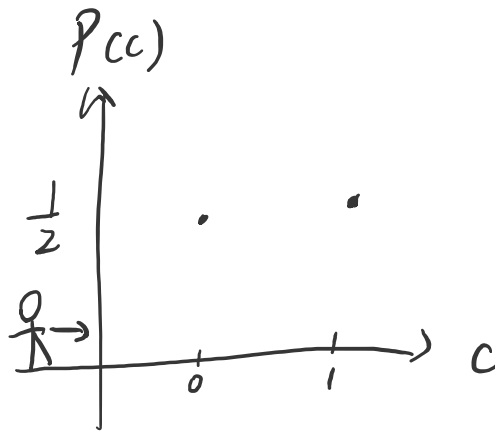
$F(+\infty) = 1$

③  $F$  is right continuous

$$F(c) = F(c^+)$$

$$F(c) = \sum_{w: w \leq c} P(w)$$

$$P(c) = F(c) - F(c^-)$$



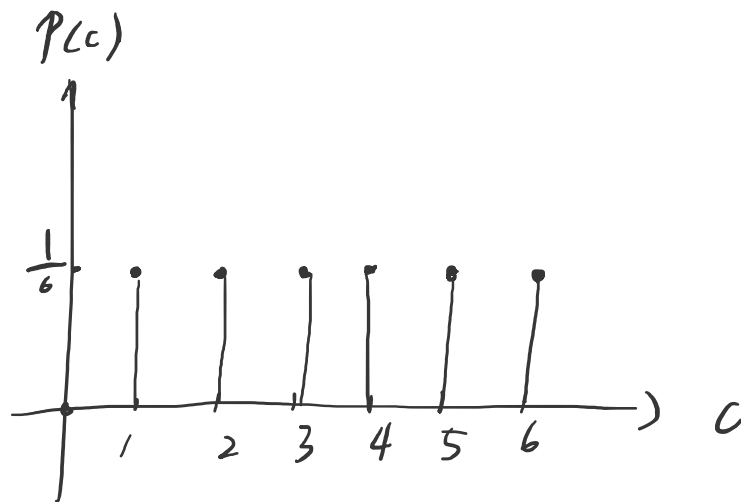
$$P\{X < 0\} + P\{X = 0\} = \frac{1}{2}$$

# Lab 1: Introduction to Python and Probability

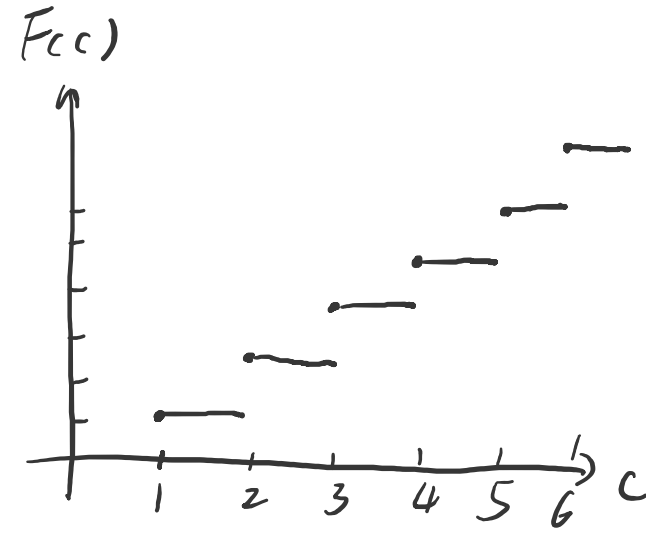
- Rolling a fair die

$c$	1	2	3	4	5	6
$p$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

pmf



CDF



# Lab 1: Introduction to Python and Probability

- In Python: Create as an object
  - $X = \underbrace{\text{scipy.stats.bernoulli}(0.5)}_{\text{module}}$
  - Think of  $X$  as a virtual coin that exists in the computer
- Use the object's methods:
  - $X.\text{mean}()$  →
  - $X.\text{var}()$  →
  - $X.\text{pmf}()$  →

# What you will do next:

- Prepare your Jupyter Notebook (Version 2.7 rather than 3.7):  
<https://www.anaconda.com/distribution/>
- Take Quiz 0 at 10:00 on Feb 18<sup>th</sup> and Quiz 1-2 on Feb 25<sup>th</sup>
- Submit your Lab 1 and Lab 2 before Feb 25<sup>th</sup> 23:59.

# Questions?

- Feel free to post on Piazza:  
<https://piazza.com/zju.edu.cn/spring2020/ece313314/home>
- Or email us.
  - Prof. Mark D. Butala: [markbutala@intl.zju.edu.cn](mailto:markbutala@intl.zju.edu.cn)
  - Haonan Chen: [haonanchen@intl.zju.edu.cn](mailto:haonanchen@intl.zju.edu.cn)
  - Yuhang Ren: [yuhangren@intl.zju.edu.cn](mailto:yuhangren@intl.zju.edu.cn)