


Chapter 2: Probability

Mehdi	Lebdi	Southwest
Yifan	Li	East
Brandon	Lockhart	Back
Jialin	Lu	Back
Navaneeth	M.	Southwest
Arjun	Mahadevan	Northeast
Seyed Mohammad	Nourbakhsh	Northeast
Shuman	Peng	Back
SeyedHamed (Hamed)	RahmaniKhezri	Southwest
Rhea	Rodrigues	Southwest
Mohammadsadegh	Saberian	Northeast
Amir Hosein	Safari	Southeast
Bahar	Salamatian	West
Xiaoyu (Atticus)	Shi	West
Hamed	Shirzad	Middle
Neda	Shokraneh Kenary	Back
Xiangyu (Shawn)	Sun	Northwest
Chhavi	Verma	East
Lai	Wei	East
Andrew	Wesson	Northwest
Yi	Xie	Back
Ke (Jack)	Zhou	Southeast
Randall	Pyke	Middle

First	Last	W2
Niloufar	Abharigolsefidi	East
Mohammad Amin	Arab	Middle
Vahid Reza	Asadi	Southwest
Puria	Azadi Moghadam	Northwest
Adam	Banks	East
Evgeni (Eugene)	Borissov	Southeast
Logan	Born	West
Philip	Cho	Back
Peiyu	Cui	Middle
Adriano (Adrian)	D'Alessandro	Southwest
Ruizhi	Deng	Northwest
Mihir	Gajjar	Southeast
Atia	Hamidi Zadeh	Northeast
Fatemeh	Hasiri	West
Sha	Hu	Northwest
Xiang	Huang	Southeast
Salman	Imtiaz	West
Mohammadmahdi	Jahanara	Middle
Matthew	Jung	Northeast
Amogh	Kallihal	Middle
Arash	Khoeini	Southeast



Assuming a normal distribution

"This is gonna work Steve."

"I know it is, because I don't know
what I'm gonna do if it doesn't."

Probability: events

$$P(A)$$

Probability: random variables

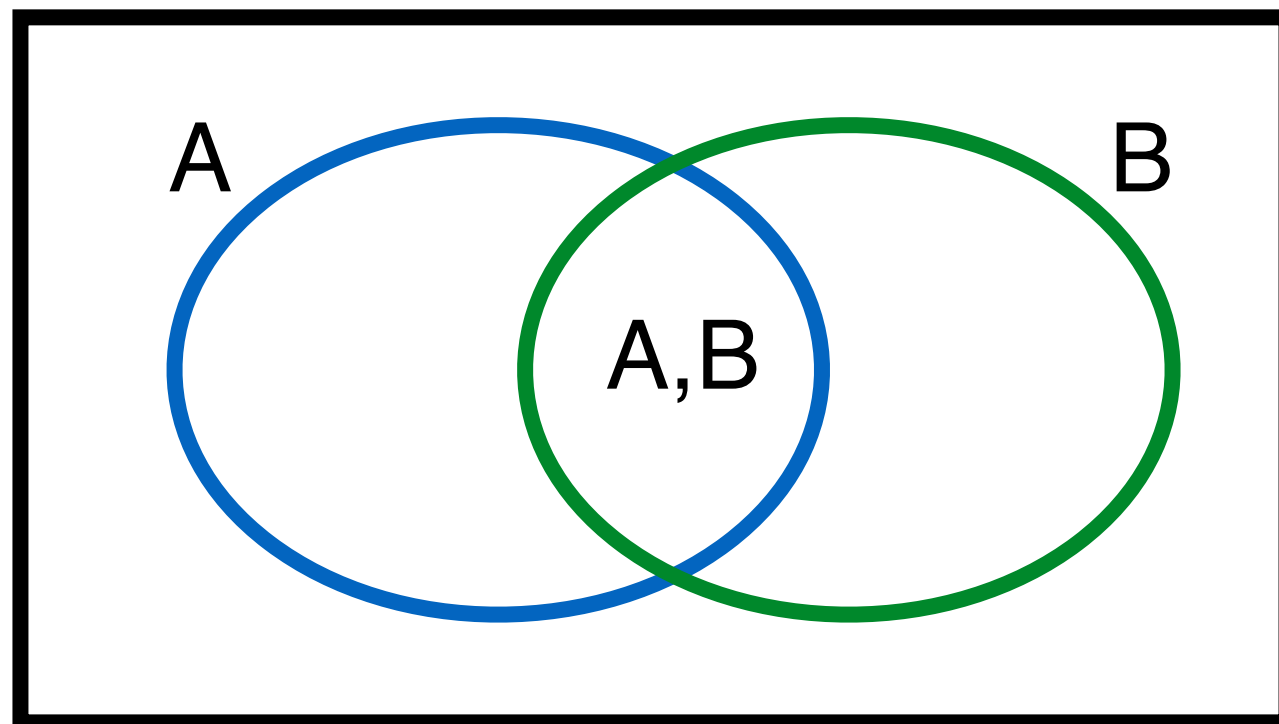
X = Rains tomorrow (true or false)

Y = Amount of rain tomorrow (in inches)

$$P(X = \text{true}) = 0.98$$

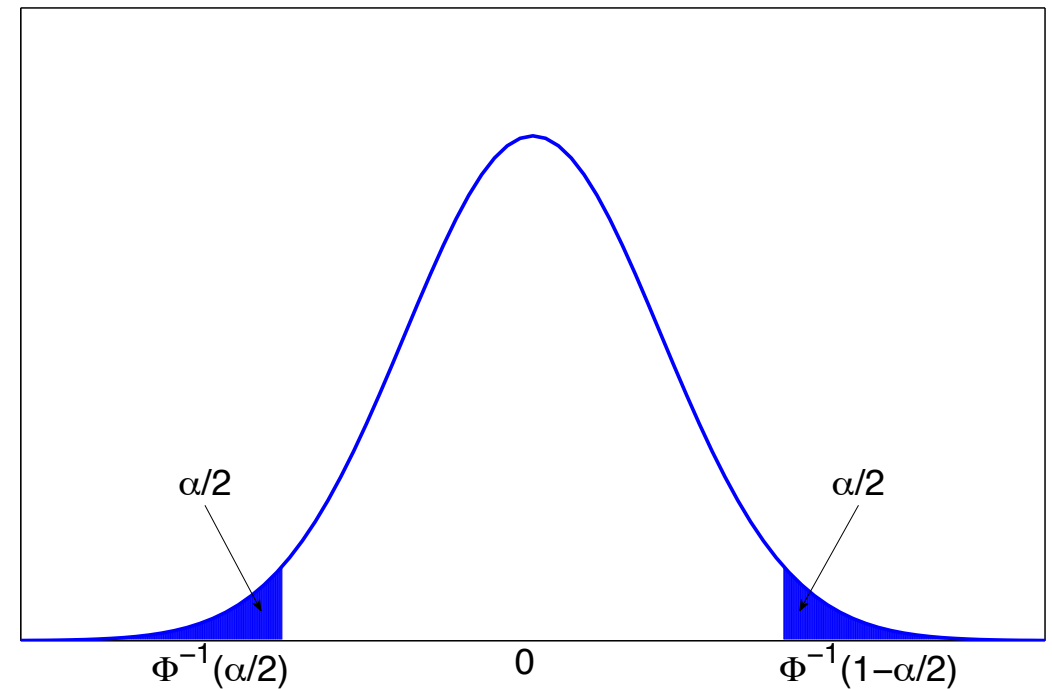
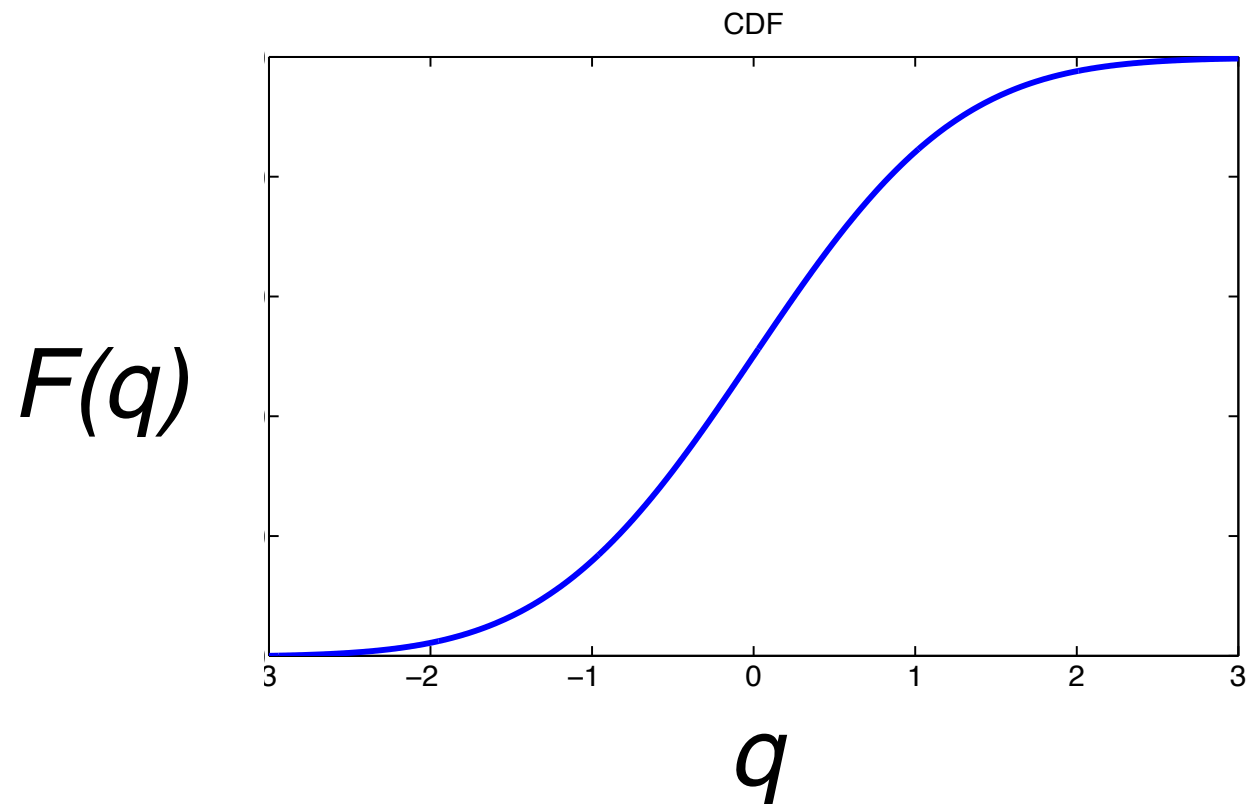
$$P(Y > 2) = 0.75$$

Joint and conditional probability



Chain rule

Continuous random variables



$$F(q) \equiv p(Y \leq q)$$

$$p(x) = \frac{d}{dx} F(x)$$

$$p(Y = 2) = 2.3$$

Question 2.1

My neighbor has two children.

- a) Suppose I ask him whether he has any boys and he says yes. What is the probability that one child is a girl?
- b) Suppose instead that I happen to see one of his children run by and it is a boy. What is the probability that the other child is a girl?

Question 2.4

After your yearly checkup, the doctor has bad news and good news. The bad news is that you tested positive for a serious disease, and that the test is 99% accurate (i.e. it gives the opposite result 1% of the time). The good news is that this is a rare disease, striking one in 10,000 people. What are the chances that you actually have the disease?

Question 3

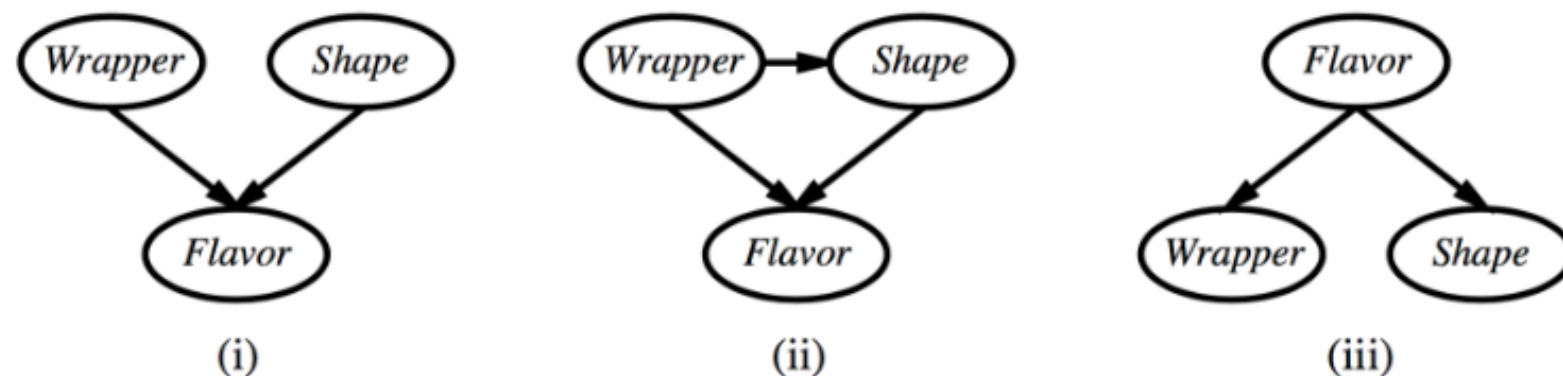
Suppose you are given a coin that lands heads with probability x and tails with probability $(1-x)$. Are the outcomes of successive flips independent given you know x ? What about if you don't know x ?

Question 4

The Surprise Candy company makes candy in two flavors: 70% are strawberry flavor and 30% are anchovy flavor. Each new piece of candy starts out with a round shape; as it moves down the production line, a machine randomly selects a certain percentage to be trimmed into a square; then, each piece is wrapped in a wrapper whose color is chosen randomly to be red or brown. 80% of strawberry candies are round and 80% have a red wrapper, while 90% of the anchovy candies are square and 90% have a brown wrapper. All candies are sold individually in sealed, identical black boxes.

Now you, the customer, have just bought a Surprise candy at the store but have not yet opened the box.

Consider these three Bayes nets.



- a) Which network(s) can correctly represent $p(\text{Flavor}, \text{Wrapper}, \text{Shape})$?
- b) Which network is the best representation?
- c) True/False: Network (i) asserts that $p(\text{Wrapper} \mid \text{Shape}) = p(\text{Wrapper})$.
- d) What is the probability that your candy has a red wrapper?
- e) In the box is a round candy with a red wrapper. What is the probability that the flavor is strawberry?
- f) An unwrapped strawberry candy is worth x on the open market and anchovy is worth a . Write an expression for the value of an unopened candy box.