STA 5364, Report 1.17

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2.5 (p. 58)

The time to death (in days) following a autologous bone marrow transplant follows a log-normal distribution with $\mu = 3.177$ and $\sigma = 2.084$.

(a)

Find the median and mean times to death.
For the log-normal distribution, the median survival time is given by:

$$t_{\text{Median}} = e^{\mu} = e^{3.177} \approx 23.96 \text{ days.}$$

For the log-normal distribution, the mean survival time is given by:

$$\mu = e^{\mu + \frac{\sigma^2}{2}} = e^{3.177 + \frac{2.084^2}{2}} = e^{3.177 + \frac{4.343}{2}} = e^{3.177 + 2.1715} = e^{5.3485} \approx 210.61 \text{ days.}$$

(b)

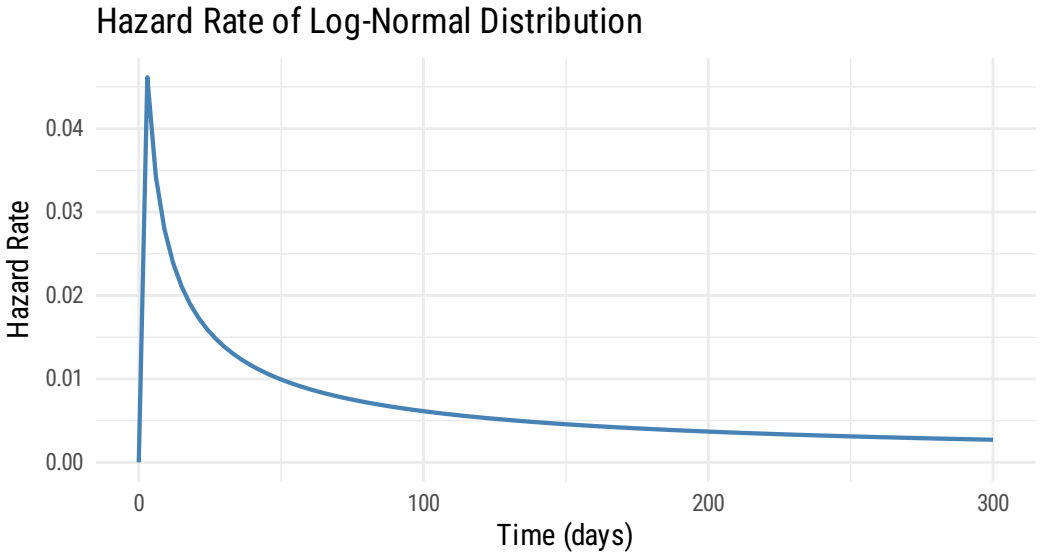
Find the 100, 200, and 300 day survival probabilities for bone marrow transplantation in patients. The survival function for the log-normal distribution is given by:

$$S(t) = P(T > t) = 1 - F(t) = 1 - \Phi\left(\frac{\ln(t) - \mu}{\sigma}\right)$$

So, for times, $t = 100, 200$, and 300, we have that the probabilities of survival are 0.247, 0.154, and 0.113 respectively.

(c)

Plot the hazard rate of the time to death and interpret the shape of this function.



The shape of this hazard function indicates that death is most likely to occur early after the transplant, as in the week of the operation. Then the hazard rate tapers down as the patient is further removed from the operation.