Practice Problem: Lab 10

Consider a problem in which we observe students to see if they took notes by hand or by laptop and recorded whether they passed or failed. Of the 67 that used a laptop 44 passed. Of the 76 that wrote by hand 56 of them passed. Construct an observed and expected table. Compute the chi-squared statistic and find the p-value from the chi-squared table. Interpret your results.

Expected cell $E_{ij} = (n_{i+} * n_{+j}) / n_{++}$

Observed

	Pass	Fail	Total
Laptop	44	23	67
Hand	56	20	76
Total	100	43	143

Expected: (67*100) / 143 = 46.85 etc

	Pass	Fail	Total
Laptop	46.85	20.14	67
Hand	53.14	22.85	76
Total	100	43	143

$$\chi^2 = \frac{(44-46.85)^2}{46.83} + \frac{(23-20.14)^2}{20.17} + \frac{(56-53.14)^2}{53.12} + \frac{(20-22.85)^2}{22.88}$$

χ^2= 1.087

df=1

From the table, everything below 1.087 is p=0.701.

Therefore p-value: 1-0.701= **0.299**

There is about a 30% probability of observing such an association by chance alone. There is no statistical evidence that writing notes on a laptop or by hand impacts test performance.

Power

```{r}
mean_diff <- mean(Corn$Crossed - Corn$Self)
sd_diff <- sd(Corn$Crossed - Corn$Self)

power.t.test(delta = mean_diff, n = 15,
             sd = sd_diff, type = "paired")
```

Practice Problem: Paired T-test:

```{r}
# Using R function:
t.test(Corn$Crossed, Corn$Self, paired = TRUE)

# By hand
Corn$corndiff <- Corn$Crossed - Corn$Self
SE <- sd(Corn$corndiff)/sqrt(15)
t <- (mean(Corn$corndiff) - 0) / SE

2*(1-pt(t, df=14))
```

```
        Paired t-test

data:  Corn$Crossed and Corn$Self
t = 2.1781, df = 14, p-value = 0.04699
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
  0.3290402 42.7376265
sample estimates:
mean of the differences
                21.53333

[1] 0.04699031
```