

# Homework1

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## 1. Exponential Density and Survival-related Functions

- (a) Let  $\hat{\lambda}$  be the maximum likelihood estimator of the parameter  $\lambda$ .

For relapse time:

$$\hat{\lambda} = \frac{6}{5+8+12+24+32+17+16+17+19+30} \approx 0.033$$

This indicates that the rate of relapse is about 3.33% per month.

For relapse time:

$$\hat{\lambda} = \frac{3}{10+12+15+33+45+28+16+17+19+30} \approx 0.013$$

This indicates that the rate of death is about 1.33% per month.

- (b)

- i. Mean is  $\int_0^\infty t\lambda e^{-\lambda t} dt = \frac{1}{\lambda}$  and I will use  $\hat{\lambda}$  to derive the following values.

Mean time to relapse:

$$\frac{1}{0.033} \approx 30.303 \text{ months}$$

$$\frac{1}{0.013} \approx 76.923 \text{ months}$$

- ii. Median is  $0.5 = e^{-\lambda\tau} \Rightarrow \tau = \frac{-\log(0.5)}{\lambda}$ . By  $\hat{\lambda}$ ,

Median time to relapse:

$$\frac{-\log(0.5)}{0.033} \approx 21.004 \text{ months}$$

$$\frac{-\log(0.5)}{0.013} \approx 53.319 \text{ months}$$