QSCI 482 Lab 6

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Part 1

1.

$$F_{\alpha(1),\nu_1=k-1,\nu_2=N-k,} \tag{1}$$

2.

$$\chi^2 = \sum_{j=1}^{2} \frac{\left(f_{ij} - \hat{f}_{ij}\right)^2}{\hat{f}_{ij}} \tag{2}$$

3.

$$\bar{X} = \frac{\sum_{i=1}^{k} \sum_{j=1}^{n_i} X_{ij}}{N} \tag{3}$$

4.

$$\phi = \sqrt{\frac{n \sum_{i=1}^{k} (\mu_i - \mu)^2}{k\sigma^2}} \tag{4}$$

Part 2

5.

```
df <- read.csv('Pig feed.csv')
df
```

```
##   Feed1 Feed2 Feed3 Feed4
## 1  60.8  68.7  69.6  61.9
## 2  67.0  67.7  77.1  64.2
## 3  65.0  75.0  75.2  63.1
## 4  68.6  73.3  71.5  66.7
## 5  61.7  71.8    NA  60.3
```

6.

```
col_means <- colMeans(df,na.rm = T)
col_means
```

```
## Feed1 Feed2 Feed3 Feed4
## 64.62 71.30 73.35 63.24
```

7.

```
xlong <- gather(data = df,key = feed,value = weight,na.rm= T)
```

8.

```
X <- mean(xlong$weight)
t_ss <- sum((xlong$weight - X)^2)
t_dof <- nrow(xlong) - 1
print(t_ss)
```

```
## [1] 479.6874
```

```
print(t_dof)
```

```
## [1] 18
```

9.

```
g_ss <- 0
for (i in colnames(df)){

  n <- (nrow(xlong[xlong$feed == i,]))
  g_ss <- g_ss +  (n* (col_means[i] - X)^2)

}
g_dof <- length(col_means) - 1
```

10.

```
alpha <- 0.05
e_ss <- t_ss - g_ss
e_dof <- t_dof - g_dof

g_ms <- g_ss / g_dof
e_ms <- e_ss / e_dof

f <- g_ms / e_ms
f.crit <- qf(alpha / 2, df1 = g_dof, df2 = e_dof,lower.tail = F)

p.value <- pf(f, df1 = g_dof, df2 = e_dof,lower.tail = F)
glue('F: {f}\nF_crit: {f.crit}\np-value: {p.value}')
```

```
## F: 12.0404038515471
## F_crit: 4.15280403006288
## p-value: 0.000283012228461251
```

11.

```
glue('total SS: {t_ss}\nGroup SS: {g_ss}\nError SS: {e_ss}\ntotal DF: {t_dof}
Group DF: {g_dof}\nError DF: {e_dof}\nGroups MS: {g_ms}\nError MS: {e_ms}'
)
```

```
## total SS: 479.687368421052
```

```
## Group SS: 338.937368421052
## Error SS: 140.75
## total DF: 18
## Group DF: 3
## Error DF: 15
## Groups MS: 112.979122807017
## Error MS: 9.38333333333336
```

```
aov.res <- aov(formula = weight~feed,data = xlong)
print(aov.res)
```

```
## Call:
##    aov(formula = weight ~ feed, data = xlong)
##
## Terms:
##                       feed Residuals
## Sum of Squares  338.9374  140.7500
## Deg. of Freedom        3        15
##
## Residual standard error: 3.063223
## Estimated effects may be unbalanced
```

```
summary(aov.res)
```

```
##             Df Sum Sq Mean Sq F value   Pr(>F)
## feed         3  338.9  112.98   12.04 0.000283 ***
## Residuals   15  140.8    9.38
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
coefficients(aov.res)
```

```
## (Intercept)   feedFeed2   feedFeed3   feedFeed4
##       64.62        6.68        8.73       -1.38
```