STA 256 Formulas

$$\sum_{k=j}^{\infty} a^k = \frac{a^j}{1-a}$$

$$\sum_{k=0}^{\infty} \frac{x^k}{k!} = e^x$$

$$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^k b^{n-k}$$

$\lim_{x\to c} \frac{g(x)}{h(x)} = \lim_{x\to c} \frac{g'(x)}{h'(x)}$ if $\frac{0}{0}$ or $\frac{\infty}{\infty}$ etc.

$$\lim_{n\to\infty} \left(1 + \frac{x}{n}\right)^n = e^x$$

$$\Gamma(\alpha) = \int_0^\infty e^{-t} t^{\alpha-1}\, dt$$

$$\Gamma(\alpha+1) = \alpha\, \Gamma(\alpha)$$

Distributive Laws of Sets:

$$A \cap \left(\cup_{j=1}^{\infty} B_j\right) = \cup_{j=1}^{\infty} (A \cap B_j)$$

$$A \cup \left(\cap_{j=1}^{\infty} B_j\right) = \cap_{j=1}^{\infty} (A \cup B_j)$$

De Morgan Laws:

$$(\cap_{j=1}^{\infty} A_j)^c = \cup_{j=1}^{\infty} A_j^c$$

$$(\cup_{j=1}^{\infty} A_j)^c = \cap_{j=1}^{\infty} A_j^c$$

Properties of probability:

1. $0 \le P(A) \le 1$ for any $A \subseteq S$
2. $P(\emptyset) = 0$
3. $P(S) = 1$
4. If $A_1, A_2 \ldots$ are disjoint subsets of S, $P\left(\cup_{k=1}^{\infty} A_k\right) = \sum_{k=1}^{\infty} P(A_k)$.
5. $P(A^c) = 1 - P(A)$
6. If $A \subseteq B$ then $P(A) \le P(B)$
7. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$_nP_k = \frac{n!}{(n-k)!}$

$\binom{n}{k} = \frac{n!}{k!\,(n-k)!}$

$\binom{n}{n_1 \cdots k_\ell} = \frac{n!}{k_1! \cdots k_\ell!}$

$P(B|A) \stackrel{def}{=} \frac{P(A \cap B)}{P(A)}$

$P(A \cap B) = P(A)P(B|A)$

$P(B) = \sum_{k=1}^{\infty} P(B|A_k)P(A_k)$

$P(B_j|A) = \frac{P(A|B_j)P(B_j)}{\sum_{k=1}^{\infty} P(A|B_k)P(B_k)}$

$P(B|A) = \frac{P(A|B)P(B)}{P(A|B)P(B)+P(A|B^c)P(B^c)}$

A and B independent means $P(A \cap B) = P(A)P(B)$

$P(k \text{ heads}) = \binom{n}{k}\theta^k(1-\theta)^{n-k}$