Some Useful Formulas

- $P(A \text{ or } B) = P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}$, $P(B) > 0$
- $P(A \cap B) = P(A) \times P(B \mid A) = P(B) \times P(A \mid B)$
- Bayes' Rule $P(B_j \mid A) = \dfrac{P(B_j \cap A)}{P(A)} = \dfrac{P(A \mid B_j)P(B_j)}{\sum_{i=1}^{k} P(A \mid B_i)P(B_i)}$ for $j = 1,2,...,k$
- $E(X) = \sum xp(x)$ *or* $E(X) = \int xf(x)dx$
- $\sigma^2 = \sum x^2 p(x) - \mu^2$ *or* $\sigma^2 = \int x^2 f(x)dx - \mu^2$
- Binomial Distribution $P(x) = \dfrac{n!}{x!(n-x)!}\pi^x(1-\pi)^{n-x}$, $x = 0,1,2,...,n$

  $\mu = E(X) = n\pi, \quad \sigma = \sqrt{n\pi(1-\pi)}$
- Poisson Distribution $P(x) = \dfrac{e^{-\lambda}\lambda^x}{x!}$, $x = 0,1,2,\ldots$

  $\mu = \lambda$, $\sigma = \sqrt{\lambda}$,
- Hypergeometric Random Variable $P(x) = \dfrac{C_{n-x}^{N-X} C_x^X}{C_n^N} = \dfrac{\binom{N-A}{n-x}\binom{A}{x}}{\binom{N}{n}}$
- Uniform Distribution $f(x) = \begin{cases} \dfrac{1}{b-a} & \text{if } a \le x \le b \\ 0 & \text{otherwise} \end{cases}$,
- Exponential Distribution $P(0 \le x \le a) = 1 - e^{-\lambda a}$