

Class 5b in-class problems, 18.05, Spring 2022

Board questions

Problem 1.

I've noticed that taxis drive past 77 Mass. Ave. on the average of once every 10 minutes. Suppose time spent waiting for a taxi is modeled by an exponential random variable

$$X \sim \text{Exponential}(1/10); \quad f(x) = \frac{1}{10}e^{-x/10}$$

- (a) Sketch the pdf of this distribution
- (b) Shade the region which represents the probability of waiting between 3 and 7 minutes
- (c) Compute the probability of waiting between 3 and 7 minutes for a taxi
- (d) Compute and sketch the cdf.

Problem 2. Gallery of distributions

Open the [Gallery of probability distributions](https://mathlets.org/mathlets/probability-distributions/) applet at

<https://mathlets.org/mathlets/probability-distributions/>

- (a) For the **standard normal** distribution $N(0, 1)$ how much probability is within 1 of the mean? Within 2? Within 3?
- (b) For $N(0, 3^2)$ how much probability is within σ of the mean? Within 2σ ? Within 3σ .
- (c) Does changing μ change your answer to problem 2?
- (d) Use the applet to find the median of the $\text{exp}(0.5)$ distribution.
(The median is the value of x where half the probability is below x and half above.)

Problem 3. Manipulating random variables

- (a) Suppose $X \sim \text{uniform}(0,2)$. If $Y = 4X$, find the range, pdf and cdf of Y .
- (b) Suppose $X \sim \text{uniform}(0,2)$. If $Y = X^3$, find the range, pdf and cdf of Y .
- (c) Suppose $Z \sim \text{Norm}(0,1)$ (standard normal). Find the range, pdf and cdf of $Y = 3Z + 2$.

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18.05 Introduction to Probability and Statistics

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