

Quiz 22 : Continuous Probability II

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This quiz does not count towards your grade. It exists to simply gauge your understanding. Treat this as though it were a portion of your midterm or final exam.

1 More Lightbulbs

Consider n lightbulbs, where the lifetime of each is exponentially distributed with parameter λ .

Hint: Let X_i denote the lifetime of the i th lightbulb. We know that $X_i \sim \text{EXPO}(\lambda)$.

1. Compute the PDF of $Z = X_1 + X_2$. We are re-deriving the *Erlang distribution*.
2. Compute the PDF of $Y = X_1 + X_2 + X_3$. Do you notice a pattern?
3. Take $N \sim \text{GEOM}(p)$ for some constant p . Compute the PDF of $X = \sum_{i=1}^N X_i$. What do you observe? Directly apply the PDF of the Erlang distribution.

$$\frac{\lambda^k x^{k-1} e^{-\lambda x}}{(k-1)!}$$