Charlie Tran

Problem Set 5: POLS 3316 Statistics for Political Science University of Houston
Fall 2023
Due November 15, 2023, 11:59 PM

For both problems, be sure to show work as instructed and to fill in the score, p-value, and whether you retain or reject the null hypothesis. Answer any specific questions.

1. Complete a X^2 (Chi-square) hypothesis test of independence on the following data. The extra tables are for your convenience, but you must set up the initial table, figure the totals and sample sizes, and expected values. You can get the p-value using the table or the R function for chi-square probability distribution:

Treated patients, no improvement: 50
Treated patients, with improvement: 75
Untreated patients, no improvement: 60
Untreated patients, with improvement: 75

H0: The variables are independent (treatment is unrelated to improvement.)
H1: The variables are dependent (treatment affects improvement.)

Table 1: The data

	TREATED	UNTREATED
IMPROVEMENT	75	75
NO IMPROVEMENT	50	60

Table 2: with Marginal Frequencies (totals)

	TREATED	UNTREATED	TOTAL
IMPROVEMENT	75	75	150
NO IMPROVEMENT	50	60	110
TOTAL	125	135	260

Table 3: expected outcomes

	TREATED	UNTREATED	TOTAL
IMPROVEMENT	$\dfrac{150 \times 125}{260}$ $= 72.11538461538462$	$\dfrac{150 \times 135}{260}$ $= 77.88461538461538$	150
NO IMPROVEMENT	$\dfrac{110 \times 125}{260}$ $= 52.88461538461538$	$\dfrac{150 \times 125}{260}$ $= 57.11538461538462$	110
TOTAL	125	135	260

Extra tables for work:

	TREATED	UNTREATED	TOTAL
IMPROVEMENT	$\dfrac{(75-72.11538461538462)^2}{72.11538461538462}$ $= 0.1153846$	$\dfrac{(75-77.88461538461538)^2}{77.88461538461538}$ $= 0.1068376$	
NO IMPROVEMENT	$\dfrac{(50-52.88461538461538)^2}{52.88461538461538}$ $= 0.1573427$	$\dfrac{(60-57.11538461538462)^2}{57.11538461538462}$ $= 0.1456876$	
TOTAL			0.5252525

	TREATED	UNTREATED	TOTAL
IMPROVEMENT	75	75	150
NO IMPROVEMENT	50	60	110
TOTAL	125	135	260

Chi-Square Score X^2: 0.5252525

p-value: 0.4686097

Retain or reject the null: reject the retain null hypothesis – treatment is unrelated to improvement

2. Complete a paired samples T-test on the following sample.

Show your work: you may either copy and paste all your R code into a document or show the math steps.

H0:   The true mean difference between the paired samples is zero.
H1:   The true mean difference between the paired samples is not equal to zero.
Is this a one or two tailed test?   Two Tailed test

Student	Score 1	Score 2	Differences
1	3	15	-12
2	2	13	-11
3	3	14	-11
4	12	21	-9
5	15	30	-15
6	16	31	-15
7	17	23	-6
8	19	21	-2
9	23	25	-2

$$x_{diff} = 9.22222, \sigma = 4.944132$$

t-score: $= -\frac{9.22222}{\frac{4.944132}{\sqrt{9}}} = -5.595859$

p-value: 0.0005127166

Retain or reject the null: reject the null hypothesis for

```
> diff <- c(-12,-11,-11,-9,-15,-15,-6,-2,-2)
> mean(diff)
[1] -9.222222
> sd(diff)
[1] 4.944132
> mean(diff)/(sd(diff)/3)
[1] -5.595859
> 2*pt(q=5.595859, df=8, lower.tail=FALSE)
[1] 0.0005127166
```

```
> score1 <- c(3,2,3,12,15,16,17,19,23)
> score2 <- c(15,13,14,21,30,31,23,21,25)
> t.test(score1, score2, paired = TRUE, alternative = "two.sided")

        Paired t-test

data:  score1 and score2
t = -5.5959, df = 8, p-value = 0.0005127
alternative hypothesis: true mean difference is not equal to 0
95 percent confidence interval:
 -13.022619  -5.421826
sample estimates:
mean difference
      -9.222222
```