STAT 1293 Assignment 3

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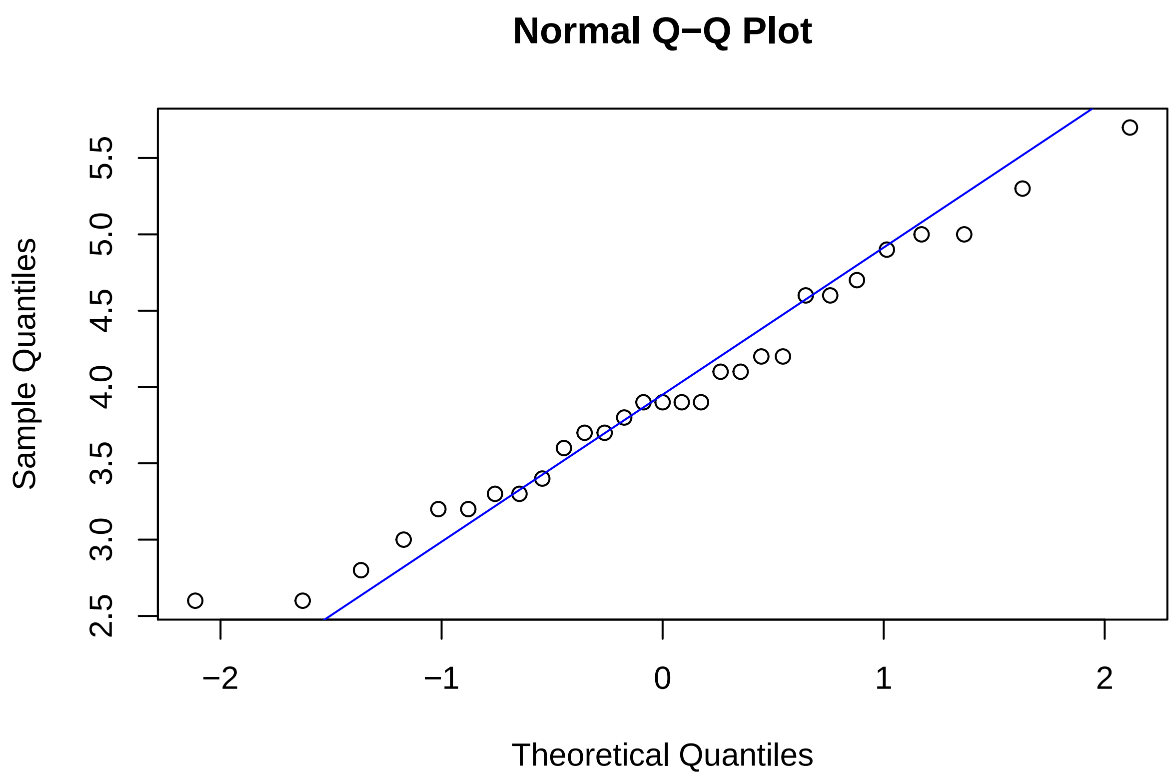
Problem 1: What do you make of Mitt? (30 points)

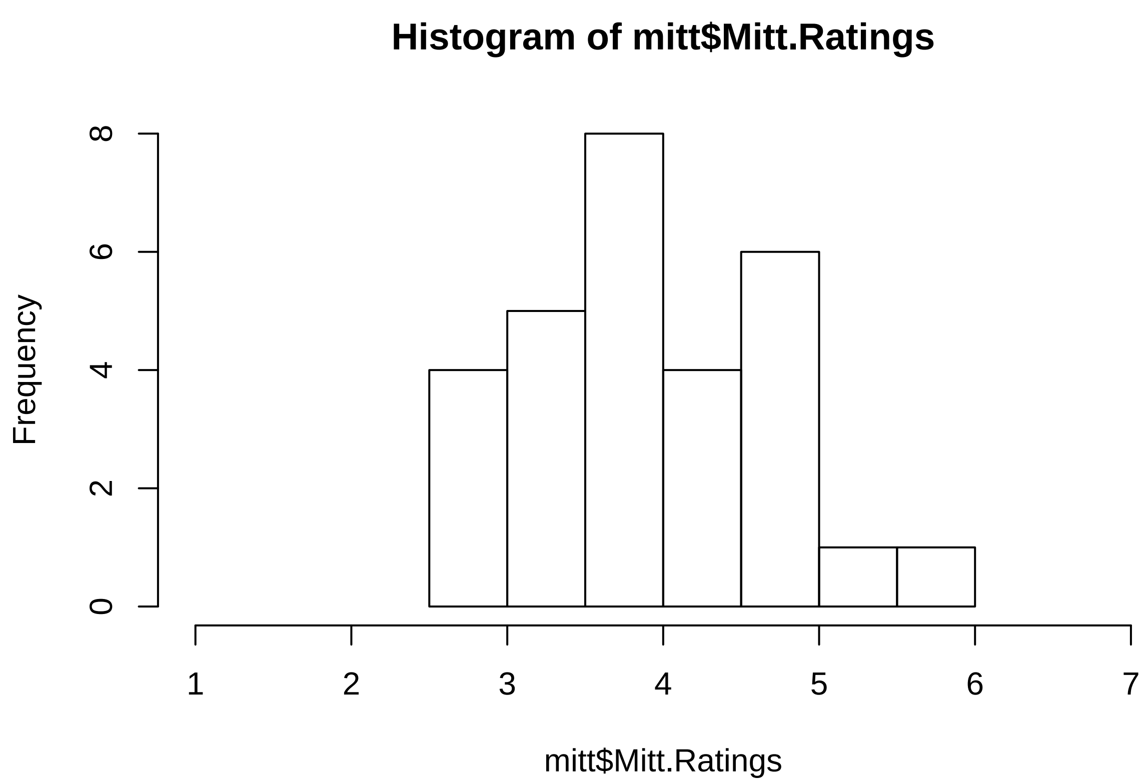
1a) Make a histogram and a Q-Q plot. Is there any sign of major deviation from Normality?

Solution:

```
mitt <- read.table("C:/Users/gordo/Desktop/mitt.txt", header = TRUE) #read in mitt
qqnorm(mitt$Mitt.Ratings)
qqline(mitt$Mitt.Ratings, col = 4)
```



```r
hist(mitt$Mitt.Ratings, xlim = c(1, 7))
```



The histogram and Q-Q plot do not suggest any sign of major deviations from Normality.

1b) Give a 95% confidence interval for the mean rating (6 points)

Solution:

```r
t.test(mitt$Mitt.Ratings, conf.level = .95)$conf.int
```

```
## [1] 3.633048 4.242814
## attr(,"conf.level")
## [1] 0.95
```

1c) Is there significant evidence at the 5% level that the mean rating is greater than 3.5?

Solution:

```r
# x_bar <- mean(mitt$Mitt.Ratings)
# s <- sd(mitt$Mitt.Ratings)
# n <- length(mitt$Mitt.Ratings)
```

```r
# df <- n - 1
# t_0 <- (x_bar - 3.5)/(s/sqrt(n))
# p_val <- 1 - pt(t_0, df)

t.test(mitt$Mitt.Ratings, alternative = "greater", mu = 3.5)
```

```
##
##  One Sample t-test
##
## data:  mitt$Mitt.Ratings
## t = 2.9423, df = 28, p-value = 0.003238
## alternative hypothesis: true mean is greater than 3.5
## 95 percent confidence interval:
##  3.684736      Inf
## sample estimates:
## mean of x
##  3.937931
```

4-Step H.T.

Hypothesis: $H_0 : \mu = 3.5$ vs. $H_a : \mu > 3.5$

Test statistic: $t_0 = \frac{\overline{x}-\mu_0}{s/\sqrt{n}}$ = `2.942314`

P-value: $P(T > t_0) = 1 - P(T < t_0)$ = `0.003237898`

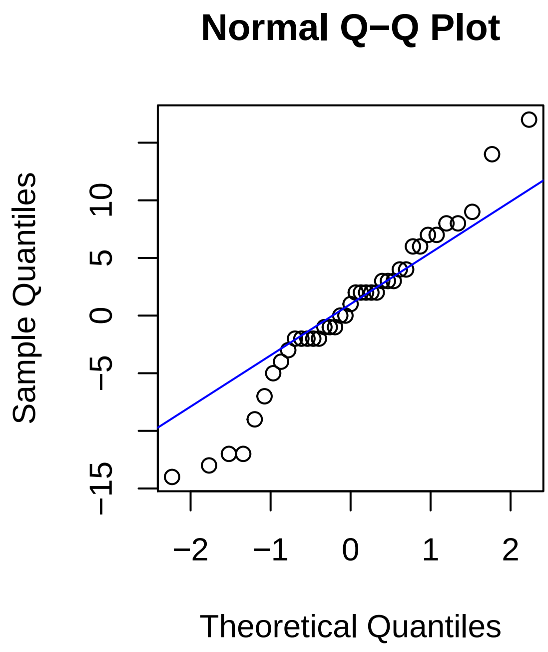
Conclusion: Reject H_0, since p-value < 0.05.

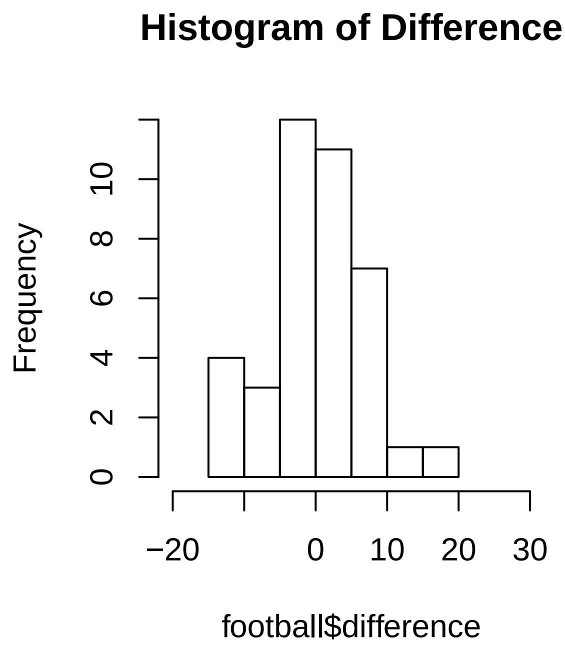
Problem 2: Kicking a helium-filled football (30 points)

2a) Create a histogram and a Q-Q plot for difference. Is it reasonable to use the `t` procedure?

Solution:

```r
football <- read.table("C:/Users/gordo/Desktop/football.txt", header = TRUE) #read in football
par(mfrow = c(1,2), pty = "s")
# qqnorm(football$Helium)
# qqnorm(football$Air)
qqnorm(football$difference)
qqline(football$difference, col = 4)
hist(football$difference, xlim = c(-20, 30), main = "Histogram of Difference")
```





Yes, although the Q-Q plot does not look good, if we look at the histogram, it looks rather normal. Note that the sample size is also 39, so the sample size is not too small, thus it is fine to perform the `t` procedure.

2b) Let $\mu_d = \mu_{helium} - \mu_{air}$. Calculate a 90% confidence interval for μ_d.

Solution:

```
d <- football$Helium - football$Air
d_bar <- mean(d)
s_d <- sd(d)
n <- length(d)
df <- n - 1
t <- qt(.90, df)

d_bar - t*s_d/sqrt(n)
```

```
## [1] -0.9725035
```

```
d_bar + t*s_d/sqrt(n)
```

```
## [1] 1.89558
```

2c) If the conclusion in part (1) is "yes", does the data give convincing evidence that the helium-filled football travels farther than the air-filled football? Let $\alpha = 0.05$

Solution:

```
t.test(d, alt = "g", mu = 0, conf.level = .90)
```

```
##
##  One Sample t-test
##
## data:  d
## t = 0.41976, df = 38, p-value = 0.3385
## alternative hypothesis: true mean is greater than 0
## 90 percent confidence interval:
##  -0.9725035        Inf
## sample estimates:
## mean of x
## 0.4615385
```

4-Step H.T.

Hypothesis: $H_0 : \mu_d = 0$ vs. $H_a : \mu_d > 0$

Test statistic: $t_0 = \frac{\bar{d} - \mu_{d,0}}{s_d/\sqrt{n}} = \texttt{0.41976}$

P-value: $P(T > t_0) = 1 - P(T < t_0) = \texttt{0.3385}$

Conclusion: Fail to reject H_0, since p-value > 0.10.

No, the data does not give convincing evidence that the helium-filled football travels father than the air-filled footballs.