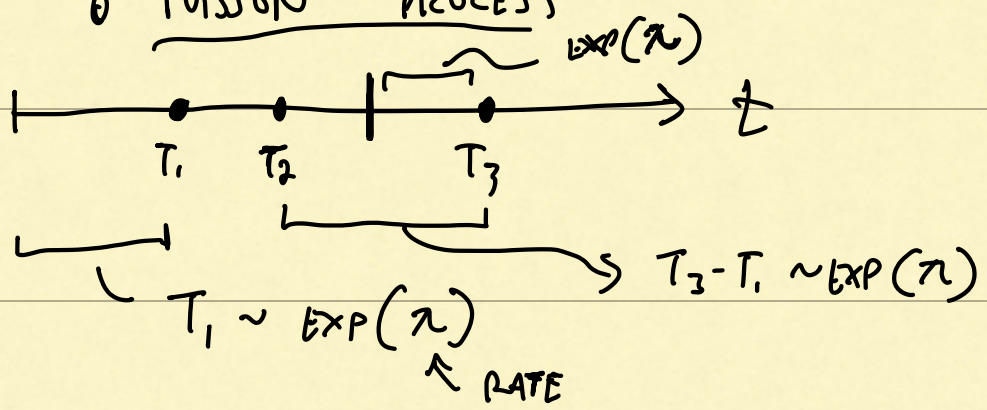
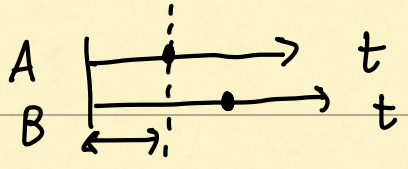
POISSON PROCESS



- EVENT A IS POISSON WITH RATE λ_A
- EVENT B IS POISSON WITH RATE λ_B

THEN THE FIRST EVENT OF EITHER A OR B IS POISSON WITH RATE $\lambda = \lambda_A + \lambda_B$

RACING PROPERTY

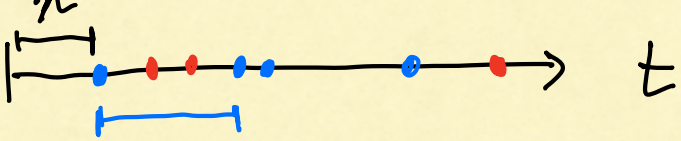


- IF A POISSON PROCESS WITH RATE λ HAS TWO TYPES, A AND B, AND EACH EVENT IS TYPE A WITH PROBABILITY p_A (AND B WITH $(1-p_A)$), INDEPENDENT OF OTHER EVENTS,

THEN

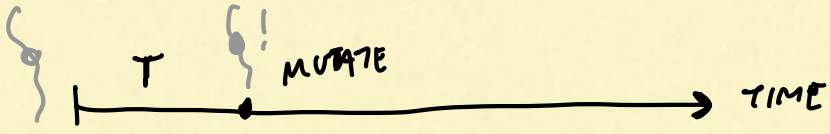
TYPE A EVENTS ARE POISSON WITH RATE $p_A \lambda$

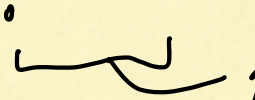
TYPE B EVENTS ARE POISSON WITH RATE $(1-p_A)\lambda$



THINNING PROPERTY

EX MUTATIONS

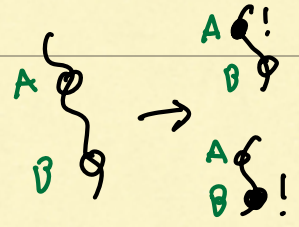




$\lambda = 1\ yr^{-1}$ $\qquad E[T] = \frac{1}{\lambda} = 1\ yr$

CASE 1

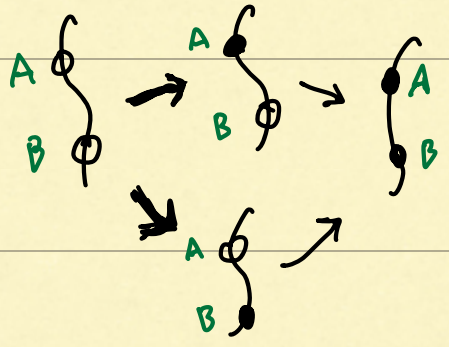
TIME TO TWO LOCI, FIRST MUTATION



POISSON WITH RATE $\lambda + \lambda = 2\lambda$

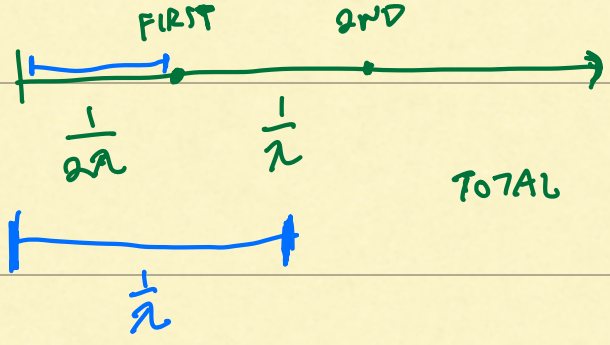
$E[\text{FIRST}] = \frac{1}{2\lambda} = 0.5\ yr$

CASE 2



TWO LOCI, TIME TO SECOND MUTATION?

$E[\text{SECOND}] = ?$



TOTAL $\frac{1}{2\lambda} + \frac{1}{\lambda} = 1.5\,\frac{1}{\lambda}$

$1.5\,\frac{1}{\lambda}$

PS 9 A

NOT $\frac{1}{2} - 30\text{MIN} = 0$

PARTITION: MUTUALLY EXCLUSIVE, COMPLETELY EXHAUSTIVE

$X_1, X_2, X_3 \ldots$

$$\mathbb{P}(Z) = \mathbb{P}(Z|X_1)\mathbb{P}(X_1) + \ldots + \mathbb{P}(Z|X_N)\mathbb{P}(X_N)$$

$$E[Z] = E[Z|X_1]\mathbb{P}(X_1) + \ldots + E[Z|X_N]\mathbb{P}(X_N)$$

LAW OF TOTAL EXPECTATION