**My shuffling and swapping methods to find the MS-optimal designs**

The shuffling and swapping are on the rows of the treatment design matrix.

The MS-optimal design is a design that maximise trace of the information matrix, maximise the average efficiency factors which is the harmonic mean of the canonical efficiency factors, minimise the trace of the square of the information matrix and minimise the variance of the canonical efficiency factors.

The numbers of the canonical efficiency factors are checked every time and making sure it does not reduce. If it reduces, it means some DF of a given treatment has moved to other strata, despite the remaining DF of a given treatment still stays intact, i.e. the average efficiency factor is large.

The method starts with a random treatment design matrix, with equal replication of all treatment groups.

The swapping method starts with swapping the first row of the treatment design matrix with all the other rows of same treatment design matrix to find the MS-optimal design.

The next step of the swapping take place on the second row of the treatment design matrix with the other rows expect the first row and aim to find the MS-optimal design.

After the swapping method performed on every row of the treatment design matrix, the method starts again on the first rows of the matrix.

The process kept on going until the average efficiency factor does not change anymore (Maybe I need to add more criterions into this.)

The resultant treatment design matrix from the above process is stored.

Then another random treatment design matrix is generated and the above processes are repeated.

The current function that I have written allows the process to repeat 20 times. This means 20 treatment design matrices will be generated.

The final step is the find a MS-optimal design out of these 20 designs.

The factorial experiments require the usage of the treatment contrast matrices generated based on the yield identities.

The treatment design matrix is then the treatment incidence matrix.

The MS-optimal design is obtained from the pre and post-multiply the information matrix by the treatment contrast matrices.

The treatment factor of the concern depends on which treatment contrast matrix that is used.

The only thing that is changing is the rows of the treatment incidence matrix. This matrix is also where the shuffling and swapping will be performed on.