NAME:

SECTION 10.3A Exercises

Need 2 Yellow "TEST OF SIGNIFICANCE TEMPLATES"

71 **Sweetening colas** Cola makers test new recipes for loss of sweetness during storage. Trained tasters rate the sweetness before and after storage. From experience, the population distribution of sweetness losses will be close to Normal. Here are the sweetness losses (sweetness before storage minus sweetness after storage) found by tasters from a random sample of 10 batches of a new cola recipe:

2.0 0.4 0.7 2.0 −0.4 2.2 −1.3 1.2 1.1 2.3

Are these data good evidence that the cola lost sweetness? Carry out a test to help you answer this question.

71 Complete Test Template

73 **Healthy bones** The recommended daily allowance (RDA) of calcium for women between the ages of 18 and 24 years is 1200 milligrams (mg). Researchers who were involved in a large-scale study of women's bone health suspected that their participants had significantly lower calcium intakes than the RDA. To test this suspicion, the researchers measured the daily calcium intake of a random sample of 36 women from the study who fell in the desired age range. The Minitab output below displays descriptive statistics for these data, along with the results of a significance test.

Descriptive Statistics: Calcium intake (mg)

Variable	N	Mean	SE Mean	StDev	Min	Q1	Med	Q3	Maximum
Calcium	36	856.2	51.1	306.7	374.0	632.3	805.0	1090.5	1425.0

One-Sample T: Calcium intake (mg)

Test of mu = 1200 vs < 1200

Variable	N	Mean	StDev	SE Mean	T	P
Calcium	36	856.2	306.7	51.1	-6.73	0.000

(a) Determine whether there are any outliers. Show your work.

(b) Interpret the P-value in context.

(c) Do these data give convincing evidence to support the researchers' suspicion? Carry out a test to help you answer this question.

73A Show work here

73B+C COMPLETE TEMPLATE

$IQR = Q3 - Q1 = 1090.5 - 632.3 = 458.2$

$Q3 + 1.5\,IQR = 1090.5 + 1.5(458.2) = 1777.8 > max = 1425$ (NO OUTLIER)

$Q1 - 1.5\,IQR = 632.3 - 1.5(458.2) = -55 < min = 374.0$ (NO OUTLIER)

7.3B The output shows a pvalue = 0.000. IF THE MEAN DAILY CALCIUM INTAKE FOR women 18 to 24 IS REALLY 1200 mg, then the likelihood of getting a sample of 36 WOMEN WITH A MEAN INTAKE OF 856.2 mg or smaller is ROUGHLY 0.

OVER →

#77 answer below

75. **Growing tomatoes** An agricultural field trial compares the yield of two varieties of tomatoes for commercial use. Researchers randomly select 10 Variety A and 10 Variety B tomato plants. Then the researchers divide in half each of 10 small plots of land in different locations. For each plot, a coin toss determines which half of the plot gets a Variety A plant; a Variety B plant goes in the other half. After harvest, they compare the yield in pounds for the plants at each location. The 10 differences (Variety A − Variety B) give $\bar{x} = 0.34$ and $s_x = 0.83$. A graph of the differences looks roughly symmetric and single-peaked with no outliers. Is there convincing evidence that Variety A has the higher mean yield? Perform a significance test using $\alpha = 0.05$ to answer the question.

75 – COMPLETE TEST Template

77. **The power of tomatoes** The researchers who carried out the experiment in Exercise 75 suspect that the large *P*-value (0.114) is due to low power.

(a) Describe a Type I and a Type II error in this setting. Which type of error could you have made in Exercise 75? Why?

(b) Explain two ways that the researchers could have increased the power of the test to detect $\mu = 0.5$.

(A) TYPE I ERROR: Experts conclude that Variety A has a higher mean yield when it actually doesn't

TYPE II ERROR: EXPERTS Conclude that there is no mean difference in yield when in fact Variety A has a higher mean yield

We could have made type II error since we failed to reject H_0

(B) 2 ways to increase power

1. increase the sample size
2. increase the significance level (α)

(10.2) REVIEW TESTS ABOUT PROPORTIONS

53. **Do you Twitter?** In late 2009, the Pew Internet and American Life Project asked a random sample of U.S. adults, "Do you ever . . . use Twitter or another service to share updates about yourself or to see updates about others?" According to Pew, the resulting 95% confidence interval is (0.167, 0.213).[15] Can we use this interval to conclude that the actual proportion of U.S. adults who would say they Twitter differs from 0.20? Justify your answer. ANSWER BELOW

The 95% Confidence interval is (.167, .213).

We can not justify the .20 differs since it is included in the interval

55. **Teens and sex** The Gallup Youth Survey asked a random sample of U.S. teens aged 13 to 17 whether they thought that young people should wait to have sex until marriage.[17] The Minitab output below shows the results of a significance test and a 95% confidence interval based on the survey data.

Session

Test and CI for One Proportion

Test of p = 0.5 vs p not = 0.5

p ≠ .5

Sample	X	N	Sample p	95% CI	Z-Value	P-Value
1	246	439	0.560364	(0.513935, 0.606794)	2.53	0.011

(a) Define the parameter of interest.

(b) Check that the conditions for performing the significance test are met in this case.

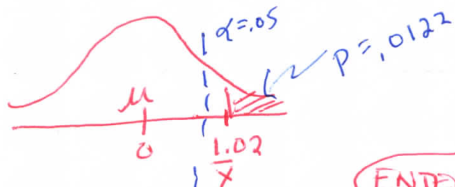
(c) Interpret the *P*-value in context.

(d) Do these data give convincing evidence that the actual population proportion differs from 0.5? Justify your answer with appropriate evidence.

COMPLETE TEST Template

10.3A #71

Test of Significance Template

Parameter of Interest	μ = actual mean amount of sweetness loss (sweetness before storage minus sweetness after storage)
Choice of Test	1 SAMPLE T TEST FOR μ
Level of Significance	$\alpha = .05$ since α was not given
Null Hypothesis	English: Symbols: $H_0: \mu = 0$
Alternative Hypothesis	English: Symbols: $H_A: \mu > 0$
Conditions of Test	① σ is unknown (T inference) ② Normal – Previous experience, population distribution is Normal ③ Random sample of 10 batches ④ Independent – there are at least 10(10) = 100 batches of the new soda available.
Sampling Distribution	Sketch of the sampling distribution of the sample statistic under the null hypothesis, indicating the mean:  ENTER DATA INT L1
Test Statistic	Formula: $t = \frac{\bar{x} - \mu}{s_x/\sqrt{n}}$ Plug-ins & Value: $\mu = 0$, $s_x = 1.196$, $\bar{x} = 1.02$, $n = 10$, $df = 9$; $t = \frac{1.02 - 0}{1.196/\sqrt{10}} = \frac{1.02}{.3782} = 2.70$
P-value	Use correct probability notation. $P(t \geq 2.70) = \text{tcdf}(2.70, E99, 9) = .0122$
Meaning of the P-value	Since $p = .0122 < \alpha = .05$, Reject H_0
Conclusions	☒ Reject null hypothesis ❐ Fail to reject null hypothesis ❐ Significant result ❐ Not Significant result English: Since the pvalue is less than the .05 significance level, we Reject H_0. It appears that there is an average loss of sweetness for this cola.

CALC STAT Test 2: T test

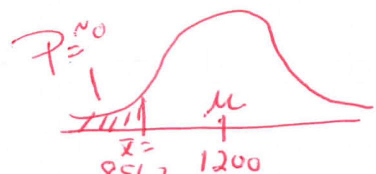
Data, $\mu_0 = 0$, L1, 1, $> \mu_0$

$t = 2.70$, $p = .0122$

#73

10.3A HW

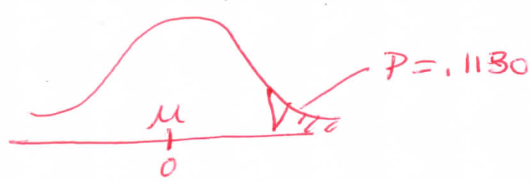
Test of Significance Template

Parameter of Interest	μ = the actual mean daily calcium intake of women 18-24
Choice of Test	1 SAMPLE T TEST FOR μ
Level of Significance	$\alpha = .05$ (since not given)
Null Hypothesis	English: Symbols: $H_0: \mu = 1200$ mg
Alternative Hypothesis	English: Symbols: $H_A: \mu < 1200$ mg
Conditions of Test	(1) σ IS UNKNOWN (T INFERENCE) (2) Random sample of 36 women (3) Normal – the sample was Large enough $n = 36 > 30$ (4) Independent – there are clearly more than 360 (36·10) women in the U.S.
Sampling Distribution	Sketch of the sampling distribution of the sample statistic under the null hypothesis, indicating the mean: 
Test Statistic	Formula: $t = \frac{\bar{x} - \mu}{s_x / \sqrt{n}}$ Plug-ins & Value: $\mu = 1200$ $\bar{x} = 856.2$ $n = 36$ $s_x = 306.7$ $t = \frac{856.2 - 1200}{306.7/\sqrt{36}} = -6.73$
P-value	Use correct probability notation. $P(t \leq -6.73) = \text{tcdf}(-1E99, -6.73, 35) \approx 0$
Meaning of the P-value	The pvalue is extremely small (about 0) so Reject H_0
Conclusions	☒ Reject null hypothesis ☐ Fail to reject null hypothesis ☐ Significant result ☐ Not Significant result English: Since p value is extremely small, we Reject H_0. It appears that women in this age group are getting less than 1200mg calcium daily, on average.

10.3A HW

#75

Test of Significance Template

Parameter of Interest	μ = the true mean difference in yield between Variety A + B tomato plants
Choice of Test	one sample t-test for μ
Level of Significance	$\alpha = .05$
Null Hypothesis	English: Symbols: $H_0: \mu = 0$
Alternative Hypothesis	English: Symbols: $H_A: \mu > 0$
Conditions of Test	(1) Random - There was random assignment (2) σ in unknown (t inference) (3) Independent - There are more than 100 of each variety of plants (4) Normal - Graphs were done and there were no outliers and they were roughly symmetric
Sampling Distribution	Sketch of the sampling distribution of the sample statistic under the null hypothesis, indicating the mean: 
Test Statistic	Formula: $t = \frac{\bar{x} - \mu}{S_x / \sqrt{n}}$ Plug-ins & Value: $\mu = 0$, $n = 10$, $df = 9$, $\bar{x} = .34$, $S_x = .83$ $t = \frac{.34 - 0}{.83 / \sqrt{10}} = \frac{.34}{.2625} = 1.30$
P-value	Use correct probability notation. $P = P(t \geq 1.30) = \text{tcdf}(1.3, E99, 9) = .1130$
Meaning of the P-value	Since the pvalue is large and greater than α, FAIL TO REJECT H_0 $.1130 > .05$
Conclusions	❒ Reject null hypothesis ☒ Fail to reject null hypothesis ❒ Significant result ❒ Not Significant result English: Since the pvalue is larger than $\alpha = .05$, we FAIL to Reject H_0. We do not have enough evidence to conclude that Variety A has a higher mean yield than Variety B.

$t = 1.295$
$P = .1137$

$S_x = .83$
$n = 10$
$> \mu_0$

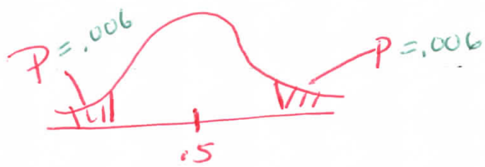
Stats
$\mu_0 = 0$
$\bar{x} = .34$

T Test

STAT Tests

10.3A HW #55

Test of Significance Template

Parameter of Interest	p = the true proportion of teens who think that young people should wait to have sex until marriage.
Choice of Test	One Sample Z test for p
Level of Significance	$\alpha = .05$
Null Hypothesis	English: Symbols: $H_0: p = .5$
Alternative Hypothesis	English: Note: Can only find CI for 2 tail tests. Symbols: $H_A: p \neq .5$
Conditions of Test	① Random Sample 439 US teens 13–17 ② Independent – The population of US Teens is greater than 4,390 (439·10) ③ normal condition men $np = 439(.5) = 219.5 \geq 10$ $nq = 439(.5) = 219.5 \geq 10$
Sampling Distribution	Sketch of the sampling distribution of the sample statistic under the null hypothesis, indicating the mean: 

Test Statistic	Formula:	Plug-ins & Value:
	$Z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$	$n = 439$ $\hat{p} = \frac{246}{439} = .56$ $p = .5$ $q = .5$ $Z = \frac{.56 - .5}{\sqrt{\frac{(.5)(.5)}{439}}} = \frac{.06}{.0239} = 2.51$

P-value	Use correct probability notation. $P(Z \leq -2.51)$ or $P(Z \geq 2.51)$ = normalcdf(2.51, E99, 0, 1) = .006 * 2 P = .012
Meaning of the P-value	Since p is smaller than α, Reject Ho .012 < .05
Conclusions	☒ Reject null hypothesis ☐ Significant result ☐ Fail to reject null hypothesis ☐ Not Significant result English: Since the pvalue is less than $\alpha = .05$, Reject Ho. We conclude that the actual proportion of teens who think that young people should wait is not .50.