Discussion 12A Recap

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1 Continuous Distributions

- Instead of defining distributions by $\mathbb{P}[X = k]$ like in the discrete case, we look at $\mathbb{P}[a \leq X \leq b]$ in the continuous setting since for any continuous distribution, it must be that $\mathbb{P}[X = k] = 0$ for every k (since our sample spaces are uncountably infinite).
- $\mathbb{P}[a \leq X \leq b] = \int_a^b f_X(x)dx$.
- Continuous distributions are determined by a probability density function, or PDF, which has the following properties:
  - It is nonnegative, i.e. $f_X(x) \geq 0 \; \forall x$.
  - Totality, i.e the integral is 1. $\int_{-\infty}^{\infty} f_X(x)dx = 1$.
- We also have a cumulative distribution function, or CDF, which is $F_X(x) = \mathbb{P}[X \leq x] = \int_{-\infty}^{x} f_X(z)dz$. Important to know that $\dfrac{dF_X(x)}{dx} = f_X(x)$ (derivative of the area under the curve gives the curve).
- Many things we did in the discrete setting also carry over to the continuous setting. Conditional distributions, marginal distribution, and independence all have the same forms.
- Know uniform and exponential distributions and their PDF's and CDF's.