Lambda vs. Mu

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Exponential distribution

The Population Model relies heavily on the use of exponentially distributed variables. An exponentially distributed variable

$$T \sim Exp(\lambda)$$

models the waiting time for an event to happen.

Meaning of λ

The parameter λ describes a rate, i.e. the (expected) number of events to happen within a time frame. Considering days as time units, for

- your heart beat, we could approximate $\lambda = 24 \cdot 60 \cdot 75 = 108.000$
- the full moon, we could approximate $\lambda = 1/29$

It describes an *event count*.

Meaning of μ

For our random variable T we know $E(t) = 1/\lambda = \mu$. That is, our expected value is the inverse of our rate. It gives the time we expect to wait until an event happens.
For our examples before, we have to wait

- $\mu = 1/108.000$ of a day (0.8 seconds) for a heartbeat to come
- $\mu = 29$ days for a full moon to happen

This describes the length of a *time interval*.

Application to the program

The program models 4 events:

- a person's death
- a person's emigration
- a woman's birth
- all the immigrations from an unknown "outside" population

We find that we can categorize these events into 2 cases:

1. Events happening *infrequently* to a person (in our population)
    - For a person's life event, it feels more natural to describe the events in terms of the expected value (e.g. time of death)
2. Events coming *frequently* from an outside source
    - Since they are very frequent and we only observe their arrival, here a description in terms of the rate (e.g. 100.000 immigrations a year) is more natural.