STA 5364, Report 1.18

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2.7 (p. 58)

The time to death (in months) for a species of rats follows a gamma distribution with shape $\alpha = 3$ and rate $\lambda = 0.2$.

(a)

Find the probability a rat will survive beyond the age of 18 months. The probability a rat will survive beyond 18 months is

$$\begin{aligned} S(18) &= \int_{18}^{\infty} \frac{0.2^3}{\Gamma(3)} t^2 e^{-0.2t} dt \\ &\approx 0.3027. \end{aligned}$$

(b)

The probability that a rat will die in its first year of life is

$$\begin{aligned} S(12) &= \int_{0}^{12} \frac{0.2^3}{\Gamma(3)} t^2 e^{-0.2t} dt \\ &\approx 0.4303. \end{aligned}$$

(c)

The mean lifetime for this species of rats is found using the mean residual life function at time $t = 0$, which is

$$\mathbb{E}[T] = \frac{\alpha}{\lambda} = \frac{3}{0.2} = 15.$$