Homework №14

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April 7, 2019

20.1 The standard error can be calculated using the formula $\text{SE} = \dfrac{s}{\sqrt{n}}$. Therefore, we have that the standard error is $\dfrac{56.9}{\sqrt{1000}} \approx 1.7993$.

20.2 The sample mean is the first value in the type of the expression $m \pm n$ (which is m). The standard error is the second value in the expression (which is n). Therefore, the sample mean is $\overline{x} = 163$ and the standard error is $\text{SE} = 15$.

20.3 (a) $t^* = 2.353$

(b) $t^* = 2.485$

20.4 (a) $t^* = 2.042$

(b) $t^* = 0.683$

20.5 (a) Since $n = 12$, $\text{df} = n - 1 = 12 - 1 = 11$. Therefore, from Table C, we get that t^* value for a the 95% confidence interval based on $n = 12$ observations is $t^* = 2.201$.

(b) Since $n = 2$, $\text{df} = n - 1 = 2 - 1 = 1$. Therefore, from Table C, we get that t^* value for a the 99% confidence interval based on $n = 2$ observations is $t^* = 63.66$.

(c) Since $n = 1001$, $\text{df} = n - 1 = 1001 - 1 = 1000$. Therefore, from Table C, we get that t^* value for a the 90% confidence interval based on $n = 1001$ observations is $t^* = 1.646$.

20.7 We start with the **PLAN** part as the **STATE** part is the description of the problem itself.

PLAN
We must approximate μ using a 99% confidence interval.

SOLVE
Below is the stemplot for the data.

4	9
5	3 6 6 6 8 8 8 9
6	1 1 2 3 5 5 6 7 7 7 8 8 9
7	0 0

The stemplot looks to be bimodal yet, there seems to be no outliers. $\overline{x} \approx 62.1667$ and $s \approx 5.8060$. Since $n = 24, \mathrm{df} = n - 1 = 24 - 1 = 23$ and $t^* = 2.807$. Therefore, the confidence interval is from $62.1667 - 2.807 \times \dfrac{5.8060}{\sqrt{24}}$ to $62.1667 + 2.807 \times \dfrac{5.8060}{\sqrt{24}}$ which is approximately the same as from 58.84 to 65.49.

CONCLUDE
We can be 99% certain that the mean percent of correct answers to indetifying the taller of two people by voice is from 58.84 to 65.49.

20.8 (a) $\mathrm{df} = n - 1 = 25 - 1 = 24$.

(b) From Table C, we get: $1.711 < t^* < 2.064$
$0.025 < P < 0.05$

(c) If $P < 0.10 = 10\%$, then the t-value is significant.
If $P > 0.05 = 5\%$, then the t-value is not significant.
If $P > 0.01 = 1\%$, then the t-value is not significant.

20.10 We know that $\overline{x} = 62.1667$ and $s = 5.8060$. The value of the test statistic is

$$t = \frac{\overline{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{\overline{62.1667} - 50}{\frac{5.8060}{\sqrt{24}}} = 10.266.$$

$\mathrm{df} = n - 1 = 24 - 1 = 23$. The corresponding one-sided P-value from Table C (for 99%) is $P = 0.0005$. Then we know that if the P-value is smaller than the significance level, the null hypothesis is rejected. In this case, $P = 0.0005 < 0.05$ and we reject the null hypothesis or H_0. Finally, we can say that there is a sufficient evidence to support the claim that implies that the mean number of correct identifications is more than 50.

20.11 We start with the **PLAN** part as the **STATE** part is the description of the problem itself.

PLAN
We must compare $\mathrm{H}_0 : \mu = 0$ with $\mathrm{H}_\mathrm{a} = \mu > 0$.

SOLVE
Below is the stemplot for the data.

-1	8 6 2 1
-0	5
0	2 3 5 5 7
1	4
2	4 8 9
3	
4	3
5	
6	4

The stemplot shows the outliers and is skewed to the right. Using t-procedures here would not gives us exact results since P-values will just be the approximations (again, because of the skeweness of the stemplot). From the data, we get that $\overline{x} = 0.1012$ and $s = 0.2263$. Therefore, $t = \dfrac{\overline{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \dfrac{0.1012 - 0}{\frac{0.2263}{\sqrt{16}}} \approx 1.79$. df $= n - 1 = 16 - 1 = 15$. We can now look up the values in Table C and get that $P < 0.05$.

CONCLUDE
We can conclude that eye grease increases sensitivity to contrast. However, since the stemplot shows the skewness, it would not be wise to place a lot of emphasis on this result.

20.12 From the previous exercise we know that $\overline{x} = 0.1012$ and $s = 0.2263$. We also know that $\overline{x} = 0.1012$ and $s = 0.2263$. Now, using Table C, we get that $t^* = 2.947$. Therefore, the confidence interval is from $0.1013 - 2.947 \times \dfrac{0.2263}{\sqrt{16}}$ to $0.1013 + 2.947 \times \dfrac{0.2263}{\sqrt{16}}$ which is approximately the same as from -0.0654 to 0.2680. Hence, the confidence interval is from -0.0654 to 0.2680.

20.38 (a) Let's construct the stemplot first. Below is the stemplot for the data.

0	6 7 8 9
1	0 0 3 3 4 9
2	0

There are is not any significant deviations from the normality. Thereforem, we can use the t-procedures.

(b) We get that $\overline{x} \approx 1.1727$ and $s \approx 0.4606$. $\text{df} = n - 1 = 11 - 1 = 10$. From Table C, we get that $t^* = 1.812$. Therefore, we get that

confidence interval is from $1.1727 - 1.812 \times \dfrac{0.4606}{\sqrt{11}}$ to $1.1727 + 1.812 \times \dfrac{0.4606}{\sqrt{11}}$ which is approximately the same as from 0.9211 to 1.4243. Hence, the confidence interval is from 0.9211 to 1.4243. Yes, I am willing to use this interval tom make an inference about the mean doubling time in a population of similar patients. If one can use 90% confidence interval, one can always use the inference.

20.41 (a) We are testing $\mathrm{H_0} : \mu = 0$ against $\mathrm{H_a} : \mu = 0$ where μ is the mean difference. The researchers used a one-sided alternative since they had the reason to believe that CO_2 would increase the growth rate. In other words, they wanted a test to show the increase in the growth rate and that is a one-sided alternative.

(b) We have $\overline{x} \approx 1.916$ and $s \approx 1.050$. Then we have $t = \dfrac{\overline{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \dfrac{1.916 - 0}{\frac{1.050}{\sqrt{3}}} \approx 3.16$.

Now, $\text{df} = n - 1 = 3 - 1 = 2$ and from Table C, we get that $0.025 < P = 0.05$. Now, since $P < 0.05 = 5\%$, this is significant at the 5% significance level.

(c) For small samples, t-procedures can be used only of the population distribution is normal. Based on the observations we have, it is not possible to asses the normality of the population.