Contents

Chapter 1

Text styles

Family is Roman
Family is Sans Serif
`Family is Typewriter`
Color is red
Toggle noun
Toggle emphasis

Chapter 2

Equations

2.1 Summation symbols and nested elements

Suppose we have a random sample Y_i for $i = 1, \ldots, n$ where $E(Y_i) = \mu$ and $Var(Y_i) = \sigma^2$. Asymptotically, the sample mean $\bar{Y} = \sum_{i=1}^{n} Y_i/n$ has a normal distribution where $E(\bar{Y}) = \mu$ and $Var(\bar{Y}) = \sigma^2/n$.

Display formula

$$\bar{Y} = \sum_{i=1}^{n} Y_i/n$$

2.2 Numbering and referencing

Below is an example of a equation numbered

$$f(y) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{(y-\mu)^2}{2\sigma^2}} \tag{2.1}$$

$$f(y) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{(y-\mu)^2}{2\sigma^2}} \tag{2.2}$$

Both Equations 2.1 and 2.2 are exactly the same!

2.3 Multiline equations

My multiline equation:

$$\begin{aligned} f(y) &= \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{(y-\mu)^2}{2\sigma^2}} && (2.3) \\ &= \frac{1}{\sigma\sqrt{2\pi}} \exp((y-\mu)^2/2\sigma^2) && (2.4) \end{aligned}$$

Chapter 3

Floating tables

Table 3.1 displays 95% confidence intervals for π. Due to the large sample size, we see that the intervals are similar with the Wald interval being the most different from the others. The lengths of the intervals are similar as well with the Clopper-Pearson interval being a little longer the others.

Table 3.1: Confidence intervals for the hepatitis C prevalence

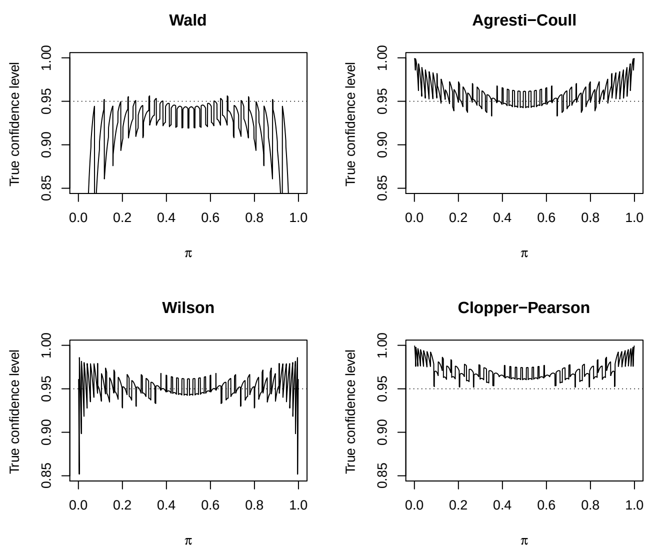
Method	Interval	Length
Wald	(0.0157, 0.0291)	0.0134
Agresti-Coull	(0.0165, 0.0302)	0.0137
Wilson	(0.0166, 0.0301)	0.0135
Clopper-Pearson	(0.0162, 0.0302)	0.0140

Chapter 4

Floating figures

Figure 4.1 provides a comparison of the true confidence levels for the Wald, Wilson, Agresti-Coull, and Clopper-Pearson intervals for π. For each plot, n is 40 and the stated confidence level is 0.95 ($\alpha = 0.05$). The true confidence level (coverage) for each interval method is plotted as a function of π. For example, the true confidence level at $\pi = 0.157$ is 0.8760 for the Wald, 0.9507 for the Wilson, 0.9507 for the Agresti-Coull, and 0.9740 for the Clopper-Pearson intervals, respectively. Obviously, none of these intervals achieve exactly the stated confidence level on a consistent basis.

Figure 4.1: True confidence levels with $n = 40$ and $\alpha = 0.05$.



Chapter 5

Prevent line indenting

Often, one observes multiple Bernoulli random variable responses through repeated sampling or *trials* in identical settings. This leads to defining separate random variables for each trial, $Y_1, \ldots, Y_n$, where n is the number of trials. If all trials are identical and independent, we can treat $W = \sum_{i=1}^{n} Y_i$ as a binomial random variable with PMF of

$$P(W = w) = \binom{n}{w} \pi^w (1 - \pi)^{n-w} \tag{5.1}$$

for $w = 0, \ldots, n$. The combination function $\binom{n}{w} = n!/[w!(n-w)!]$ counts the number of ways w successes and $n - w$ failures can be ordered. The expected value of W is $E(W) = n\pi$, and the variance of W is $Var(W) = n\pi(1-\pi)$. Notice that the Bernoulli distribution is a special case of the binomial distribution when $n = 1$.

Chapter 6

LaTeX code

Suppose Y_i for $i = 1, \ldots, n$ is a random sample from a normal population with mean μ and variance σ^2.

Chapter 7

Code boxes

Continuing from the last example, below is how the calculations are performed in R:

```
> p.tilde <- (w + qnorm(p = 1-alpha/2)^2 / 2) / (n +
    qnorm(p = 1-alpha/2)^2)
> p.tilde
[1] 0.4277533

> #Wilson C.I.
> round(p.tilde + qnorm(p = c(alpha/2, 1-alpha/2)) *
    sqrt(n) / (n + qnorm(p = 1-alpha/2)^2) *
    sqrt(pi.hat*(1-pi.hat) + qnorm(p =
    1-alpha/2)^2/(4*n)), 4)
[1] 0.1682 0.6873

> #Agresti-Coull C.I.
> var.ac <- p.tilde*(1-p.tilde) / (n + qnorm(p =
    1-alpha/2)^2)
> round(p.tilde + qnorm(p = c(alpha/2, 1-alpha/2)) *
    sqrt(var.ac), 4)
[1] 0.1671 0.6884
```

After calculating $\tilde{\pi}$, we calculate the Wilson and Agresti-Coull intervals through one line of code for each. Note that executing part of a line of code can help highlight how it works. For example, one can execute `qnorm(p = c(alpha/2, 1-alpha/2))` to see that it calculates -1.96 and 1.96.

Chapter 8

Example references

Bilder (2009) examines how group testing can be used to determine who is human and who is Cylon on the TV show *Battlestar Galactica*. If only the humans on the Galactica knew of this research, they could have reach Earth much faster.

Bilder et al. (2010) proposes “informative retesting” which is a method to decrease the number of tests needed to screen a population for a disease.

Appendix A

The big proof

This is a really big proof.

Bibliography

Bilder, C. R. (2009). Human or cylon? Group testing on 'Battlestar Galactica'. *Chance*, 22(3):46–50.

Bilder, C. R., Tebbs, J. M., and Chen, P. (2010). Informative retesting. *Journal of the American Statistical Association*, 105(491):942–955.

Index