(there should probably be a figures title page here)

```
library(tidyverse)
library(readxl)
library(smmr)
```

Figure 1: Packages

```
  treatment height
   low       10.1
   low        9.7
   medium     4.8
   medium    11.3
   high      10.3
   high       9.8
```

Figure 2: Data file stored in `biscuit1.txt`

```
treatment length
low 6.1
low 6.5
medium 8.7
medium 10.3
high 3.1
high 13.8
```

Figure 3: Data file stored in `biscuit2.txt`

```
test3 <- read_delim("biscuit2.txt")
```

```
## Rows: 6 Columns: 2
## -- Column specification --------------------------------------------------------
## Delimiter: " "
## chr (1): treatment
## dbl (1): length
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

The dataframe as read in:

```
## # A tibble: 6 x 2
##   treatment length
##   <chr>      <dbl>
## 1 low          6.1
## 2 low          6.5
## 3 medium       8.7
## 4 medium      10.3
## 5 high         3.1
## 6 high        13.8
```

Figure 4: Alternative way of reading data file stored in `biscuit2.txt`

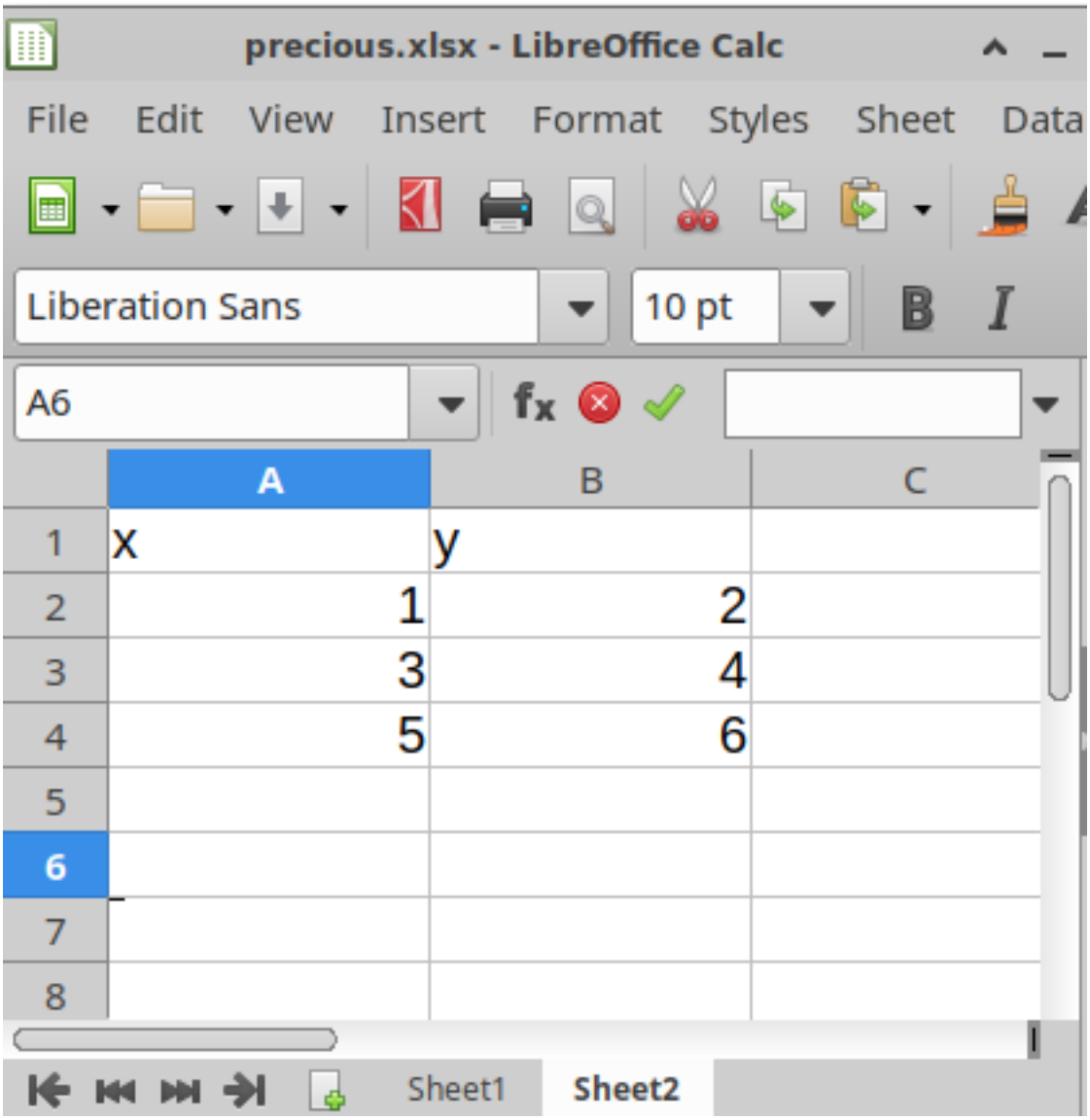


Figure 5: Spreadsheet to be read into R

```
eggs %>% slice(1:20)
```

```
## # A tibble: 20 x 3
##    day   weight day_number
##    <chr>  <dbl>      <dbl>
##  1 A         55          1
##  2 A         53          1
##  3 A         56          1
##  4 A         63          1
##  5 A         66          1
##  6 A         58          1
##  7 A         53          1
##  8 A         57          1
##  9 A         61          1
## 10 A         53          1
## 11 B         59          2
## 12 B         62          2
## 13 B         56          2
## 14 B         51          2
## 15 B         61          2
## 16 B         75          2
## 17 B         57          2
## 18 B         60          2
## 19 B         55          2
## 20 B         74          2
```

Figure 6: Egg weight data (first 20 rows)

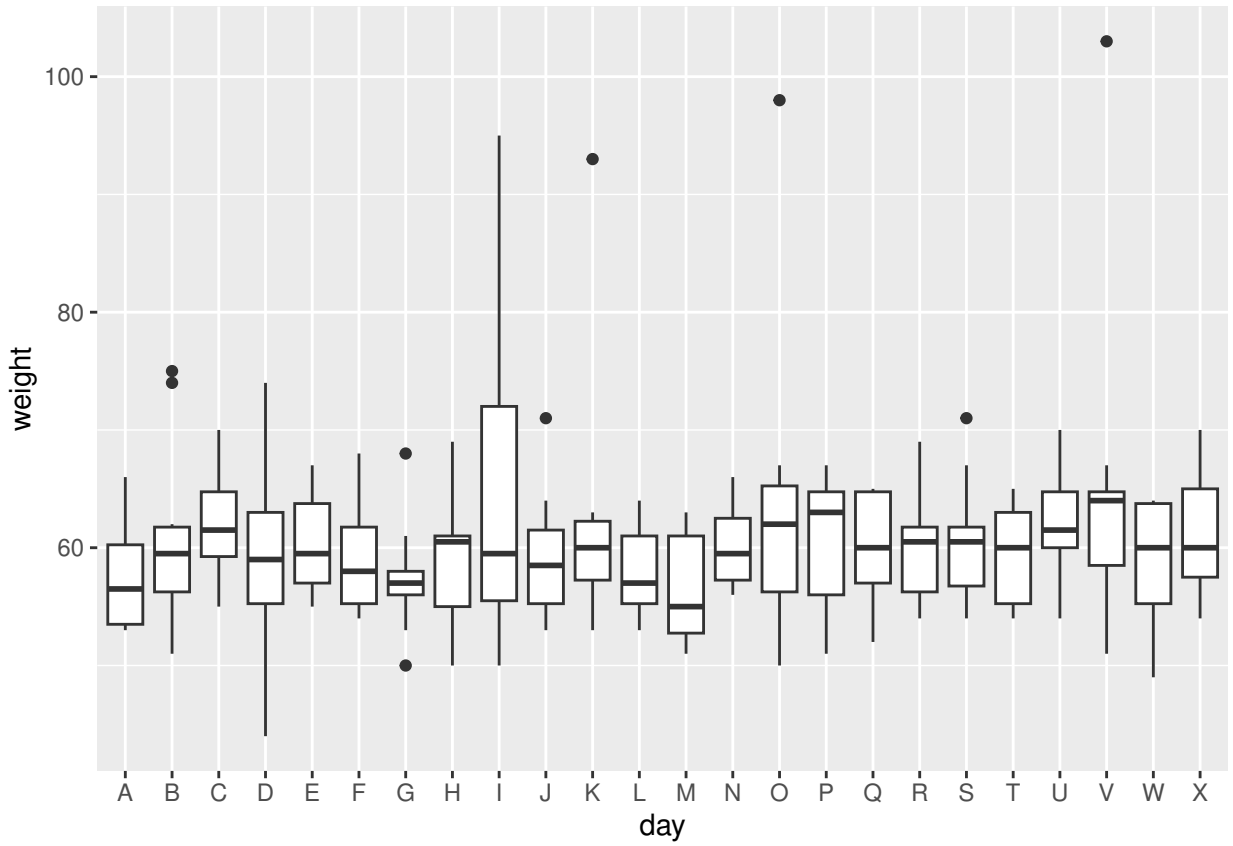


Figure 7: Graph of egg weight data

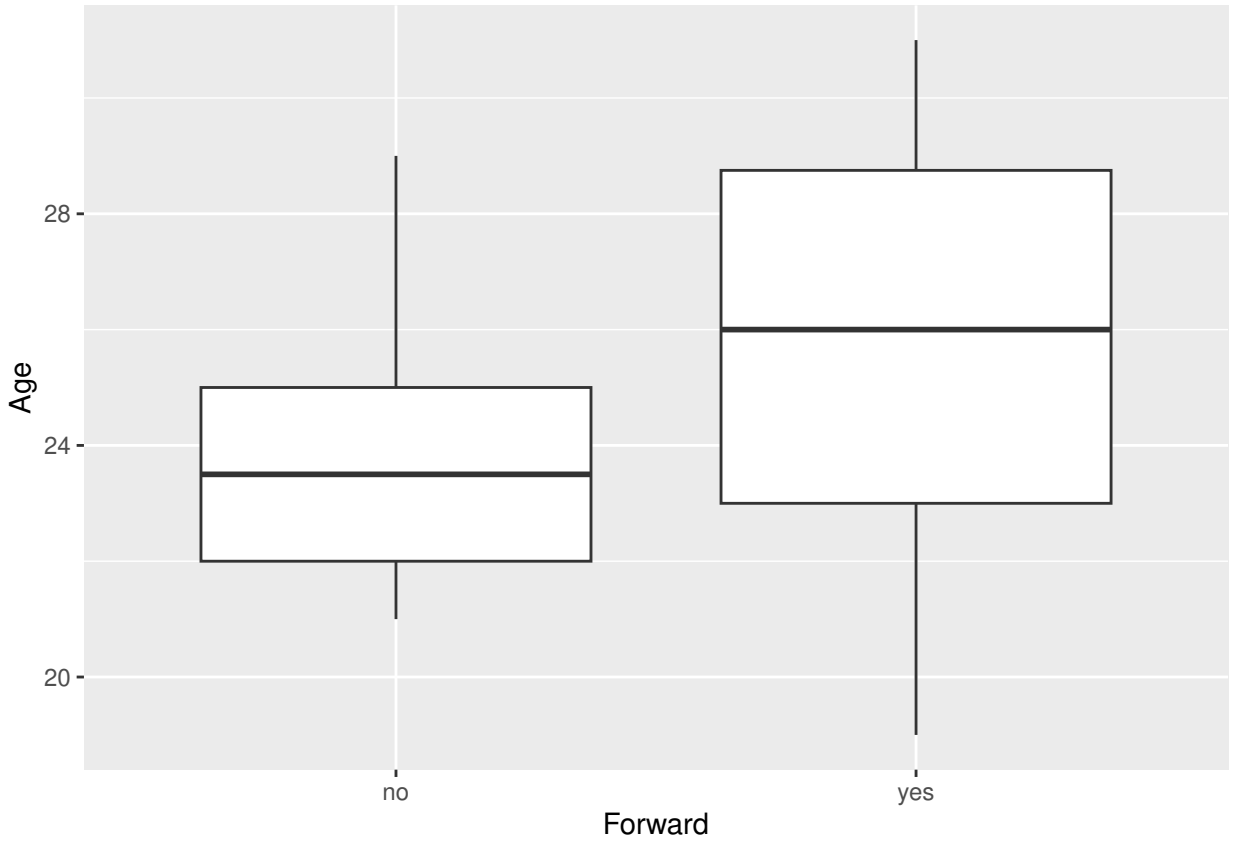
```
seattlepets
```

```
## # A tibble: 52,519 x 7
##    license_issue_date license_number animal_name species primary_breed
##    <date>             <chr>          <chr>       <chr>   <chr>
##  1 2018-11-16         8002756        Wall-E      Dog     Mixed Breed, Medium (u~
##  2 2018-11-11         S124529        Andre       Dog     Terrier, Jack Russell
##  3 2018-11-21         903793         Mac         Dog     Retriever, Labrador
##  4 2018-11-23         824666         Melb        Cat     Domestic Shorthair
##  5 2018-12-30         S119138        Gingersnap  Cat     Domestic Shorthair
##  6 2018-12-16         S138529        Cody        Dog     Retriever, Labrador
##  7 2017-10-04         580652         Millie      Dog     Terrier, Boston
##  8 2018-08-09         S142558        Sebastian   Cat     Domestic Shorthair
##  9 2018-08-20         S142546        Madeline    Cat     Domestic Shorthair
## 10 2018-12-08         S123830        Cleo        Cat     Domestic Shorthair
## # ... with 52,509 more rows, and 2 more variables: secondary_breed <chr>,
## #   zip_code <chr>
```

Figure 8: Seattle pets data (some)

```
## # A tibble: 26 x 8
##    Player          Position   Age Goals Assists PlusMinus PenMins Forward
##    <chr>           <chr>    <dbl> <dbl>   <dbl>     <dbl>   <dbl> <chr>
##  1 Chris Tierney   C           24     9      39       -22      26 yes
##  2 Magnus Paajarvi LW          27    11       8       -14       6 yes
##  3 Bobby Ryan      LW          31    15      27       -29      35 yes
##  4 Dylan DeMelo    D           25     4      18        -1      32 no
##  5 Cody Ceci       D           25     7      19       -22      18 no
##  6 Brady Tkachuk   LW          19    22      23       -10      75 yes
##  7 Colin White     C           22    14      27       -24      24 yes
##  8 Mikkel Boedker  RW          29     7      28       -23       6 yes
##  9 Thomas Chabot   D           22    14      41       -12      32 no
## 10 Zack Smith      C           30     9      19        -6      81 yes
## # ... with 16 more rows
```

Figure 9: Ottawa Senators data (some)




```
OttawaSenators2019 %>%
  count(Forward)
```

```
## # A tibble: 2 x 2
##   Forward     n
##   <chr>   <int>
## 1 no          8
## 2 yes        18
```

Figure 10: Boxplot by position and age, with other information

```
##
##  Welch Two Sample t-test
##
## data:  Age by Forward
## t = -1.4615, df = 19.779, p-value = 0.1596
## alternative hypothesis: true difference in means between group no and group yes is not equal to 0
## 95 percent confidence interval:
##  -4.4855683  0.7911238
## sample estimates:
##  mean in group no mean in group yes
##          23.87500          25.72222
```

Figure 11: t-test for Ottawa Senators data

```
tibble(sim = 1:1000) %>%
  rowwise() %>%
  mutate(my_sample = list(rnorm(15, 50, 9))) %>%
  mutate(t_test = list(t.test(my_sample, mu = 55))) %>%
  mutate(p_value = t_test$p.value) %>%
  count(p_value <= 0.05)
```

```
## # A tibble: 2 x 2
## # Rowwise:
##   `p_value <= 0.05`     n
##   <lgl>             <int>
## 1 FALSE               508
## 2 TRUE                492
```

Figure 12: A power analysis

```
tibble(sim = 1:1000) %>%
  rowwise() %>%
  mutate(my_sample = list(rnorm(30, 50, 9))) %>%
  mutate(t_test = list(t.test(my_sample, mu = 55))) %>%
  mutate(p_value = t_test$p.value) %>%
  count(p_value <= 0.05)
```

```
## # A tibble: 2 x 2
## # Rowwise:
##   `p_value <= 0.05`     n
##   <lgl>             <int>
## 1 FALSE               159
## 2 TRUE                841
```

Figure 13: A second power analysis

```
abbey
```

```
## # A tibble: 31 x 1
##    nickel
##     <dbl>
##  1    5.2
##  2    6.5
##  3    6.9
##  4    7
##  5    7
##  6    7
##  7    7.4
##  8    8
##  9    8
## 10    8
## # ... with 21 more rows
```

Figure 14: Nickel content data (some)

```
ggplot(abbey, aes(x = nickel)) + geom_histogram(bins = 10)
```

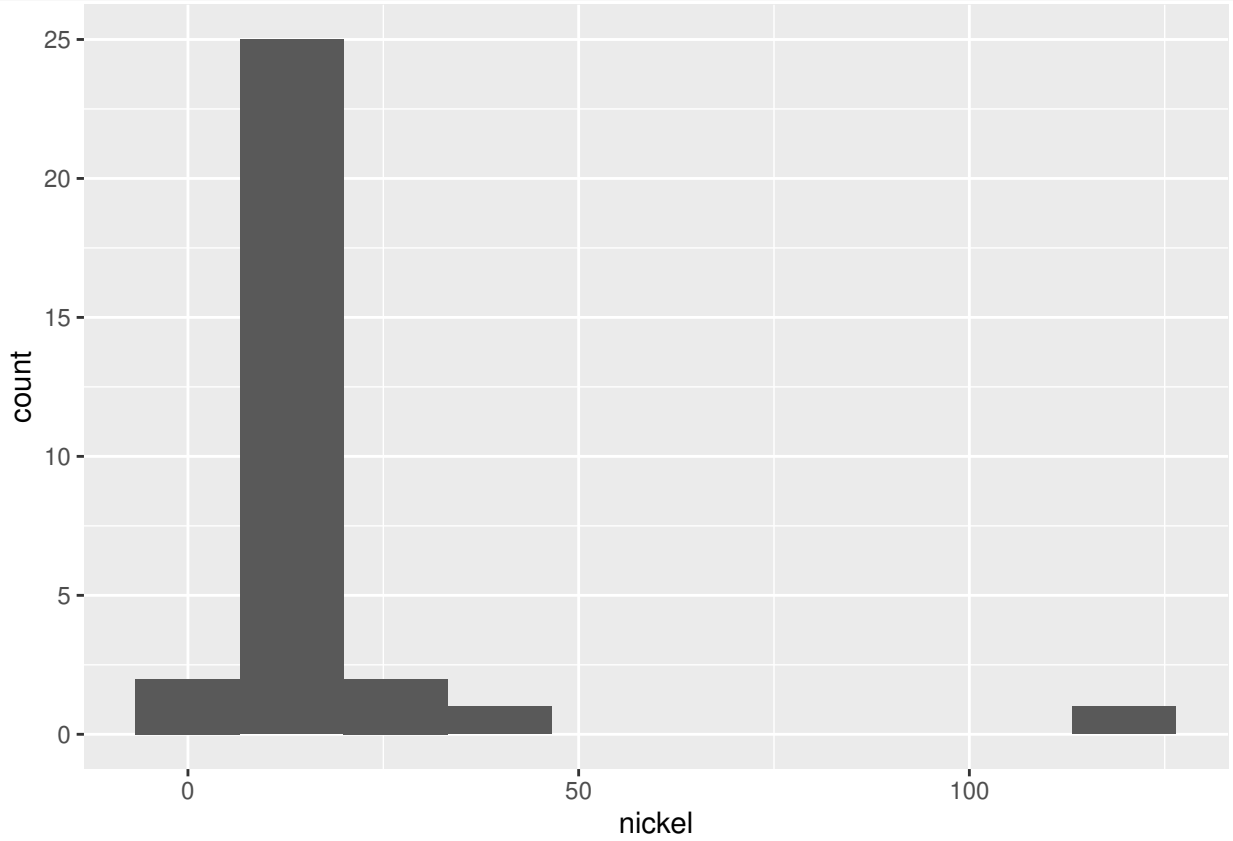


Figure 15: Nickel content histogram

```
tibble(sim = 1:1000) %>%
  rowwise() %>%
  mutate(my_sample = list(sample(abbey$nickel, replace = TRUE))) %>%
  mutate(my_mean = mean(my_sample)) %>%
  ggplot(aes(x = my_mean)) + geom_histogram(bins = 10)
```

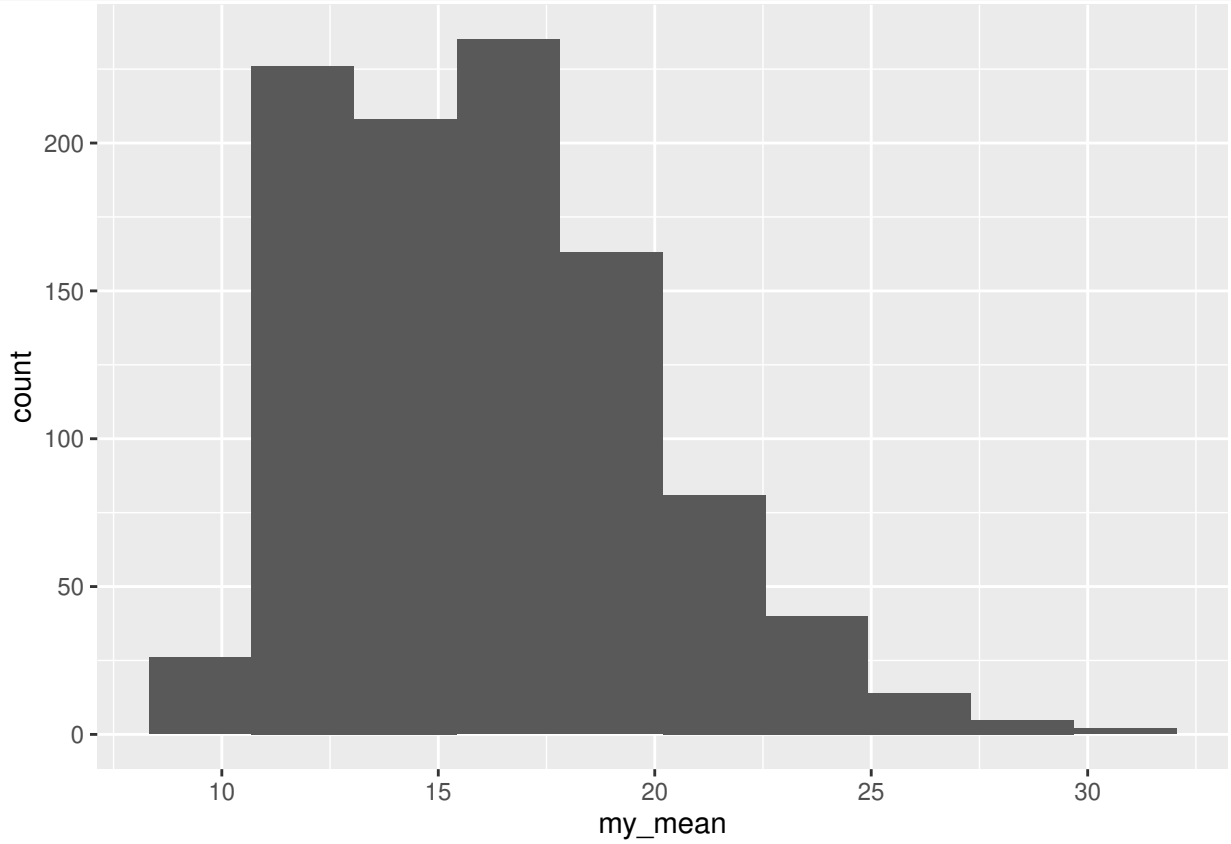


Figure 16: Nickel content further analysis

```
with(abbey, t.test(nickel))
```

```
##
##  One Sample t-test
##
## data:  nickel
## t = 4.1901, df = 30, p-value = 0.0002259
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##   8.204894 23.808009
## sample estimates:
## mean of x
##  16.00645
```

Figure 17: Nickel content confidence interval 1

```
ci_median(abbey, nickel)
```

```
## [1]  8.005078 13.997131
```

Figure 18: Nickel content confidence interval 2

```
sign_test(abbey, nickel, 15)
```

```
## $above_below
## below above
##    23     8
##
## $p_values
##   alternative    p_value
## 1       lower 0.00533692
## 2       upper 0.99833655
## 3   two-sided 0.01067384
```

Figure 19: A test