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MATH-310
2-21-2020

HMWK 4

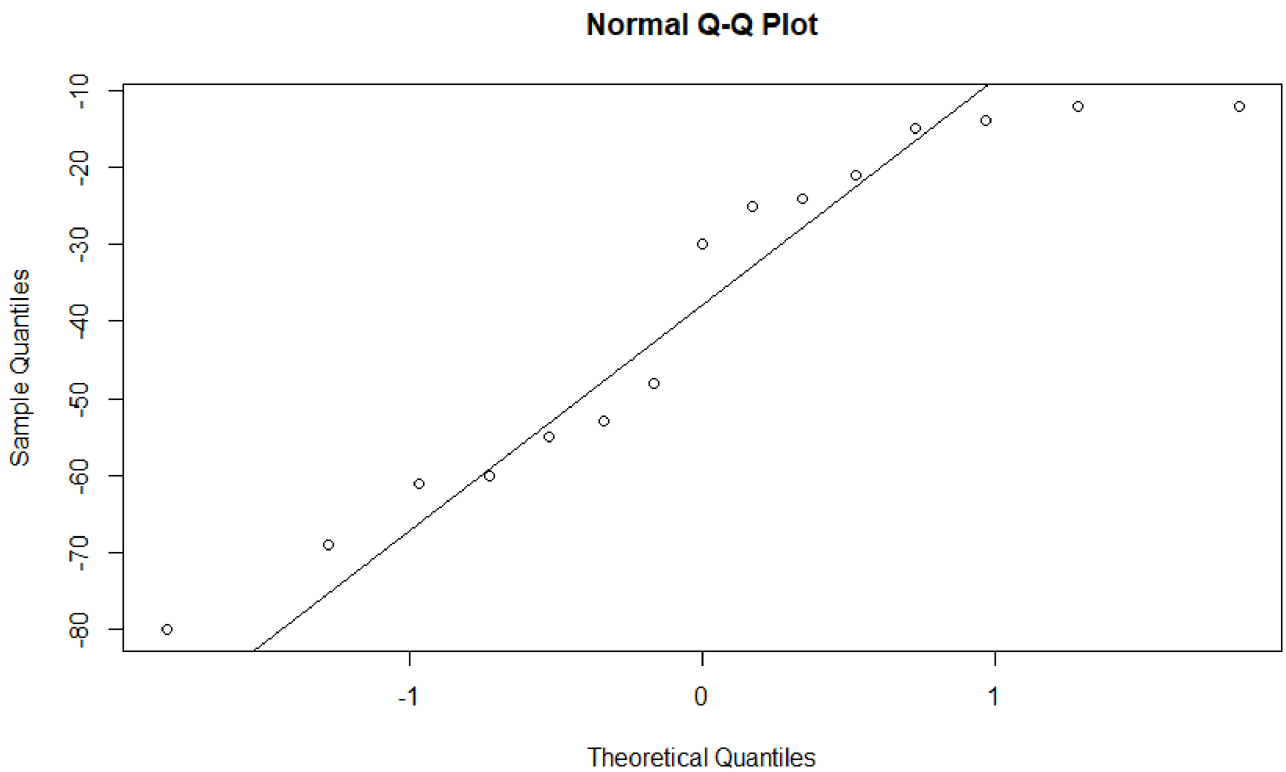
*1 (*a) Given that the bounds are (-0.524, -0.288), which does not include 0, it can be concluded that there is indeed a significant difference between the indoor and outdoor concentrations of Hexavalent chromium.

```
[1] indoor_concentrations <- indoor[,2]
[2] outdoor_concentrations <- outdoor[,2]
[3] sdi = sd(indoor_concentrations)
[4] sdo = sd(outdoor_concentrations)
[5] meandiff = mean(indoor_concentrations - outdoor_concentrations)
[6] sddiff = sqrt(sdi2/length(indoor_concentrations) +
sdo2/length(outdoor_concentrations))
[7] zscore = qnorm(0.05)
[8] b = meandiff - zscore*sddiff
[9] a = meandiff + zscore*sddiff
```

(b) (-1.22, 0.404)

```
[1] sdio = sd(indoor_concentrations - outdoor_concentrations)
[2] z = qt(0.025, 32, lower.tail=FALSE)*sqrt(34/33)
[3] lower_bound = meandiff - sdio*z # -1.22
[4] upper_bound = meandiff + sdio*z # 0.404
```

*2 (a) The data appears to fall under a normal distribution.



(b) The lower bound is -28.1

```
[1] data <- c(-24, -12, -55, -15, -30, -60, -14, -21, -48, -12,
-25, -53, -61, -69, -80)
[2] means = mean(age)
[3] z = qt(0.05, length(data)-1, lower.tail=TRUE)*(sd(data)/sqrt(length(data)))
[4] means - z # -29.05901
```

(c) The upper bound is 49.1

```
[1] means + z #49.14
```

(d) Pairing when the average difference = 0 does not make any sense because then the age at onset and the age at diagnosis would be the same.

(e) Given that `t_stat < table_score`, the null hypothesis can be rejected.

```
[1] t_stat = (means + 25)/(sd(data)/sqrt(length(data))) # -2.272445
[2] table_score = qt(0.05, length(data)-1, lower.tail=TRUE) #
-1.76131
```

3 (a) $H_0 : p_2 = p_3, H_a : p_3 \neq p_2$

(b) $p_3 - p_2$ or $\frac{x_3 - x_2}{n}$

(c) $P := \frac{(x_2 - x_3)^2}{x_2 + x_3}$

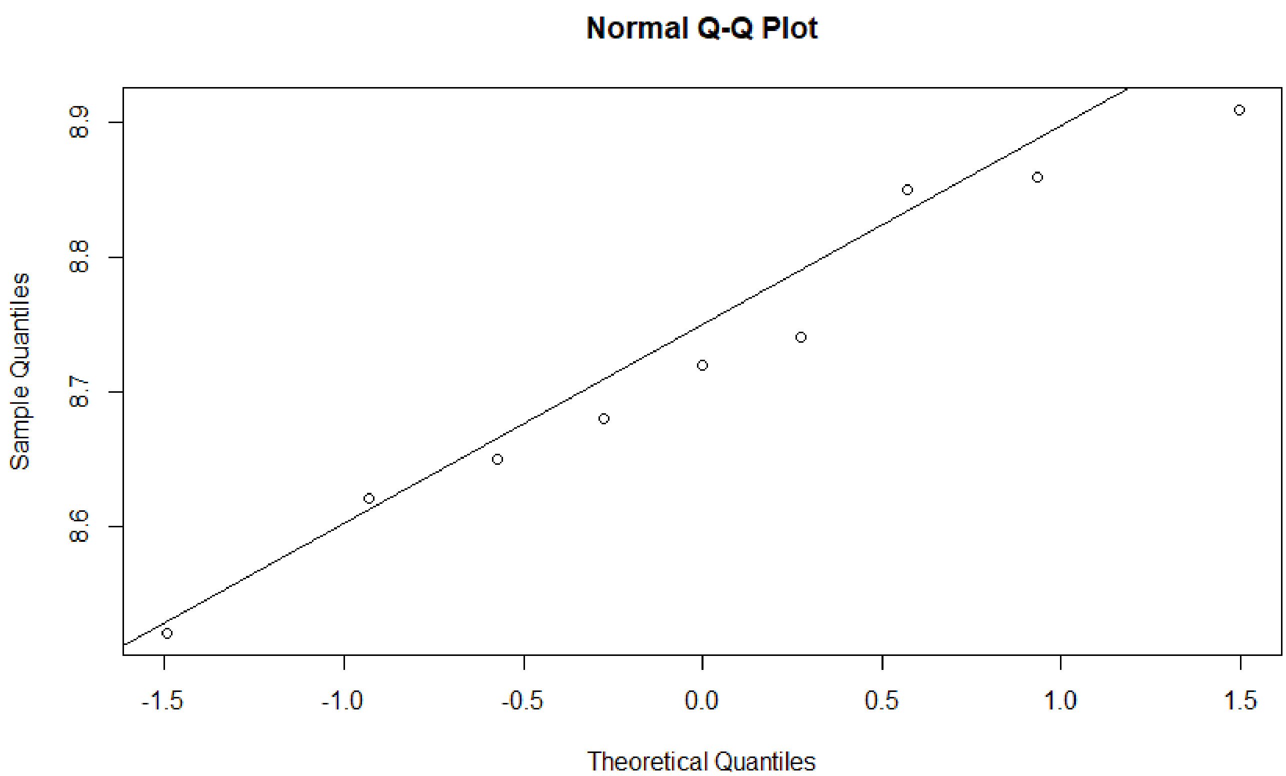
(d) Assuming a standard α level of 0.05, the true proportion of supporters are observed to have increased given that the yield of the McNemar test was less than the alpha level ($0.00815 < 0.05$).

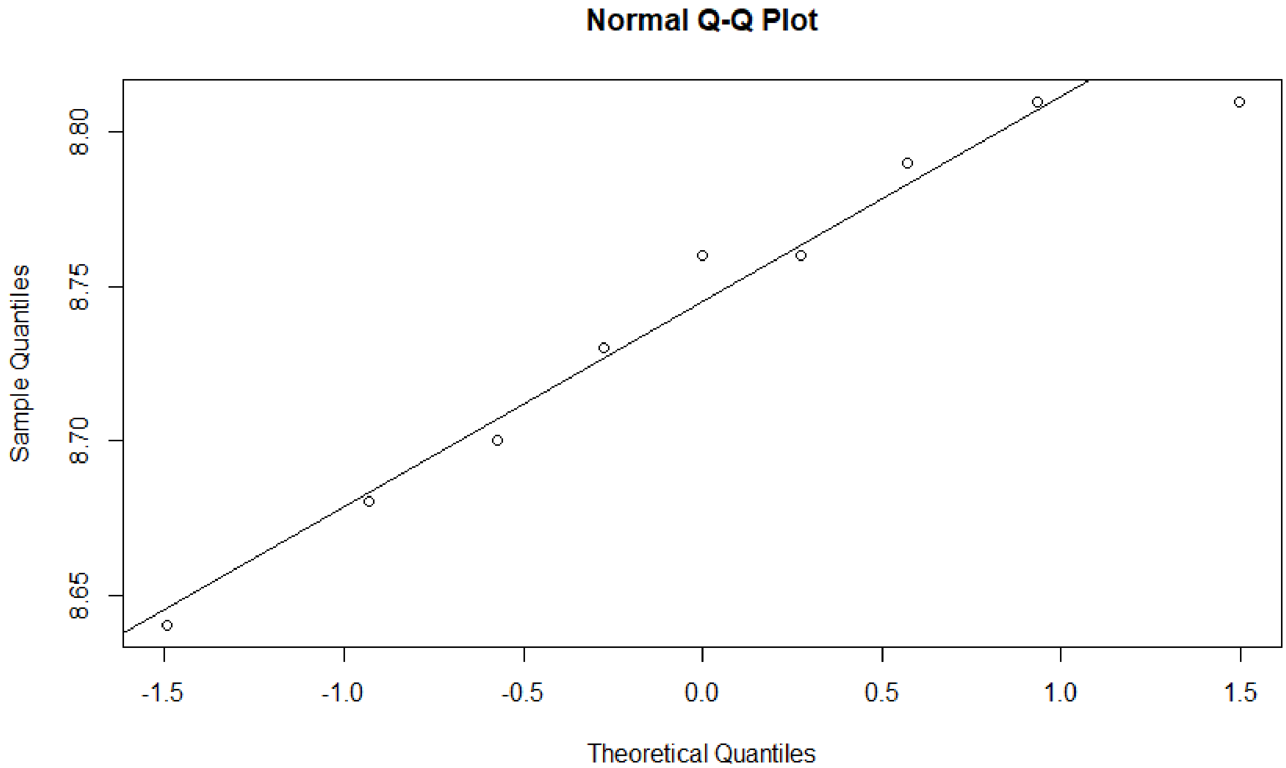
```
[1] M <- matrix(c(350, 200, 150), nrow = 2)    [2] mcnemar.test(M) #
Returns p-value of 0.00815
```

(e) Assuming a standard α level of 0.05, it cannot be concluded that the drug reduce migraine headaches as the test statistic was greater than the McNemar test ($-1.34 > -3.84$).

```
[1] x_1 = 44, x_2 =34, x_3 = 46, x_4 = 30
[2] (x_2 - x_3)/sqrt(x_2 + x_3) # -1.34
[3] M <- matrix(c(x_1, x_2, x_3, x_4), nrow = 2)
[4] mcnemar.test(m) # -3.84
```

4 (a) Both the energizer and ultracell data has been observed to be normal.





(b) Note that because the F statistic (4.55) is greater than the table score calculated (4.43), it can be concluded that there is a significant difference between the variances of the batteries.

```
[1] ve = var(energizer)
[2] vu = var(ultracell)
[3] F = (ve/vu) # 4.55 [4] score = qf(0.025, 8, 8, lower.tail=FALSE)
# 4.43
```

(c) I would not pay the extra money because the variance of the energizer batteries is too high.