I. **Pre-class material** Either read the indicated textbook sections OR watch the indicated video.

(a) **Sections to Read** (All content from Blitzstein and Hwang's *Introduction to Probability* unless otherwise noted). A digital copy of the textbook is available for free via the authors' website.

- 7.1 (Just part 7.1.2 and 7.1.3 on Continuous and Hybrid Variables)

(b) **Videos to Watch** (All videos from Blitzstein's Math 110 YouTube channel, unless otherwise noted)

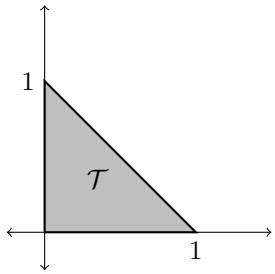
- Lecture 19: Joint, Conditional, and Marginal Distributions

II. **Objectives** (By the end of the day's class, students should be able to do the following:)

- Calculate the joint PDF given marginal and conditional PDFs of continuous random variables, and vice verse.
- Interpret the values of the conditional PDF as statements about probabilities of events.
- Determine whether two or more continuous random variables are independent given either their joint PDF, or their marginal and conditional PDFs.
- Compute conditional probabilities for hybrid random vectors.

III. **Reflection Questions** (Submit answers on Gradescope `https://www.gradescope.com/courses/425901`)

1) Suppose X and Y are continuous random variables. In your own words, explain what the conditional density function $f_{X|Y}(x|y)$ represents, and how it relates to conditional probabilities.
2) Why do you think the textbook author chooses to write $P(Y = y)$ for the marginal distribution of Y when Y is discrete, and $f_Y(y)$ for the marginal distribution when Y is continuous? (i.e. why would it be inappropriate to use $P(Y = y)$ for both discrete and continuous marginal distributions?)
3) Let (X, Y) be a point selected uniformly at random in the triangle $\mathcal{T} = \{(x, y) : 0 \leq x \leq y \leq 1\}$ (shown below):



Give an intuitive explanation for why the variables X and Y are not independent. Additionally, explain why the marginal distribution of each is not uniform. (You don't need to explicitly calculate the marginal distributions)

IV. **Additional Feedback** Are there any topics you would like further clarification about? Do you have any additional questions based on the readings / videos? *If not, you may leave this section blank.*