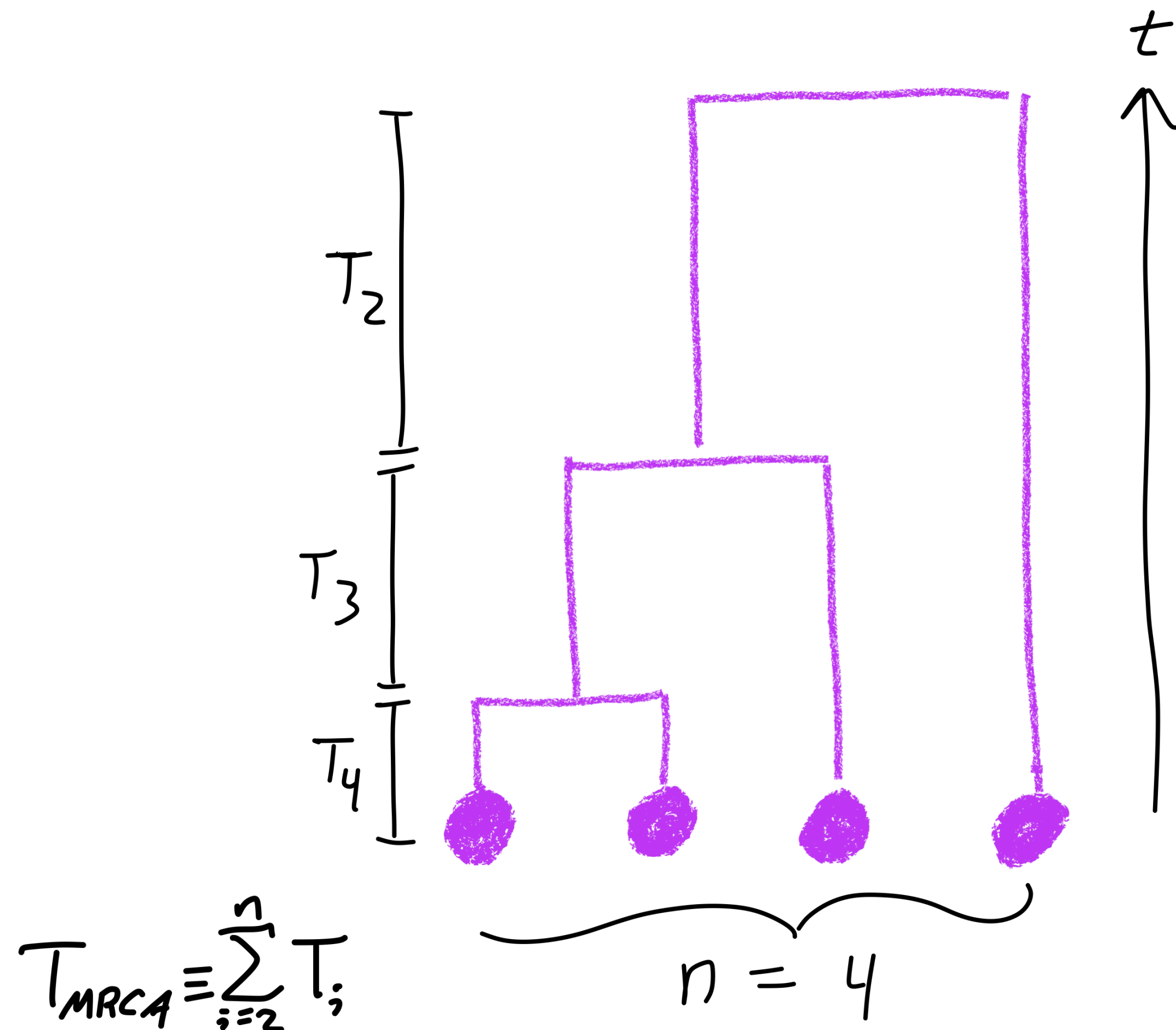


Coalescent theory

Updating the previous results



"intercoalescence"
times

$$E[T_i] = \frac{2N}{\binom{i}{2}}$$

Exp. dist.

$$p(t_i) = \frac{\binom{i}{2}}{2N} e^{-\frac{\binom{i}{2}}{2N} t_i}$$

- Each pair is a process w/ rate $\frac{2}{2N}$
- The pairs race to coalesce

Coalescent theory

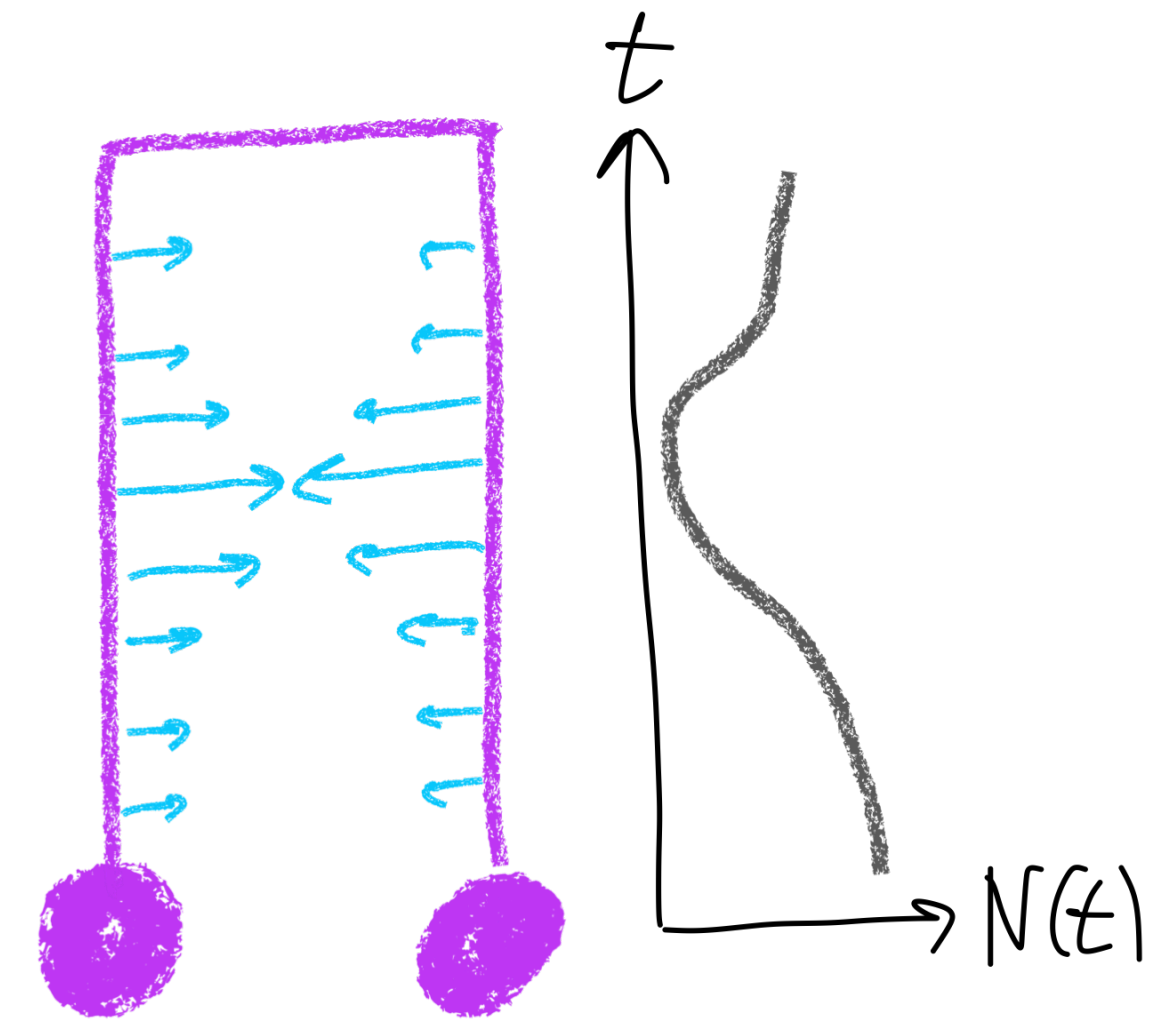
Population size determines coalescence rate

What if population size varies over time? $N(t)$

[Like students adding/dropping mid-quarter in coalescent theory]

$N(t)$ distorts time scale from the standard coalescent

- time compressed when $N(t)$ is small
- time stretched when $N(t)$ is large



The details:

$$P(T_i = t_i) = \frac{\binom{i}{2}}{2N_{t_i}} \prod_{j=2}^{t_i-1} \left(1 - \frac{\binom{i}{2}}{2N_j}\right)$$

big $N \rightarrow$ $p(t_i) = \frac{\binom{i}{2}}{2N(t_i)} \exp\left(-\binom{i}{2} \int_0^t \frac{ds}{2N(s)}\right)$

inhomogeneous Poisson process