

## Applying the Generalized $t$ -Test: In-Class Exercise

Psychology 311

Spring, 2013

### Key

1. (a) Is this a between-subjects, within-subjects, or between-within design?

*Answer.* This is a between-within design. There are two independent samples, and each independent sample is measured twice.

Test the following hypotheses:

- (b) For the CH condition, the experimental and control methods have the same mean.

*Answer.* We begin by selecting out the rows of the data frame for which the condition is CH.

```
> data.b <- X[X$condition=='CH',]
```

Notice that, for these subjects *considered alone*, we have a within-subjects design. So to do the significance test, we reduce the two columns of data to one column of difference scores:

```
> Db <- data.b[,1] - data.b[,2]
```

We need to load in the code for our Generalized  $t$  statistic function. In what follows, I assume you've copied this code to your current working directory.

```
> source("GeneralizedTCode.r")
```

Next, we do the 1-Sample  $t$ -test that the mean of the difference scores is zero.

```
> GeneralizedT(mean(Db),sd(Db),length(Db),1)
```

```
[1] -2.71607228 19.00000000 0.01370535
```

- (c) For the R condition, the experimental and control methods have the same mean.

*Answer.* The approach is virtually identical to the previous problem. We begin by selecting out the rows of the data frame for which the condition is R.

```
> data.c <- X[X$condition=='R',]
```

Notice that, for these subjects *considered alone*, we have a within-subjects design. So to do the significance test, we reduce the two columns of data to one column of difference scores:

```
> Dc <- data.c[,1] - data.c[,2]
```

Next, we do the 1-Sample  $t$ -test that the mean of the difference scores is zero.

```
> GeneralizedT(mean(Dc),sd(Dc),length(Dc),1)
```

```
[1] 1.91898547 19.00000000 0.07013463
```

- (d) The change in reaction time (relative to the control method) for the CH group is the same as the corresponding change for the R group.

*Answer.* Note that for each of the two independent groups, we already have computed the difference scores. So our test of no interaction can be accomplished easily in a variety of ways.

```
> means <- c(mean(Db),mean(Dc))
```

```
> sds <- c(sd(Db),sd(Dc))
```

```
> ns <- c(length(Db),length(Dc))
```

```
> weights <- c(1,-1)
```

```
> GeneralizedT(means,sds,ns,weights)
```

```
[1] -3.324926233 38.000000000 0.001967603
```

Table 1: Data for Problem 1

	Experimental	Control	condition
1	2200	2430	CH
2	2474	2278	CH
3	2314	2228	CH
4	2329	2426	CH
5	2279	2470	CH
6	2112	2587	CH
7	2283	2508	CH
8	2272	2562	CH
9	2361	2462	CH
10	2325	2493	CH
11	2323	2309	CH
12	2334	2488	CH
13	2246	2482	CH
14	2320	2423	CH
15	2373	2297	CH
16	2125	2448	CH
17	2446	2376	CH
18	2379	2330	CH
19	2294	2533	CH
20	2432	2257	CH
21	2461	2290	R
22	2303	2300	R
23	2371	2349	R
24	2510	2205	R
25	2466	2268	R
26	2484	2382	R
27	2433	2567	R
28	2341	2327	R
29	2531	2523	R
30	2298	2335	R
31	2458	2220	R
32	2240	2394	R
33	2369	2417	R
34	2418	2361	R
35	2523	2419	R
36	2447	2485	R
37	2351	2238	R
38	2229	2245	R
39	2388	2226	R
40	2497	2531	R