https://www.youtube.com/watch?v=qj_6UNDMmBI

UNIVERSITY OF OXFORD

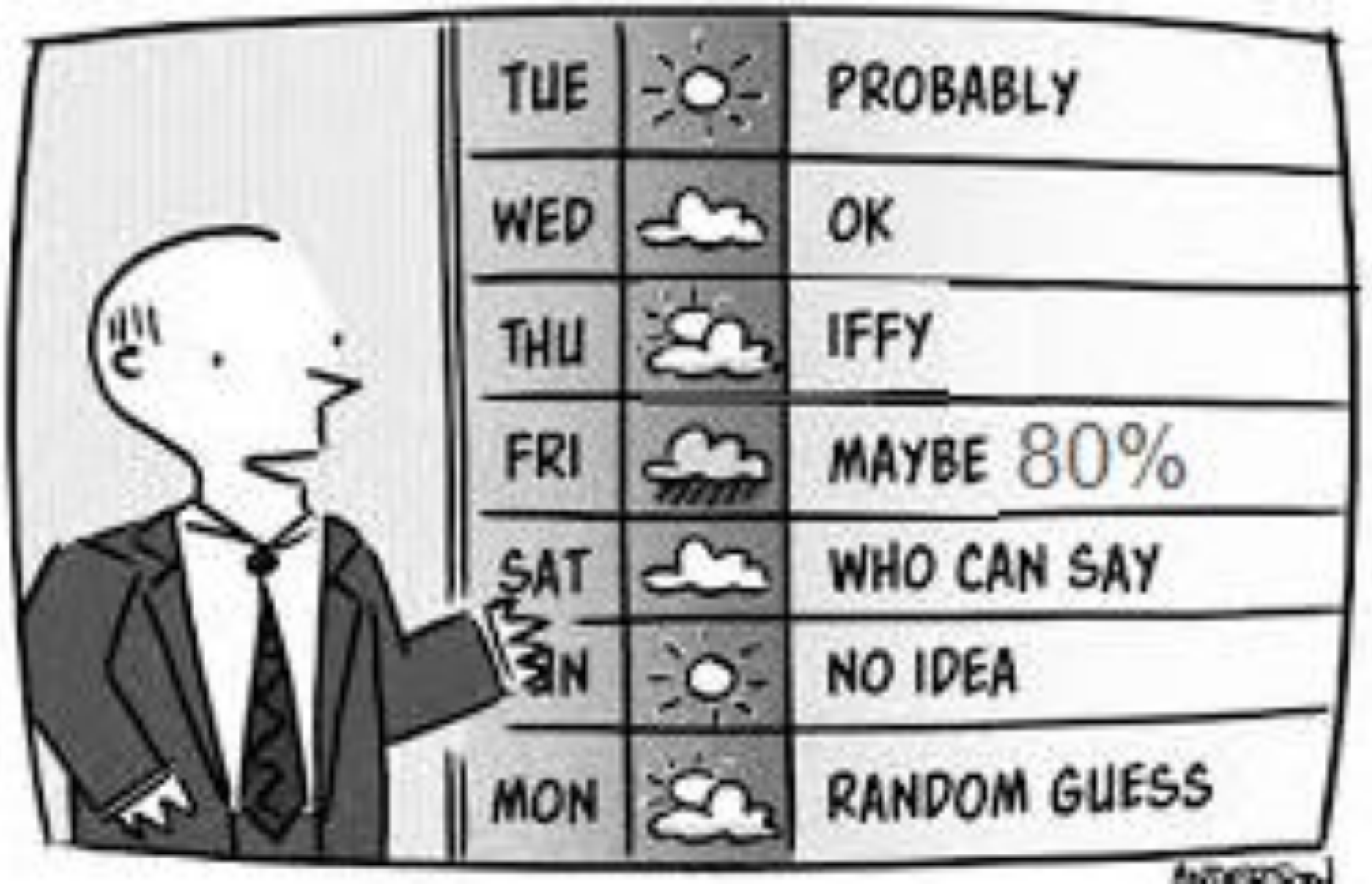
DEPARTMENT OF STATISTICS

Walking in Oxford on a cold and rainy day

With prof. Matthias Winkel

80% chance of rain

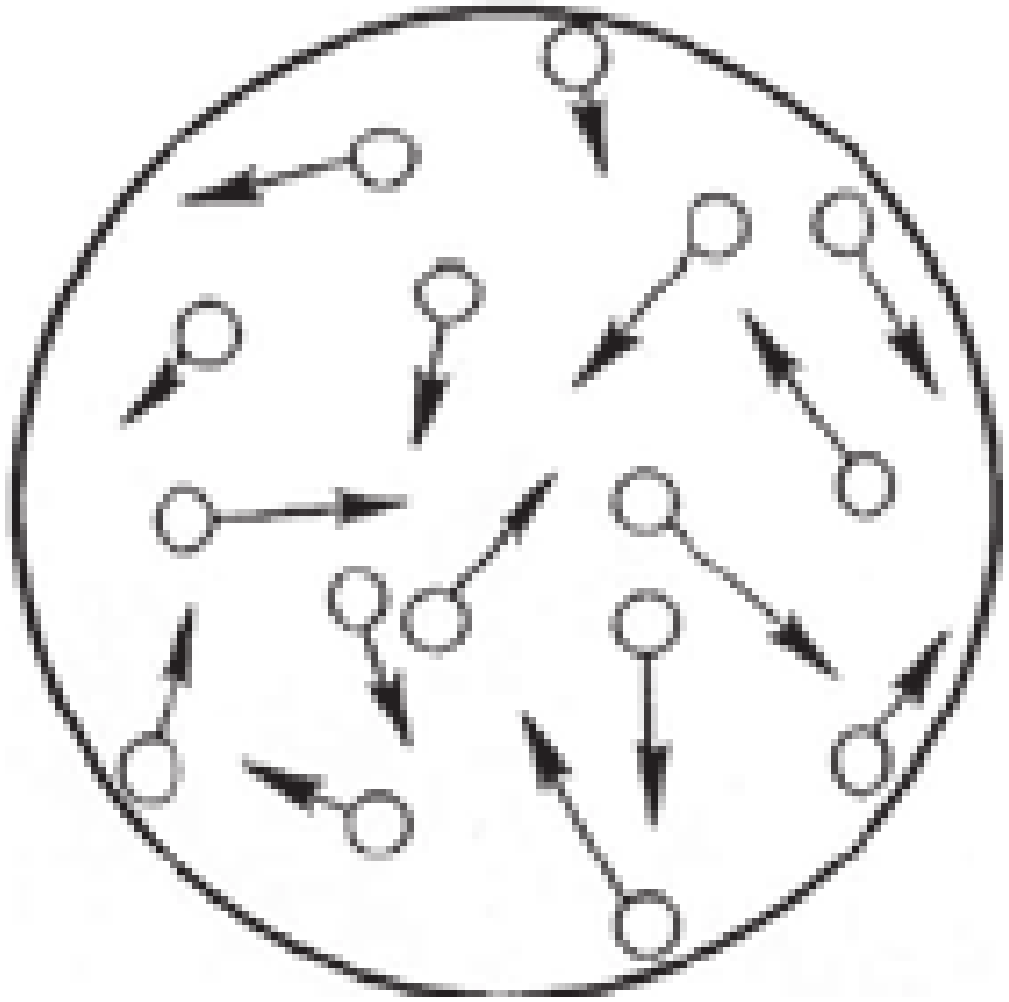
says the Met Office in its weather forecast for Oxford an 80% chance of rain.

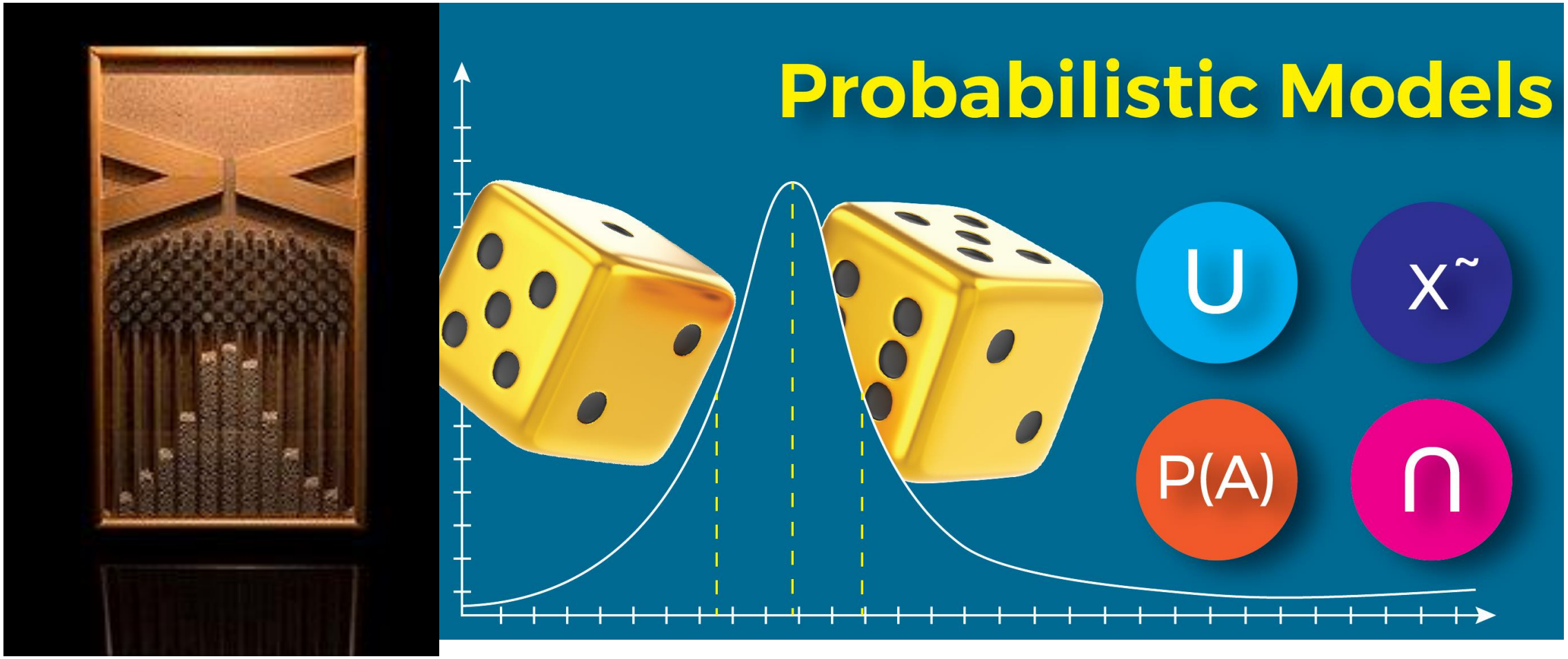


Is weather random?

That's some philosophical questions here.

In the real world many things, that we don't fully understand or fully observe, may appear to be random.




Probabilistic Models
U
X̃
P(A)
∩

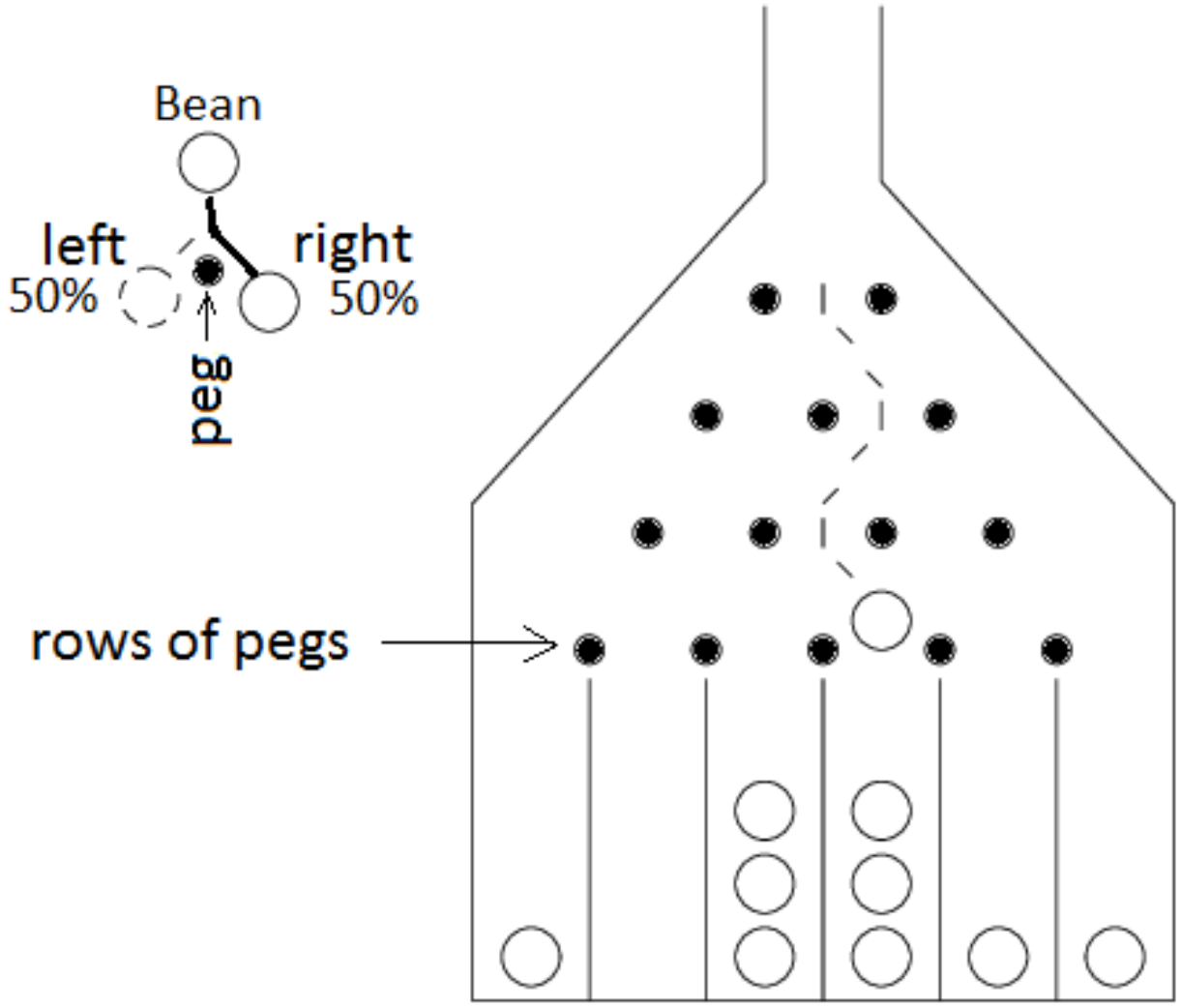
Bean machine

Consists of a vertical board with interleaved rows of pegs.

Beans are dropped from the top and, when the device is level, jumped either left or right as they hit the pegs.

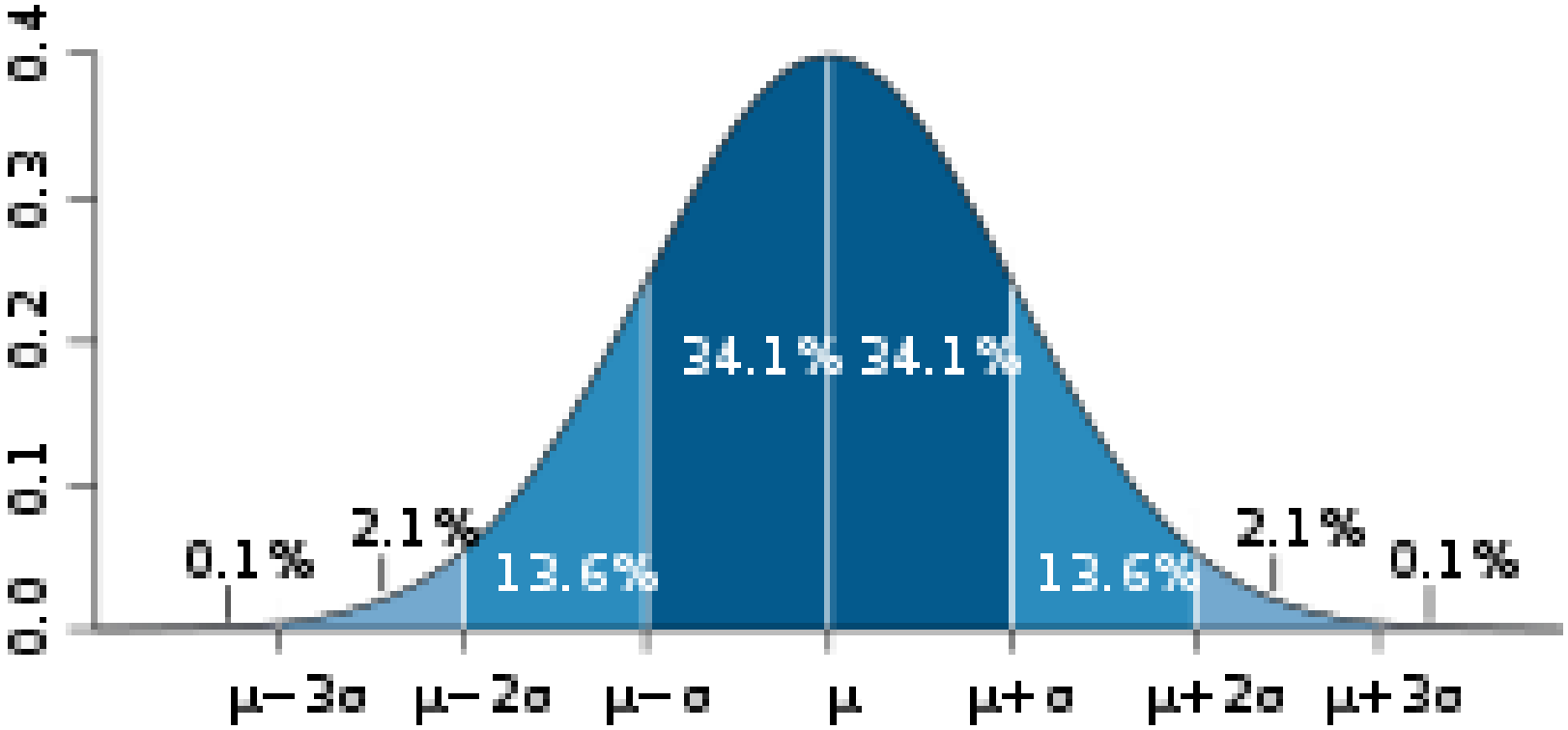
And they are collected into bins at the bottom,

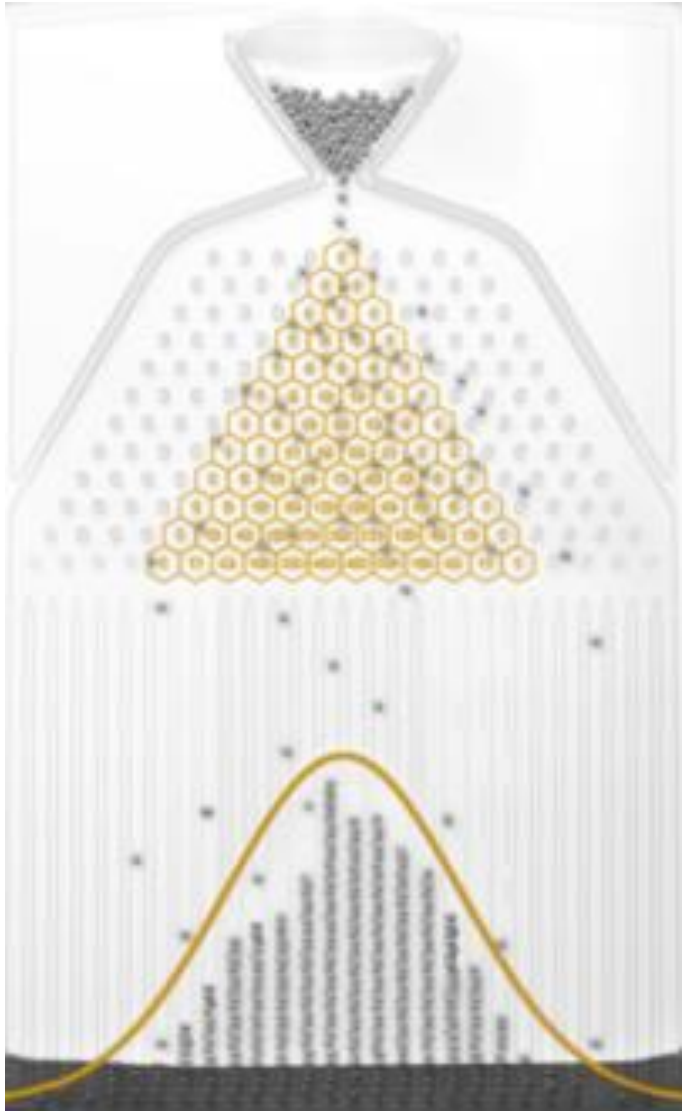
where the height of bead columns, accumulated in the bins, approximate a bell curve.

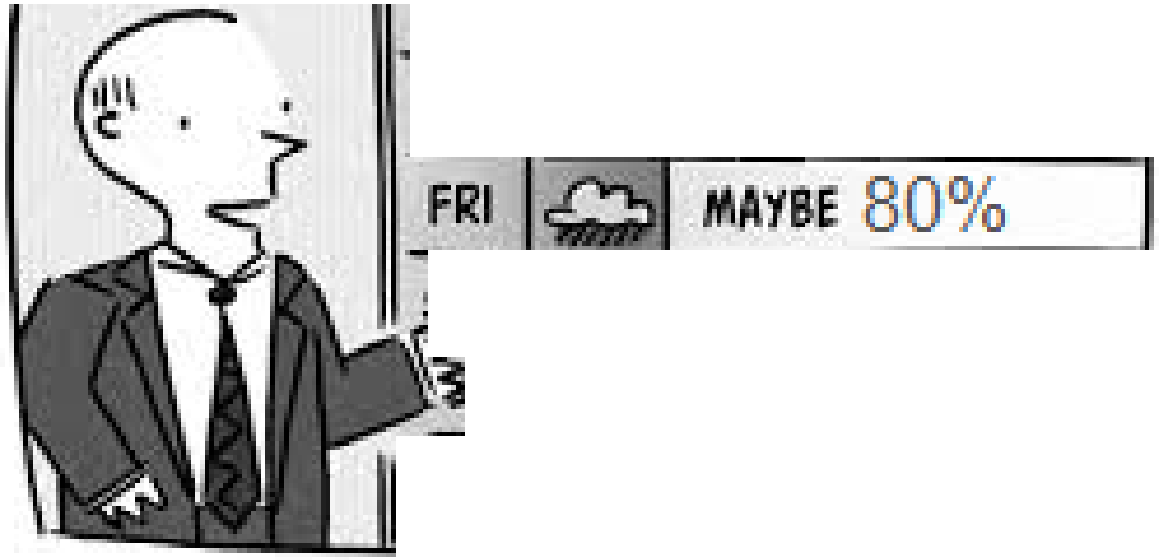


https://en.wikipedia.org/wiki/File:Galton_box.webm

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

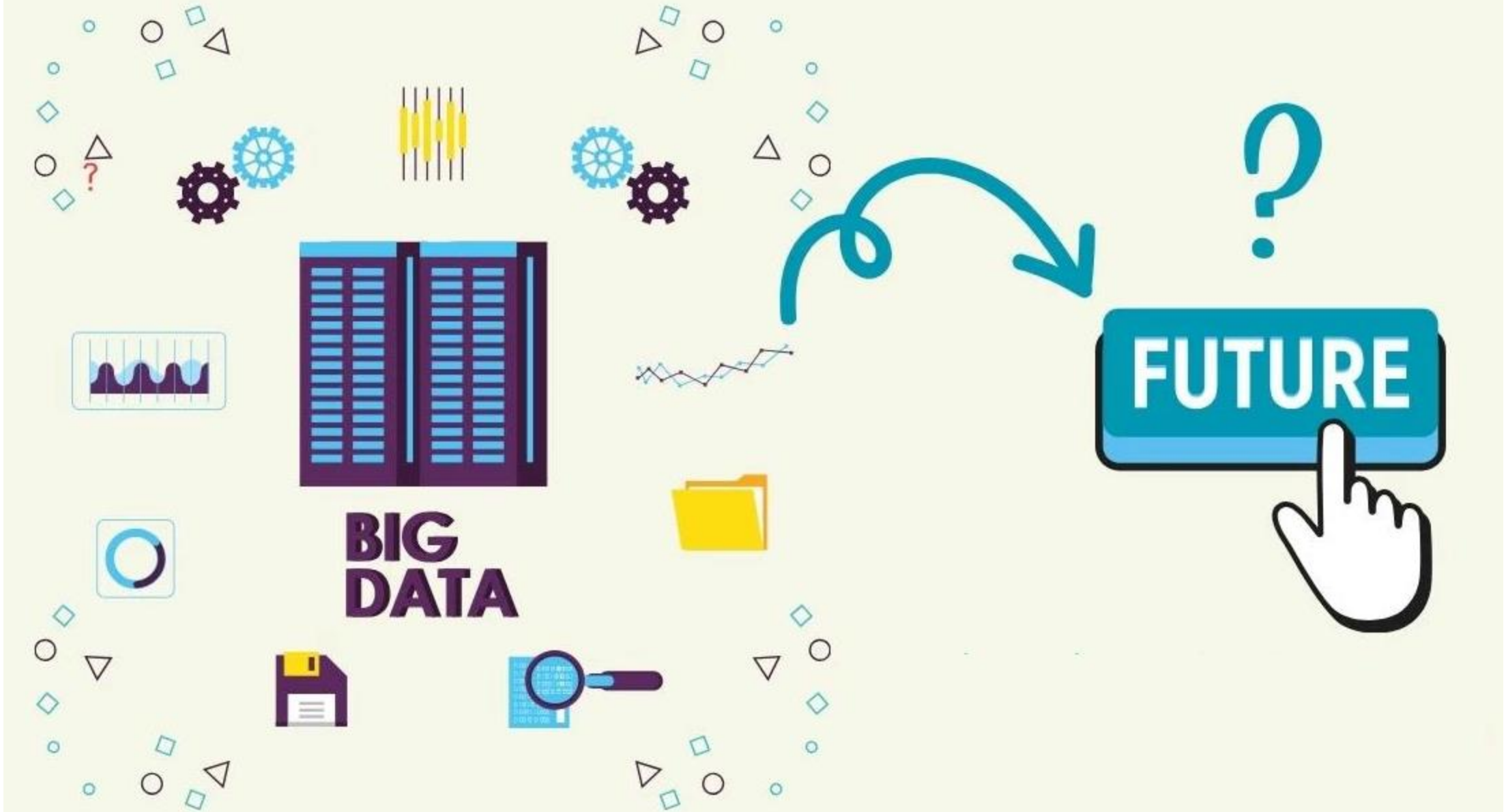




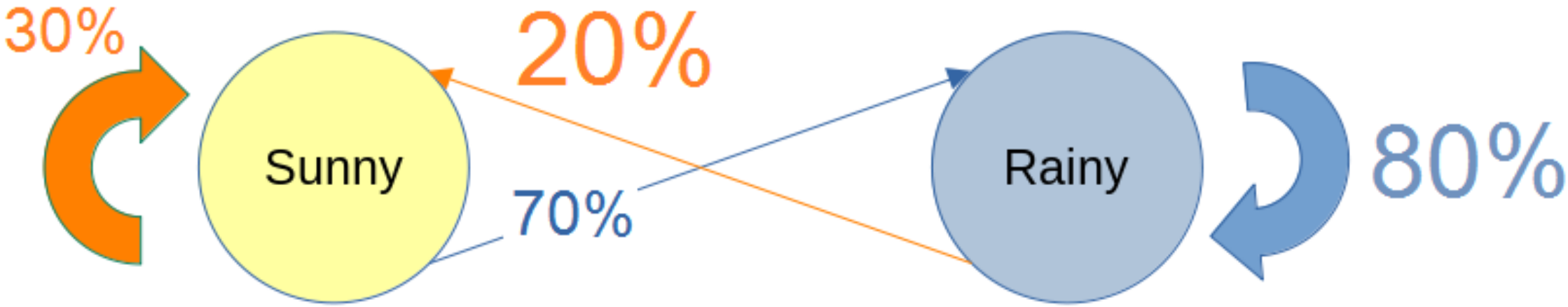

FRI
MAYBE 80%

Making a Weather Forecast

Statistica can predict the future based on the past



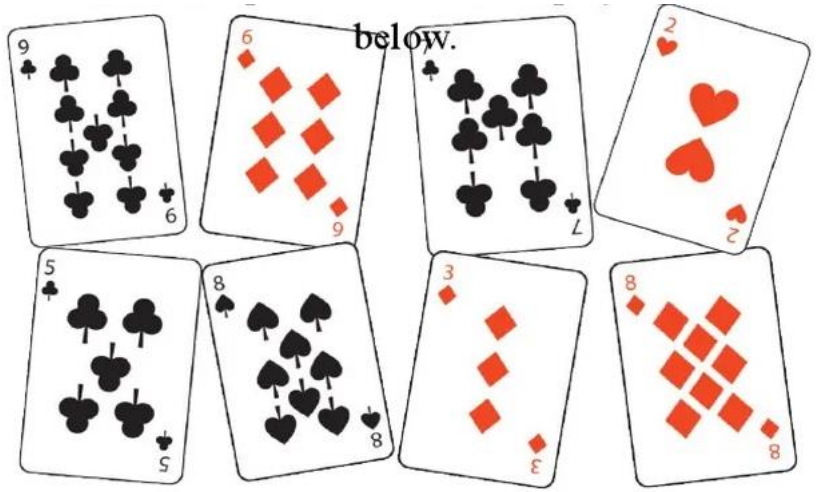
Markoff Chain Probability Model for Oxford Weather

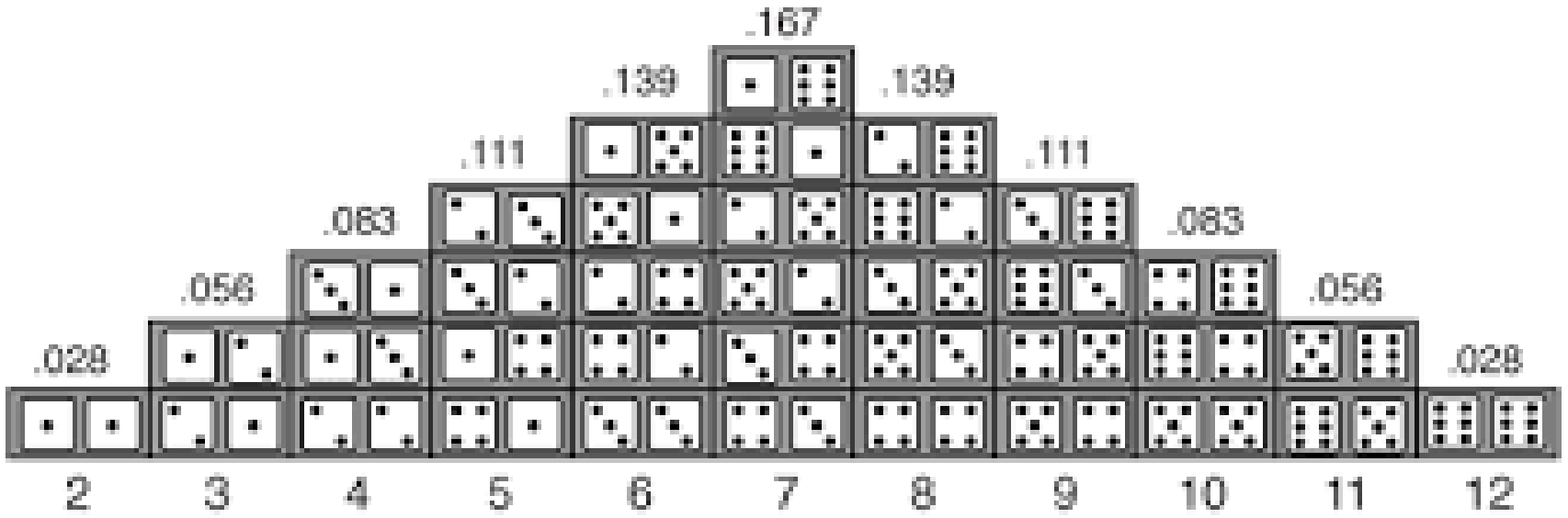


If it is Sunny today, the probability that it will be Rainy tomorrow is 70%

If it is Rainy today, there is an 80% chance that it will be rainy tomorrow.

below.

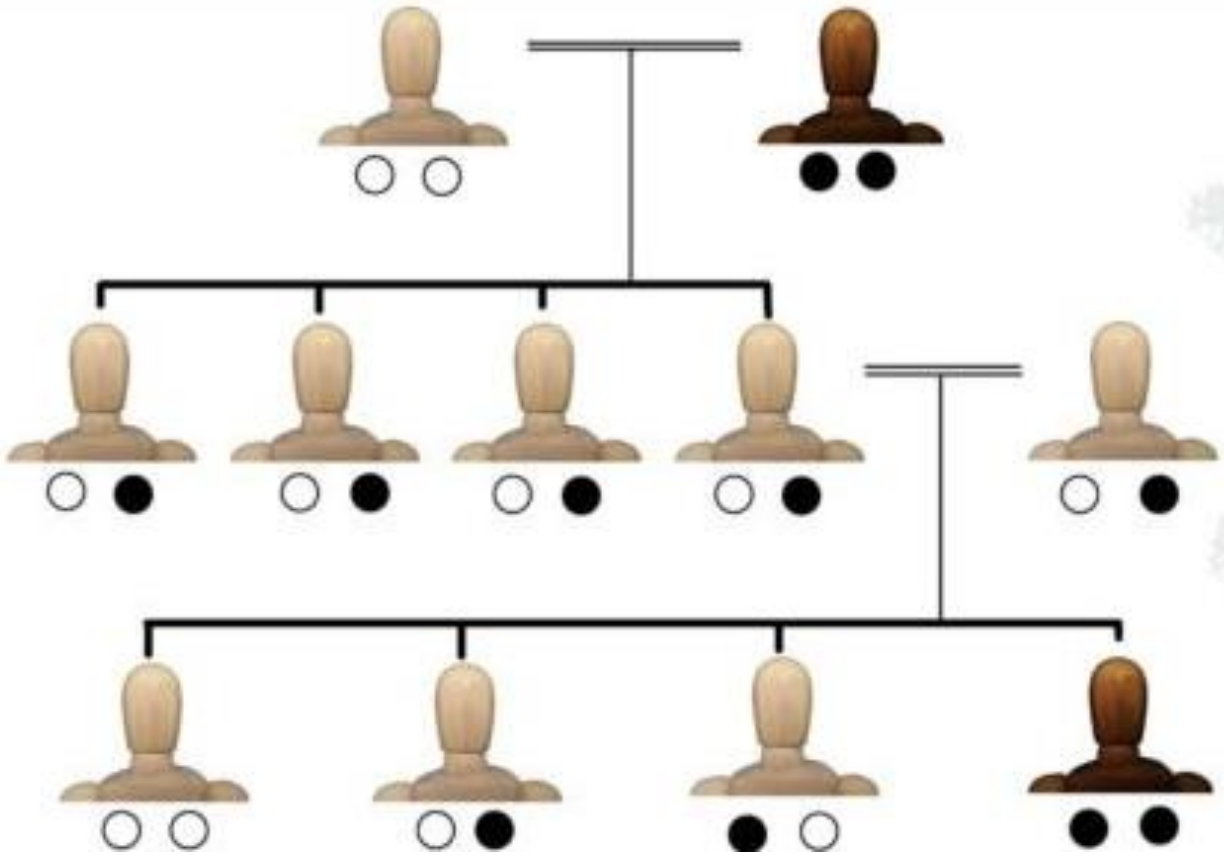




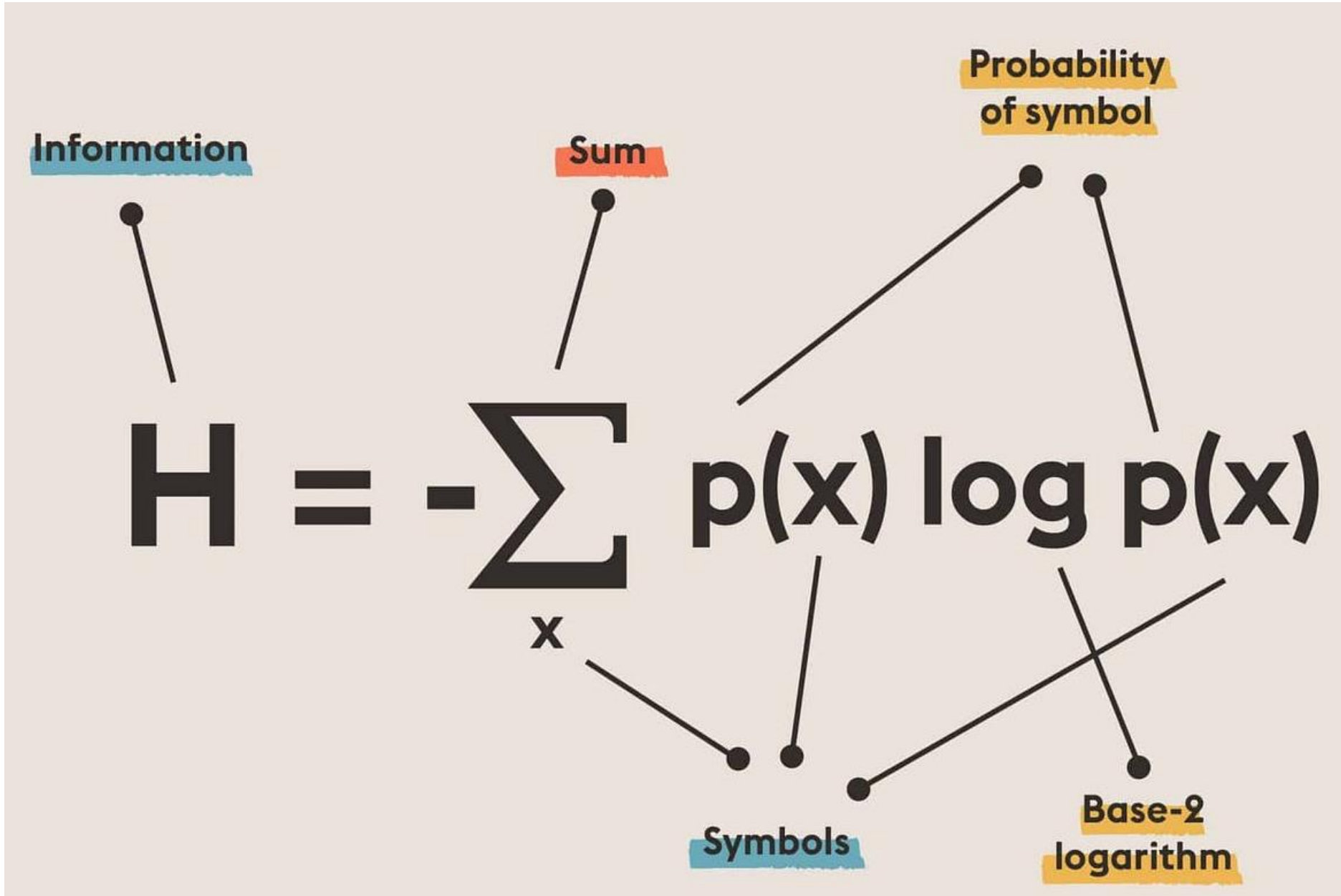
Total number of microstates: 36

CFA (Chartered Financial Analyst)

Probability



In biology, probability is used in predicting the outcome of a genetic cross

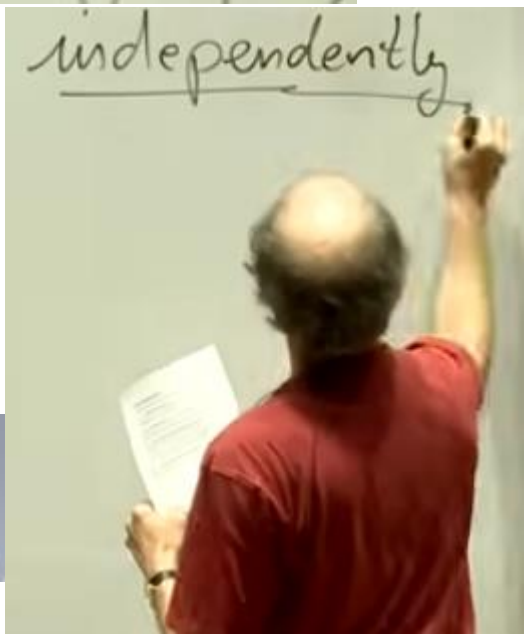

Information
Sum
Probability of symbol
H = -∑ p(x) log p(x)
x
Symbols
Base-2 logarithm

Motivation: 80% chance of rain

Let A_j be the event of rain at 9am on day j of this term, $1 \leq j \leq n$

Let Aj be the event of rain at 9 a.m. on day j of this term 1<=j<=n

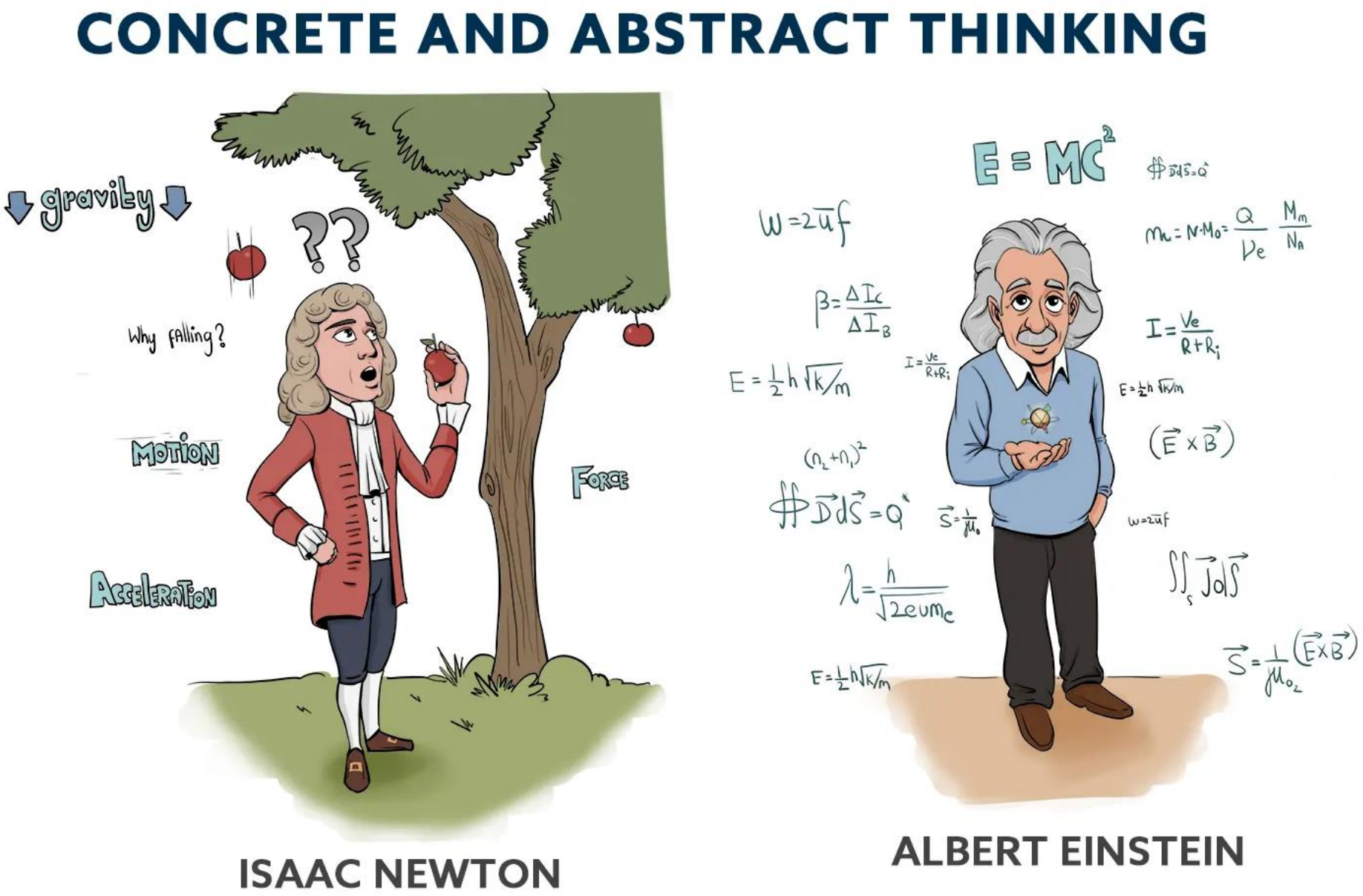
Suppose the events A_i each have probability p,



Oxford

Tue 13th	Wed 14th	Thu 15th	Fri 16th
10° 9°	13° 10°	13° 8°	11° 7°
70%	70%	70%	80%

School ==formalism==> University



If ever I get even smaller [text] and you can't see please tell me, because that's useful feedback, useful interaction that we can have in a lecture, so please don't hold back


CHALK TALK
AN OPPORTUNITY TO HAVE A
CONVERSATION IN WRITING


ink +
think

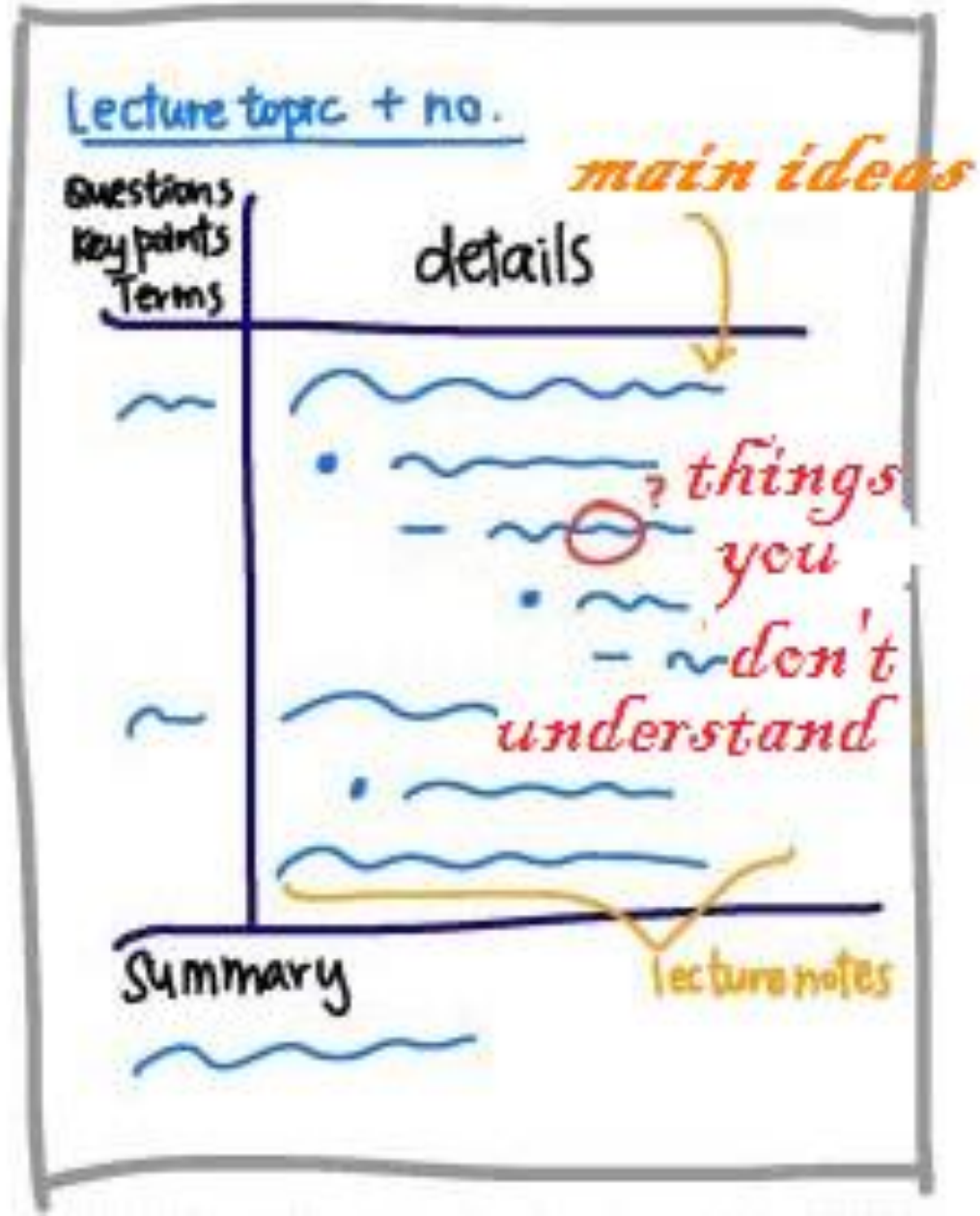
Bad way

Good way 1. listening

2. first way of processing

3. **Writing,** incl. sth., you're not quite sure about

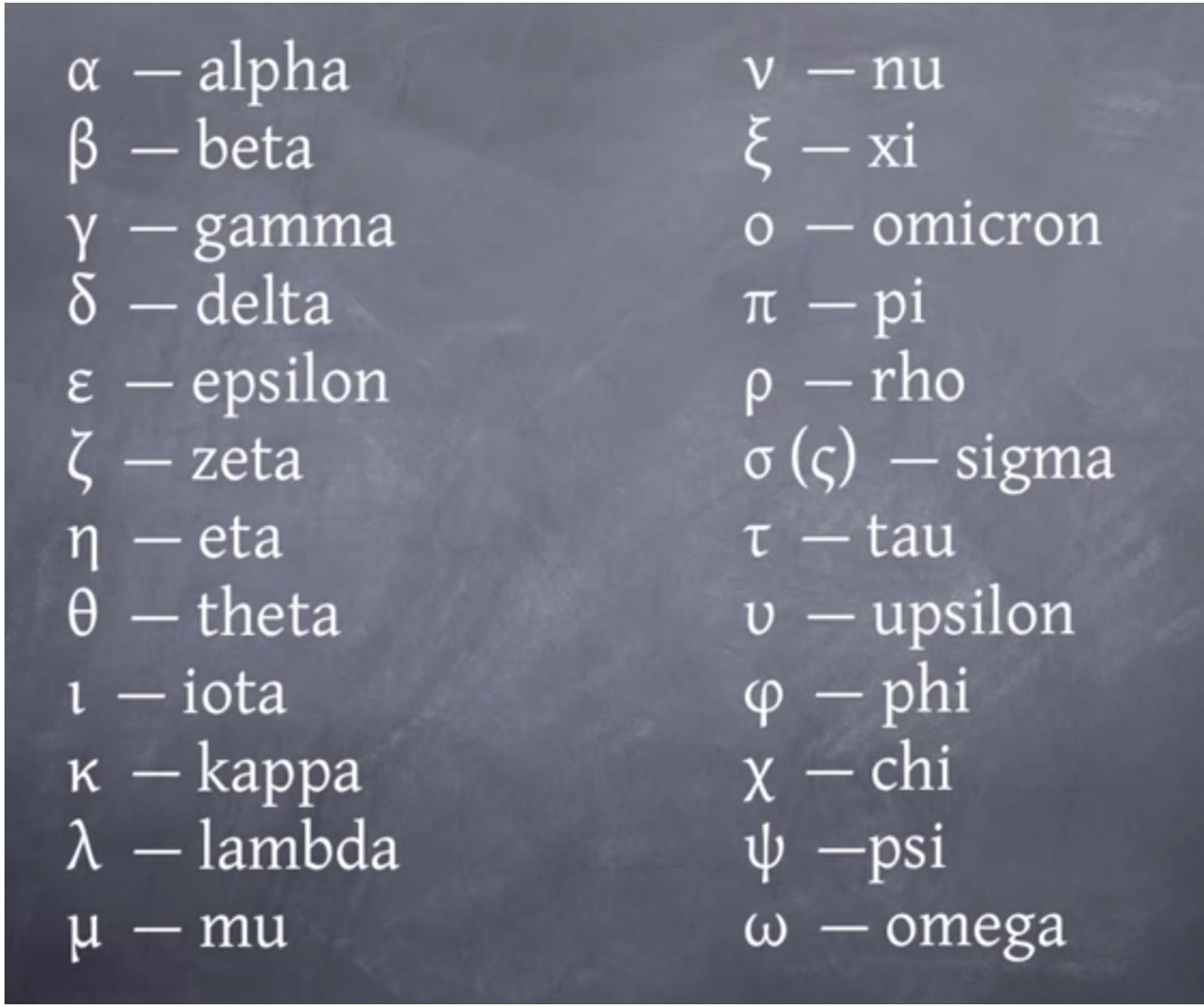
You get the most out of lecture by doing some-thing such as taking notes If you can



"Instead of taking notes, can I just purchase a transcript of today's lesson?"

1. Events and probabilities

https://www.youtube.com/watch?v=Aqb4dpC7sxU



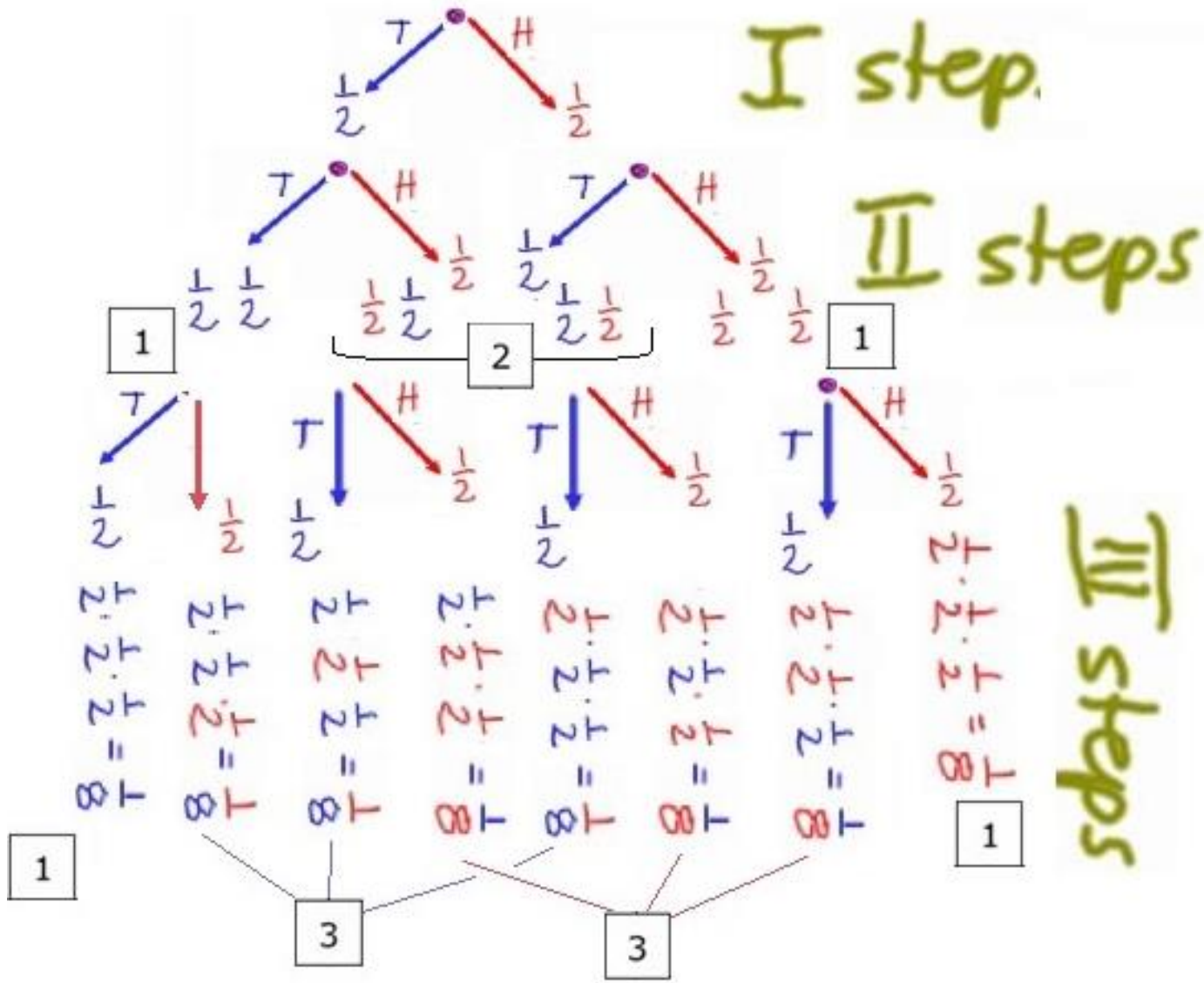
the rain in Spain stays mainly in a plain

Seventeenth century painting. France, the time of the "Three Musketeers". WHAT DO YOU SEE IN THE PICTURE

My honor is at the end of my sword

1								1
1	1							2
1	2	1						4
1	3	3	1					8
1	4	6	4	1				16
1	5	10	10	5	1			32
1	6	15	20	15	6	1		64
1	7	21	35	35	21	7	1	128

Pascal's triangle



				1				1
				1	1			2
			1	2	1			4
			1	3	3	1		8
		1	4	6	4	1		16
		1	5	10	10	5	1	32
	1	6	15	20	15	6	1	64
1	7	21	35	35	21	7	1	128

Newton's binomial

$$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k$$

$$\begin{aligned}
(a+b)^0 &= 1 \\
(a+b)^1 &= a+b \\
(a+b)^2 &= a^2 + 2ab + b^2 \\
(a+b)^3 &= a^3 + 3a^2b + 3ab^2 + b^3 \\
(a+b)^4 &= a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4 \\
(a+b)^5 &= a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5
\end{aligned}$$

Shannon Hartley Theorem

This is a measure of the *capacity* on a channel; it is impossible to transmit information at a faster rate without error.

$$C = B\log_2(1+S/N)$$

- C = capacity (in bit/s)
- B = bandwidth of channel (Hz)
- S = signal power (in W)
- N = noise power (in W)

It is more usual to use SNR (in dB) instead of power ratio. If (as with terrestrial and commercial communications systems) S/N >> 1, then rewriting in terms of log10.

$$C = B\frac{\log_{10}(S/N)}{\log_{10}2} = B\frac{10\log_{10}(S/N)}{10.\log_{10}2} = B\frac{SNR}{3.01}$$