Pre-class preparation

If you'd like a refresher on change-of-variables from Calculus, please watch this video.

Please watch the following video OR read the following textbook sections from Blitzstein and Hwang's *Introduction to Probability* (second edition):

- Video: Transformations
- Textbook: Section 8.1 (skip Examples 8.1.5 and 8.1.10 if you want. They're good to see, but you won't be assessed on them!)

Objectives

By the end of the day's class, students should be able to do the following:

- State the change-of-variables formula in both one and several dimensions.
- For 1-D transformation, understand when the single-variable change of variables formula applies and when to use the CDF method instead.
- Use the multivariate change-of-variables formula to compute the joint PDF of transformations of 2 or 3 variables.

Reflection Questions

Please submit your answers to the following questions to the corresponding Canvas assignment by 7:45AM:

1. Suppose X and Y are two random variables with joint PDF $f_{X,Y}$, and define $T = X+Y$ and $U = X-Y$. We will go through the motions of setting up the joint PDF of (T, U).
   (a) Find the inverse of the transformation by expressing X and Y as explicit functions of T and U (i.e. find s_1, s_2 as in the notation of the video).
   (b) Calculate the Jacobian matrix J of the inverse transformation, and find the absolute value of its determinant.
   (c) Find a formula for the joint PDF $f_{T,U}$ of (T, U) in terms of $f_{X,Y}$ and the variables t, u.
   (d) What is the last thing we would need to obtain to fully specify the joint PDF of (T, U)?
2. (Optional) Is there anything from the pre-class preparation that you have questions about? What topics would you like would you like some more clarification on?