TMA 4275 Lifetime Analysis 2014
Homework 1

Problem 1

(R&H, Ex. 2.1, slightly extended). A component with time to failure T has constant failure rate $z(t) = \lambda = 2.5 \cdot 10^{-5}(\text{hours})^{-1}$

a) Determine the probability that the component survives a period of 2 months without failure.

b) Find the MTTF (Mean Time To Failure) of the component.

c) Find the probability that the component survives its MTTF. Show that this probability does not depend on the value of λ.

Problem 2

(R&H, Ex. 2.2, slightly extended). A machine with constant failure rate λ will survive a period of 100 hours without failure, with probability 0.50.

a) Determine the failure rate λ.

b) Find the probability that the machine will survive 500 hours without failure.

c) Determine the probability that the machine will fail within 1000 hours, when you know that the machine was functioning at 500 hours.

Does this probability change if "functioning at 500 hours" is replaced by "functioning at 100 hours"?

Problem 3

(R&H, Ex. 2.8, slightly extended). A component with time to failure T has failure rate function (hazard function) $z(t) = kt$ for $t > 0$ and $k > 0$.

a) Determine the probability that the component survives 200 hours, when $k = 2.0 \cdot 10^{-6}(\text{hours})^{-2}$.

b) Determine the MTTF of the component when $k = 2.0 \cdot 10^{-6}(\text{hours})^{-2}$.

c) Determine the probability that a component which is functioning after 200 hours is still functioning after 400 hours, when $k = 2.0 \cdot 10^{-6}(\text{hours})^{-2}$.

Does this probability change if "functioning after 200 hours is still functioning after 400 hours" is replaced by "functioning after 100 hours is still functioning after 300 hours"?

c) Does this distribution belong to any of the known distribution classes?

Problem 4

(R&H, Ex. 2.10). A component with time to failure T has failure rate function (hazard function)

$$z(t) = \frac{t}{1+t} \text{ for } t > 0$$

a) Make a sketch of the failure rate function.

b) Determine the corresponding probability density function $f(t)$.

c) Determine the MTTF of the component.

d) Does this distribution belong to any of the known distribution classes described?