Statistical Methods: Homework 13

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1 13.3.2

Recall the depth perception data described in Question 8.2.6. Use a paired t test with $\alpha = 0.05$ to compare the numbers of trials needed to learn depth perception for Mothered and Unmothered lambs.

Answer:

WE USE A PAIRED 2 SIDED T TEST

```
mothered = c(2,3,5,3,2,1,1,5,3,1,7,3,5)
> mothered = c(2,3,5,3,2,1,1,5,3,1,7,3,5)
> unmothered = c(3,11,10,5,5,4,2,7,5,4,8,12,7)
> total = cbind(mothered, unmothered, mothered-unmothered)
>
> t.test(mothered, unmothered, paired=TRUE, alternative = "two.sided")

  Paired t-test

data:  mothered and unmothered
t = -4.5029, df = 12, p-value = 0.000723
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -4.794047 -1.667491
sample estimates:
mean of the differences
              -3.230769
```

Since the p value is less than .025 ($0.000723 < .025$), We reject H_0 and conclude the difference are significant.

2 13.3.6

Let $D_1, D_2, ..., D_b$ be the within-block differences as defined in this section. Assume that the D_i are normal with μ_D and variance σ_D^2, for $i = 1, 2, ..., b$ Derive formula for $100(1-\alpha)$ confidence interval for μ_D. Apply this formula to the data of Case Study 13.3.1 and construct a 95% confidence interval for the true average hemoglobin difference (b̈efore walk änd äfter walk)̈.

Answer:

$$P(-t_{\frac{\alpha}{2},n} < \frac{\bar{d}_i - \mu}{\frac{\sigma}{\sqrt{n}}} < t_{\frac{\alpha}{2},n}) = 1 - \alpha$$

$$P(-t_{\frac{\alpha}{2},n} < \frac{\bar{d} - \mu}{\frac{\sigma}{\sqrt{n}}} < t_{\frac{\alpha}{2},n}) = 1 - \alpha$$

$$P(-t_{\frac{\alpha}{2},n} * \frac{\sigma}{\sqrt{n}} < \bar{d} - \mu < t_{\frac{\alpha}{2},n} * \frac{\sigma}{\sqrt{n}}) = 1 - \alpha$$

$$P(-t_{\frac{\alpha}{2},n} * \frac{\sigma}{\sqrt{n}} + \mu < \bar{d} < t_{\frac{\alpha}{2},n} * \frac{\sigma}{\sqrt{n}} + \mu) = 1 - \alpha$$

So,

$$C.I. = (\mu - t_{\frac{\alpha}{2},n} * \frac{\sigma}{\sqrt{n}} < \bar{d} < \mu + t_{\frac{\alpha}{2},n} * \frac{\sigma}{\sqrt{n}})$$

Plugging in the values from the example:

$$C.I. = (.47 - 2.2281 * \frac{.813}{\sqrt{10}}, .47 + 2.2281 * \frac{.813}{\sqrt{10}})$$

$$C.I. = (-.1, 1.04)$$

3 14.2.6

Analyze the Shoshoni rectangle data (Case Study 7.4.2) with a sign test. Let $\alpha = 0.05$.

Answer:

The hypotethical median should be .618 for the rectangles fo be of the golden ratio variety.

```
shoshani <- c( 0.693,0.662, 0.690, 0.606, 0.570,0.749, 0.672,
    0.628, 0.609, 0.844, 0.654, 0.615, 0.668, 0.601, 0.576, 0.670,
    0.606, 0.611, 0.553, 0.933)
> med <- sum(shoshani>.618)
> count <- length(shoshani)
> testst <- (med-count/2)/(sqrt(20/4))
> pval <- pnorm(testst)
> med
[1] 11
> count
[1] 20
> testst
[1] 0.4472136
> pval
[1] 0.6726396
```

```
>
```

Since the p value is .67, we fail to reject H_0 and conclude that the the rectangles are similar to the golden ratio variety.