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Instructions: This is an open notes, open book, collaborative quiz. No Internet allowed.

**Question:** Let  $T$  be the time when the first event occurs in a Poisson random process. Obtain the pdf of  $T$ .

**Answer:**

$\forall t \geq 0$ , we have.

$$F_T(t) \triangleq \text{Prob}(T \leq t)$$

$$= 1 - \text{Prob}(T > t)$$

$$= 1 - P_{S_t}(0), \quad \text{recall } P_{S_t}(k) = \frac{(\lambda t)^k e^{-\lambda t}}{k!}$$

$$= 1 - e^{-\lambda t}$$

$$\Rightarrow f_T(t) = \frac{d}{dt} F_T(t) = \lambda e^{-\lambda t}, \quad t \geq 0.$$

called "exponential r.v."  
w parameter  $\lambda$