IS5 in R: More About Tests and Intervals (Chapter 16)

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Introduction and background

This document is intended to help describe how to undertake analyses introduced as examples in the Fifth Edition of *Intro Stats* (2018) by De Veaux, Velleman, and Bock. This file as well as the associated R Markdown reproducible analysis source file used to create it can be found at http://nhorton.people.amherst.edu/is5.

This work leverages initiatives undertaken by Project MOSAIC (http://www.mosaic-web.org), an NSF-funded effort to improve the teaching of statistics, calculus, science and computing in the undergraduate curriculum. In particular, we utilize the `mosaic` package, which was written to simplify the use of R for introductory statistics courses. A short summary of the R needed to teach introductory statistics can be found in the mosaic package vignettes (https://cran.r-project.org/web/packages/mosaic). A paper describing the mosaic approach was published in the *R Journal*: https://journal.r-project.org/archive/2017/RJ-2017-024.

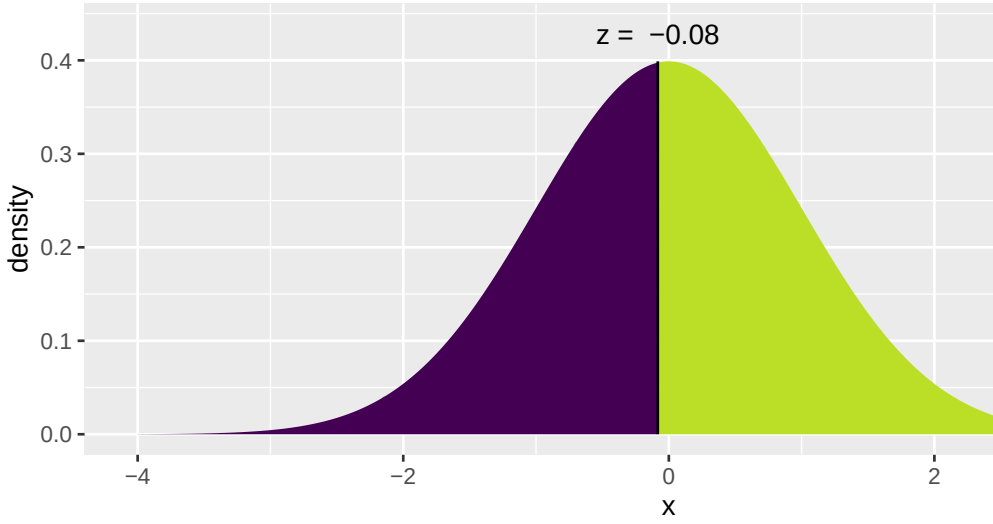
Chapter 16: More About Tests and Intervals

```
library(mosaic)
```

Section 16.1: Interpreting P-Values

What to Do with a Low P-Value

```
# curve on page 511
xqnorm(p = .467, mean = 0, sd = 1, verbose = FALSE)
```

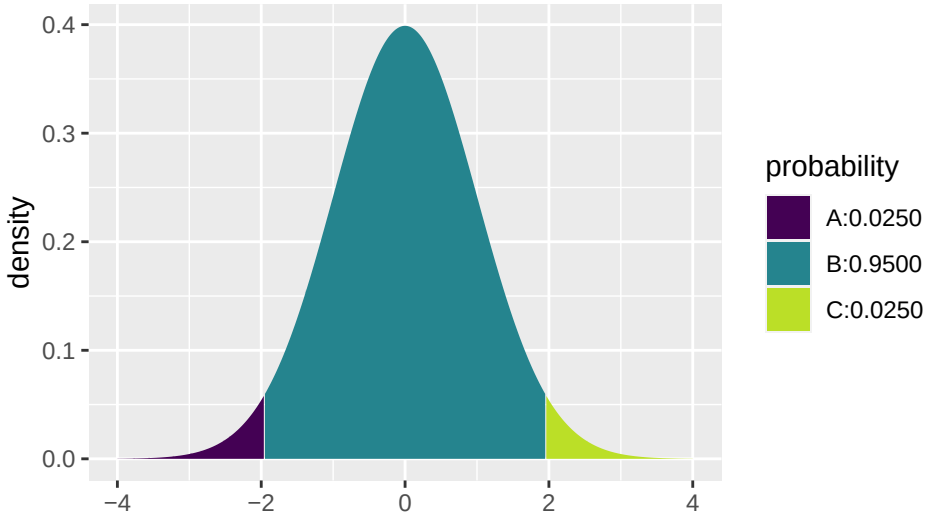


What to Do with a High P-Value

```
## [1] -0.08281329
```

Section 16.2: Alpha Levels and Critical Values

```
# Figure 16.1, page 513
xpnorm(q = c(-1.96, 1.96), mean = 0, sd = 1, verbose = FALSE)
```




```
## [1] 0.0249979 0.9750021
```

Section 16.3: Practical vs. Statistical Significance

Section 16.4: Errors

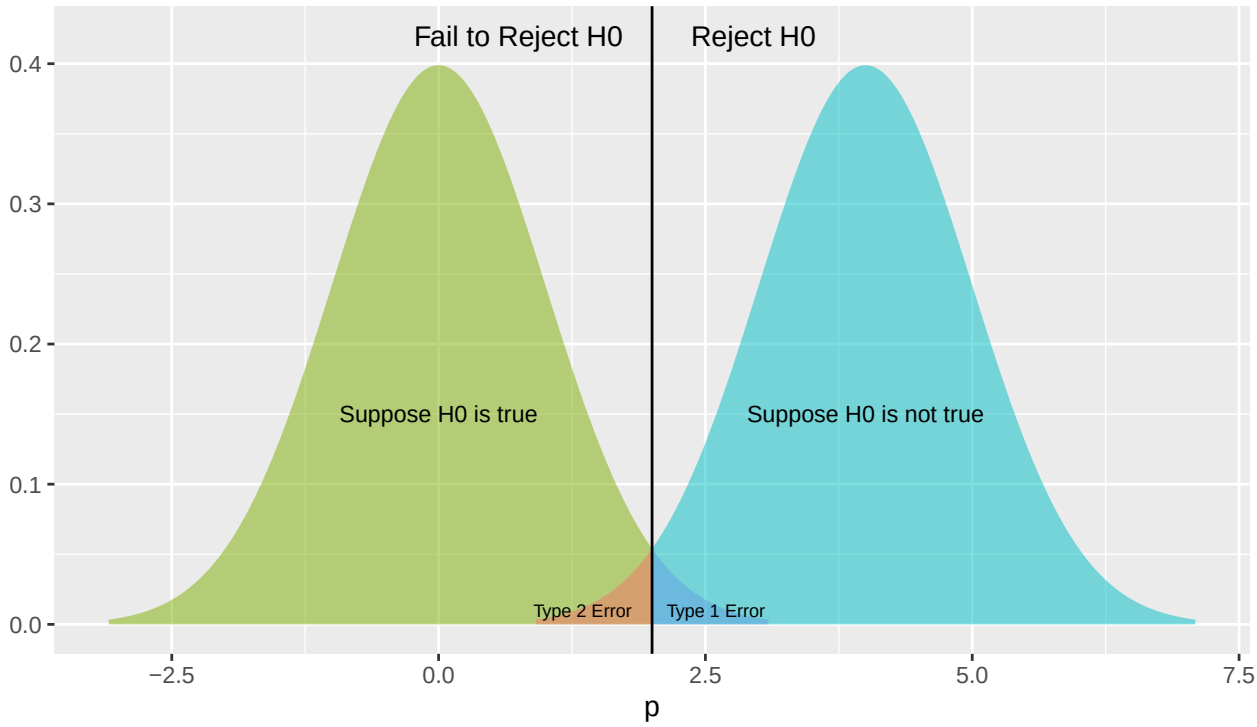
Power

Effect Size

```
# Figure 16.2, page 520
gf_dist("norm",
  mean = 0, sd = 1, fill = ~ cut(x, c(-Inf, 2, 100, Inf)), geom = "area",
  alpha = .5
) %>%
  gf_dist("norm",
    mean = 4, sd = 1, fill = ~ cut(x, c(-Inf, -100, 2, Inf)), geom = "area",
    alpha = .5
  ) %>%
  gf_labs(x = "p", y = "") %>%
  gf_vline(xintercept = 2) %>%
  gf_refine(annotate(geom = "text", x = .75, y = .42, label = "Fail to Reject H0")) %>%
  gf_refine(annotate(geom = "text", x = 2.95, y = .42, label = "Reject H0")) %>%
  gf_refine(annotate(geom = "text", x = 0, y = .15, size = 3, label = "Suppose H0 is true")) %>%
  gf_refine(annotate(geom = "text", x = 1.35, y = .01, size = 2.5, label = "Type 2 Error")) %>%
  gf_refine(annotate(geom = "text", x = 2.6, y = .01, size = 2.5, label = "Type 1 Error")) %>%
  gf_refine(annotate(geom = "text", x = 4, y = .15, size = 3, label = "Suppose H0 is not true")) +
  guides(fill = FALSE) # To remove the legend
```

A Picture Worth $\frac{1}{P(z>3.09)}$ Words

```
## Warning: geom_vline(): Ignoring `mapping` because `xintercept` was provided.
```


Fail to Reject H0
Reject H0
0.4
0.3
0.2
0.1
0.0
Suppose H0 is true
Suppose H0 is not true
Type 2 Error
Type 1 Error
−2.5
0.0
2.5
5.0
7.5
p