Stats 300 **Spring 2024**

What Matched-Pairs is, and is not

A matched-pairs study or experiment means that there is a large number of individuals, and each individual creates two numbers (data) that match each other in some way. You end up with two lists of numbers that match together in pairs, in only one natural way.

Ex 1: Does a drug reduce cholesterol? The individuals are people, and the two numbers (for each person) are cholesterol levels in the blood before and after the drug is given. For each person, the two numbers (before and after) match up because they come from the same person. Your data might look something like this:

Person	Cholesterol Level before	Cholesterol Level after
1	210	205
2	188	181
3	200	190

etc. Each row has two numbers (cholesterol levels) that match up because they come from the same person. The two numbers in each row have something in common that two numbers from two different rows do not.

Ex 2: Do home teams score more than road teams in the NBA? The individuals are basketball games, and the two numbers for each game are the home team's score and the road team's score. These two numbers are matched up for each game.

Ex 3: Does the San Francisco Chronicle and Los Angeles Times give movies equal ratings, on average? To address this, look at a number of different movies reviewed by both papers. The individuals are movies, and the two numbers for each movie are the number of stars (say between zero and four) given to each reviewed movie.

Ex 4: Does Enterprise Rent-a-car charge the same, on average, as Avis, for rentals of Intermediate size cars at major US airports? The individuals are different airports (in different cities), and we match up the daily rental for these two companies at a large number of airports, creating our two lists of data.

Here are some examples that are not matched-pairs.

Ex 5: Do women and men score the same on a driving test? You may have a list of, say, 50 men's scores and 50 women's scores, but they don't form 50 matched pairs in a natural way. A particular man's score does not match up with any one woman's score any more than some other woman's score. No correspondence is more natural than any other.

Ex 6: Are an equal number of points scored, on average, in NBA games and men's college basketball games. Again, there is no natural way to match up the list of NBA scores with the list of college scores.

Ex 7: Does a cholesterol drug work equally well in people from two different age groups? Again, there is no unique way to match up people from these two groups.

Sample problems for Matched-Pairs

1) A city wants to study the average cost households pay for heating in the winter compared to cooling in the summer. Test the hypothesis that the average costs for heating and cooling are different at the 5% significance level.

Household	Heating	Cooling
1	$168	$159
2	$256	$234
3	$392	$386
4	$284	$293
5	$190	$198
6	$424	$429
7	$370	$352
8	$258	$230
9	$186	$182
10	$349	$350
11	$230	$238
12	$297	$275
13	$343	$344
14	$393	$373

2) Does Lap Band help people lose weight? Twenty people are chosen. Their weights are recorded before and after using Lap Band for 6 months. Test the claim that the average weight loss is positive for all Lap Band users. Use $\alpha = 1\%$.

Person	Weight Before	Weight After
1	155	140
2	171	163
3	199	201
4	223	209
5	138	135
6	248	253
7	241	231
8	192	184
9	147	147
10	130	131
11	178	184
12	215	202
13	237	223
14	183	181
15	250	248
16	221	223
17	156	156
18	141	138
19	172	167
20	180	179