README FILE FOR ANOVA

1-)ANOVA1_partition_TSS(data_set)

- This return the sum of squares one way anova layout basically. data_set format should be:

```
data_set = 6×4
      28    33    18    11
      23    36    21    14
      14    34    20    11
      27    29    22    16
       0    31    24     0
       0    24     0     0
```

```
toxin_1=transpose([28 23 14 27 0 0]);%
toxin_2=transpose([33 36 34 29 31 24]);
toxin_3=transpose([18 21 20 22 24 0]);
control=transpose([11 14 11 16 0 0]);
data_set=[toxin_1 toxin_2 toxin_3 control]
```

- Zeros are just used to force to dataset in matrix form, however in function they are not count as n_i.
- Output is the following form:

```
values=[ss_total ss_w ss_b];
```

- Namely; SS Total, SS Within and SS Between are printing out in vector respectively from left to right.

2-) ANOVA1_test_equality(data_set,alpha)

- data_set format is also same with above.
- It returns ANOVA1 table with p-value of ratio F, the output format is the same as ANOVA table but the value at the location of 3rd row-3th column is p-value, and the output

df	SS	MS	F
$I-1$	ss_b	$ss_b/(I-1)$	$\frac{ss_b/(I-1)}{ss_w/(n-I)}$
$n-I$	ss_w	$ss_w/(n-I)$	
$n-1$	ss_{total}	+-	

- It also returns whether hypothesis rejected or not, it's just displaying.

3-) ANOVA2_partition_TSS(X)

- The input format X is redesigned for the function, the example below is quite clear to understand how to give X as input here:

	Cold	Warm	Hot
Super	4, 5, 6, 5	7, 9, 8, 12	10, 12, 11, 19
Best	6, 6, 4, 4	13, 15, 12, 12	12, 13, 10, 13

```
X=[];
X(:,:,1)=[4 5 6 5;6 6 4 4];
X(:,:,2)=[7 9 8 12;13 15 12 12];
X(:,:,3)=[10 12 11 19;12 13 10 13];
```

- The Output is the following, we have SStotal, SSa, SSb, SSab, SSe respectively in vector:

```
values=[sstotal ssa ssb ssab sse];
```

4-) ANOVA2_MLE(X)

- The Input format is the same with ANOVA2_partition_TSS.
- As output, it just display the values of MLE's on console, there is no vector or matrix format here, that's a void function actually.

5-) ANOVA2_test_equality(X,alpha,choice)

- Input X is the same with the 4 and 3 above. Alpha is just a significance value of your test.
- The output is given in accordance with your choice, choices can be "A", "B" or "AB" only, if all a's are assummed to be zero then you must put "A" to the console, if all b's are zero then "B" and if all delta(i,j)'s are zero then just give the "AB". A returns the first, B returns second and AB returns third row of the table below.

Source	degrees of freedom	SS	MS	F
A	$I-1$	SS_A	MS_A	MS_A/MS_E
B	$J-1$	SS_B	MS_B	MS_B/MS_E
$A \times B$	$(I-1)(J-1)$	SS_{AB}	MS_{AB}	MS_{AB}/MS_E
within	$IJ(K-1)$	SS_E	MS_E	
Total	$IJK-1$	SS_{total}		

- Namely, it gives matrix as table.

6-) Bonferroni_correction(alpha,m) & Sidak_correction(alpha,m)

- m is the test number, Alpha is just a significance value of your test and this funtions returns new version of alpha's. They return number.

7-) ANOVA1_is_contrast(c) & ANOVA1_is_orthagonal(n,c1,c2)

- They are boolean functions, and returns bool as a matter of course. The being conrast or orthagonal situation returns bool=1, true i.e.
- Orthagonal function is just taking a two c vector, while contrast is taking one. The input vectors are in the form of row vector. Also n, c1,c2 must be the same size to avoid error.

```
c1=[1 -4 3 3];c2=[1 -4 3 0];
ANOVA1_is_orthagonal(n,c1,c2)
```

- One of example is the output is below, it's displaying the sitution of being contrast and returns the logical value as stated above. Orthagonal function have also check the contrast property also, that's why it also repot the contrast property.

```
Not contrast
It's contrast
One of c is not contrast
ans = logical
    0
```

8-) ANOVA1_CI_linear_combs(dataset,C,alpha,choice)

- Dataset must be in the form of what we designed in function 1 in readme file and alpha is again significance.
- C is m x I matrix, when I is the # of treatment while m is the # of tests. Each row of C gives coefficients for linear combination.
- The Output is basically the vector which have 2 numbers which are two terminals of interval like below.

```
ans = 1×2
    5.3527   -5.3527
```

- Caveat!! This intervals just represented the bounds; for example, this function just returns the value of red marked part of the set below, not the lhs of the inequality. However, It's enough to state CI actually.

$$\Theta^{\mathrm{CI}} = \left\{ (\mu_1, \ldots, \mu_I) : \left| \bar{X}_i - \bar{X}_j - (\mu_i - \mu_j) \right| \leq \frac{q_{\alpha, I, n-I}}{\sqrt{2}} \sqrt{\frac{SS_w}{n-I} \frac{2}{n_*}}, \quad \forall i \neq j \right\}$$

- According to choice, they control C whether is convenient for this choice or not; if it's convenient then it will returns. **However if it returns 0 0 then your choice and C matrix are contradict the each other, for example you write "Sidak" but C is not orthagonal contrast etc.**
- The choice can be "Scheffe", "Bonferroni", "Sidak", "Best", "Tukey".

9-) ANOVA1_test_linear_combs(dataset,C,alpha,d,choice)

- All explanations are the same with above, function-8. However the output differs. I prefer the give p-value with the bounds which I showed above, so the output format is below. First two elements represent bounds while the last one is p-value. It's just basically row vector.

```
ans = 1×3
    5.3527   -5.3527    0.9871
```