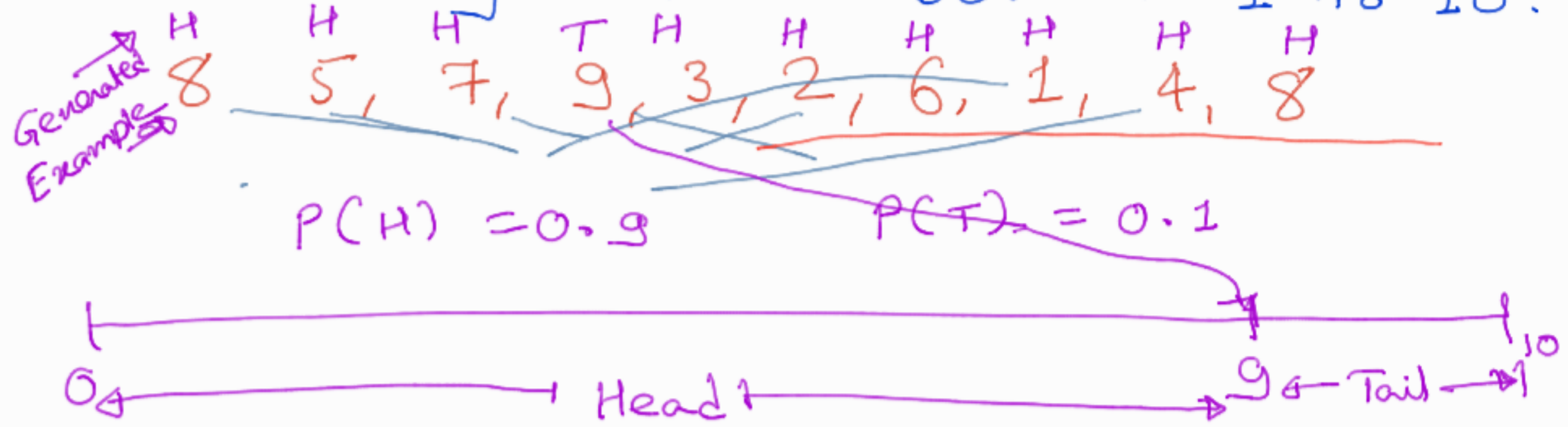
One example, two ideas, and a theory

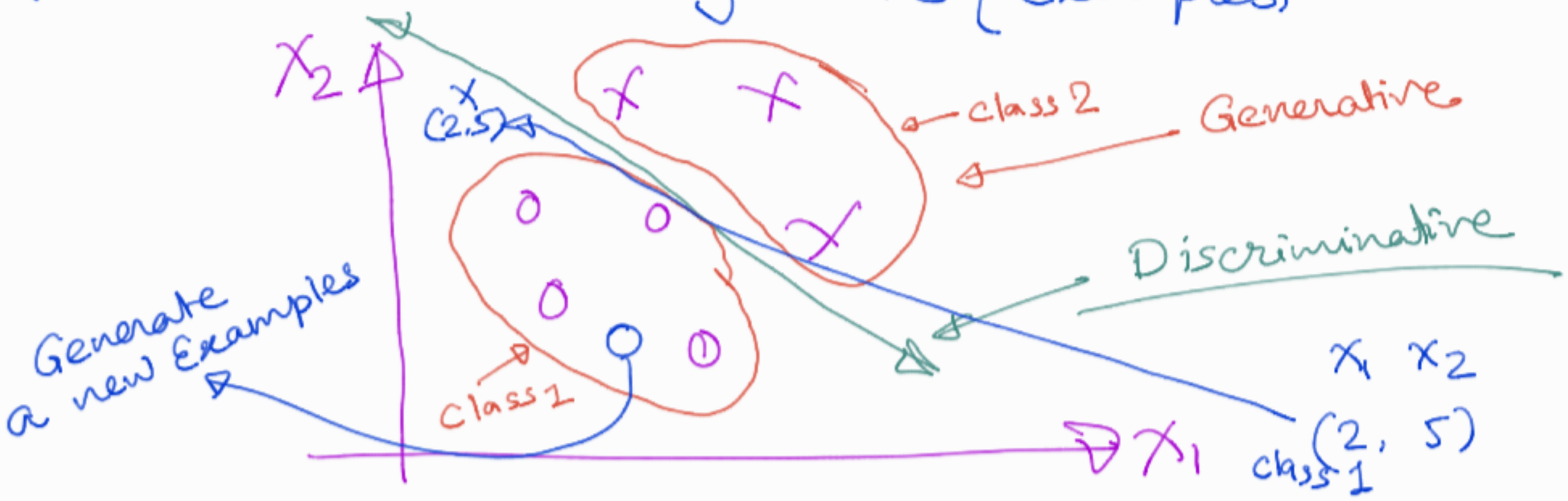
Idea 1

* Assume any number between 1 to 10.

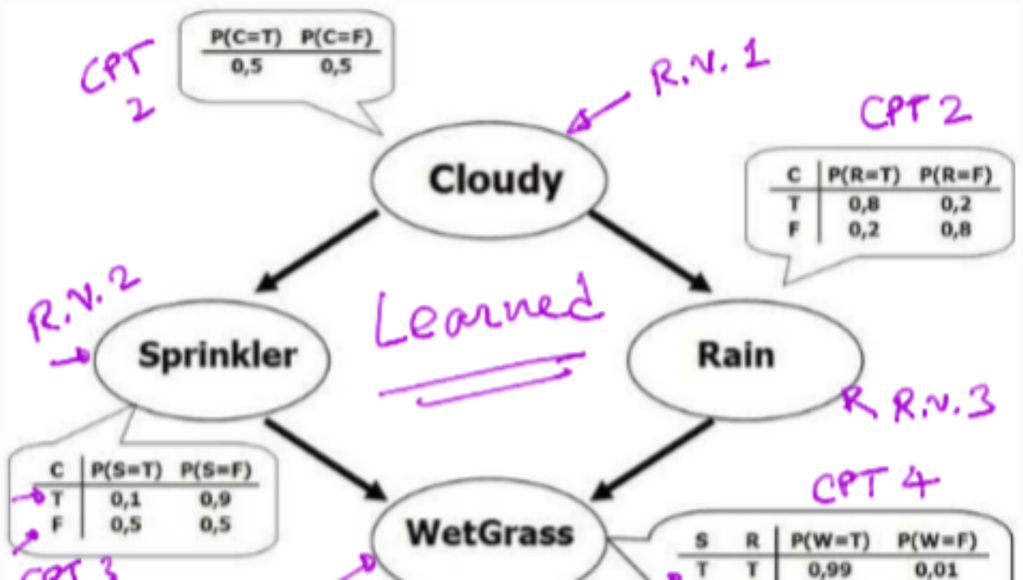


Idea 2:

"Generative Model Can generate (examples)"



(Obligatory) Example



Calculate

$$P(WG=T / S=T, C=F) \; ?$$

$$= \frac{P(WG=T, S=T, C=F)}{P(S=T, C=F)}$$

$$= \frac{\sum P(WG=T, S=T, C=F, R)}{\sum P(WG=T, S=T, C=F, R) + \sum P(WG=T, S=T, C=F, R)}$$

R.V.4

T	F	0,9	0,1
F	T	0,9	0,1
F	F	0,0	1,0

$$= \frac{\sum_{R} P(WG, S=T, C=F, R)}{\sum_{W,R} P(WG, S=T, C=F, R)}$$

$P(WG, S, R, C)$

$= P(WG/S, R) \cdot P(S/C) \cdot P(R/C) \cdot P(C)$

Numerator

$$\sum_{R} P(WG=T, S=T, C=F, R)$$

$$= P(WG=T, S=T, C=F, R=T) + P(WG=T, S=T, C=F, R=F)$$

Numerator

$$= P(WG=T/S=T, R=T) \cdot P(S=T/C=F) \cdot P(R=T/C=F) \cdot P(C=F)$$

Find These values fere CPT

$$+ P(WG=T/S=T, R=F) \cdot P(S=T/C=F) \cdot P(R=F/C=F) \cdot P(C=F)$$

$$= 0.0495 + 0.18 = \boxed{0.2295}$$

Denominator

$$\sum_{W,R} P(WG, S=T, C=F, R)$$

$$= P(WG=T, S=T, C=F, R=T) = 0.0495$$
$$+ P(WG=F, S=T, C=F, R=T) = 0.0005$$
$$+ P(WG=T, S=T, C=F, R=F) = 0.18$$
$$+ P(WG=F, S=T, C=F, R=F) = 0.02$$
$$= \boxed{0.25}$$

$= 0.25$

$$\boxed{P(WG=T/S=T, C=F) = \frac{0.2295}{0.25}}$$

Exact Inference

- Calculate probability using the learned model parameters (CPTs)
- It requires marginalization.

- In worst → How many terms do you need to calculate ?

$O(2^{n-1})$ ← # Random variable

$O(a^n)$ ← Intractable
Not polynomial
NP-Hard

"Exact enferencing in a Bayesian Network is a NP-Hard problem"
(સરવાળ વિચાર કી જુએ !!)

"Approximate Inferencing"

② → Generate samples from the known distribution
① → The distribution is learned from the data
③ → Calculate probabilities using generated samples.