Student: _____ **Date:** _____	**Instructor:** Andreas Lazari **Course:** Math2620 F - Fall 2018	**Assignment:** Chapter 9.2-Homework

1. Determine the point estimate of the population mean and margin of error for the confidence interval.

   Lower bound is 19, upper bound is 31.

   Point estimate, $\bar{x} = \frac{19+31}{2} = 25$

   The point estimate of the population mean is 25.

   The margin of error for the confidence interval is 6.

   Margin of error or Sampling error: $31 - 25 = 6$.

2. Determine the point estimate of the population mean and margin of error for the confidence interval.

   Lower bound is 18, upper bound is 26.

   $\bar{x} = \frac{18+26}{2} = 22$

   The point estimate of the population mean is 22.

   The margin of error for the confidence interval is 4.

   Margin of error or Sampling error: $26 - 22 = 4$.

3. A simple random sample of size n is drawn from a population that is normally distributed. The sample mean, $\bar{x}$, is found to be 113, and the sample standard deviation, s, is found to be 10.
(a) Construct a 98% confidence interval about μ if the sample size, n, is 14.
(b) Construct a 98% confidence interval about μ if the sample size, n, is 26.
(c) Construct a 99% confidence interval about μ if the sample size, n, is 14.
(d) Could we have computed the confidence intervals in parts (a)-(c) if the population had not been normally distributed?
[1] Click the icon to view the table of areas under the t-distribution.

(a) Construct a 98% confidence interval about μ if the sample size, n, is 14.

$\bar{X} \sim t_{13}$
use TI83/84
(105.92, 120.08)

Lower bound: 105.9 ; Upper bound: 120.1
(Use ascending order. Round to one decimal place as needed.)

(b) Construct a 98% confidence interval about μ if the sample size, n, is 26.

(108.13, 117.87)

Lower bound: 108.1 ; Upper bound: 117.9
(Use ascending order. Round to one decimal place as needed.)

How does increasing the sample size affect the margin of error, E?

- ○ **A.** As the sample size increases, the margin of error stays the same.
- ● **B.** As the sample size increases, the margin of error decreases.
- ○ **C.** As the sample size increases, the margin of error increases.

(c) Construct a 99% confidence interval about μ if the sample size, n, is 14.

(104.95, 121.05)

Lower bound: 105 ; Upper bound: 121.1
(Use ascending order. Round to one decimal place as needed.)

Compare the results to those obtained in part (a). How does increasing the level of confidence affect the size of the margin of error, E?

- ● **A.** As the percent confidence increases, the size of the interval increases.
- ○ **B.** As the percent confidence increases, the size of the interval stays the same.
- ○ **C.** As the percent confidence increases, the size of the interval decreases.

(d) Could we have computed the confidence intervals in parts (a)-(c) if the population had not been normally distributed?

- ○ **A.** No, the population does not need to be normally distributed.
- ○ **B.** Yes, the population does not need to be normally distributed.
- ○ **C.** Yes, the population needs to be normally distributed.
- ● **D.** No, the population needs to be normally distributed.

use TI 83/84

1: Table of t-Distribution Areas

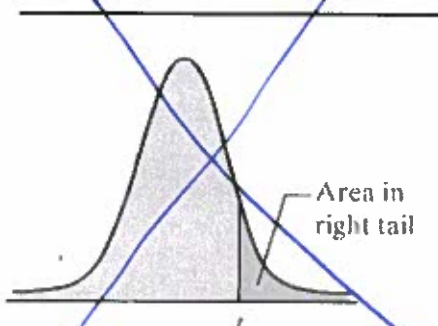


Table VI

4. A simple random sample of size n is drawn. The sample mean, $\bar{x}$, is found to be 18.1, and the sample standard deviation, s, is found to be 4.1.
[2] Click the icon to view the table of areas under the t-distribution.

$\bar{X} \sim t_{34}$.

(a) Construct a 95% confidence interval about μ if the sample size, n, is 35.

Use TI-83/84

Lower bound: 16.69 ; Upper bound: 19.51
(Use ascending order. Round to two decimal places as needed.)

(16.692, 19.508)

(b) Construct a 95% confidence interval about μ if the sample size, n, is 51.

Lower bound: 16.95 ; Upper bound: 19.25
(Use ascending order. Round to two decimal places as needed.)

(16.947, 19.253)

How does increasing the sample size affect the margin of error, E?

- A. The margin of error does not change.
- **B. The margin of error decreases.**
- C. The margin of error increases.

(c) Construct a 99% confidence interval about μ if the sample size, n, is 35.

Lower bound: 16.21 ; Upper bound: 19.99
(Use ascending order. Round to two decimal places as needed.)

(16.209, 19.991)

Compare the results to those obtained in part (a). How does increasing the level of confidence affect the size of the margin of error, E?

- A. The margin of error decreases.
- **B. The margin of error increases.**
- C. The margin of error does not change.

(d) If the sample size is 16, what conditions must be satisfied to compute the confidence interval?

- A. The sample must come from a population that is normally distributed and the sample size must be large.
- B. The sample size must be large and the sample should not have any outliers.
- **C. The sample data must come from a population that is normally distributed with no outliers.**

2: Table of t-Distribution Areas

use TI83/84

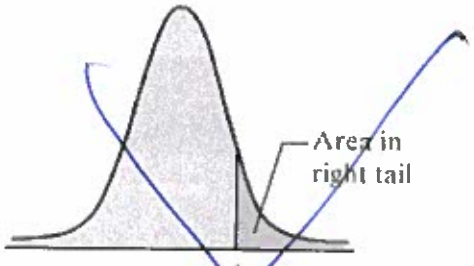


Table VI

t-Distribution
Area in Right Tail

df	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001

5. A survey was conducted that asked 1016 people how many books they had read in the past year. Results indicated that $\bar{x} = 12.5$ books and $s = 16.6$ books. Construct a 99% confidence interval for the mean number of books people read. Interpret the interval.

[3] Click the icon to view the table of critical t-values.

$\bar{X} \sim t_{1015}$

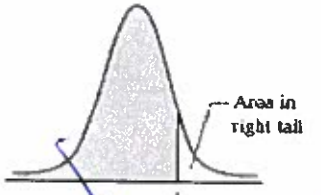
Construct a 99% confidence interval for the mean number of books people read and interpret the result. Select the correct choice below and fill in the answer boxes to complete your choice.
(Use ascending order. Round to two decimal places as needed.)

(11.156, 13.844)

- A. There is a 99% chance that the true mean number of books read is between _____ and _____.
- B. If repeated samples are taken, 99% of them will have a sample mean between _____ and _____.
- C. There is 99% confidence that the population mean number of books read is between 11.16 and 13.84.

3: Table of Critical t-Values

use TI 83/84



t-Distribution
Area in Right Tail

Degrees of Freedom	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005
1	1.000	1.376	1.963	3.078	6.314	12.706	15.894	31.821	63.657	127.321	318.309	636.619
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.089	22.327	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.215	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437

6. The following data represent the pH of rain for a random sample of 12 rain dates. A normal probability plot suggests the data could come from a population that is normally distributed. A boxplot indicates there are no outliers. Complete parts a) through d) below.

5.05	5.72	4.99	4.80
5.02	4.68	4.74	5.19
4.61	4.76	4.56	5.30

[4] Click the icon to view the table of critical t-values.

(a) Determine a point estimate for the population mean.

$\bar{x}$ is 4.95

A point estimate for the population mean is 4.95.
(Round to two decimal places as needed.)

(b) Construct and interpret a 95% confidence interval for the mean pH of rainwater. Select the correct choice below and fill in the answer boxes to complete your choice.
(Use ascending order. Round to two decimal places as needed.)

○ **A.** If repeated samples are taken, 95% of them will have a sample pH of rain water between _____ and _____.

● **B.** There is 95% confidence that the population mean pH of rain water is between 4.74 and 5.16.

(4.739, 5.1644)

○ **C.** There is a 95% probability that the true mean pH of rain water is between _____ and _____.

(c) Construct and interpret a 99% confidence interval for the mean pH of rainwater. Select the correct choice below and fill in the answer boxes to complete your choice.
(Use ascending order. Round to two decimal places as needed.)

(4.6515, 5.2518)

● **A.** There is 99% confidence that the population mean pH of rain water is between 4.65 and 5.25.

○ **B.** There is a 99% probability that the true mean pH of rain water is between _____ and _____.

○ **C.** If repeated samples are taken, 99% of them will have a sample pH of rain water between _____ and _____.

(d) What happens to the interval as the level of confidence is changed? Explain why this is a logical result.

As the level of confidence increases, the width of the interval (1) increases. This makes sense since the (2) Margin of error (3) increases as well.

4: Table of Critical t-Values

60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
70	0.678	0.847	1.044	1.294	1.667	1.994	2.093	2.381	2.648	2.899	3.211	3.435
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
90	0.677	0.846	1.042	1.291	1.662	1.987	2.084	2.368	2.632	2.878	3.183	3.402
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
z	0.674	0.842	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.090	3.291
Degrees of Freedom	**0.25**	**0.20**	**0.15**	**0.10**	**0.05**	**0.025**	**0.02**	**0.01**	**0.005**	**0.0025**	**0.001**	**0.0005**

***t*-Distribution**
Area in Right Tail

(1) ○ decreases.
● increases.

(2) ● margin of error
○ sample size
○ point estimate

(3) ● increases as well.
○ decreases as well.

7. The accompanying data represent the total travel tax (in dollars) for a 3-day business trip in 8 randomly selected cities. A normal probability plot suggests the data could come from a population that is normally distributed. A boxplot indicates there are no outliers. Complete parts (a) through (c) below.

68.79 78.69 70.97 84.57 79.13 86.43 101.94 99.61

[5] Click the icon to view the table of critical t-values.

$\bar{x} = 83.76625 \approx 83.77$

(a) Determine a point estimate for the population mean travel tax.

A point estimate for the population mean travel tax is $\$$ 83.77 .
(Round to two decimal places as needed.)

(b) Construct and interpret a 95% confidence interval for the mean tax paid for a three-day business trip.

Select the correct choice below and fill in the answer boxes to complete your choice.
(Round to two decimal places as needed.)

(73.65, 93.88)

- **A.** One can be 95 % confident that the mean travel tax for all cities is between $\$$ 73.65 and $\$$ 93.88 .
- **B.** The travel tax is between $\$$ _____ and $\$$ _____ for _____ % of all cities.
- **C.** There is a _____ % probability that the mean travel tax for all cities is between $\$$ _____ and $\$$ _____ .
- **D.** One can be _____ % confident that the all cities have a travel tax between $\$$ _____ and $\$$ _____ .

(c) What would you recommend to a researcher who wants to increase the precision of the interval, but does not have access to additional data?

- **A.** The researcher could decrease the level of confidence.
- **B.** The researcher could decrease the sample standard deviation.
- **C.** The researcher could increase the level of confidence.
- **D.** The researcher could increase the sample mean.

5: Table of Critical t-Values

Degrees of Freedom	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005
36	0.681	0.852	1.052	1.306	1.688	2.028	2.131	2.434	2.719	2.990	3.333	3.582
37	0.681	0.851	1.051	1.305	1.687	2.026	2.129	2.431	2.715	2.985	3.326	3.574
38	0.681	0.851	1.051	1.304	1.686	2.024	2.127	2.429	2.712	2.980	3.319	3.566
39	0.681	0.851	1.050	1.304	1.685	2.023	2.125	2.426	2.708	2.976	3.313	3.558
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
70	0.678	0.847	1.044	1.294	1.667	1.994	2.093	2.381	2.648	2.899	3.211	3.435
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
90	0.677	0.846	1.042	1.291	1.662	1.987	2.084	2.368	2.632	2.878	3.183	3.402
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
z	0.674	0.842	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.090	3.291

t Distribution
Area in Right Tail

8. A doctor wants to estimate the mean HDL cholesterol of all 20- to 29-year-old females. How many subjects are needed to estimate the mean HDL cholesterol within 3 points with 99% confidence assuming s = 18.9 based on earlier studies? Suppose the doctor would be content with 90% confidence. How does the decrease in confidence affect the sample size required?
[6] Click the icon to view a partial table of critical values.

A 99% confidence level requires 264 subjects. (Round up to the nearest subject.)

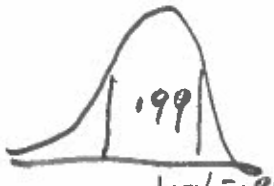
A 90% confidence level requires 108 subjects. (Round up to the nearest subject.)

How does the decrease in confidence affect the sample size required?

- A. Decreasing the confidence level increases the sample size needed.
- B. Decreasing the confidence level decreases the sample size needed.
- C. The sample size is the same for all levels of confidence.

6: Partial Critical Value Table

Level of Confidence, $(1-\alpha)\cdot 100\%$	Area in Each Tail, $\frac{\alpha}{2}$	Critical Value, $z_{\alpha/2}$
90%	0.05	1.645
95%	0.025	1.96
99%	0.005	2.575



$1-\alpha = .99 \Rightarrow \alpha = .01$, $\frac{\alpha}{2} = .005$

$n = \left(\frac{z_{\alpha/2} \cdot s}{E}\right)^2$

for 99% $z_{\alpha/2} = \text{InvN}(.005) = \pm 2.5758$

$n = \left(\frac{(2.5758)(18.9)}{3}\right)^2 = 263.33305 \approx 264$

For 90% $\Rightarrow 1-\alpha = .9 \Rightarrow \alpha = .10 \Rightarrow \frac{\alpha}{2} = .05$

$z_{\alpha/2} = \text{InvN}(.05) = \pm 1.6448$

$n = \left(\frac{(1.6448)(18.9)}{3}\right)^2 = 107.376 \approx 108$

9. People were polled on how many books they read the previous year. Initial survey results indicate that s = 17.1 books. Complete parts (a) through (d) below.
[7] Click the icon to view a partial table of critical values.

$1-\alpha=.95 \Rightarrow \alpha=.05 \quad \alpha/2=.025$

$Z_{\alpha/2}=\text{InvN}(.025)=\pm 1.9599$

(a) How many subjects are needed to estimate the mean number of books read the previous year within four books with 95% confidence?

This 95% confidence level requires 71 subjects. (Round up to the nearest subject.)

$n=\left(\frac{(1.9599)(17.1)}{4}\right)^2=70.2001 \approx 71$

(b) How many subjects are needed to estimate the mean number of books read the previous year within two books with 95% confidence?

This 95% confidence level requires 281 subjects. (Round up to the nearest subject.)

$n=\left(\frac{(1.9599)(17.1)}{2}\right)^2$

(c) What effect does doubling the required accuracy have on the sample size?

- (●) **A.** Doubling the required accuracy nearly quadruples the sample size.
- ( ) **B.** Doubling the required accuracy nearly doubles the sample size.
- ( ) **C.** Doubling the required accuracy nearly halves the sample size.
- ( ) **D.** Doubling the required accuracy nearly quarters the sample size.

$n=280.8019$

$n=281$

(d) How many subjects are needed to estimate the mean number of books read the previous year within four books with 99% confidence?

$Z_{\alpha/2}=\text{InvN}(.005)=\pm 2.5758$

This 99% confidence level requires 122 subjects. (Round up to the nearest subject.)

$n=\left(\frac{(2.5758)(17.1)}{4}\right)^2$

Compare this result to part **(a)**. How does increasing the level of confidence in the estimate affect sample size? Why is this reasonable?

$n=121.2541$

$n \approx 122$

- ( ) **A.** Increasing the level of confidence increases the sample size required. For a fixed margin of error, greater confidence can be achieved with a smaller sample size.
- ( ) **B.** Increasing the level of confidence decreases the sample size required. For a fixed margin of error, greater confidence can be achieved with a smaller sample size.
- ( ) **C.** Increasing the level of confidence decreases the sample size required. For a fixed margin of error, greater confidence can be achieved with a larger sample size.
- (●) **D.** Increasing the level of confidence increases the sample size required. For a fixed margin of error, greater confidence can be achieved with a larger sample size.

7: Partial Critical Value Table

Level of Confidence, $(1-\alpha)\cdot 100\%$	Area in Each Tail, $\frac{\alpha}{2}$	Critical Value, $z_{\alpha/2}$
90%	0.05	1.645
95%	0.025	1.96
99%	0.005	2.575

1. 25

6

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2. 22

4

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3. 105.9

120.1

108.1

117.9

B. As the sample size increases, the margin of error decreases.

105.0

121.1

A. As the percent confidence increases, the size of the interval increases.

D. No, the population needs to be normally distributed.

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4. 16.69

19.51

16.95

19.25

B. The margin of error decreases.

16.21

19.99

B. The margin of error increases.

C. The sample data must come from a population that is normally distributed with no outliers.

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5. C.

There is 99% confidence that the population mean number of books read is between **11.16** and **13.84**.

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6. 4.95

B. There is 95% confidence that the population mean pH of rain water is between **4.74** and **5.16**.

A. There is 99% confidence that the population mean pH of rain water is between **4.65** and **5.25**.

(1) increases.

(2) margin of error

(3) increases as well.

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7. 83.77

A.

One can be 95.00 % confident that the mean travel tax for all cities is between $ 73.65 and $ 93.88 .

A. The researcher could decrease the level of confidence.

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8. 264

108

B. Decreasing the confidence level decreases the sample size needed.

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9. 71

281

A. Doubling the required accuracy nearly quadruples the sample size.

122

D.

Increasing the level of confidence increases the sample size required. For a fixed margin of error, greater confidence can be achieved with a larger sample size.
