MAT325 Lab 2

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#############
####  1  ####
#############
```

(a) Set up the test to compare the mean distance for the four brands. Use α =.10.

Let

$$\begin{aligned} \bar{x_a} &= \text{ the mean distance of brand A} \\ \bar{x_b} &= \text{ the mean distance of brand B} \\ \bar{x_c} &= \text{ the mean distance of brand C} \\ \bar{x_d} &= \text{ the mean distance of brand D} \end{aligned}$$

Step 1:

$$\begin{aligned} H_o &: \bar{x_a} = \bar{x_b} = \bar{x_c} = \bar{x_d} \\ H_a &: \exists i, j \text{ such that } \bar{x_i} \neq \bar{x_j} \end{aligned}$$

Step 2:

(b) Obtain the test statistics and p-value. Give the appropriate conclusion.

```
##             Df Sum Sq Mean Sq F value   Pr(>F)
## df$BRAND     3 2794.4   931.5   43.99 3.97e-12 ***
## Residuals   36  762.3    21.2
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

So,

$$\begin{aligned} fval &= 43.99 \\ pval &= 3.97 * 10^{-12} \\ \alpha &= 0.10 \end{aligned}$$

Step 3:

$$pval = 3.97 * 10^{-12} < \alpha = 0.10$$

Step 4: We reject the H_o.

Step 5: There is sufficient evidence to suggest at a significance level of 0.10 that the mean distances of the four brands are not equal.

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####  2  ####
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```

(a) Are there differences among the mean tast scores for the four groups? Use α =.05.

Let

$$\begin{aligned}\bar{x_a} &= \text{ the mean distance of group AR}\\ \bar{x_b} &= \text{ the mean distance of group AC}\\ \bar{x_c} &= \text{ the mean distance of group A}\\ \bar{x_d} &= \text{ the mean distance of group P}\end{aligned}$$

Step 1:

$$\begin{aligned}H_o &: \bar{x_a} = \bar{x_b} = \bar{x_c} = \bar{x_d}\\ H_a &: \exists i, j \text{ such that } \bar{x_i} \neq \bar{x_j}\end{aligned}$$

Step 2:

```
##             Df Sum Sq Mean Sq F value   Pr(>F)
## df1$GROUP    3 0.9506  0.3169   10.29 3.76e-05 ***
## Residuals   40 1.2317  0.0308
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

So,

$$\begin{aligned}fval &= 10.29\\ pval &= 3.76 * 10^{-5}\\ \alpha &= 0.05\end{aligned}$$

Step 3:

$$pval = 3.76 * 10^{-5} < \alpha = 0.05$$

Step 4: We reject the H_o.

Step 5: There is sufficient evidence to suggest at a significance level of 0.05 that the mean test scores for the four groups are different.

(b) What assumptions must be met in order to ensure the validity of the inference you made in part a.

1. Each group sample is drawn from a normally distributed population.
2. All populations have a common variance.
3. All samples are drawn independently of each other.
4. Within each sample, the observations are sampled randomly and independently of other.
5. Factor effects are additive

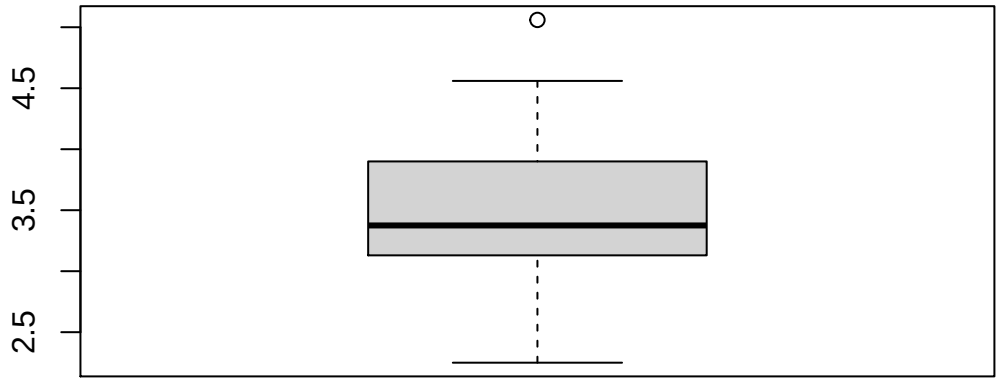
```
#############
####  3  ####
#############
```

a. Find the descriptive statistics for Al-Be ratio are:

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   2.250   3.150   3.375   3.507   3.895   5.060

##
##  Also, the standard deviation for Al-Bi ratio is: 0.6343864
```

b. Construct a boxplot for the data and identify any outliers



c. Construct an analysis of vairiance of the data. Is there sufficient evidence to indicate difference among mean Ai-Be ratios for the five boreholes? Test using $\alpha = .10$.

Let

$\bar{x_a} =$ the mean ratio of borehole UMRB-1
$\bar{x_b} =$ the mean ratio of borehole UMRB-2
$\bar{x_c} =$ the mean ratio of borehole UMRB-3
$\bar{x_d} =$ the mean ratio of borehole SWRA
$\bar{x_e} =$ the mean ratio of borehole SD

Step 1:

$$H_o : \bar{x_a} = \bar{x_b} = \bar{x_c} = \bar{x_d} = \bar{x_e}$$
$$H_a : \exists i, j \text{ such that } \bar{x_i} \neq \bar{x_j}$$

Step 2:

```
##              Df Sum Sq Mean Sq F value   Pr(>F)
## df2$BOREHOLE  4  5.836  1.4589   7.251 0.000784 ***
## Residuals    21  4.225  0.2012
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

So,

$$fval = 7.251$$
$$pval = 0.000784$$
$$\alpha = .10$$

Step 3:

$$pval = 0.000784 < \alpha = .10$$

Step 4: We reject the H_o.

Step 5: There is sufficient evidence to suggest at a significance level of 0.10 that the mean Ai-Be ratios for the five boreholes are different.