I - treaments and J- population in each treatment.

Model: $y_{ij} = \mu + \alpha_i + \epsilon_{ij}$ with errors ϵ_{ij} being independent Normal $(0, \sigma^2)$ and differential effect $\sum_{i=1}^{I} \alpha_i = 0$

Null Hypothesis: $\alpha_1 = \alpha_2 = \ldots = \alpha_I = 0$

Alternative Hypothesis: One of the α_i differ from 0.

I - treaments and J- population in each treatment.

$$\text{Total Sum of squares} := \sum_{i=1}^{I}\sum_{j=1}^{J}(y_{ij} - \bar{y})^2$$
$$= \sum_{i=1}^{I}\sum_{j=1}^{J}(y_{ij} - \bar{y_{i\cdot}})^2 + J\sum_{i=1}^{I}(\bar{y_{i\cdot}} - \bar{y})^2$$
$$:= \text{Sum of squares within treatment groups}$$
$$+ \text{Sum of squares between treatment groups}$$

In Short:

$$\text{SS}_{\text{total}} = \text{SS}_{\text{W}} + \text{SS}_{\text{B}}$$

I - treaments and J- population in each treatment.

Test Statistic:

$$F := \frac{\text{SS}_{\text{B}}/(I-1)}{\text{SS}_{\text{W}}/(I(J-1)}$$

where $F \sim F(I-1, I(J-1))$

Decide on α

Calculate p-value : $= P\left(F(I-1, I(J-1)) > \frac{\text{SS}_{\text{B}}/(I-1)}{\text{SS}_{\text{W}}/(I(J-1)}\right)$

Reject Null Hypothesis if p-value is less that α

1. Execute a `for loop` in R via the following code.

```
> for (i in 1:10) {
+   if (!i %% 2){
+     next
+   }
+     print(i)
+ }

[1] 1
[1] 3
[1] 5
[1] 7
[1] 9
```

   Describe what it is doing.

2. Use the `searchtimes.csv, firingrate.csv` from (Sripati and Olson 2010) data.

   (a) Using `read.csv` with additional option `skip =2` read the above datasets into R, as variables `S` and `F`.

   ```
   > S= read.csv("searchtimes.csv", skip=2, header=TRUE)
   > F= read.csv("firingrates.csv", skip=2, header=TRUE)
   ```

   (b) From the 18 column (9 corresponding pairs of images) in the dataset `firingrates.csv` using the `for loop` compute the L_1 distance[1] between the firing rates across the pairs. Assign variable `LONE` for this data (it should be a vector of length 9).

   ```
   > LONE = rep(1:18)
   > for(i in 1:9){ LONE[i] = sum(abs(F[,2*i-1]-F[,2*i]))}
   > LONE = LONE/114
   ```

   (c) Deduce what this code achieves.

   ```
   > RLONE = replicate(2, LONE)
   > FLONE = c(t(RLONE))
   ```

   (d) There should be 18 columns in for each image pair, providing the search times. Convert `S` into search delays by subtracting the baseline reaction time of 328 ms and store it in `SD`.

   (e) Deduce what this code achieves

   ```
   > SD= S-328
   > STSD = SD*FLONE
   ```

   (f) Deduce what this code achieves

   ```
   > n = rep(72,18)
   > group = rep(1:18,n)
   > VSTSD = unlist(STSD, use.names=FALSE)
   > AOVDATA = data.frame(y = VSTSD, group = factor(group))
   ```

   (g) Using the `oneway.test` to test whether all the 18 image pairs $E[s_{ij}LONE_{ij}]$ is the same. Please justify your answer.

   ```
   > oneway.test(y~group, data=AOVDATA, var.equal=TRUE)

           One-way analysis of means

   data:  y and group
   F = 9.4655, num df = 17, denom df = 1278, p-value < 2.2e-16
   ```

[1] for vectors $x_1, x_2, \ldots, x_n$ and $y_1, y_2, \ldots, y_n$ we shall designate the L_1 distance by $\frac{1}{n}\sum_{i=1}^{n} \mid x_i - y_i \mid$