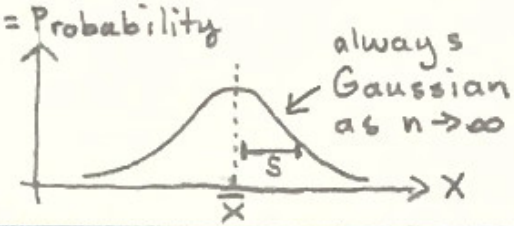
③ Randomness:

$$X(t) = X_1(t) + X_2(t) + X_3(t) + \cdots X_n(t)$$

even more random! ↑ ↑ random variable

Central Limit Theorem:



$\bar{X} = \bar{X}_1 + \bar{X}_2 + \cdots$ is the average

$s^2 = s_1^2 + s_2^2 + \cdots$ gives the standard deviation s

④ Bayesian inference:

The statistics of "what if?"

example: coin toss } THTTHTHHTTTHHTHH ··· vs. TTHHTTHHTTHHTT ···

Will H happen IF two Ts just happened?

Bayes' formula:

$$P(A|B) = P(B|A) \cdot \frac{P(A)}{P(B)}$$

← Probability A happens; ← Probability B happens

↑ Probability that A happens if B is true; ↑ Probability that B happens if A is true

Example of how to use IF = conditional probability:

"Lauda won 3 times out of 4 races against Hunt"

Who do you bet on, what odds?

Let P(B) be the chance Hunt wins.

P(B) = 0.25, so odds are 3:1 against Hunt and you bet on Lauda!

WHAT IF Hunt drives better than Lauda in rain. The 1 out of 4 times Hunt won, it rained. The forecast for race 5 is hard rain.

Now who do you favor?

Let A = "it rains" and B = "Hunt wins"

$$P(B|A) = P(A|B) \cdot \frac{P(B)}{P(A)} = 1 \cdot \frac{0.25}{0.25} = 1$$

↑ Hunt wins if it rains; ↑ It rains if Hunt wins

Bet on Hunt!

What if Hunt loses after all? Bayes can be updated:

$$P(B|A) = 1 \cdot \frac{0.2}{0.4} = 0.5$$

The odds are still even.