Practice Problems

Problem 1

1256 individuals were tested in a saliva-based screening test for HIV. We know that 368 of the individuals tested have HIV, and 358 of them tested positive in the saliva-based screening test. Overall there were a total of 360 positive test results.

a. Construct a contingency table for the data.
b. What is the sensitivity of the saliva test?
c. What is the specificity?

Problem 2

The distribution of LDL cholesterol levels in a certain population is approximately normal with mean 90 mg/dl and standard deviation 8 mg/dl.

a. What is the probability an individual will have a LDL cholesterol level above 100 mg/dl?

b. Suppose we have a sample of 5 people from this population. What is the probability that at least one of them having levels above 100 mg/dl?

Problem 3

A psychologist was interested in exploring whether or not male and female college students have different driving behaviors. She focused on the fastest speed ever driven by an individual to see if the mean fastest speed driven by male college students differs from than the mean fastest speed driven by female college students. She surveyed 34 male college students and 29 female college students. The mean for males was 105.5 mph while the mean for females was 90.9 mph. The two samples had a pooled standard deviation of 16.9.

a. Conduct a t-test comparing the two groups.

b. Construct a 95% confidence interval for this difference.

Problem 4

A team from Yale School of Medicine took a look at 1,433 people diagnosed with intracranial meningioma, the most commonly diagnosed brain tumor in the United States. Researchers compared these patients to a test group of 1,350 people without tumors. Participants offered self-reported lifetime dental X-ray histories. Researchers then analyzed the X-rays that these two groups had undergone.

a. What type of study is this? What type of test would you perform?

b. If the odds ratio calculated for this study turned out to be (0.64, 1.15), what would you conclude?

Answers

Problem 1

a.

```
##        HIV No HIV
## Test + 358      2
## Test -  10    886
```

b. $358/368 = 0.973$
c. $886/888 = 0.998$

Problem 2

a.

```
(z <- (100-90)/8)
```

```
## [1] 1.25
```

```
(p <- pnorm(z,lower.tail=FALSE))
```

```
## [1] 0.1056498
```

When you use the table, you get the area below that value. In order to get the probability of an LDL level above 100, subtract this value from 1.

b.

```
1-dbinom(0,5,p)
```

```
## [1] 0.4278128
```

Use the binomial distribution to calculate this by hand: $\frac{n!}{k!(n-k)!}p^k(1-p)^{n-k}$

Problem 3

a. $SE = 16.9 * \sqrt{\frac{1}{34} + \frac{1}{29}} = 4.272$

$t = \frac{105.5-90.9}{4.272} = 3.42$
From the table, the p-value with $df = 61$ is between 0.001 and 0.005.

b. $(105.5 - 90.9) \pm 2.00(4.272)$

14.6 ± 8.544

$(6.06, 23.14)$

Problem 4

a. Retrospective; Chi-square or Fisher's Exact

b. The confidence interval contains 1, so this would suggest that it is not significant.

Problem 5

Paired T-test, 2 sample T-test, Chi-sq or Fisher's Exact