

So

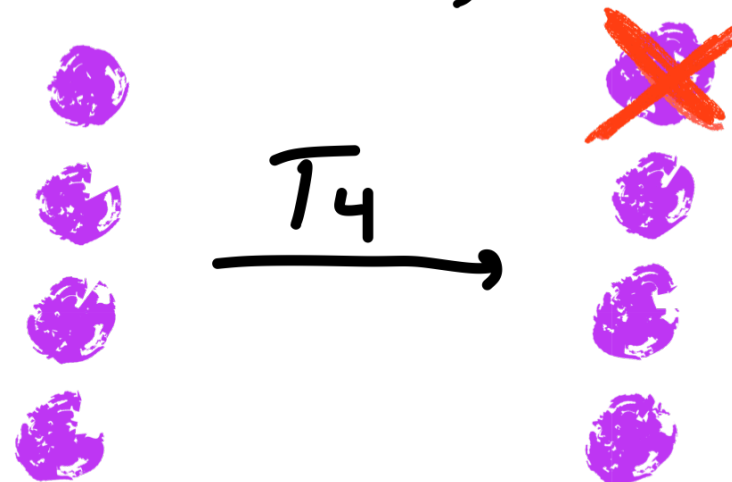
$$\begin{aligned} \mathbb{E}[T_{20 \rightarrow 0}] &= \mathbb{E}[T_{20}] + \mathbb{E}[T_{19}] + \dots + \mathbb{E}[T_1] \\ &= 1 + \frac{20}{19} + \dots + \frac{20}{1} = 1 + 20 \sum_{i=1}^{19} \frac{1}{i} \approx 72 \end{aligned}$$

Question: How many classes do you expect
until all 20 students have been
called on?

When there are i students left to call on,
 the prob of rolling one of these remaining i

is $\frac{i}{20}$

$$\mathbb{E}[T_i] = \frac{1}{i/20} = \frac{20}{i}$$



$i = 20, 19, \dots, 1$

Core-essential theory

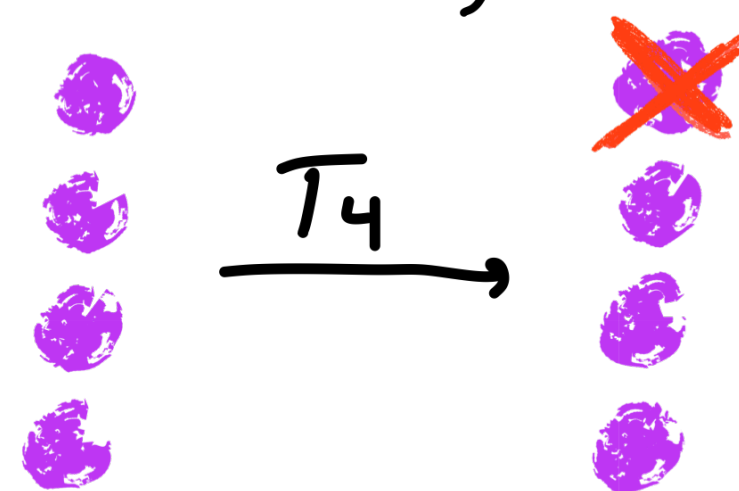


Cole-escent theory

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Cole-escent theory

Generalize: Class size N (and N -sided die)
sample of $n \leq N$ students