HW7

3.)

A. Here the relevant null hypothesis will answer the above question that is if the null hypothesis is true then we can answer the question above as not and yes if we reject the null hypothesis. Reading the data into r we have that the F value we get from out estimates is much bigger than that of the f value with the given significance of .05 meaning we can reject the null hypothesis and concluded that at least 2 means are different out of the 4.

```
> rat = read.table("/Users/arturovillalobos/Desktop/STAT_212_rcode/hw7/SleepRem.txt",header=T)
>
> ratdata = data.frame(rat)
>
> fitrat = aov(values~as.factor(ind),data = ratdata)
>
> anova(fitrat)
Analysis of Variance Table

Response: values
               Df Sum Sq Mean Sq F value    Pr(>F)
as.factor(ind)  3 5881.7 1960.58  21.093 8.322e-06 ***
Residuals      16 1487.1   92.95
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> qf(.95,3,16)
[1] 3.238872
>
```

B. Box plot , Equal Variance assumptions,Normality Q-Qplot:

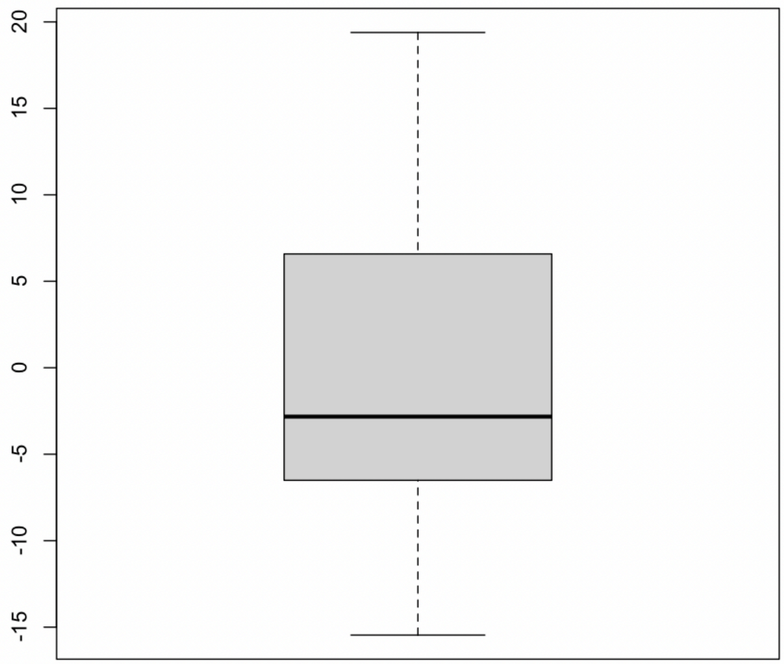
Below is a screen plot of the analysis of the variance table testing the assumptions made on equal variance . Since our p-value is greater than our level or significance we can conclude that our assumptions of equal variance hold true in this case

```
PROBLEMS 97    OUTPUT    DEBUG CONSOLE    TERMINAL

> anova(aov(resid(aov(ratdata$values~ratdata$ind))**2~ratdata$ind))
Analysis of Variance Table

Response: resid(aov(ratdata$values ~ ratdata$ind))^2
            Df Sum Sq Mean Sq F value Pr(>F)
ratdata$ind  3  18771    6257  0.6051 0.6212
Residuals   16 165450   10341
> 
```

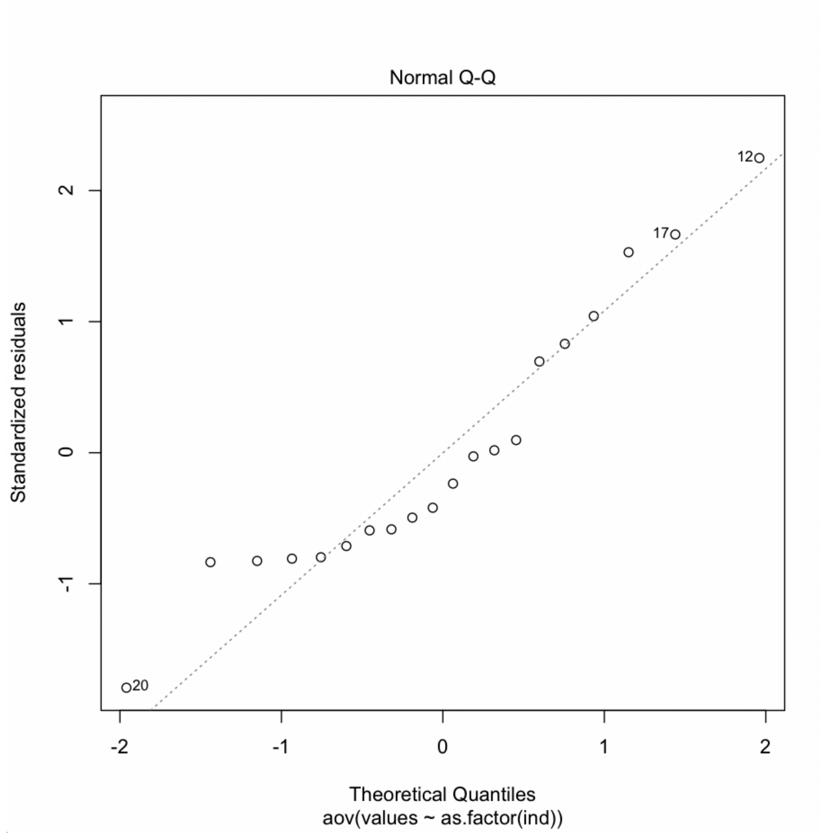
As for the normality assumption we can see from the screen grab below that our p-value is greater than our level of significance and thus we can conclude that the variable being tested have a normal distribution across the different groups.

```
PROBLEMS 99    OUTPUT    DEBUG CONSOLE    TERMINAL

> shapiro.test(resid(aov(ratdata$values~ratdata$ind)))

        Shapiro-Wilk normality test

data:  resid(aov(ratdata$values ~ ratdata$ind))
W = 0.92585, p-value = 0.1285

> 
```

Below is the box plot which as you can see there are no outliers in this data set . This plot also shows a slightly skewed distribution



Below is the Q-Q plot which from the picture I can be said that for the most part the data seems to fall along the line save for a few points towards the left . This is consistent with our other conclusions that the data follows the normality assumption.



6.)

a.) to answer whether or not there is a difference in pore size given the fact that temperature is changing we follow the same methodology as before . Below is the summary statistics for the data showing that we can reject the null hypothesis that all means across the groups are the same and that at least 2 means are different as supported by the fact that our F values from the data is much bigger than the F we get from the table:

```
PROBLEMS 109   OUTPUT   DEBUG CONSOLE   TERMINAL
> anova(fitpore)
Analysis of Variance Table

Response: values
                Df Sum Sq Mean Sq F value    Pr(>F)
as.factor(temp)  3 4.4474 1.48246  11.437 0.0002958 ***
Residuals       16 2.0740 0.12963
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> qf(.95,3,16)
[1] 3.238872
>
```

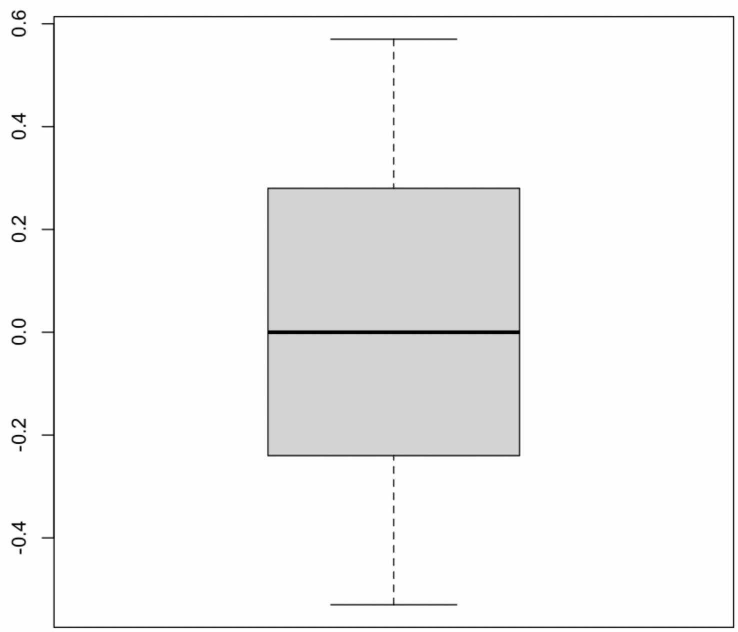
c.) Box plot , Equal Variance assumptions,Normality Q-Qplot:

Here again we can see from the analysis of variance table that we can check our assumptions of equal variance and with a significance of .05 the screen grab below shows that this data barley satisfies this assumption as the p-value here is = 0.0656

```
PROBLEMS 108   OUTPUT   DEBUG CONSOLE   TERMINAL
> anova(aov(resid(aov(poredata$values~poredata$temp))**2~poredata$temp))
Analysis of Variance Table

Response: resid(aov(poredata$values ~ poredata$temp))^2
              Df   Sum Sq  Mean Sq F value Pr(>F)
poredata$temp  1 0.053257 0.053257  3.8438 0.0656 .
Residuals     18 0.249399 0.013855
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>
```

As fr checking the normality assumption a Shapiro test shows that again our p value (0.8255) is greater than the given level of significant meaning we can accept the normality assumption .

The box plot below shows us that there are no outliers and as opposed to the previous data this data seems to not be as tailed :



Finally we can conclude that the normality assumption is valid especially based on the plot below as this plot seems to be even more adherent to the line as the previous plot: