Assignment1_stat453

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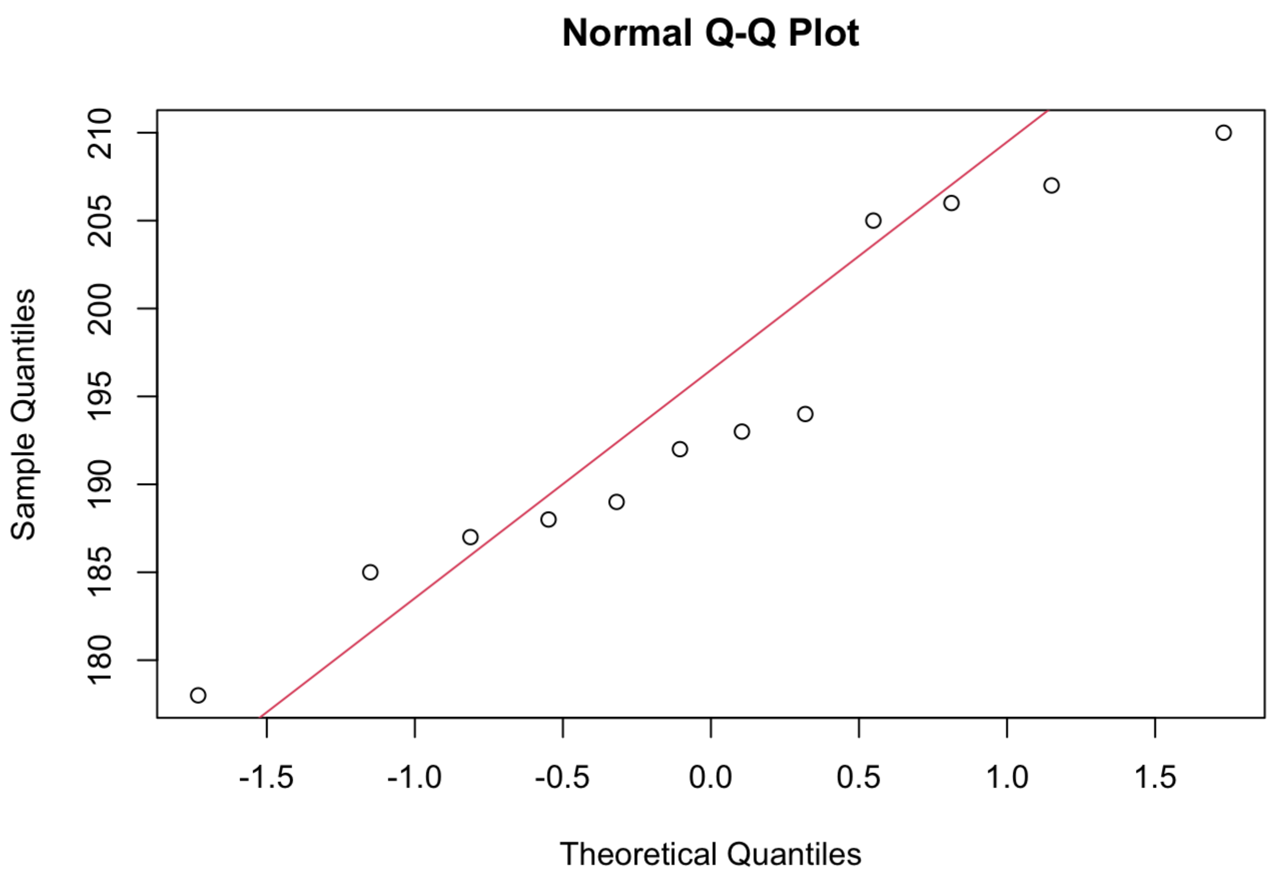
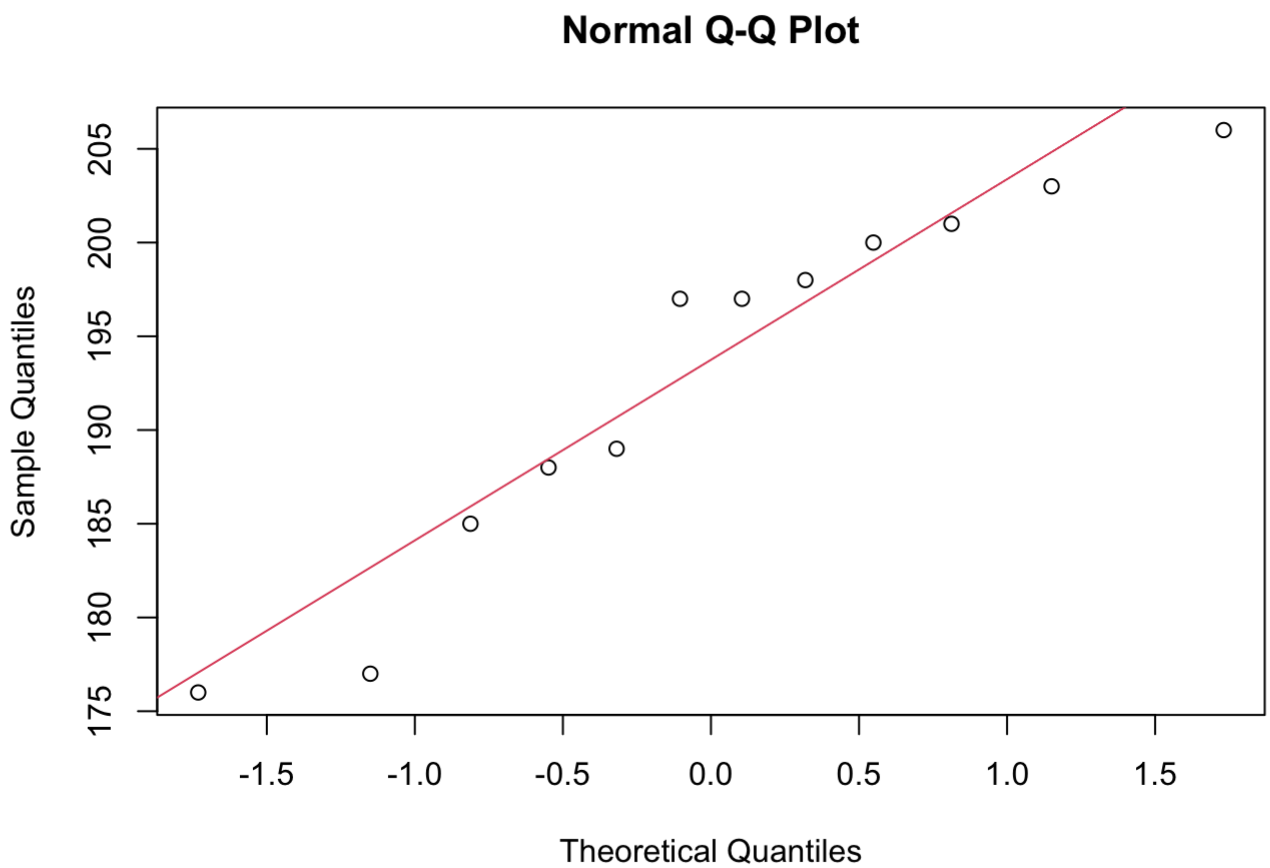
Question2 a) Ho: u1 >=l u2 Ha: u1 < u2

```
# Deflection temperatures for formulation 1 and 2
f1 <- c(206, 193, 192, 188, 207, 210, 205, 185, 194, 187, 189, 178)
f2 <- c(177, 176, 198, 197, 185, 188, 206, 200, 189, 201, 197, 203)

# Q-Q plot for formulation 1
qqnorm(f1)
qqline(f1, col = 2)
```




```
# Q-Q plot for formulation 2
qqnorm(f2)
qqline(f2, col = 2)
```




```
#From the q-q plots, all points are around the straight lines.
#SO the distribution is nornally distributed.


#To cheeck if the variance is the same or not
#I used a var.test

#Ho:σ1^2=σ2^2
#Ha:σ1^2=/=σ2^2



var.test(f1,f2)
```

```
##
##  F test to compare two variances
##
## data:  f1 and f2
## F = 1.046, num df = 11, denom df = 11, p-value = 0.9419
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.3011181 3.6334674
## sample estimates:
## ratio of variances
##           1.045994
```

```
#From the variance test, the p-value is 0.9419 which is much larger than a = 0.05. So we
fail to reject Ho. So the variance of 2 samples are


# Two-Sample T-Test
t_test_result <- t.test(f2, f1, alternative = "greater",paired = FALSE,
                        var.equal = TRUE, conf.level = 0.95)

# Display the T-Test Results
print("Two-Sample T-Test:")
```

```
## [1] "Two-Sample T-Test:"
```

```
print(t_test_result)
```

```
##
##  Two Sample t-test
##
## data:  f2 and f1
## t = -0.34483, df = 22, p-value = 0.6333
## alternative hypothesis: true difference in means is greater than 0
## 95 percent confidence interval:
##  -8.471217       Inf
## sample estimates:
## mean of x mean of y
##  193.0833  194.5000
```

#From the two-sample t test above, since the p-value = 0.6333 we fail to #reject Ho. There is a insignificant evidence that the deflection temperature #under load for formulation 2 exceeds that of formula 1.

#b)

#From the confidence interval which is (-oo, 8.4712), we can see that #the confidence interval #contains 0. It means we fail to reject H0 which is the same result as part a. #So the confidence interval support my answer above.

3 (a) Ho: u <= 225 vs Ha: u >225

```
#(b)
hours <- c(159, 224, 222,149, 280, 379, 362, 260, 101, 179, 168, 485, 212, 264,
           250, 170)


# I used t test since the sample size is quite small
t.test(hours, alternative = 'greater', mu = 225)
```

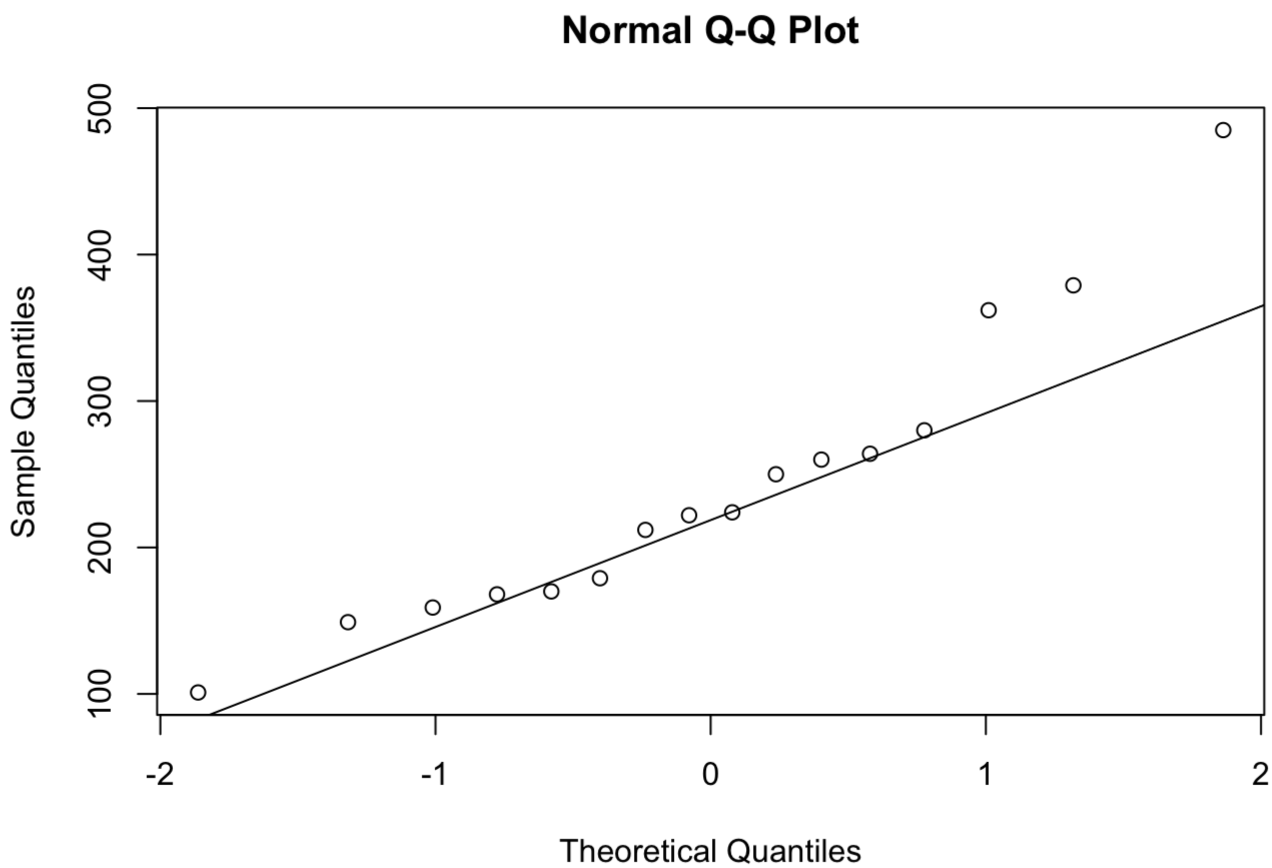
```
##
##  One Sample t-test
##
## data:  hours
## t = 0.66852, df = 15, p-value = 0.257
## alternative hypothesis: true mean is greater than 225
## 95 percent confidence interval:
##  198.2321      Inf
## sample estimates:
## mean of x
##     241.5
```

```
#From the graph above we know that since p-value = 0.257 which is bigger than
#0.05, we fail to reject Ho. There is an insignificant evidence that the hours
#to repait an electric instrument is greater than 225.





#c)
qqnorm(hours)
qqline(hours)
```

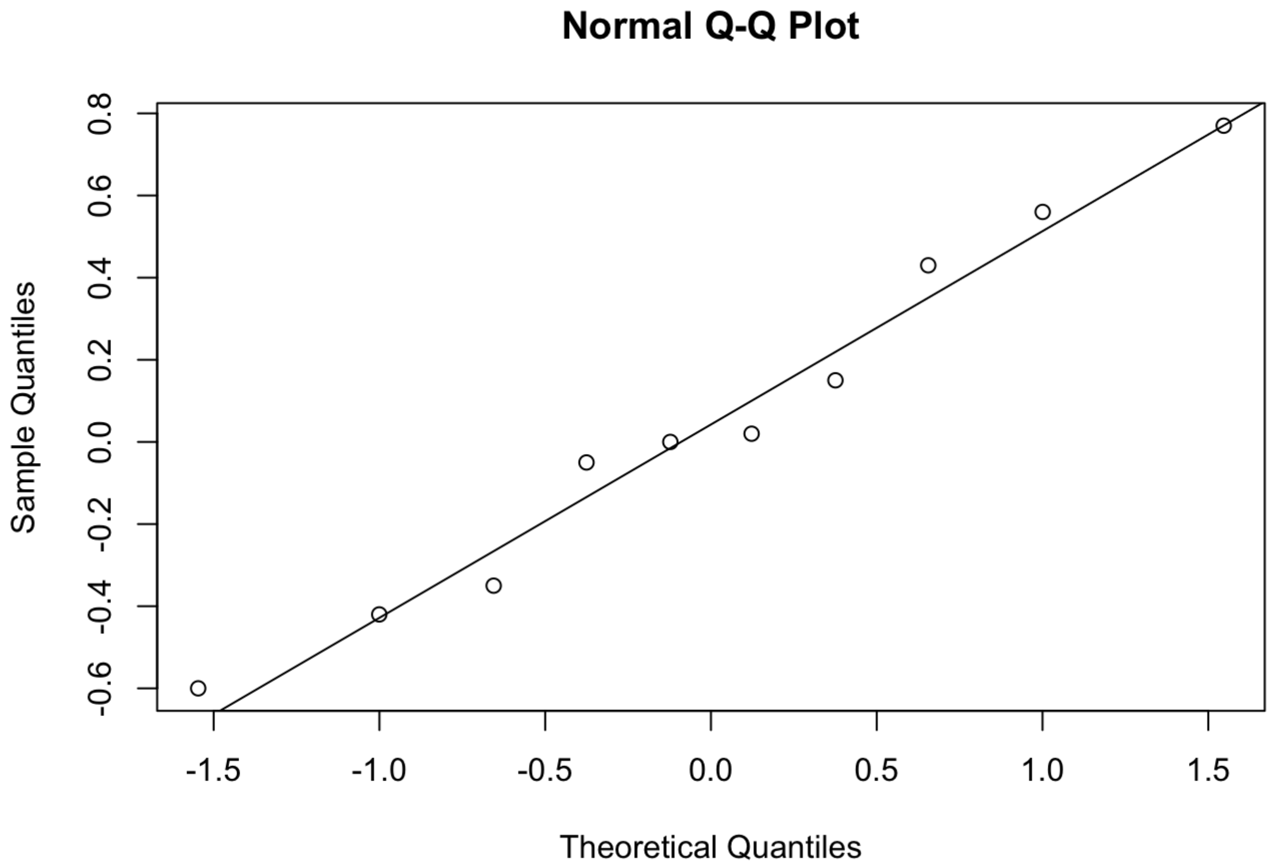



```
#From the q-qplot above, it looks the distribution is a positive skewed and have
#havier tails.Also it has a outlier at the end of the graph.
#However, since almost of all points are near the stright line, the distribution
#is not normally distributed.

#d)
```

4.

```
#(b)Ho: ud = 0 Ha: ud =/= 0
order1<- c(5.73,5.80,8.42,6.84,6.43,8.76,6.32,7.62,6.59,7.67)
order2<- c(6.08,6.22,7.99,7.44,6.48,7.99,6.32,7.60,6.03,7.52)
difference = order1 - order2
qqnorm(difference)
qqline(difference)
```




```
t.test(order1,order2, alternative = "two.sided", paired = TRUE)
```

```
##
##  Paired t-test
##
## data:  order1 and order2
## t = 0.36577, df = 9, p-value = 0.723
## alternative hypothesis: true mean difference is not equal to 0
## 95 percent confidence interval:
##  -0.2644148  0.3664148
## sample estimates:
## mean difference
##           0.051
```

#From the paired t test above, we got that the p-value is 0.723 which is #much greater than the a = 0.05, so we fail to reject Ho. #There is an insignificant evidence that the mean score depend on #birth order.

```
#5)(a)
#let u1  the mean of thickness at 95 degree and u2 the mean of thickness at 100 degree
# Ho:u1 = u2 Ha = u1 > u2
lower_temp <- c(11.176,7.089,8.097,11.739,11.291,10.759,6.467,8.315)
higher_temp <- c(5.623,6.748,7.461,7.015,8.133,7.418,3.772,8.963)

t_test = t.test(lower_temp, higher_temp, alternative = "greater", paired = FALSE, var.eq
ual
       = TRUE,conf.level = 0.95)

t_test
```

```
##
##  Two Sample t-test
##
## data:  lower_temp and higher_temp
## t = 2.6549, df = 14, p-value = 0.009424
## alternative hypothesis: true difference in means is greater than 0
## 95 percent confidence interval:
##  0.8330468       Inf
## sample estimates:
## mean of x mean of y
##  9.366625  6.891625
```

```
#From the graph above we know that since p-value = 0.009424 which is much smaller
#than 0.05, we reject Ho. There is an significant evidence that higher baking
#temperature result in wafers with a lower mean photoresist thickness.

#(b)
t_test$conf.int
```

```
## [1] 0.8330468       Inf
## attr(,"conf.level")
## [1] 0.95
```

```
#I got the confidence (0.8330468,Inf)
#こきゃる
```

```
#6
type_1 <- c(65, 82,81,67, 57,59, 66,75, 82,70)
type_2 <- c(64,56,71,69,83,74,59,65, 79, 82)

#(a)
#Ho:σ1^2= σ2^2
#Ha:σ1^2=/= σ2^2
var.test(type_1, type_2)
```

```
##
##  F test to compare two variances
##
## data:  type_1 and type_2
## F = 0.97822, num df = 9, denom df = 9, p-value = 0.9744
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.2429752 3.9382952
## sample estimates:
## ratio of variances
##          0.9782168
```

```
#Since the p-value is 0.9229 which is much larger than a = 0.05,
#we fail to reject Ho. There is an insignificant evidence that
#the variance of two types are not the same

#b)
#Ho:u1 = u2
#Ha:u1 =/= u2
t.test(type_1, type_2, var.equal = TRUE)
```

```
##
##  Two Sample t-test
##
## data:  type_1 and type_2
## t = 0.048008, df = 18, p-value = 0.9622
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -8.552441  8.952441
## sample estimates:
## mean of x mean of y
##      70.4      70.2
```

```
#Since the p-value is 0.9622 which is much larger than a = 0.05,
#we fail to reject Ho. There is an insignificant evidence that
#the mean burning times are not equal.
```