Homework 5 Solutions
Math 150

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5.8 Twitter users and news, Part I. The z-score that yields a 99% confidence interval is $z = 2.575$. Therefore the 99% confidence interval is

$$52 \pm 2.575 \times 2.4 = 52 \pm 6.18 = (45.82, 58.18).$$

5.10 Twitter users and news, Part II.

(a) False. The 99% includes numbers smaller than 50% as possibilities, so we cannot make that conclusion at the $\alpha = 0.01$ significance level.

(b) False. The standard error is not about how many users were included, it is an estimate for the variability in samples of the size used in the survey.

(c) False. More data shrinks the standard error.

(d) False. The "net" required to trap with 99% confidence is wider than the "net" required to trap with 90% confidence.

5.11 Waiting at an ER, Part I.

(a) False. We're certain what the average waiting time for these 64 patients is. We calculated it!

(b) True. That's what the confidence interval tells us.

(c) False. 95% of confidence intervals "trap" the parameter, but not 95% of samples lie inside this particular confidence interval. At least we can't say that.

(d) False. It's the other way around. The interval is wider because we need to be more sure the parameter is "trapped".

(e) True. The sample mean is the midpoint of the confidence interval (which is 137.5) and the margin of error is half of the length of the confidence interval (which is 9.5).

(f) False. We need to quadruple the sample size. That is because the standard error changes by the square root of the sample size. $\sqrt{4n} = 2\sqrt{n}$, while $\sqrt{2n} \neq 2\sqrt{n}$.

5.14 Coupons driving visits. Note that the proportion is $p = 142/603 = 0/2355$. The standard error is

$$SE = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.2355 \cdot 0.7645}{603}} = 0.0173.$$

Then the 95% confidence interval is

$$(0.2355 - 1.96 \cdot 0.0173, 0.2355 + 1.96 \cdot 0.0173) = (0.2016, 0.2694).$$

5.16 Identify hypotheses, Part II.

(a) In words:

Null Hypothesis: The average calorie intake after menus displayed calorie counts is the same as the average calorie intake before menus displayed calorie counts, i.e., $\mu = 1100$.

Alternative Hypothesis: The average calorie intake after menus displayed calorie counts is the different than the average calorie intake before menus displayed calorie counts, i.e., $\mu \neq 1100$.

In symbols:

$$H_0 : \mu = 1100.$$
$$H_A : \mu \neq 1100.$$

(b) In words:

Null Hypothesis: The average Verbal Reasoning score is the same now as the average Verbal Reasoning score in 2004, i.e., $\mu = 462$.

Alternative Hypothesis: The average Verbal Reasoning score is different now than the average Verbal Reasoning score in 2004, i.e., $\mu \neq 462$.

In symbols:

$$H_0 : \mu = 462.$$
$$H_A : \mu \neq 462.$$

5.25 Testing for Fibromyalgia.

(a) The null hypothesis is "The anti-depressants don't affect the symptoms of fibromyalgia". The alternative hypothesis is that the antidepressants do affect the symptoms.

(b) A type 1 error would be to conclude that the antidepressants affect the symptoms when they actually don't.

(c) A type 2 error would be to conclude that the antidepressants don't affect the symptoms when they actually do.

5.29 Testing for food safety.

(a)

Null Hypothesis: Sanitary regulations are being met at the restaurant.

Alternative Hypothesis: Sanitary regulations are not being met at the restaurant.

(b) Sanitary regulations are being met, but the inspector considers the restaurant is not meeting regulations and revokes the license.

(c) Sanitary regulations are not being met, but the inspector doesn't come to that conclusion.

(d) A Type 1 error is more problematic for the owner because the restaurant loses the license unfairly.

(e) A Type 2 error is more problematic for the diners because the restaurant is in gross violation of sanitary regulations, yet the restaurant remains open.

(f) As a diner, I would prefer strong evidence instead of very strong evidence. This would make a Type 2 error less likely.

5.30 True or false.

(a) **True**, because the 99% confidence interval is wider than the 95% confidence interval.

(b) **False**, because the significance level is the probability of making a Type 1 error. One possible correct statement is: "Decreasing the significance level (α) will decrease the probability of making a Type 1 Error." There are other correct ways of making a correct statement regarding α and the type of error.

(c) **False**, when we fail to reject the null hypothesis, it doesn't mean we accept the null hypothesis, it means that the null hypothesis is plausible. There's no phrasing of this statement that keeps the gist of the statement while transforming it from False to True.

(d) **True**, because the larger the sample size, the more likely it is we detect small differences.