Chapter 4
Probability of the complement of event $A$: $P(A^c) = 1 - P(A)$

**Multiplication rules**
- $A, B$ independent: $P(A \text{ and } B) = P(A)P(B)$
- General: $P(A \text{ and } B) = P(A | B)P(B)$
- General: $P(A \text{ and } B) = P(B | A)P(A)$

**Additional Rules**
- $A, B$ mutually exclusive: $P(A \text{ or } B) = P(A) + P(B)$
- General: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

**Permutations Rule**
- $P(n, r) = \frac{n!}{(n-r)!}$

**Combinations Rule**
- $C(n, r) = \frac{n!}{r!(n-r)!}$

Chapter 5

- Mean of a discrete probability distribution: $\mu = \sum xP(x)$
- Standard deviation of a discrete probability distribution: $\sigma = \sqrt{\sum (x - \mu)^2 P(x)}$
- For a binomial distribution: $r$ is the number of successes in $n$ trials, $p =$ probability of success, $q =$ probability of failure, $q = 1 - p$
- Binomial probability distribution: $P(r) = C(n, r)p^r q^{n-r}$
- Mean of a binomial probability distribution: $\mu = np$
- Standard deviation of a binomial probability distribution: $\sigma = \sqrt{npq}$.

Chapter 6

- Standard Score: $Z = \frac{x - \mu}{\sigma}$
- Mean and standard deviation of $\bar{x}$-distribution: $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$
- Standard Score for $\bar{x}$: $Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$
- Mean and standard deviation of $\hat{p}$ distribution: $\mu_{\hat{p}} = p$ and $\sigma_{\hat{p}} = \sqrt{\frac{pq}{n}}$

Chapter 7

- Confidence interval for $\mu$: $\bar{x} - E < \mu < \bar{x} + E$, where
  - $E = z_{c} \frac{\sigma}{\sqrt{n}}$ when $\sigma$ is known
  - $E = t_{c} \frac{s}{\sqrt{n}}$ when $\sigma$ is unknown with $df = n - 1$

- Confidence interval for $p$ where $np > 5, nq > 5$: $\hat{p} - E < p < \hat{p} + E$ where $E = z_{c} \sqrt{\frac{pq}{n}}$

- Confidence interval for $\mu_1 - \mu_2$, independent samples: $(\bar{x}_1 - \bar{x}_2) - E < \mu < (\bar{x}_1 - \bar{x}_2) + E$, where
  - $E = z_{c} \frac{s_1^2/n_1 + s_2^2/n_2}{\sigma_1^2/n_1 + \sigma_2^2/n_2}$ when both $\sigma_1$ and $\sigma_2$ are known.
  - $E = t_{c} \frac{s_1^2/n_1 + s_2^2/n_2}{\sigma_1^2/n_1 + \sigma_2^2/n_2}$ when both $\sigma_1$ and $\sigma_2$ are unknown and $df = \min(n_1 - 1, n_2 - 1)$
Confidence interval for \( p_1 - p_2 \): 
\[ \left( \hat{p}_1 - \hat{p}_2 \right) - E < p_1 - p_2 < \left( \hat{p}_1 - \hat{p}_2 \right) + E \]
where 
\[ E = z_c \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}} \]
where \( n_1 \hat{p}_1 > 5, n_1 \hat{q}_1 > 5, n_2 \hat{p}_2 > 5, n_2 \hat{q}_2 > 5 \) are all true.

Sample Size for Estimating:

- Means: \( n = \left( \frac{\sigma}{E} \right)^2 \)
- Proportions: with preliminary estimate for \( p \): \( n = p(1 - p) \left( \frac{z_c}{E} \right)^2 \)
- Proportions: with no estimate for \( p \): \( n = \frac{1}{4} \left( \frac{z_c}{E} \right)^2 \)

Chapter 8: below are the sample test statistics

- For \( \mu \) when \( \sigma \) is known: 
  \[ z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} \]
- For \( \mu \) when \( \sigma \) is unknown: 
  \[ t = \frac{\bar{x} - \mu}{s / \sqrt{n}} \] with \( df = n - 1 \)
- For \( p \) where \( np > 5, nq > 5 \): 
  \[ z = \frac{\bar{p} - p}{\sqrt{pq/n}} \]
- For paired differences \( d \), \( \sigma_1 \) and \( \sigma_2 \) are known: 
  \[ t = \frac{\bar{d} - \mu_d}{s_d / \sqrt{n}} \] with \( df = n - 1 \)