Lecture 2.

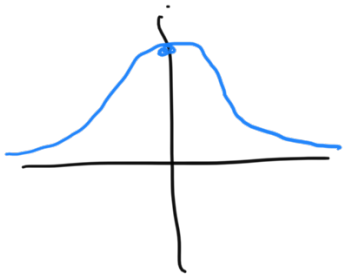
Central Limit Thm: $X_1, X_2, X_3, \ldots$ indep, identically dist r.v. $Ave(X_i)=0$, $var(X_i)=$

$$\frac{X_1 + \ldots + X_n}{\sqrt{n}} \longrightarrow \text{Standard normal dist.}$$

as $n \to \infty$.

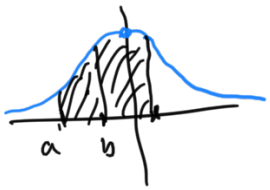
Normal Distribution

Define in terms of its probability Density Function (pdf).



$$f(x) = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}$$

Standard normal



What does Prob. Density Function mean?

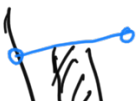
Suppose $X \sim N(0,1)$ "is standard normal"

(0 = Average, 1 = Variance)

$$Prob(X \in [a,b]) = \int_a^b F(x)\,dx.$$

$$= \int_a^b \frac{1}{\sqrt{2\pi}} e^{-x^2/2}\,dx$$

PdF For $\mathcal{U}(0,1)$ uniform



$$g(x) = \begin{cases} 1 & \text{if } x \in (0,1) \\ 0 & \text{otherwise} \end{cases}$$

$$\text{Prob}(Y \in [a,b]) = \int_a^b g(x)\,dx$$

Assume $0 \le a \le b \le 1$

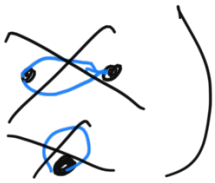
$$= \int_a^b 1\,dx = x\Big|_a^b = b - a$$

New Topic: Graph Theory aka Network

Vertices (aka nodes)

Edges: each edge connects a pair of different vertices

↑ (No multiple edges, No self-edges)



Examples

(1) Facebook: (or any social network)

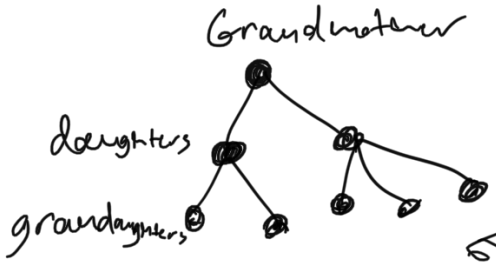
Vertices: people

Edges: Two people share an edge if they are friends

(2) Genealogy

Vertices: people

Edge: Two people share an edge if one is parent of the other

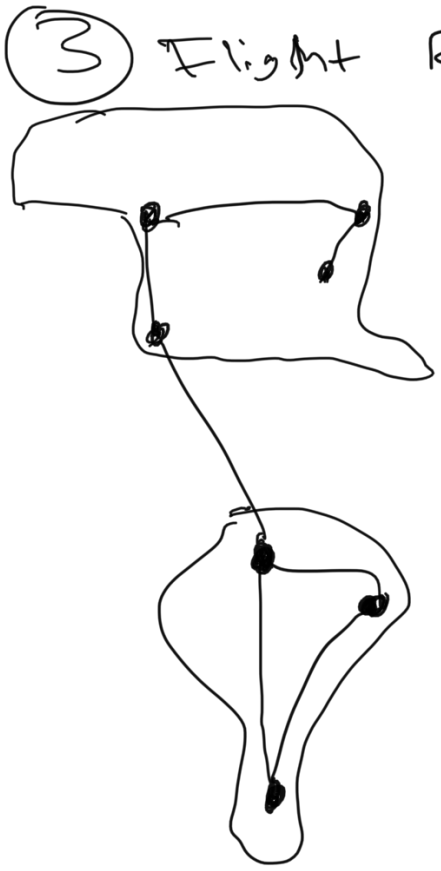


← Graph like this never

Has any loops

Such a graph is called a tree.

3 Flight Routes



Vertices: cities

Edges: Two cities connected if there's a flight between