FORMULA SHEET

$P(A^c) = 1 - P(A)$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

FOR $B_1, \ldots, B_K$ mutually exclusive and exhaustive events

$$P(A) = \sum_{i=1}^{K} P(A \cap B_i) = \sum_{i=1}^{K} P(A|B_i) B_i$$

$$P(B_j | A) = \frac{P(A|B_j) P(B_j)}{\sum_{i=1}^{K} P(A|B_i) P(B_i)} \quad \text{Bayes Rule}$$

$P(A \cap B) = P(A) \cdot P(B)$ under Independence

pmf: $f(x) = P(X = x)$,

CDF $F(x) = P(X \leq x) = \sum_{y : y \leq x} f(y)$

where $x \in$ set of possible values of X, i.e x is such that $f(x) > 0$. $\rightarrow D = \{x : f(x) > 0\}$

$\sum_{x \in D} f(x) = 1$

$P(a \leq X \leq b) = F(b) - F(a^-)$ where a^- is the largest possible value of X less than a

$$E(X) = \mu_X = \sum_{x \in D} x \cdot f(x)$$

$$E(h(X)) = \sum_{x \in D} h(x) \cdot f(x)$$

$$E(aX + b) = a E(X) + b \quad \text{for constants } a, b$$

$$V(X) = \sum_{x \in D} (x - \mu_X)^2 \cdot f(x) = E\left[(X - \mu_X)^2\right]$$

$$= E(X^2) - \mu_X^2$$

$$\sigma_X = \sqrt{V(X)}$$

$$V(aX + b) = a^2 V(X)$$

$X \sim Bin(n, p)$ if $f(x) = \binom{n}{x} p^x (1-p)^{n-x}$, $x = 0, 1, \ldots n$

$X \sim Ber(p) \equiv Bin(1, p)$ if $f(x) = \begin{cases} p & \text{if } x = 1 \\ 1-p & \text{if } x = 0 \end{cases}$