HW3

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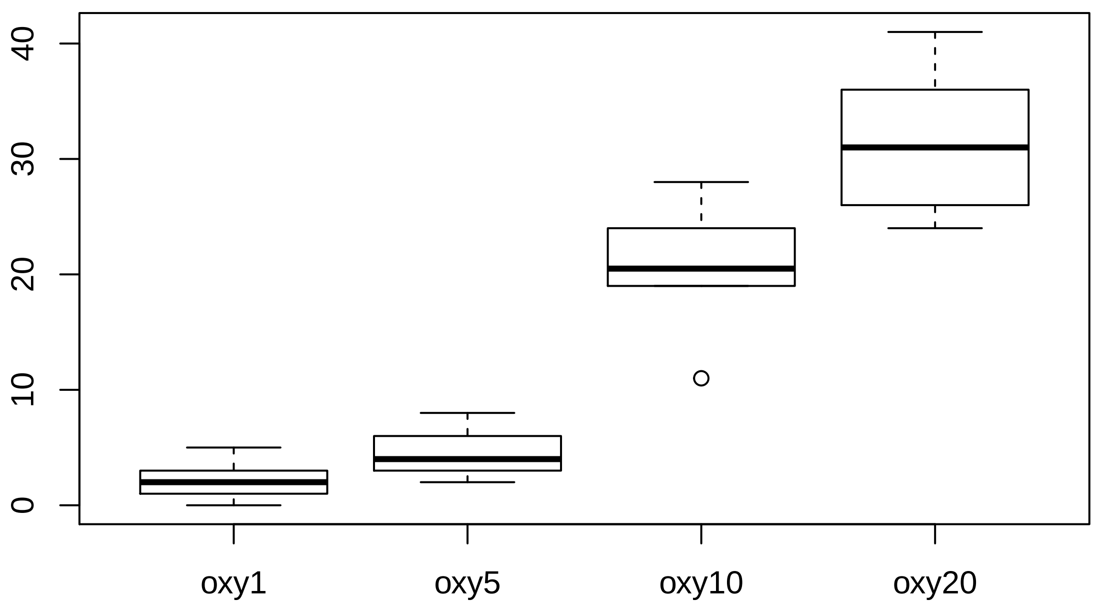
Problem 1

a)

```r
oxy1 = c(1,5,2,1,2,2,4,3,0,2)
oxy5 = c(4,8,2,3,8,5,6,4,3,3)
oxy10 = c(20,26,24,11,28,20,19,19,21,24)
oxy20 = c(37,30,26,24,41,25,36,31,31,33)

df <-  data.frame(oxy1, oxy5, oxy10, oxy20)

boxplot(df)
```



No.

b)

Hartley test

```r
s2 <- apply(df,MARGIN = 2,FUN = var)
max(s2)/min(s2)
```

```
## [1] 14
```

```r
qmaxFratio(0.95, 9, 4)
```

```
## [1] 6.311665
```

$df = 9$, $r = 4$

$H(0.95, 4, 9) = 6.31$

$H^* > H$. rejecting the null hypothesis $H_0 = \sigma_1^2 = \cdots = \sigma_4^2$

c)

```r
s2 <- apply(sqrt(df),MARGIN = 2,FUN = var)
max(s2)/min(s2)
```

```
## [1] 1.63767
```

```r
qmaxFratio(0.95, 9, 4)
```

```
## [1] 6.311665
```

$df = 9$, $r = 4$

$H(0.95, 4, 9) = 6.31$

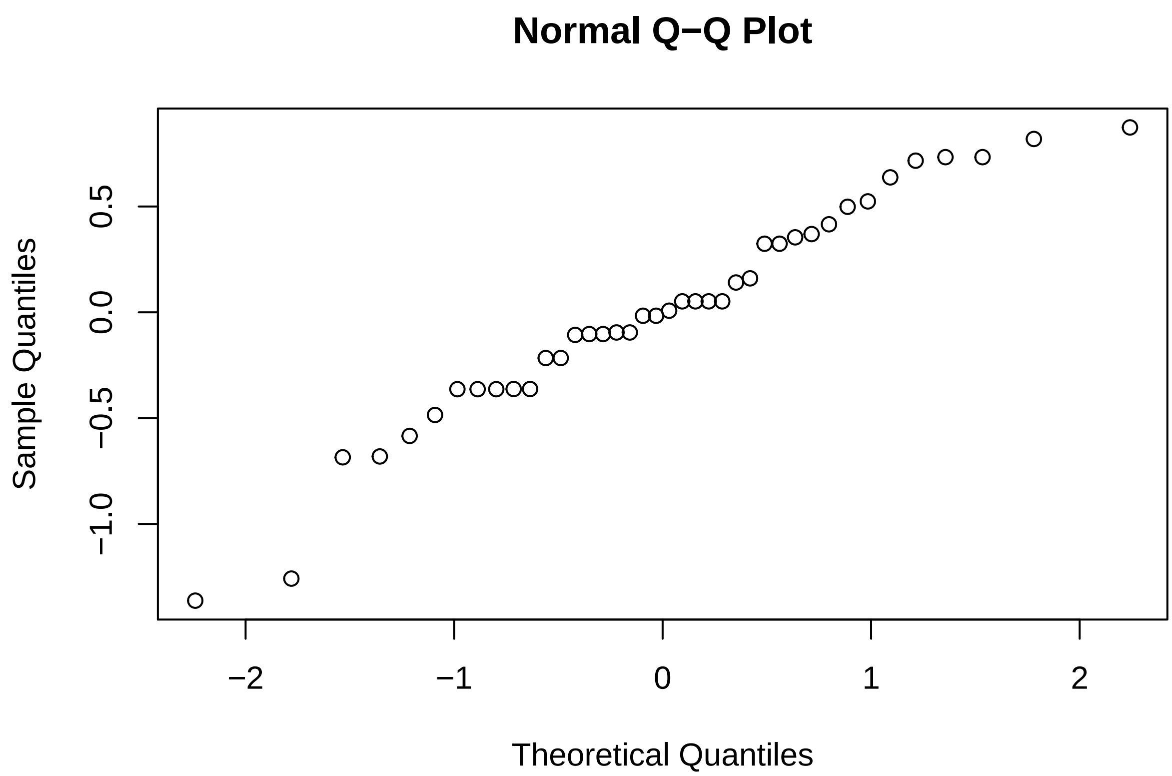
$H^* \leq H$. can't rejecting the null hypothesis $H_0 = \sigma_1^2 = \cdots = \sigma_4^2$.

d)

```r
df <- data.frame(y=c(oxy1, oxy5, oxy10, oxy20), x=as.factor(rep(1:4, each=10)))

fit <- aov(sqrt(y) ~ x, df)

qqnorm(fit$residuals)
```



The residual plots does not indicate serious departure from normality except the two point at the bottom tail.

Problem 2

a)

```
mu <- matrix(c(10, 5 ,9, 8, 12 ,7 ,11 ,10, 8 ,3 ,7 ,6), nrow=3, ncol=4, byrow=T)

mudot <- sum(mu)/(nrow(mu) * ncol(mu))
```

$\mu_{..} = 8$

$\mu_{.j} = 10, 5, 9, 8$

$\mu_{i.} = 8, 10, 6$

$\alpha_{1,2,3} = 0, 2, -2$

$\beta_{1,2,3,4} = 2, -3, 1, 0$

b)

because it is possible to express all μ_{ij} as the sum of $\mu_{..} + \alpha_i + \beta_k$. there's no interaction between the two factors of a and b.

Problem 3

a)

```r
mu <- matrix(c(8, 5, 9 ,10 ,12 ,11, 7 ,10, 8, 3 ,7 ,6), nrow=3, ncol=4, byrow=T)

mudot <- sum(mu)/(nrow(mu) * ncol(mu))
```

$\mu_{..} = 8$

$\mu_{.j} = 9.3333333, 6.3333333, 7.6666667, 8.6666667$

$\mu_{i.} = 8, 10, 6$

$\alpha_{1,2,3} = 0, 2, -2$

$\beta_{1,2,3,4} = 1.3333333, -1.6666667, -0.3333333, 0.6666667$

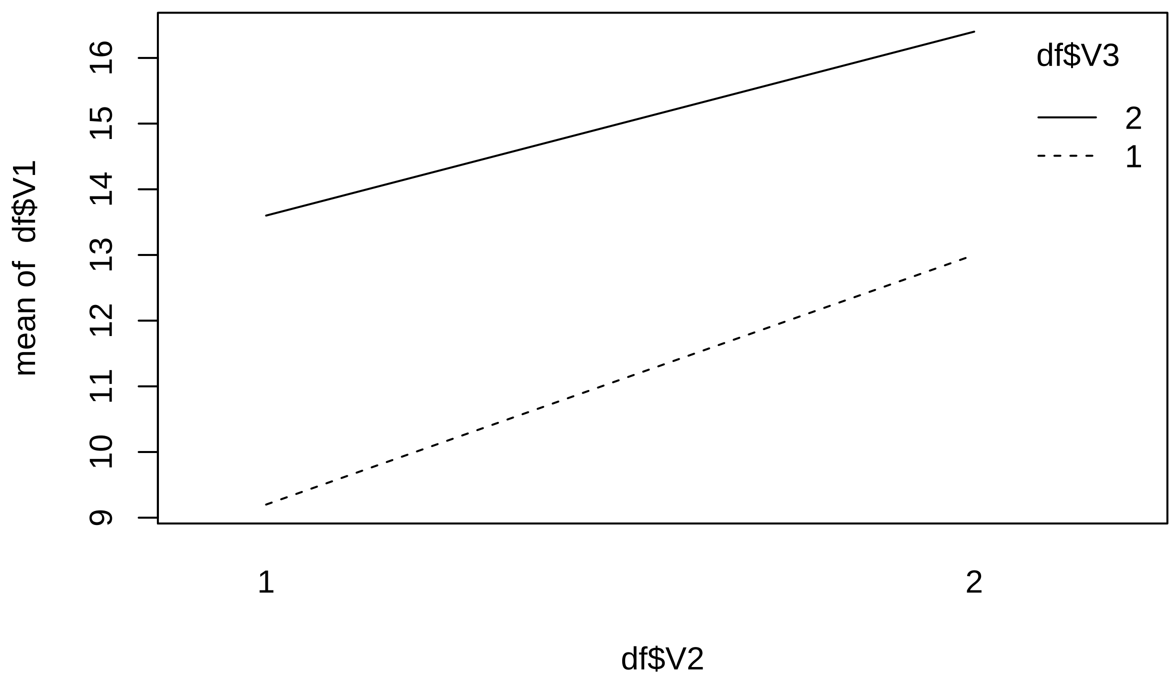
b)

because it's not possible to express all μ_{ij} as the sum of $\mu_{..} + \alpha_i + \beta_k$. there are interaction between the two factor of a and b.

Problem 4

a)

```r
df <- read.table('./CH19PR12.txt')
df$V2 <- as.factor(df$V2)
df$V3 <- as.factor(df$V3)
interaction.plot(df$V2, df$V3, df$V1)
```



since the slope of the lines are not zero it is the evidence that V2 has an effect and since the the two lines indicating the levels ov V3 have different heights the V3 has an effect. The two lines are almost parrallel to each other which shows that there no significant interaction.

b)

```
fit <- lm(V1 ~ V2 + V3 + V2 * V3 , df)
anova(fit)
```

```
## Analysis of Variance Table
##
## Response: V1
##           Df Sum Sq Mean Sq F value   Pr(>F)
## V2         1  54.45  54.450  8.9630 0.008589 **
## V3         1  76.05  76.050 12.5185 0.002734 **
## V2:V3      1   1.25   1.250  0.2058 0.656202
## Residuals 16  97.20   6.075
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

c)

$H_0 : all(\alpha\beta)_{ij} = 0$

$H_a : notall(\alpha\beta)_{ij}$ equal zero

$F^* = \frac{MSAB}{MSE} = 0.2057613$

$F = 4.1131653$

$F^* < F$ concluding H_0, eye contact and sex do not interact in their effect on applicant job sucess.

d)

for eye contact:

$H_0 : \alpha_1 = \cdots = \alpha_2 = 0$

$H_a : (notall)\alpha_i$equal zero

$F^* = \frac{54.450}{6.075} = 8.962963$

$F = 4.1131653$

$F^* > F$, we conclude H_a that factor eye contact means are not equal and there's some definite effect associated with eye contact and level of sucess.

for sex:

$H_0 : \beta_1 = \cdots = \beta_2 = 0$

$H_a : (notall)\beta_i$equal zero

$F^* = \frac{76.050}{6.075} = 12.5185185$

$F = 4.1131653$

$F^* > F$, we conclude H_a that factor sex means are not equal and there's some definite effect associated with sex and level of sucess.