

**\*On my honor, as a Rochester Institute of Technology student, I have neither given nor received unauthorized assistance in taking this exam. I have not looked up methods or ideas during the course of the exam. Typing your name here acknowledges agreement with this statement.\***

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## Problem 1

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The length of time it takes for a group of students to complete the SAT is normally distributed with a mean of 2.6 hours and a standard deviation of 0.24 hours. A sample size of  $n=18$  is drawn randomly from the population.

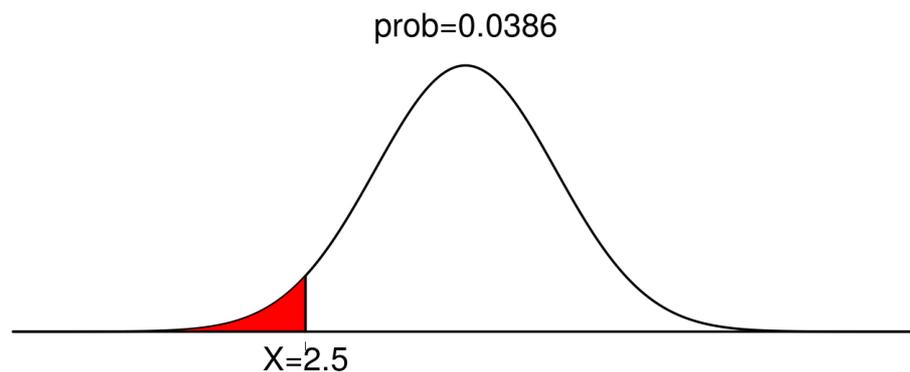
1. Describe the sampling distribution of the sample means by discussing shape, center, and spread.

The population, according to the problem, is defined as normally distributed, so the shape is normal.

The sample center is the sample mean, at 2.6 hours.

the sample standard error is 0.056 hours.

2. What is the probability that the sample mean time to complete the SAT is less than 2.5 hours? Show your work, and clearly state your answer.



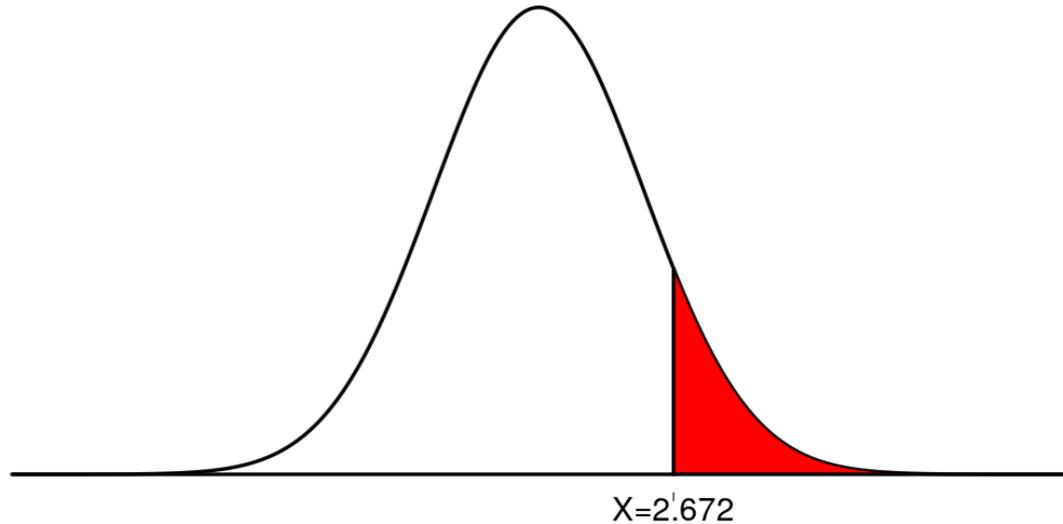
The probability of the sample mean time to complete the SAT being less than 2.5 hours is 3.86%.

3. Complete the sentence:

There is a 10% chance that the sample mean time to complete the SAT will be MORE than 2.672 hours.

Show your work, and clearly state your answer.

Prob=0.1003



## Problem 2

A random sample of 1000 children in New York State were polled and 205 stated that they had dressed as Spiderman for Halloween in 2019.

1. Estimate, with 90% confidence that the proportion of all NYS children that dressed as Spiderman for Halloween in 2019. Provide your technology output here.

Now we can combine the LB and UB to get the 90% confidence interval:

$$\pi \in (0.184, 0.226)$$

2. Interpret the confidence interval in the context of the problem.  
I am 90% confident that between 18.4% and 22.6% of children in NYS dressed as Spiderman for Halloween in 2019.
3. Show your work as you decide if the normality assumption has been met. Clearly state your answer.

$$n(p)(1 - p) \geq 10 \tag{1}$$

$$1000(0.205)(1 - 0.205) \geq 10$$

$$1000(0.205)(0.795) \geq 10$$

$$162.975 \geq 10$$

$\therefore$

*The sample can be assumed to be normal.*

4. A recent new article stated that 15% of children in NYS were dressed as Spiderman for Halloween. Does the confidence interval you built support this statement? Explain.  
The confidence interval I built does not support this statement, as it is not within the confidence interval. It would be technically correct, as it is below the entire confidence

interval, but the confidence interval does not agree with it.

## Problem 3

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The mayor of a small city has suggested that the state construct and operate a new prison there, arguing that the construction project and resulting jobs will be good for the local economy. A total of 183 residents show up for a public hearing on the proposal, and a show of hands finds only 31 in favor of the prison project. **The 95% confidence interval is calculated as (.115, .224)**

1. Interpret, in the context of the problem, the confidence interval result.  
There is 95% confidence that between 11.5% and 22.4% of city residents are in favor of the prison project.
2. State the point estimate for the proportion of all residents that are in favor.  
The point estimate is 16.95%.
3. Find the margin of error for the confidence interval.  
The margin of error for the confidence interval is 5.45%.
4. Describe in detail and in a complete sentence what happens to the confidence interval if, instead of a 95% confidence interval, a 90% confidence interval were built. Be specific about your explanation.  
Because the percent confidence is decreasing, the  $Z_{crit}$  value also goes down, resulting in a smaller margin of error.

## Problem 4

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A US automobile manufacturer is excited about the latest technology in reducing gas mileage in one of its new car models. The sample mean miles per gallon (MPG) and standard deviation for a random sample of 61 cars was found to be 43.6MPG and 1.3MPG respectively.

1. Construct a 95% confidence interval for the population mean miles per gallon for a new car model for this US auto manufacturer. Provide your technology output here.  
**We determined on the Work tab that the 95% confidence interval for the mean was:**

$$\mu \in (43.274, 43.926)$$

2. Interpret the confidence interval in the context of the problem.  
I am 95% confident that the true mean is between 43.274MPG and 43.926MPG.
3. Show your work as you decide if the normality assumption has been met. Clearly state your answer.  
There are more than 30 samples, so the normality assumption has been met, and the sample can be assumed normal.
4. The automobile manufacturer believes that the average mileage per gallon of this new model exceeds the mean EPA rating of 43 miles per gallon. Does this 95% CI support this statement? Explain in a complete sentence.  
This 95% CI does support this statement, as the entire CI is above 43MPG.

## Problem 5

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It is very time consuming to find rattlesnakes and nerve racking to measure them. A scientist randomly finds 12 snakes from the Central Pennsylvania area and measures their length. The following 12 measurements, in inches, are obtained:

<b>40.2</b>	<b>43.1</b>	<b>45.5</b>	<b>44.5</b>	<b>39.5</b>	<b>38.5</b>
40.3	41.0	41.6	43.1	44.9	42.8

1. Estimate with 95% confidence, the population mean length of a rattlesnake from Central PA. Provide your technology output here.

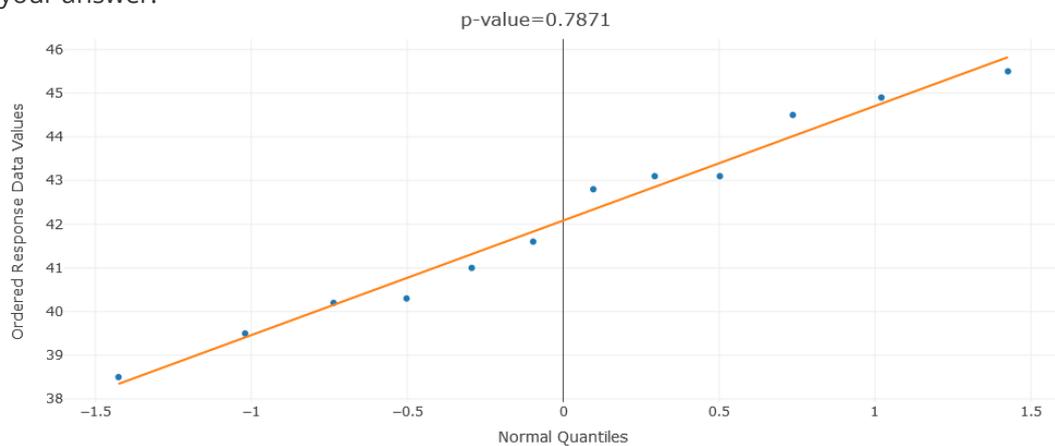
We determined on the Work tab that the 95% confidence interval for the mean was:

$$\mu \in (40.653, 43.513)$$

2. Interpret the confidence interval in the context of the problem.

I am 95% confident that the mean length of a rattlesnake from Central PA is between 40.653 inches and 43.513 inches.

3. Show your work as you decide if the normality assumption has been met. Clearly state your answer.



The sample size is smaller than 30 points, so I constructed an NPP plot. The p-value, shown above as 0.7871, is greater than 0.05. Therefore, the sample can be assumed normal.

4. The scientist is planning on making the following statement: "Rattlesnakes from Central PA measure 42 inches in length." Does the 95% confidence interval that we built support this statement? Explain your answer in a complete sentence.

The confidence interval does support this statement, as 42 inches is within the confidence interval.

This is the end of the exam. You should have completed 4 problems. Once you have completed the next two items in red, please submit the file to the Exam 2 Part 2 Assignment drop box.

Insert an image of your cheat sheet here:

