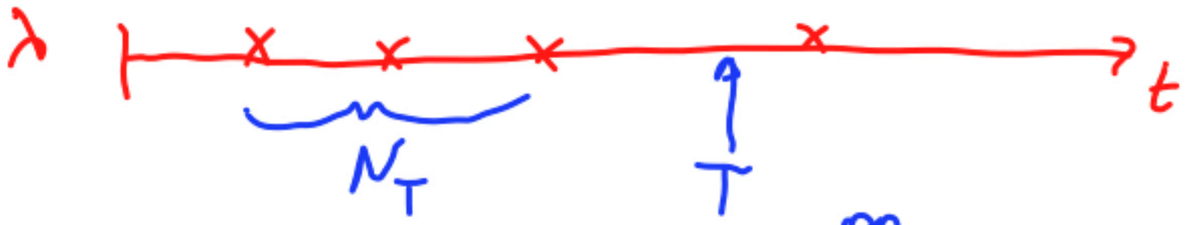
Poisson(λ) arrivals during $[0,T]$; T: independent exponential(μ)

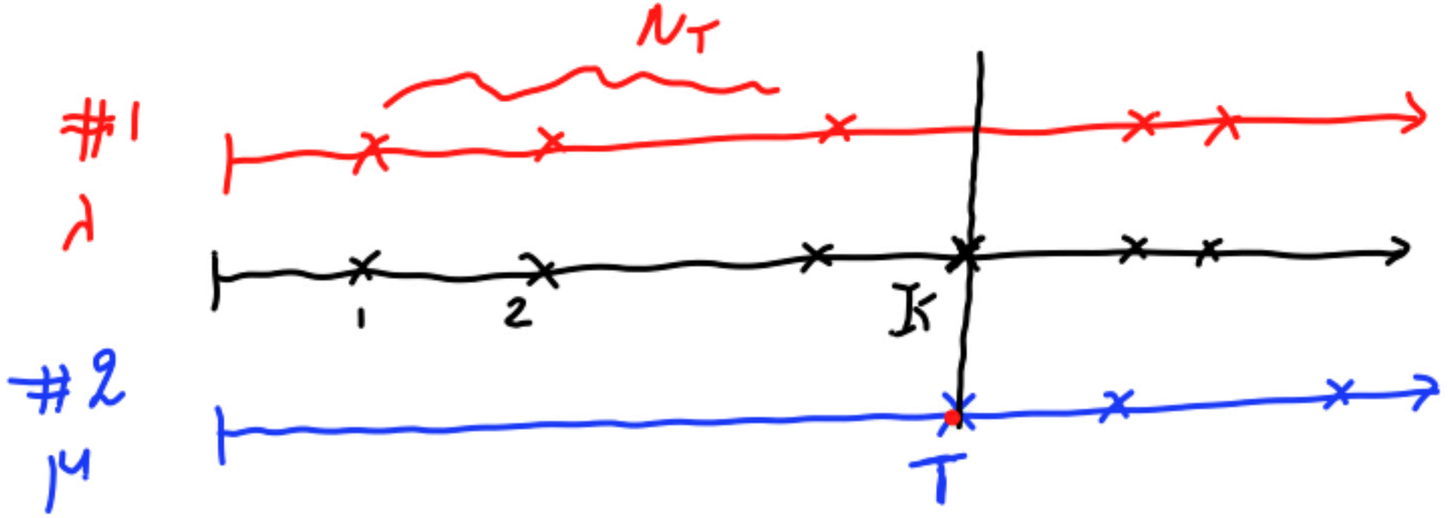


$$P(N_T = k) = \int_0^\infty P(N_T = k \mid T = t)\, f_T(t)\, dt$$

$$P(N_t = k \mid T = t)$$

$$= \int_0^\infty \frac{(\lambda t)^k e^{-\lambda t}}{k!}\, \mu e^{-\mu t}\, dt.$$

Poisson(λ) arrivals during $[0,T]$; T: independent exponential(μ)



$K = N_T + 1$

K = # arrivals in merged process till get one that comes from blue

Arrival in merged process: trial

"success" if it comes from blue

K = # trials till success

$P(\text{success}) = \frac{\mu}{\lambda+\mu}$

independent

Geometric with parameter $\mu/(\lambda+\mu)$