Stat 371-003, Solutions to Homework #8

1. "There's a 95% chance that the true effect is between –4.5 and –9.3 mm Hg."

   No. The true effect is some fixed but unknown value; we can't talk about probability. In advance, the investigators had a 95% chance of getting a confidence interval that contained the true effect; after the fact, the interval either contains the true effect or doesn't.

2. "There's a 99.1% chance that the treatment affects blood pressure."

   No. The P-value is the chance of getting data as or more extreme than was observed *if the null hypothesis (no treatment effect) were true.* We can't talk about the chance that the treatment has an effect.

3. **10.5 (pg 400)**

   The expected counts are 106.875, 35.625, 35.625, 11.875.

   The χ^2 statistic is

   $$\frac{(111-106.875)^2}{106.875}+\frac{(37-35.625)^2}{35.625}+\frac{(34-35.625)^2}{35.625}+\frac{(8-11.875)^2}{11.875}\approx 1.55$$

   Comparing this to the χ^2 distribution with 3 degrees of freedom (Table 9, pg 686), we find that the P-value is > 0.2, and so we fail to reject the null hypothesis and conclude that the data conform reasonably well to the proportions 9:3:3:1.

   In R, we could calculate the P-value with `1 - pchisq(1.55, 3)` $\approx$ 0.67.

   Alternatively, we could type

   ```
   ob <- c(111, 37, 34, 8)
   chisq.test(ob, p=c(9/16, 3/16, 3/16, 1/16))
   ```

4. **10.26 (pg 412)**

   The expected counts are

		Treatment	
		Ancrod	*Placebo*
Hemorrhage?	Yes	8.93	9.07
	No	239.07	242.93
	Total	248	252

   The χ^2 statistic is

   $$\frac{(13-8.93)^2}{8.93}+\frac{(5-9.07)^2}{9.07}+\frac{(235-239.07)^2}{239.07}+\frac{(247-242.93)^2}{242.93}\approx 3.82$$

Comparing this to the χ^2 distribution with 1 degree of freedom (Table 9, pg 686), we see that the P-value is between 0.05 and 0.10. At $\alpha = 0.05$, we would fail to reject the null hypothesis and conclude that there is insufficient evidence to show that there is a difference in the frequency of hemorrhage between the two groups. **But it's really close!**

In R, we would calculate the P-value with `1-pchisq(3.82, 1)` ≈ 0.051.

Or we could do the whole thing with:

```
tab <- rbind( c(13,5), c(235, 247) )
chisq.test(tab)
```

5. **10.46 (pgs 428)**

   We create a table with the data as follows:

   ```
   tab <- rbind( c(2,21), c(8, 16) )
   ```

   Note that the second row contains the numbers of individuals with low serum levels (not the totals)!

   (a) χ^2 **test**

   `chisq.test(tab)` gives a P-value of **0.088**. This is based on a "continuity correction".

   The vanilla version of the χ^2 test (as we've discussed in class) could be performed via `chisq.test(tab, correct=FALSE)` and gives a P-value of **0.039**.

   (b) **Fisher's exact test**

   `fisher.test(tab)` gives a p-value of **0.072**.

   With either test, we find that we have insufficient evidence to conclude that the two therapies differ in effectiveness.