$f(t)$ : Time to Failure density function. (PDF)
Describes the failure behaviour of the system

$F(t)$ : unreliability (CDF)$(P(T \leq t)$
The prob. that a system will fail and will not perform the intended function before time $t$.

$R(t) = 1 - F(t)$ : Reliability (CCDF)$(P\, T > t)$

The prob. that a system will survive after $t$ and will perform the intended function.

$h(t) = \dfrac{f(t)}{R(t)}$ : Hazard
Instantaneous failure in $[t, t+\Delta t]$ divided by $\Delta t$.

$$h(t) \equiv \lim_{\Delta t \to 0} \frac{P(t < T \leq t+\Delta t \mid T \geq t)}{\Delta t} = \lim_{\Delta t \to 0} \frac{P(t < T \leq t+\Delta t,\ T \geq t) / P(T \geq t)}{\Delta t}$$

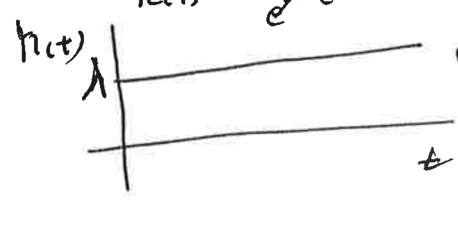
$$= \lim_{\Delta t \to 0} \frac{P(t < T \leq t+\Delta t)}{R(t)\cdot \Delta t} = \left(\lim_{\Delta t \to 0} \frac{F(t+\Delta t) - F(t)}{\Delta t}\right) \Big/ R(t) = \frac{f(t)}{R(t)}$$

Example: $f(t) = \begin{cases} \lambda e^{-\lambda t} & t \geq 0 \\ 0 & \text{otherwise} \end{cases}$

$F(t) = 1 - e^{-\lambda t} \quad t \geq 0$

$R(t) = 1 - F(t) = e^{-\lambda t} \quad t \geq 0$

$h(t) = \dfrac{f(t)}{R(t)} = \dfrac{\lambda \cancel{e^{-\lambda t}}}{\cancel{e^{-\lambda t}}} = \lambda$




where $T \sim EXP(\lambda)$

More realistic Hazard Function: