Problem: E. coli cell division rate = 4 divisions/hr. (≈15 min)

- control.
- taxol ⇒ MT inhibitor

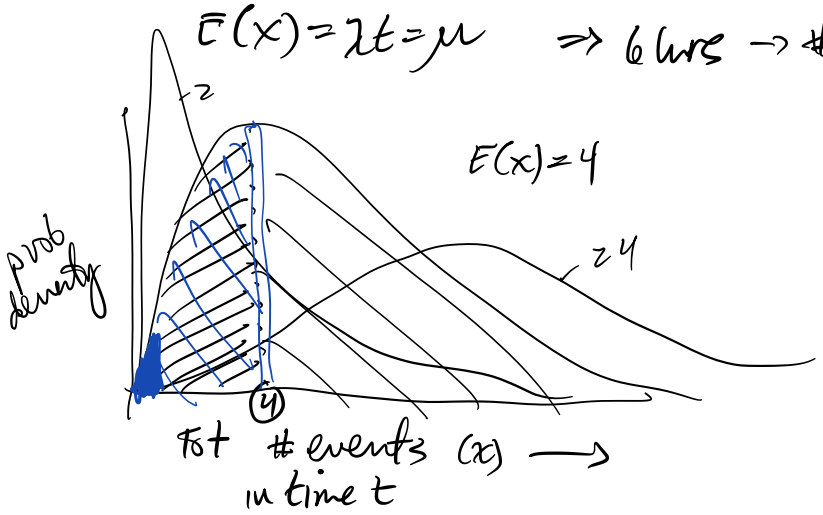
Poisson ⇒ # divisions (in some unit of time t)

PDF: $P[X=x] = e^{-\lambda t}\frac{(\lambda t)^x}{x!} = e^{-\mu}\frac{\mu^x}{x!}$

time t: $\mu/t=1$

$X \sim \text{pois}(\lambda)$

$E(X) = \lambda t = \mu$ ⇒ 6 hrs → # div's in 6 hrs. $6 \cdot 4 = 24$ $\mu = 24$



dqpr

- dpois = PDF = $P[X=x]$
- ppois = CDF = $P[X \le x]$

  ppois(lower.tail = F) = 1−CDF = $P[X > x]$
- qpois(prob, λ) value of x → prob. prob = 0.5 → q = MEDIAN
- rpois(#, λ)
- [1]pois(#, λ) λ/t μ $\mu/\text{pt.}$

what is prob exactly 4 div's in 1hr?

PDF $P(X=4)? = e^{-4}\frac{4^4}{4!}$ ⇒ dpois(4, lambda=4)

CDF $P(X \le 4)? = \sum_{0}^{4} e^{-\lambda}\frac{\lambda^x}{x!}$ ⇒ ppois(4, 4)

$\sum$ dpois(0:4, lambda=4)

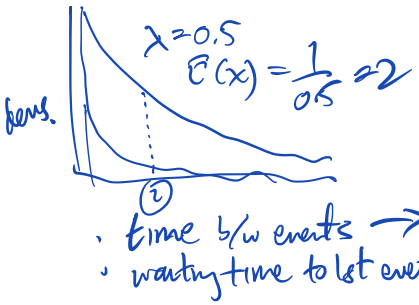
TAXOL: $P(X \le 1)?$ ⇒ ppois(1, 4) ⇒ small p-value

∴ unlikely that taxol has no effect on division rate (reject null model with $\lambda = 4$)

Poisson ⇒ # div per time

Exponential ⇒ time between divs

$E(X) = \frac{1}{\lambda}$



PDF: $f(x) = Pr[X=x] = \lambda e^{-\lambda t}$, $x \geq 0$

λ = "rate"

λ = 4 /hr $E(X) \frac{1}{\lambda} = 0.25$

$P[X=2] = dexp(x, rate = \frac{1}{\lambda}) = dexp(2, 0.25)$

$P[X \leq 2] = pexp($ $)$

$X > 2$ $pexp($ $, lower.tail = F)$

$P[x_1 \leq X < x_2] = P[x_2] - P[x_1]$

Poisson: $X \sim POI(\lambda)$: $Pr[X=x] = e^{-\lambda}\lambda^x / x!$

Exponential: $X \sim EXP(\lambda)$: $Pr[X=x] = \lambda e^{-\lambda t}$

"MATHY": both defined in terms of λ

In R, dpois(x, λ) : parameter is λ = # events in t units of time

dexp(x, rate): parameter is **rate** = $1/\lambda$

↳ interval of time b/w events

e.g. for λ = 4 divisions/hr

$\frac{1}{\lambda}$ = 0.25 hr/division