221 Spiking Networks
Exercise 3: Multi-interval distribution

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Subset of Poisson events

Consider Poisson events with a rate λ. Given an integer $n > 1$, we systematically select a fraction $1/n$ of the original events to obtain a new event sequence. We can proceed in two ways:

Alternative 1 (Erlang process): Select every n^{th} event of the original process, in other words, select event numbers n, $2n$, $3n$, ... while discarding all others.

Alternative 2: Select every event with independent probability $1/n$, discarding all unselected events.

1 Assignment

Obtain the interval densities of the two alternative derivative processes! Confirm that the expected interval is n/λ in both cases and that the densities integrate to unity in both cases!

Hints: the Poisson count probability integrates to 1 for all $n \geq 0$

$$\int_0^\infty P_n(t)\,\lambda\,dt = \int_0^\infty \frac{(\lambda t)^n}{n!}\,e^{-\lambda t}\,\lambda\,dt = 1$$

The n-interval density relates to the count density as follows

$$f_n(x) = \frac{n}{x}\,P_n(x) = \lambda\,P_{n-1}(x)$$