

Class 19: More Probability Density: Cumulative Distributions Calculus II

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Figure 1: Mugs like the ones in TAB. Four mugs currently sell for \$27.50 on amazon.com. Image source: <https://www.amazon.com/Serami-White-Coffee-Ceramic-Construction/dp/B07D6XNJ6X>.

Let us suppose that the probability that a TAB mug is dropped and broken is constant in time. (E.g., perhaps there is a 7% chance every month that the mug is dropped and broken.) Let t refer to the lifetime of a mug. Then the distribution of the random variable t is well approximated by an exponential distribution function:

$$p(x) = Ae^{-\lambda t}, \quad (1)$$

for $t \geq 0$. We'll use $\lambda = 0.1$.

1. Sketch $p(x)$.
2. Find A in terms of λ .
3. What is the probability that a mug lasts less than two months?
4. What is the probability that a mug lasts between two and four months?
5. Calculate the cumulative probability $P(x)$.
6. Sketch $P(x)$.
7. Use $P(x)$ to answer problems 2-3 again.
8. What is the mean lifetime?
9. What is the median lifetime?