Lab 7

Every experimental design starts with a pre-randomized design plan that will:

- List out all possible treatment levels (could come from one or more treatment factors)
- Decide number of replicates per treatment level

For a completely randomized design (CRD) plan, assignment of treatments to EUs is done completely at random and preserves the desired replication.

Question 1: experimental plan Consider our pizza dough example from class with three times allowing the dough to rise. Write out the pre-design plan (treatment levels & number of replicates). You can decide the number of replicates.

A randomization procedure is valid if:

- all permutations of treatment labels are equally likely
- it preserves the desired replication

This is not the same as saying every EU has the same chance to be assigned a given treatment

Question 2: valid randomization? Would the following procedure be a valid randomization, why or why not?

```
set.seed(03082022)
trt_levels <- 3
replicates <- 5
EUs <- trt_levels * replicates

data.frame(EUs = 1:EUs, trt = sample(3,15, replace = T)) %>% kable()
```

EUs	trt
1	1
2	1
3	3
4	1
5	1
6	1
7	3
8	1
9	3
10	1
11	1
12	1
13	1

EUs	trt
14	2
15	3

Consider a design that with two treatment levels and 3 replicates for each replicate. Assume randomization is determined by a coin flip for each participant - until the quota for given treatment level has been met.

Consider the following randomization and associated probabilities

EUs	1	2	3	4	5	6
TRT	1	2	2	1	1	2
Prob	1/2	1/2	1/2	1/2	1/2	1

for this randomization procedure, the last treatment procedure is completely determined. So the probability of this design would be $\left(\frac{1}{2}\right)^5$

Question 3: permutation probability Calculate the probability of each permutation below. Does this result in a valid randomization procedure?

EUs	1	2	3	4	5	6
perm 1	1	2	2	2	1	1
perm 2	2	2	2	1	1	1
perm 3	1	2	2	1	1	2

There are many valid ways to generate a CRD. The easiest is to use computer randomization:

1. Create a list of EUs from 1 to N
2. Generate random number for each EU
3. Sort by EUs by random number
4. Assign first r_1 to treatment 1, assign next r_2 to treatment 2...

Note steps 1 - 3 can be done with sample in `R`.

Question 4: design randomization Write code to create a valid randomization for your experimental settings in Question 1.

Treatments do not have to be equally replicated for a design to be called a CRD, its a CRD due to the randomization procedure.

CRDS are recommended when EUs are fairly homogeneous

Nuisance factors are either:

- Held constant
- Measured and adjusted for with analysis of covariance