Sparrows' nests experiment analysis

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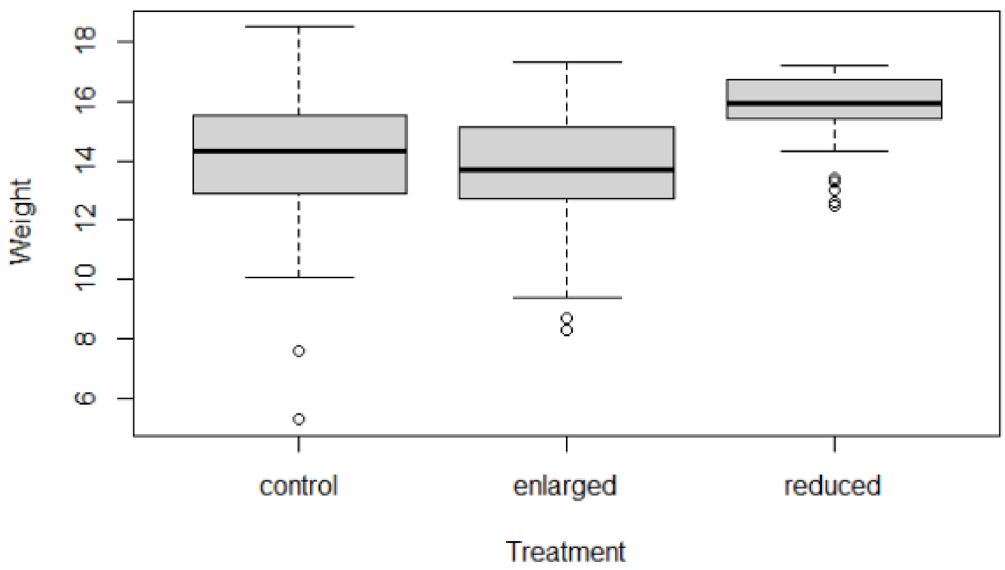
I. Introduction

In this question we are going to see if different nest for sparrows on Kent Island attracted different size sparrows in the experiment. We are going to use hypothesis testing and the confidence of difference of mean weight between treatments to determine whether the mean of weights of birds with are attracted by different type of nests are the same or not by using R.

II. Summary

Here is the boxplot of the data, and the sample means and sample standard deviations table: (all from R)



Treatment	Sample weight mean	Sample weight sd
control	13.92444	2.419631
enlarge	13.51556	2.103996
reduced	15.56923	1.459252

From the plot we could see that the average weight medians of different treatment are different from each other because they are not in the same line. And average weight medians of birds that attracted by nests which are manipulated to be a smaller next than normal is the largest, average weight medians of birds that attracted by nests which are manipulated to be a larger nest that normal is the smallest. The spread of each groups is not similar. Also, from the table we could know each groups' sample weight mean and sample weight standard deviation which shows that the sample means are different from each other, and that might show that there is a difference between birds' weight attracted by different nest for sparrows on Kent Island.

III. Diagnostics

Assumption: At least one of the group's weight mean is different from another.

From the boxplot graph we can notice that there are several outliers in each group. So, we use R to remove those outliers. And use the new data to create an ANOVA table:

```
Analysis of Variance Table

Response: Weight
           Df  Sum Sq Mean Sq F value    Pr(>F)
Treatment   2  86.101  43.050  15.412 1.374e-06 ***
Residuals 104 290.512   2.793
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
[1] 15.41156
[1] 1.373998e-06
```

IV. Analysis

H0: Weight means of each different groups of treatment are the same.

HA: At least one of the group's weight mean is different from another.

With the new data without outliers, we could find F-value and P-value and use them to determine our hypothesis test. And then we calculate the power of the test and use the power to determine the strength of the test.

F-value	P-value	power
15.41156	1.373998e-06	0.999207

From the anova table we could get F-value (15.41156), and P-value (1.373998e-06), and use these values, then we get power=0.999207 and confidence interval for the following (in C.I. table).

Because we believe that there is a difference between each different nest, so we use confidence intervals of the weight difference between two nests to determine it.

Here is the table for the result calculation: (assuming: a=0.05)

C.I. for largest sparrow nest	(15.46723, 16.91372)
C.I. for difference between control nest to the enlarged nest	(-0.1915319, 1.2380436)
C.I. for difference between control nest to the reduced nest	(-2.800736 , -1.036030)

Because P-value < 0.05, reject null hypothesis, which shows that there is at least one of the group's weight mean is different from another. And the power is close to 1 which means that the test is strong.

V. Interpretation

Since our permutation p-value is less than alpha for any reasonable choice of alpha (p-value < 0.01), we conclude that at least one of the group's weight mean is different from another.

To assess the differences in more detail, we found the weight range of the difference between control nest to the enlarged nest is from

–0.1915319 to 1.2380436, and the weight range of the difference between control nest to the reduced nest is from -2.800736 to –1.03630, which means that the weight of the birds which attracted by control nest is mostly larger than birds attracted by enlarged nest, and the weight of the birds which attracted by reduced nest is larger than birds attracted by control nest.

This suggests differ significantly between the mean weight of sparrows in the control and the expanded group, with more sparrows in the reduced group than in the control group, while the mean weight of sparrows in the control group was greater than in the enlarged group.

VI. Conclusion

We conclude with statistical significance that at least one group has a different weight mean than the other group. And the mean weight of the reduced group was significantly different from the control group weight. This means that into a smaller than normal sparrow nest can attract heavier sparrows.

````
###R code###
```{r,echo=FALSE}
library(dplyr)
library(plyr)
sparrow <- read.csv("C:/Users/windows/Desktop/New folder
````
````

```
(3)/Statistics/STA 106/Rstu/data set/sparrow.csv")

all.ave = aggregate(Weight ~ Treatment, data = sparrow, mean)

all.ave

all.ave = aggregate(Weight ~ Treatment, data = sparrow, sd)

all.ave

boxplot(Weight ~ Treatment, data = sparrow)




c1=filter(sparrow,Treatment=="control")

summary(c1)

IQR1=15.50-12.90

low1=12.90-1.5*IQR1

low1

CO1 = filter(sparrow,Treatment=="control" & Weight > low1)




c2=filter(sparrow,Treatment=="enlarged")

summary(c2)

IQR2=15.10-12.70

low2=12.70-1.5*IQR2
```

low2

CO2 = filter(sparrow,Treatment=="enlarged" & Weight > low2)

c3=filter(sparrow,Treatment=="reduced")

summary(c3)

IQR3=16.70-15.43

low3=15.5-1.5*IQR3

low3

CO3 = filter(sparrow,Treatment=="reduced" & Weight > low3)

CO=rbind.fill(CO1,CO2,CO3)

CO

```

```{r,echo=FALSE}

the.model = lm(Weight~Treatment, data=CO)

anova.table = anova(the.model)

anova.table

````
Fvalue = anova.table[1,4]
Fvalue
Pvalue = anova.table[1,5]
Pvalue
```
```{r,echo=FALSE}
group.means = by(CO$Weight,CO$Treatment,mean)
group.nis = by(CO$Weight,CO$Treatment,length)
MSE = anova(lm(Weight ~ Treatment, data = CO))[2,3]
give.me.power = function(ybar,ni,MSE,alpha){
a = length(ybar)
nt = sum(ni)
overall.mean = sum(ni*ybar)/nt
phi = (1/sqrt(MSE))*sqrt( sum(ni*(ybar - overall.mean)^2)/a)
phi.star = a *phi^2
Fc = qf(1-alpha,a-1,nt-a)
power = 1 - pf(Fc, a-1, nt-a, phi.star)
return(power)
}
POW = give.me.power(group.means,group.nis,MSE,0.05)
POW
```
````
````

````
```{r,echo=FALSE}
give.me.CI = function(ybar,ni,ci,MSE,multiplier){
if(sum(ci) != 0 & sum(ci !=0 ) != 1){
return("Error - you did not input a valid contrast")
} else if(length(ci) != length(ni)){
return("Error - not enough contrasts given")
}
else{
estimate = sum(ybar*ci)
SE = sqrt(MSE*sum(ci^2/ni))
CI = estimate + c(-1,1)*multiplier*SE
result = c(estimate,CI)
names(result) = c("Estimate","Lower Bound","Upper Bound")
return(result)
}
}
t.value = qt(1-0.05/2, sum(group.nis) - length(group.nis))
ci.1 = c(0,0,1)
CI1 = give.me.CI(group.means,group.nis,ci.1,MSE,t.value)
CI1
```
```{r,echo=FALSE}
````
````

```
give.me.CI = function(ybar,ni,ci,MSE,multiplier){
if(sum(ci) != 0 & sum(ci !=0 ) != 1){
return("Error - you did not input a valid contrast")
} else if(length(ci) != length(ni)){
return("Error - not enough contrasts given")
}
else{
estimate = sum(ybar*ci)
SE = sqrt(MSE*sum(ci^2/ni))
CI = estimate + c(-1,1)*multiplier*SE
result = c(estimate,CI)
names(result) = c("Estimate","Lower Bound","Upper Bound")
return(result)
}
}
t.value = qt(1-0.05/2, sum(group.nis) - length(group.nis))
ci.2 = c(1,-1,0)
CI2 = give.me.CI(group.means,group.nis,ci.2,MSE,t.value)
CI2
```

```{r,echo=FALSE}
give.me.CI = function(ybar,ni,ci,MSE,multiplier){
```

```
if(sum(ci) != 0 & sum(ci !=0 ) != 1){
return("Error - you did not input a valid contrast")
} else if(length(ci) != length(ni)){
return("Error - not enough contrasts given")
}
else{
estimate = sum(ybar*ci)
SE = sqrt(MSE*sum(ci^2/ni))
CI = estimate + c(-1,1)*multiplier*SE
result = c(estimate,CI)
names(result) = c("Estimate","Lower Bound","Upper Bound")
return(result)
}
}
t.value = qt(1-0.05/2, sum(group.nis) - length(group.nis))
ci.3 = c(1,0,-1)
CI3 = give.me.CI(group.means,group.nis,ci.3,MSE,t.value)
CI3
```