2) slow reactions: 1, 2, 5
fast reactions: 3, 4
fast populations: prot
slow populations: DNAon, DNAoff
state: \((x_p, x_{on}, x_{off})_{\text{slow part}}\)

flow function:

\[
\frac{dx_p}{dt} = c_3 \cdot x_{on} - c_4 \cdot x_p(t)
\]

\[
\lambda(t) = c_1 x_{on} + c_2 x_{off} + c_3 x_{on} \cdot x_p(t)
\]

3) Set \(\lambda(t) = \sum_{j=\hat{a}+1}^{\hat{h}} \alpha_j (x^p(t), x^s)\). Then

\[
\frac{d}{dt} g(t) = -\lambda(t) \cdot g(t)
\]

We have to prove that \(g(t) = \exp(-\int_0^t \lambda(\tau) d\tau)\) because then we automatically get

\[
P(Y > t) = P(g(t) > U)
= P(\exp(-\int_0^t \lambda(\tau) d\tau) > U)
\]
\[ = \exp \left( -\int_{\sigma}^{t} \lambda(\tau) \, d\tau \right) \]

Since

\[ \frac{d}{d\tau} \left( \exp \left( -\int_{\sigma}^{t} \lambda(\tau) \, d\tau \right) \right) = -\lambda(\tau) \exp \left( -\int_{\sigma}^{t} \lambda(\tau) \, d\tau \right) \]

and

\[ \exp \left( -\int_{\sigma}^{t} \lambda(\tau) \, d\tau \right) = 1 \]

we directly get

\[ g(\tau) = \exp \left( -\int_{\sigma}^{t} \lambda(\tau) \, d\tau \right). \]