Week 4 R Practice

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Introduction

Quick recap of the four steps of Hypothesis testing:

1. Formulate hypotheses
2. Identify a test statistic
3. Compute the P-value. The smaller the P-value, the stronger the evidence against the null hypothesis.
4. Compare the p-value with alpha If p<=alpha, the null hypothesis is ruled out.

```
knitr::opts_chunk$set(echo = TRUE)
library(MASS) #Loading the package MASS
library(datasets)
library(dplyr)
```

Load the MASS, datasets and other required packages in R using the library function

```
## Warning: package 'dplyr' was built under R version 3.6.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following object is masked from 'package:MASS':
##
##     select
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(ggpubr)
```

```
## Warning: package 'ggpubr' was built under R version 3.6.3
```

```
## Loading required package: ggplot2
```

```
## Warning: package 'ggplot2' was built under R version 3.6.3
```

```
## Loading required package: magrittr
```

Two-sample t-test to test difference in means

Use the "cats" dataset to answer the question, "do male and female cat samples have the same body weight?"

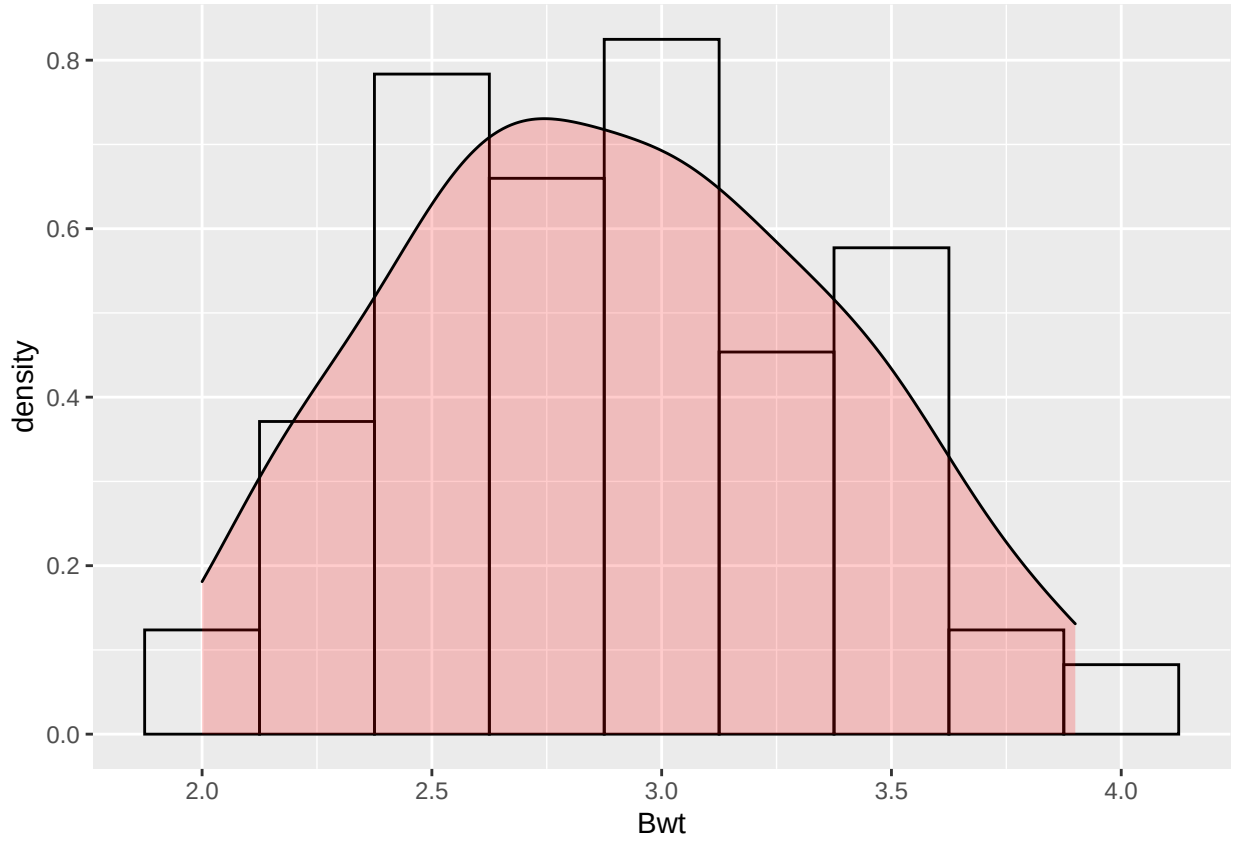
```
?cats
```

code:

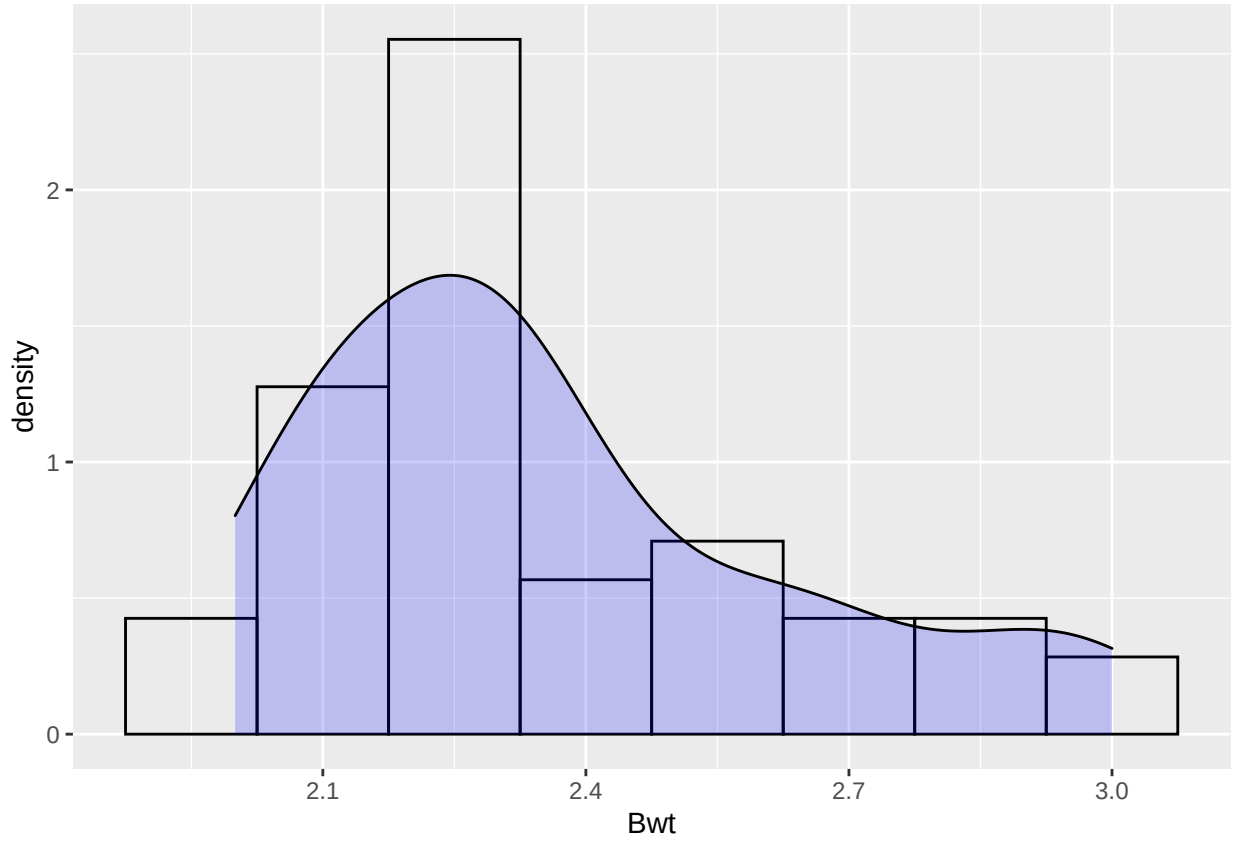
```
## starting httpd help server ... done
```

```
View(cats)
male <- subset(cats, subset=(cats$Sex=="M")) # used subset function to get separate vectors for male an
female <- subset(cats, subset=(cats$Sex=="F"))

ggplot(male,aes(x=Bwt)) +
    geom_histogram(aes(y=..density..),binwidth=0.25,colour="black", fill="light grey") +
        geom_density(alpha=.2, fill="red")
```




```
ggplot(female,aes(x=Bwt)) +
    geom_histogram(aes(y=..density..),binwidth=0.15,colour="black", fill="light grey") +
        geom_density(alpha=.2, fill="blue")
```




```
male_sample <- sample(male, size = 29, replace = TRUE) #Taking sample of 29 values so that n<30 to sati
female_sample <- sample(female, size = 29, replace = TRUE)
```

As we need to find out if the bwt of male cats and female cats are same or not, we'll use a two tailed t test

Null hypothesis (H0) is as follows: Male and female cat samples have the same body weight, i.e difference of mean (mud) = 0

Alternative hypothesis (H1) is as follows: Male and female cat samples have unequal body weight, i.e difference of mean (mud) != 0

Test for equal or unequal variance using F-test Test for the variance of the body weight in male and female cats.

```
ftest_unpaired = var.test(male$Bwt, female$Bwt, paired=FALSE)
ftest_unpaired
```

code:

```
##
##  F test to compare two variances
##
```

```
## data:  male$Bwt and female$Bwt
## F = 2.9112, num df = 96, denom df = 46, p-value = 0.0001157
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  1.723106 4.703057
## sample estimates:
## ratio of variances
##           2.911196
```

Interpretation of the result

Since the true ratio of variances is not equal to 1, this implies that the Body weight of male cats and body weight of female cats have unequal variances.

```
ttest_unpaired = t.test(male$Bwt, female$Bwt,
                        var.equal = FALSE,
                        paired = FALSE)
ttest_unpaired
```

Two sample unpaired t test with unequal variances

```
##
##  Welch Two Sample t-test
##
## data:  male$Bwt and female$Bwt
## t = 8.7095, df = 136.84, p-value = 8.831e-15
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  0.4177242 0.6631268
## sample estimates:
## mean of x mean of y
##  2.900000  2.359574
```

Intepretation of the results

Since p-value < alpha (0.05), we can reject the NULL hypothesis and adopt our alternative hypothesis that mud!=0, i.e., male and female cats do not have same body weights.

Perform Test of equal or given proportions

Using the "bacteria" data set, answer the question, "did the drug treatment have a significant effect of the presence of the bacteria compared with the placebo?"

```
MASS::bacteria
```

code:

```
##     y ap hilo week  ID     trt
## 1   y  p   hi    0 X01 placebo
## 2   y  p   hi    2 X01 placebo
## 3   y  p   hi    4 X01 placebo
## 4   y  p   hi   11 X01 placebo
## 5   y  a   hi    0 X02   drug+
## 6   y  a   hi    2 X02   drug+
## 7   n  a   hi    6 X02   drug+
## 8   y  a   hi   11 X02   drug+
## 9   y  a   lo    0 X03    drug
## 10  y  a   lo    2 X03    drug
## 11  y  a   lo    4 X03    drug
## 12  y  a   lo    6 X03    drug
## 13  y  a   lo   11 X03    drug
## 14  y  p   lo    0 X04 placebo
## 15  y  p   lo    2 X04 placebo
## 16  y  p   lo    4 X04 placebo
## 17  y  p   lo    6 X04 placebo
## 18  y  p   lo   11 X04 placebo
## 19  y  p   lo    0 X05 placebo
## 20  y  p   lo    2 X05 placebo
## 21  y  p   lo    4 X05 placebo
## 22  y  p   lo    6 X05 placebo
## 23  y  p   lo   11 X05 placebo
## 24  y  a   lo    0 X06    drug
## 25  y  a   lo    2 X06    drug
## 26  y  a   lo    4 X06    drug
## 27  y  a   lo   11 X06    drug
## 28  y  a   hi    0 X07   drug+
## 29  n  a   hi    2 X07   drug+
## 30  n  a   hi    4 X07   drug+
## 31  n  a   hi    6 X07   drug+
## 32  y  a   hi   11 X07   drug+
## 33  n  p   hi    0 X08 placebo
## 34  y  p   hi    2 X08 placebo
## 35  y  p   hi    4 X08 placebo
## 36  y  p   hi    6 X08 placebo
## 37  y  p   hi   11 X08 placebo
## 38  y  p   lo    0 X09 placebo
## 39  y  p   lo    2 X09 placebo
## 40  y  p   lo    4 X09 placebo
## 41  y  p   lo    6 X09 placebo
## 42  y  p   lo   11 X09 placebo
## 43  y  a   hi    0 X10   drug+
## 44  y  a   hi    6 X10   drug+
## 45  y  p   hi    0 X11 placebo
## 46  y  p   hi    2 X11 placebo
## 47  y  p   hi    4 X11 placebo
## 48  y  p   hi    6 X11 placebo
## 49  y  p   hi   11 X11 placebo
## 50  y  a   lo    0 X12    drug
## 51  n  a   lo    2 X12    drug
## 52  n  a   lo    4 X12    drug
## 53  y  a   lo    6 X12    drug
```

```
## 54  y  a   lo   11 X12    drug
## 55  y  p   hi    0 X13 placebo
## 56  y  p   hi    2 X13 placebo
## 57  y  p   hi    4 X13 placebo
## 58  y  p   hi    6 X13 placebo
## 59  y  p   hi   11 X13 placebo
## 60  y  p   lo    0 X14 placebo
## 61  y  p   lo    2 X14 placebo
## 62  n  p   lo    4 X14 placebo
## 63  y  a   lo    0 X15    drug
## 64  y  a   lo    2 X15    drug
## 65  y  a   lo    4 X15    drug
## 66  y  a   lo    6 X15    drug
## 67  y  a   lo   11 X15    drug
## 68  y  a   hi    0 X16   drug+
## 69  y  a   hi    2 X16   drug+
## 70  n  a   hi    4 X16   drug+
## 71  y  a   hi    6 X16   drug+
## 72  y  a   hi   11 X16   drug+
## 73  y  p   hi    0 X17 placebo
## 74  y  p   hi    2 X17 placebo
## 75  y  p   hi    4 X17 placebo
## 76  n  p   hi    6 X17 placebo
## 77  y  p   hi   11 X17 placebo
## 78  y  a   lo    0 X18    drug
## 79  y  a   lo    2 X18    drug
## 80  n  a   lo    4 X18    drug
## 81  n  a   lo    6 X18    drug
## 82  n  a   lo   11 X18    drug
## 83  y  p   lo    0 X19 placebo
## 84  y  p   lo    2 X19 placebo
## 85  n  p   lo    4 X19 placebo
## 86  y  p   lo    6 X19 placebo
## 87  n  p   lo   11 X19 placebo
## 88  y  a   hi    0 X20   drug+
## 89  y  a   hi    2 X20   drug+
## 90  y  a   hi    4 X20   drug+
## 91  y  a   hi   11 X20   drug+
## 92  y  p   hi    0 X21 placebo
## 93  y  p   hi    2 X21 placebo
## 94  y  p   hi    4 X21 placebo
## 95  y  p   hi    6 X21 placebo
## 96  y  p   hi   11 X21 placebo
## 97  y  p   hi    0 Y01 placebo
## 98  y  p   hi    2 Y01 placebo
## 99  y  p   hi    4 Y01 placebo
## 100 y  p   hi    6 Y01 placebo
## 101 y  p   hi   11 Y01 placebo
## 102 n  p   lo    0 Y02 placebo
## 103 y  p   lo    2 Y02 placebo
## 104 n  p   lo    4 Y02 placebo
## 105 y  p   lo    6 Y02 placebo
## 106 n  p   lo   11 Y02 placebo
## 107 y  a   hi    0 Y03   drug+
```

```
## 108 y  a   hi    2 Y03   drug+
## 109 y  a   hi    4 Y03   drug+
## 110 n  a   hi    6 Y03   drug+
## 111 n  a   hi   11 Y03   drug+
## 112 n  a   lo    0 Y04    drug
## 113 y  a   lo    2 Y04    drug
## 114 n  a   lo    4 Y04    drug
## 115 n  a   lo   11 Y04    drug
## 116 y  p   hi    0 Y05 placebo
## 117 n  p   hi    2 Y05 placebo
## 118 n  p   hi   11 Y05 placebo
## 119 y  p   lo    0 Y06 placebo
## 120 y  p   lo    2 Y06 placebo
## 121 y  p   lo    6 Y06 placebo
## 122 y  p   lo   11 Y06 placebo
## 123 y  a   lo    0 Y07    drug
## 124 y  a   lo    2 Y07    drug
## 125 y  a   lo    4 Y07    drug
## 126 n  a   lo    6 Y07    drug
## 127 n  a   lo   11 Y07    drug
## 128 y  a   hi    0 Y08   drug+
## 129 y  a   hi    4 Y08   drug+
## 130 y  a   hi    6 Y08   drug+
## 131 n  a   hi   11 Y08   drug+
## 132 y  p   lo    0 Y09 placebo
## 133 y  p   lo    4 Y09 placebo
## 134 y  p   lo    6 Y09 placebo
## 135 y  p   lo   11 Y09 placebo
## 136 y  a   lo    0 Y10    drug
## 137 y  a   lo    2 Y10    drug
## 138 n  a   lo    4 Y10    drug
## 139 y  a   lo    6 Y10    drug
## 140 y  a   lo   11 Y10    drug
## 141 y  p   hi    0 Y11 placebo
## 142 y  p   hi    2 Y11 placebo
## 143 y  p   hi    4 Y11 placebo
## 144 y  p   hi    6 Y11 placebo
## 145 y  p   hi   11 Y11 placebo
## 146 y  a   hi    0 Y12   drug+
## 147 y  a   hi    4 Y12   drug+
## 148 y  a   lo    0 Y13    drug
## 149 n  a   lo    2 Y13    drug
## 150 n  a   lo    4 Y13    drug
## 151 n  a   lo    6 Y13    drug
## 152 y  p   hi    0 Y14 placebo
## 153 y  p   hi    2 Y14 placebo
## 154 y  p   hi   11 Y14 placebo
## 155 y  a   lo    0 Z01    drug
## 156 y  a   lo    2 Z01    drug
## 157 y  a   lo   11 Z01    drug
## 158 y  p   hi    0 Z02 placebo
## 159 y  p   hi    2 Z02 placebo
## 160 y  p   hi    4 Z02 placebo
## 161 y  p   hi    6 Z02 placebo
```

```
## 162 y  p   hi   11 Z02 placebo
## 163 y  a   hi    0 Z03   drug+
## 164 y  a   hi    2 Z03   drug+
## 165 y  a   hi    4 Z03   drug+
## 166 y  a   hi    6 Z03   drug+
## 167 y  a   hi   11 Z03   drug+
## 168 y  p   hi    0 Z05 placebo
## 169 y  p   hi    2 Z05 placebo
## 170 n  p   hi    4 Z05 placebo
## 171 y  p   hi    6 Z05 placebo
## 172 n  p   hi   11 Z05 placebo
## 173 n  a   hi    0 Z06   drug+
## 174 y  a   hi    4 Z06   drug+
## 175 n  a   lo    0 Z07    drug
## 176 y  a   lo    2 Z07    drug
## 177 y  a   lo    4 Z07    drug
## 178 n  a   lo    6 Z07    drug
## 179 y  a   lo   11 Z07    drug
## 180 y  a   hi    0 Z09   drug+
## 181 y  a   hi    2 Z09   drug+
## 182 y  a   hi    6 Z09   drug+
## 183 y  a   hi   11 Z09   drug+
## 184 y  p   hi    0 Z10 placebo
## 185 y  p   hi    2 Z10 placebo
## 186 y  p   hi    4 Z10 placebo
## 187 y  p   hi    6 Z10 placebo
## 188 y  p   hi   11 Z10 placebo
## 189 y  a   lo    0 Z11    drug
## 190 y  a   lo    2 Z11    drug
## 191 y  a   lo    4 Z11    drug
## 192 y  a   lo    6 Z11    drug
## 193 y  a   lo   11 Z11    drug
## 194 y  a   hi    0 Z14   drug+
## 195 y  a   hi    2 Z14   drug+
## 196 y  a   hi    4 Z14   drug+
## 197 y  a   hi    6 Z14   drug+
## 198 n  a   hi   11 Z14   drug+
## 199 y  a   lo    0 Z15    drug
## 200 y  a   lo    4 Z15    drug
## 201 y  a   lo    6 Z15    drug
## 202 y  a   hi    0 Z19   drug+
## 203 y  a   hi    2 Z19   drug+
## 204 y  a   hi    4 Z19   drug+
## 205 y  a   hi    6 Z19   drug+
## 206 y  a   hi   11 Z19   drug+
## 207 y  a   lo    0 Z20    drug
## 208 y  a   lo    2 Z20    drug
## 209 n  a   lo    6 Z20    drug
## 210 n  a   lo   11 Z20    drug
## 211 y  a   hi    0 Z24   drug+
## 212 y  a   hi    2 Z24   drug+
## 213 y  a   hi    4 Z24   drug+
## 214 n  a   hi    6 Z24   drug+
## 215 n  a   hi   11 Z24   drug+
```

```
## 216 y  a   hi    0 Z26   drug+
## 217 y  a   hi    2 Z26   drug+
## 218 y  a   hi    4 Z26   drug+
## 219 n  a   hi    6 Z26   drug+
## 220 y  a   hi   11 Z26   drug+
```

```
?bacteria
View(bacteria)

active <- subset(bacteria, subset=(bacteria$ap=="a")) # taking subset with the presence of the drug eit

placebo <- subset(bacteria, subset=(bacteria$ap=="p"))

active
```

```
##     y ap hilo week  ID   trt
## 5   y  a   hi    0 X02 drug+
## 6   y  a   hi    2 X02 drug+
## 7   n  a   hi    6 X02 drug+
## 8   y  a   hi   11 X02 drug+
## 9   y  a   lo    0 X03  drug
## 10  y  a   lo    2 X03  drug
## 11  y  a   lo    4 X03  drug
## 12  y  a   lo    6 X03  drug
## 13  y  a   lo   11 X03  drug
## 24  y  a   lo    0 X06  drug
## 25  y  a   lo    2 X06  drug
## 26  y  a   lo    4 X06  drug
## 27  y  a   lo   11 X06  drug
## 28  y  a   hi    0 X07 drug+
## 29  n  a   hi    2 X07 drug+
## 30  n  a   hi    4 X07 drug+
## 31  n  a   hi    6 X07 drug+
## 32  y  a   hi   11 X07 drug+
## 43  y  a   hi    0 X10 drug+
## 44  y  a   hi    6 X10 drug+
## 50  y  a   lo    0 X12  drug
## 51  n  a   lo    2 X12  drug
## 52  n  a   lo    4 X12  drug
## 53  y  a   lo    6 X12  drug
## 54  y  a   lo   11 X12  drug
## 63  y  a   lo    0 X15  drug
## 64  y  a   lo    2 X15  drug
## 65  y  a   lo    4 X15  drug
## 66  y  a   lo    6 X15  drug
## 67  y  a   lo   11 X15  drug
## 68  y  a   hi    0 X16 drug+
## 69  y  a   hi    2 X16 drug+
## 70  n  a   hi    4 X16 drug+
## 71  y  a   hi    6 X16 drug+
## 72  y  a   hi   11 X16 drug+
## 78  y  a   lo    0 X18  drug
## 79  y  a   lo    2 X18  drug
## 80  n  a   lo    4 X18  drug
```

```
## 81  n  a   lo    6 X18  drug
## 82  n  a   lo   11 X18  drug
## 88  y  a   hi    0 X20 drug+
## 89  y  a   hi    2 X20 drug+
## 90  y  a   hi    4 X20 drug+
## 91  y  a   hi   11 X20 drug+
## 107 y  a   hi    0 Y03 drug+
## 108 y  a   hi    2 Y03 drug+
## 109 y  a   hi    4 Y03 drug+
## 110 n  a   hi    6 Y03 drug+
## 111 n  a   hi   11 Y03 drug+
## 112 n  a   lo    0 Y04  drug
## 113 y  a   lo    2 Y04  drug
## 114 n  a   lo    4 Y04  drug
## 115 n  a   lo   11 Y04  drug
## 123 y  a   lo    0 Y07  drug
## 124 y  a   lo    2 Y07  drug
## 125 y  a   lo    4 Y07  drug
## 126 n  a   lo    6 Y07  drug
## 127 n  a   lo   11 Y07  drug
## 128 y  a   hi    0 Y08 drug+
## 129 y  a   hi    4 Y08 drug+
## 130 y  a   hi    6 Y08 drug+
## 131 n  a   hi   11 Y08 drug+
## 136 y  a   lo    0 Y10  drug
## 137 y  a   lo    2 Y10  drug
## 138 n  a   lo    4 Y10  drug
## 139 y  a   lo    6 Y10  drug
## 140 y  a   lo   11 Y10  drug
## 146 y  a   hi    0 Y12 drug+
## 147 y  a   hi    4 Y12 drug+
## 148 y  a   lo    0 Y13  drug
## 149 n  a   lo    2 Y13  drug
## 150 n  a   lo    4 Y13  drug
## 151 n  a   lo    6 Y13  drug
## 155 y  a   lo    0 Z01  drug
## 156 y  a   lo    2 Z01  drug
## 157 y  a   lo   11 Z01  drug
## 163 y  a   hi    0 Z03 drug+
## 164 y  a   hi    2 Z03 drug+
## 165 y  a   hi    4 Z03 drug+
## 166 y  a   hi    6 Z03 drug+
## 167 y  a   hi   11 Z03 drug+
## 173 n  a   hi    0 Z06 drug+
## 174 y  a   hi    4 Z06 drug+
## 175 n  a   lo    0 Z07  drug
## 176 y  a   lo    2 Z07  drug
## 177 y  a   lo    4 Z07  drug
## 178 n  a   lo    6 Z07  drug
## 179 y  a   lo   11 Z07  drug
## 180 y  a   hi    0 Z09 drug+
## 181 y  a   hi    2 Z09 drug+
## 182 y  a   hi    6 Z09 drug+
## 183 y  a   hi   11 Z09 drug+
```

```
## 189 y  a   lo    0 Z11  drug
## 190 y  a   lo    2 Z11  drug
## 191 y  a   lo    4 Z11  drug
## 192 y  a   lo    6 Z11  drug
## 193 y  a   lo   11 Z11  drug
## 194 y  a   hi    0 Z14 drug+
## 195 y  a   hi    2 Z14 drug+
## 196 y  a   hi    4 Z14 drug+
## 197 y  a   hi    6 Z14 drug+
## 198 n  a   hi   11 Z14 drug+
## 199 y  a   lo    0 Z15  drug
## 200 y  a   lo    4 Z15  drug
## 201 y  a   lo    6 Z15  drug
## 202 y  a   hi    0 Z19 drug+
## 203 y  a   hi    2 Z19 drug+
## 204 y  a   hi    4 Z19 drug+
## 205 y  a   hi    6 Z19 drug+
## 206 y  a   hi   11 Z19 drug+
## 207 y  a   lo    0 Z20  drug
## 208 y  a   lo    2 Z20  drug
## 209 n  a   lo    6 Z20  drug
## 210 n  a   lo   11 Z20  drug
## 211 y  a   hi    0 Z24 drug+
## 212 y  a   hi    2 Z24 drug+
## 213 y  a   hi    4 Z24 drug+
## 214 n  a   hi    6 Z24 drug+
## 215 n  a   hi   11 Z24 drug+
## 216 y  a   hi    0 Z26 drug+
## 217 y  a   hi    2 Z26 drug+
## 218 y  a   hi    4 Z26 drug+
## 219 n  a   hi    6 Z26 drug+
## 220 y  a   hi   11 Z26 drug+
```

```
count_active <- nrow(active) # count of rows with the drug present
count_active
```

```
## [1] 124
```

```
placebo
```

```
##     y ap hilo week  ID     trt
## 1   y  p   hi    0 X01 placebo
## 2   y  p   hi    2 X01 placebo
## 3   y  p   hi    4 X01 placebo
## 4   y  p   hi   11 X01 placebo
## 14  y  p   lo    0 X04 placebo
## 15  y  p   lo    2 X04 placebo
## 16  y  p   lo    4 X04 placebo
## 17  y  p   lo    6 X04 placebo
## 18  y  p   lo   11 X04 placebo
## 19  y  p   lo    0 X05 placebo
## 20  y  p   lo    2 X05 placebo
## 21  y  p   lo    4 X05 placebo
```

```
## 22  y  p   lo    6 X05 placebo
## 23  y  p   lo   11 X05 placebo
## 33  n  p   hi    0 X08 placebo
## 34  y  p   hi    2 X08 placebo
## 35  y  p   hi    4 X08 placebo
## 36  y  p   hi    6 X08 placebo
## 37  y  p   hi   11 X08 placebo
## 38  y  p   lo    0 X09 placebo
## 39  y  p   lo    2 X09 placebo
## 40  y  p   lo    4 X09 placebo
## 41  y  p   lo    6 X09 placebo
## 42  y  p   lo   11 X09 placebo
## 45  y  p   hi    0 X11 placebo
## 46  y  p   hi    2 X11 placebo
## 47  y  p   hi    4 X11 placebo
## 48  y  p   hi    6 X11 placebo
## 49  y  p   hi   11 X11 placebo
## 55  y  p   hi    0 X13 placebo
## 56  y  p   hi    2 X13 placebo
## 57  y  p   hi    4 X13 placebo
## 58  y  p   hi    6 X13 placebo
## 59  y  p   hi   11 X13 placebo
## 60  y  p   lo    0 X14 placebo
## 61  y  p   lo    2 X14 placebo
## 62  n  p   lo    4 X14 placebo
## 73  y  p   hi    0 X17 placebo
## 74  y  p   hi    2 X17 placebo
## 75  y  p   hi    4 X17 placebo
## 76  n  p   hi    6 X17 placebo
## 77  y  p   hi   11 X17 placebo
## 83  y  p   lo    0 X19 placebo
## 84  y  p   lo    2 X19 placebo
## 85  n  p   lo    4 X19 placebo
## 86  y  p   lo    6 X19 placebo
## 87  n  p   lo   11 X19 placebo
## 92  y  p   hi    0 X21 placebo
## 93  y  p   hi    2 X21 placebo
## 94  y  p   hi    4 X21 placebo
## 95  y  p   hi    6 X21 placebo
## 96  y  p   hi   11 X21 placebo
## 97  y  p   hi    0 Y01 placebo
## 98  y  p   hi    2 Y01 placebo
## 99  y  p   hi    4 Y01 placebo
## 100 y  p   hi    6 Y01 placebo
## 101 y  p   hi   11 Y01 placebo
## 102 n  p   lo    0 Y02 placebo
## 103 y  p   lo    2 Y02 placebo
## 104 n  p   lo    4 Y02 placebo
## 105 y  p   lo    6 Y02 placebo
## 106 n  p   lo   11 Y02 placebo
## 116 y  p   hi    0 Y05 placebo
## 117 n  p   hi    2 Y05 placebo
## 118 n  p   hi   11 Y05 placebo
## 119 y  p   lo    0 Y06 placebo
```

```
## 120 y  p   lo    2 Y06 placebo
## 121 y  p   lo    6 Y06 placebo
## 122 y  p   lo   11 Y06 placebo
## 132 y  p   lo    0 Y09 placebo
## 133 y  p   lo    4 Y09 placebo
## 134 y  p   lo    6 Y09 placebo
## 135 y  p   lo   11 Y09 placebo
## 141 y  p   hi    0 Y11 placebo
## 142 y  p   hi    2 Y11 placebo
## 143 y  p   hi    4 Y11 placebo
## 144 y  p   hi    6 Y11 placebo
## 145 y  p   hi   11 Y11 placebo
## 152 y  p   hi    0 Y14 placebo
## 153 y  p   hi    2 Y14 placebo
## 154 y  p   hi   11 Y14 placebo
## 158 y  p   hi    0 Z02 placebo
## 159 y  p   hi    2 Z02 placebo
## 160 y  p   hi    4 Z02 placebo
## 161 y  p   hi    6 Z02 placebo
## 162 y  p   hi   11 Z02 placebo
## 168 y  p   hi    0 Z05 placebo
## 169 y  p   hi    2 Z05 placebo
## 170 n  p   hi    4 Z05 placebo
## 171 y  p   hi    6 Z05 placebo
## 172 n  p   hi   11 Z05 placebo
## 184 y  p   hi    0 Z10 placebo
## 185 y  p   hi    2 Z10 placebo
## 186 y  p   hi    4 Z10 placebo
## 187 y  p   hi    6 Z10 placebo
## 188 y  p   hi   11 Z10 placebo
```

```
count_placebo <- nrow(placebo) # count of rows with the drug absent
count_placebo
```

```
## [1] 96
```

```
p_active <- sum(active$y == "n") #TRUE is interpreted as 1 and FALSE as 0, this returns the number of T
p_active
```

```
## [1] 31
```

```
p_placebo <- sum(placebo$y == "n") #Returns count of rows wherever bacteria is absent in case of placeb
p_placebo
```

```
## [1] 12
```

```
31/124 # proportion of children without bacteria while being treated with drug
```

```
## [1] 0.25
```

```r
12/96  # proportion of children without bacteria while being given placebo
```

```
## [1] 0.125
```

Group active with drug: n = 124 Group placebo without drug: n = 96

The number of infections persisting in each group is as follow:

Proportion of Group active without bacteria: n = 124, p= 31 patients without bacteria, p/n = 31/124=0.25
Proportion of Group placebo without bacteria: n = 96, p= 12 patients without bacteria, p/n =12/96= 0.125

As we need to find out if the drug treatment had a significant reduction in the presence of bacteria, we'll use a one-tailed, two sample t test for proportions.

Null hypothesis (H0) is as follows: The drug treatment did not cause a significant reduction in the presence of bacteria in the infected patients, i.e. P(Active) = P(Placebo), where P(Active) represents the proportion of patients who lost the bacteria because of the drug and P(Placebo) represents the proportion of patients who lost the bacteria because of the placebo, i.e. without the drug.

Alternative hypothesis (H1) is as follows: The drug treatment caused a significant reduction in the presence of bacteria in the infected patients, i.e. P(Active) > P(Placebo)

```r
?prop.test
```

```r
tproportions = prop.test(x = c(p_active, p_placebo), n = c(count_active, count_placebo),
                         alternative = "greater")
tproportions
```

one-tailed, two sample t test for proportions.

```
##
##  2-sample test for equality of proportions with continuity correction
##
## data:  c(p_active, p_placebo) out of c(count_active, count_placebo)
## X-squared = 4.6109, df = 1, p-value = 0.01588
## alternative hypothesis: greater
## 95 percent confidence interval:
##  0.03106271 1.00000000
## sample estimates:
## prop 1 prop 2
##  0.250  0.125
```

Interpretation of the result

The p-value of the test is 0.01588, which is less than the significance level alpha = 0.05. We can conclude that the drug treatment had a significant effect of the presence of the bacteria compared with the placebo, i.e. it significantly reduced the presence of bacteria in children.