

STAT 8010: HW3

March 04, 2020

Problem 1

This data set, *InvisibilityCloak.csv*, provides the number of mischievous acts committed by two groups of people

, those with and those without an invisibility cloak. The variables in this data set are:

- **Participant**: Identification number of a participant.
- **Cloak**: Experimental group (0 = without a cloak of invisibility, 1 = with a cloak of invisibility).
- **Mischief**: the number of mischievous acts committed by a participant.

Suppose a researcher would like to examine if invisibility cloak affects the number mischievous acts committed.

Load the data

```
dat1 <- read.csv("./Data Sets/InvisibilityCloak.csv")
str(dat1)
```

```
## 'data.frame':    24 obs. of  3 variables:
## $ Participant: int  1 2 3 4 5 6 7 8 9 10 ...
## $ Cloak      : int  0 0 0 0 0 0 0 0 0 0 ...
## $ Mischief   : int  3 1 5 4 6 4 6 2 0 5 ...
```

```
dat1$Cloak <- as.factor(dat1$Cloak)
```

a. State the null and alternative hypotheses

Let $\mu_1(\mu_2)$ be the average number of mischievous acts committed by a participant without (with) a cloak of invisibility

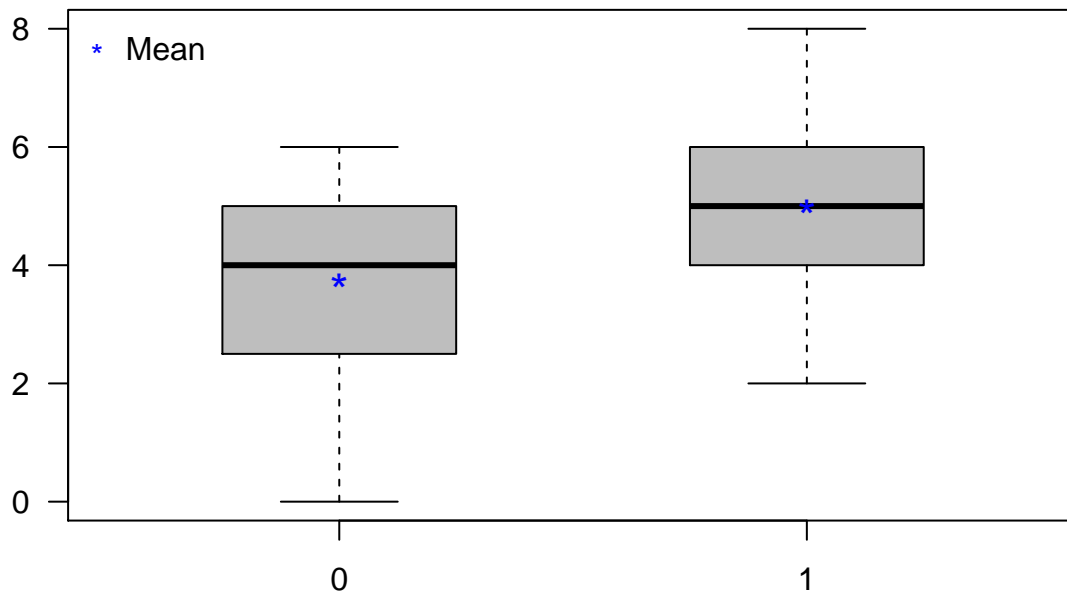
$H_0 : \mu_1 - \mu_2 = 0$ vs. $H_a : \mu_1 - \mu_2 \neq 0$

Data summary

```
library(dplyr)
summary1 <- dat1 %>%
  select(Mischief, Cloak) %>%
  group_by(Cloak) %>%
  summarise(mean = mean(Mischief),
            sd = sd(Mischief),
            n = length(Mischief))
summary1
```

```
## # A tibble: 2 x 4
##   Cloak mean    sd    n
##   <fct> <dbl> <dbl> <int>
## 1 0      3.75  1.91    12
## 2 1      5      1.65    12

boxplot(Mischief ~ Cloak, data = dat1, col = "gray",
        las = 1, boxwex = 0.5)
points(1, summary1$mean[1], pch = "*", cex = 1.5,
       col = "blue")
points(2, summary1$mean[2], pch = "*", cex = 1.5,
       col = "blue")
legend("topleft", legend = "Mean", pch = "*",
       col = "blue", bty = "n")
```



Test for $\sigma_1 = \sigma_2$

```
var.test(Mischief ~ Cloak, data = dat1)

##
## F test to compare two variances
##
## data:  Mischief by Cloak
## F = 1.3417, num df = 11, denom df = 11, p-value = 0.6343
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.3862357 4.6605462
## sample estimates:
## ratio of variances
##      1.341667
```

Pooled-t test

```
t.test(formula = Mischief ~ Cloak, data = dat1,  
       var.equal = T)
```

```
##  
## Two Sample t-test  
##  
## data: Mischief by Cloak  
## t = -1.7135, df = 22, p-value = 0.1007  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -2.7629284 0.2629284  
## sample estimates:  
## mean in group 0 mean in group 1  
## 3.75 5.00
```

Non pooled-t test

```
t.test(formula = Mischief ~ Cloak, data = dat1,  
       var.equal = F)
```

```
##  
## Welch Two Sample t-test  
##  
## data: Mischief by Cloak  
## t = -1.7135, df = 21.541, p-value = 0.101  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -2.764798 0.264798  
## sample estimates:  
## mean in group 0 mean in group 1  
## 3.75 5.00
```