Paired Samples and Blocks (Chapter 21)

Patrick Frenett, Vickie Ip, and Nicholas Horton (nhorton@amherst.edu)

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Introduction and background

This document is intended to help describe how to undertake analyses introduced as examples in the Fourth Edition of *Intro Stats* (2013) by De Veaux, Velleman, and Bock. More information about the book can be found at http://wps.aw.com/aw_deveaux_stats_series. This file as well as the associated R Markdown reproducible analysis source file used to create it can be found at https://nhorton.people.amherst.edu/is4.

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 (http://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.

Note that some of the figures in this document may differ slightly from those in the IS4 book due to small differences in datasets. However in all cases the analysis and techniques in R are accurate.

Chapter 21: Paired samples and Blocks

Section 21.1: Paired data

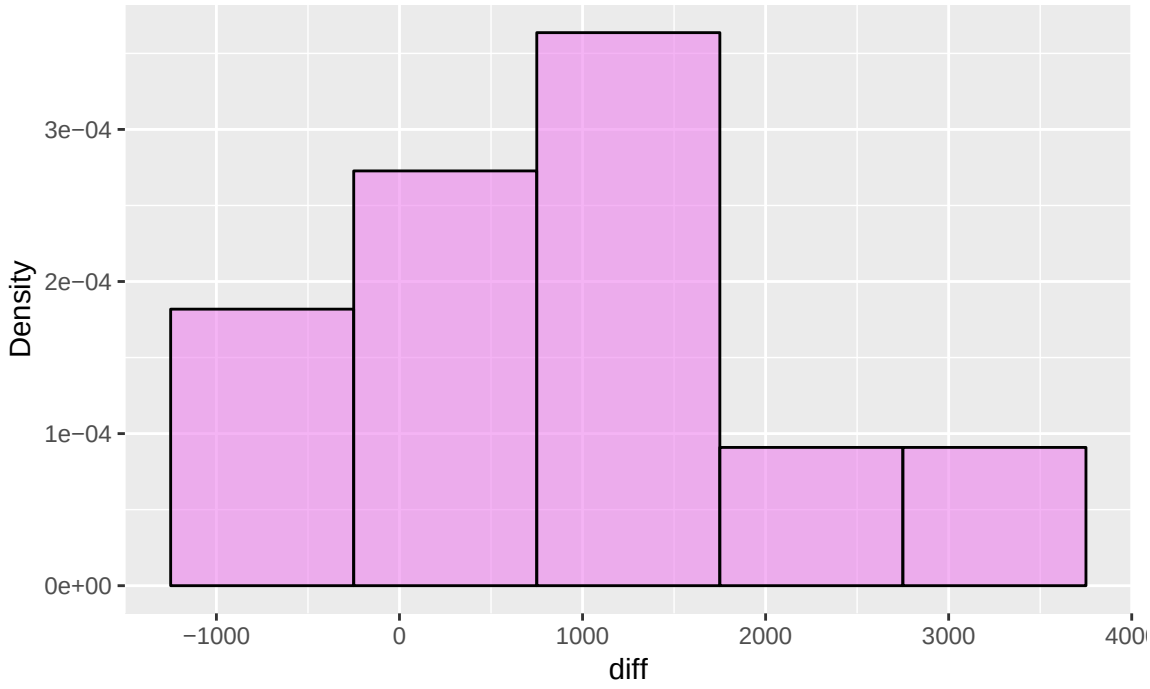
The example on page 586 compares the mileage of 11 field workers using either a 5 day or 4 day schedule.

```
require(mosaic)
fiveday <- c(2798, 7724, 7505, 838, 4592, 8107, 1228, 8718, 1097, 8089, 3807)
fourday <- c(2914, 6112, 6177, 1102, 3281, 4997, 1695, 6606, 1063, 6392, 3362)
ds <- data.frame(fiveday, fourday)
ds <- mutate(ds, diff = fiveday - fourday)
ds
```

```
##    fiveday fourday diff
## 1     2798    2914 -116
## 2     7724    6112 1612
## 3     7505    6177 1328
## 4      838    1102 -264
## 5     4592    3281 1311
## 6     8107    4997 3110
## 7     1228    1695 -467
## 8     8718    6606 2112
## 9     1097    1063   34
## 10    8089    6392 1697
## 11    3807    3362  445
```

Section 21.2: Assumptions and conditions

```
gf_histogram(..density.. ~ diff, binwidth = 1000, center = 500/2, data = ds, fill = "violet",
  col = TRUE, alpha = 0.6) %>%
  gf_labs(y = "Density") # page 589
```




```
t.test(~ diff, data = ds)
```

```
##
##  One Sample t-test
##
## data:  diff
## t = 2.858, df = 10, p-value = 0.01701
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##   216.4276 1747.5724
## sample estimates:
## mean of x
##       982
```

Section 21.3: Confidence intervals for matched pairs

The same result is seen as on page 595 for the confidence interval for the population difference in mileage using the (results not shown).

```
t.test(~ diff, data = ds)$conf.int
```