Introduction to Statistics
Activity 9.4a **SOLUTIONS**

Hypothesis Testing Conclusions

You have an idea for a stationary business, featuring pens that can write, erase, do your taxes, shoot lasers, and are made of chocolate! You attract a venture capitalist investor, but they will only agree to finance your product development if you can show them that at least 45% of new businesses in Syracuse tend to survive more than 5 years – the national proportion. You look up the city records for businesses that were started five years ago – out of 165 businesses, 85 are still open.

a) With the following numbers, write a conclusion to present to your investor to convince them to fund your venture, in context! $p_0 = 0.45$, $\hat{p} = 0.51$, $n = 165$, $z = 2.5641$, $\alpha = 0.05$, P-value = 0.0052
Conclusion has three parts: Evidence, Decision, In-Context Summary.
(Make sure you include a direct appeal to your investor!)

Since P-value = 0.0052< 0.05 = α, we reject the null hypothesis (H_0: p = 0.45). So, we have evidence to conclude that more that 45% of new businesses in Syracuse are still in business after 5 years. This supports the idea that our business venture is a great investment opportunity!

b) Given $p_0 = 0.45$ and $\hat{p} = 0.51$, did I do the math right? Please check the z-score and P-value. Does it change the decision?

$$z = \frac{0.51 - 0.45}{\sqrt{\frac{0.45(1-0.45)}{165}}}$$

Nope, z should have been 1.549. Giving us P-score of 0.0607. This would have changed our decision!

You get the funding and are now finding sources for pen parts and different types of paper. You find a bulletproof origami paper that looks interesting. You want to know if $1.50 per sheet is a good deal. You check 23 other types of origami paper and find the average price per sheet is $1.35 with a standard deviation of $0.40. Is the bulletproof paper more expensive? If so, you won't carry it, but if it's not, it might be worth it, due to its uniqueness.

c) With the following numbers, write a conclusion:
$\mu_0 = 1.50$, $\bar{x} = 1.35$, $n = 23$, $s = 0.6$, $t = 1.199$, $\alpha = 0.05$, P-value = 0.121

Conclusion has three parts: Evidence, Decision, In-Context Summary.
(Remember to address whether you are buying it or not!)

Since P-value of 0.121 is bigger than $\alpha = 0.05$, we fail to reject the null hypothesis (H_0: $\mu = 1.5$). So, we have insufficient evidence to conclude that the bulletproof origami paper is significantly more expensive than other types of origami paper. We decide to buy and stock the paper.

d) Given only $\bar{x} = 1.35$ and $\mu_0 = 1.50$, did I do the math right? What's the actual t-score?

$$t = \frac{1.35 - 1.50}{\frac{0.6}{\sqrt{23}}} = -1.199$$

The sign is reversed!

e) Why did I use t, and not z, as my test statistic?

We must use the t-distribution when we work with means, because we do not have the population standard deviation σ. We only have the sample standard deviation, s. Therefore, we have error based on our sample size, with less error as we increase the sample size.