Summary of Useful Equations

Chapter 2

Mean:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Standard deviation:

$$s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

Chapter 3

Factorials:

$$k! = \begin{cases} k \times (k-1) \times \cdots \times 1 & \text{if } k \text{ is a positive integer} \\ 1 & \text{if } k = 0 \end{cases}$$

Permutations:

$${}_kP_r = \frac{k!}{(k-r)!}$$

Combinations:

$${}_kC_r = \frac{k!}{r!(k-r)!}$$

Inclusion-exclusion:

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

Multiplication Rule:

$$P(A \text{ and } B) = P(A) \times P(B|A)$$

Conditional probability:

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$$

Bayes' rule:

$$P(D|+) = \frac{P(+|D) \times P(D)}{P(+|D) \times P(D) + P(+|\text{not } D) \times P(\text{not } D)}$$

Sensitivity:

$$\text{sensitivity} = P(+|D)$$

Specificity:

$$\text{specificity} = P(-|\text{not } D)$$

Chapter 4

Standard error of the sample mean:

$$\text{SE}(\bar{x}) = \frac{\sigma}{\sqrt{n}}$$

Chapter 5

Binomial Distribution:

$$\begin{aligned} P(X = x) &= {}_nC_x p^x (1-p)^{n-x} \quad \text{for } x = 0, \ldots, n \\ \text{mean} = \mu &= np \\ \text{standard deviation} = \sigma &= \sqrt{np(1-p)} \end{aligned}$$

Poisson Distribution:

$$\begin{aligned} P(X = x) &= \frac{e^{-\mu}\mu^x}{x!} \quad \text{for } x = 0, 1, 2, \ldots \\ \text{mean} &= \mu \\ \text{standard deviation} &= \sqrt{\mu} \end{aligned}$$

Normal Distribution:

$$\begin{aligned} z &= \frac{x - \mu}{\sigma} \\ x &= \mu + z\sigma \end{aligned}$$

Chapters 6 and 7

See confidence interval and hypothesis test summary equations.

Chapter 9

One-way ANOVA:

$$\begin{aligned} g &= \text{number of groups} \\ n_i &= \text{sample size of the } i\text{th sample} \\ N &= \text{combined sample size} \\ \bar{x}_i &= \text{sample mean of the } i\text{th sample} \\ \bar{x} &= \text{grand mean} \\ SS_{\text{among}} &= \sum_{i=1}^{g} n_i (\bar{x}_i - \bar{x})^2 \\ SS_{\text{within}} &= \sum_{i=1}^{g} (n_i - 1) s_i^2 \\ df_{\text{among}} &= g - 1 \\ df_{\text{within}} &= N - g \\ MS_{\text{among}} &= SS_{\text{among}} / df_{\text{among}} \\ MS_{\text{within}} &= SS_{\text{within}} / df_{\text{within}} \\ F &= MS_{\text{among}} / MS_{\text{within}} \\ \hat{\sigma} &= \sqrt{MS_{\text{within}}} \end{aligned}$$