$\mu_0 = 20$ $n = 18$ $\bar{x} = 20.74$ $s = 1.22$

1. A researcher wants to test whether soft drinks sold at a large restaurant chain contain the advertised 20 ounces. A random sample of 18 soft drinks found a mean of 20.74 with a standard deviation of 1.22 ounces. Is this sufficient evidence to show the mean fill is not 20 ounces?

a. (2 points) State the appropriate null and alternative hypothesis.

$H_0: \mu = 20$ $H_A: \mu \neq 20$

b. (1 points) Calculate the test statistic.

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{20.74 - 20}{1.22/\sqrt{18}} = 2.57$$

c. (2 points) Calculate the corresponding p-value (or range of p-values).

x2

pvalue = .0197 or $.01 < \text{pvalue} < .02$

d. (2 points) Make and justify a statistical decision using a significance level of 5%.

pvalue $< \alpha = .05$ RTN!

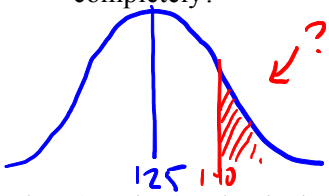
e. (3 points) Interpret your decision in the context of the problem.

There is enough evidence to conclude that the mean fill for the soft drinks is not 20 ounces.

2. A tire manufacturer designed a new tread pattern for its all-weather tires. Repeated tests were conducted on cars of approximately the same weight traveling at 60 miles per hour. The tests showed that the new tread pattern enables the cars to stop completely in an average distance of 125 feet with a standard deviation of 6.5 feet and that the stopping distances are approximately normally distributed..

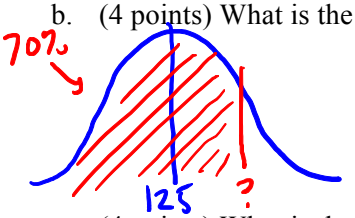
$\mu = 125$ $s = 6.5$

a. (4 points) What is the probability that a time with a new tread pattern takes more than 140 feet to stop completely?



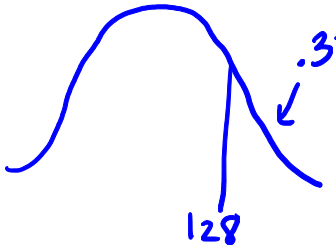
normalcdf(140,99999,125,6.5)
= 0.0105

b. (4 points) What is the 70th percentile of the distribution of stopping distances?



invNorm(.7,125,6.5) = 128.4086 feet

c. (4 points) What is the probability that at least 2 cars out of 5 randomly selected cars in the study will stop in a distance that is greater than the distance calculated in part (b) ?



BINOMIAL!
$n = 5$
$p = .3$

b ← oops.
0 (1) 2 3 4 5

1-binomcdf(5,.3,1)
= 1-.5282 = .4718

3. For each of the following, determine which test would be used. Note, two tests will not be used.

a) ZTest – single mean	d) Two sample TTest for means
b) TTest – single mean	e) Paired means, TTest for differences
c) One proportion Z test	f) Two proportion Z Test

1 group 2 groups 2 obs means = Quant prop = cat

D Before beginning a unit on frog anatomy, a seventh-grade biology teacher gives each of the 24 students in the class a pretest to assess their knowledge of frog anatomy. The teacher wants to compare the effectiveness of an instructional program in which students physically dissect frogs with the effectiveness of a different program in which students use computer software that only simulates the dissection of a frog. After completing one of the two programs, students will be given a posttest to assess their knowledge of frog anatomy. The teacher will then analyze the changes in the test scores (score on posttest minus score on pretest). Quantitative

D One of the two fire stations in a certain town responds to calls in the northern half of the town, and the other fire station responds to calls in the southern half of the town. One of the town council members believes that the two fire stations have different mean response times. Response time is measured by the difference between the time an emergency call comes into the fire station and the time the first fire truck arrives at the scene of the fire.

Ho: $\mu_N = \mu_S$ Ha: $\mu_N \neq \mu_S$

F For many years, the medically accepted practice of giving aid to a person experiencing a heart attack was to have the person who placed the emergency call administer chest compression (CC) plus standard mouth-to-mouth resuscitation (MMR) to the heart attack patient until the emergency response team arrived. However, some researchers believed that CC alone would be a more effective approach.
In the 1990s a study was conducted in Seattle in which 518 cases were randomly assigned to treatments: 278 to CC plus standard MMR and 240 to CC alone. A total of 64 patients survived the heart attack: 29 in the group receiving CC plus standard MMR, and 35 in the group receiving CC alone.

cat x=29 n=278

B A consumer organization was concerned that an automobile manufacturer was misleading customers by overstating the average fuel efficiency (measured in miles per gallon, or mpg) of a particular car model. The model was advertised to get 27 mpg. To investigate, researchers selected a random sample of 10 cars of that model. Each car was then randomly assigned a different driver. Each car was driven for 5,000 miles, and the total fuel consumption was used to compute mpg for that car.

~~A~~ B Ho: $\mu = 27$ Ha: $\mu < 27$

C A group of 300 housewives was interviewed to determine if there is a preference for one of two detergents. Detergent A was favored by 135 housewives; the others favored Detergent B.

cat Ho: $p = .5$ Ha: p

B If a new process for copper mining is to be adopted, it must produce at least 50 tons of ore per day. A 5-day trial gave the following results: 50 47 53 51 52

quant Ho: $\mu \geq 50$ Ha: $\mu < 50$

F Two sets of 60 high school students each were taught algebra by two methods, respectively. The experimental group used programmed learning and no formal lectures; the control group was given formal lectures by a teacher. At the end of the experiment both groups were given a standardized test, and the number of students scoring above 85% was recorded: 41 out of 60 of the experimental group had scores above 85%; 24 out of 60 in the control group had scores above 85%. Test the hypothesis that the two groups were not different in their performance on the standardized test.

cat Ho: $P_E = P_C$ Ha: $P_E = P_C$

E Ten sets of identical twins, all wanting to learn French, were divided into two groups, each group containing one of each twin pair. Group 1 was flown to France, where they lived for one month. Group 2 was enrolled in an intensive French course at a local university. At the end of one month, all subjects were given a standard French language exam.

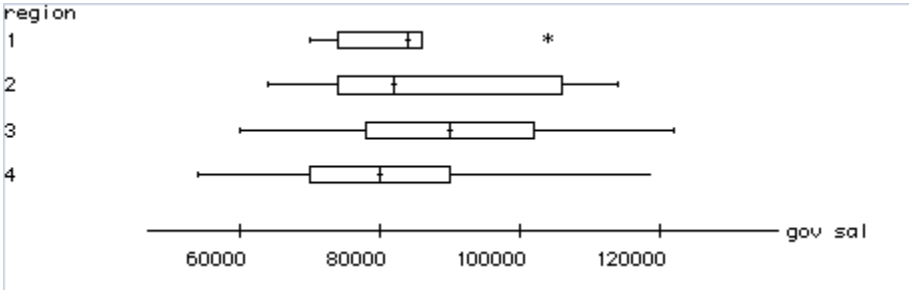
quant Ho: $\mu_D = 0$

$T_F - T_U =$

A A vegetable canner claims that the mean fill per 16-ounce can is 16.1 ounces. Several underweight complaints have been lodged against the company, and the canner wants to see if the machine setting for the fill mechanism is correct. That is, he wishes to test the hypothesis that $\mu = 16.1$ ounces. Experience with the machine has shown that the variation in fill observed over a number of years is $\sigma = .11$ ounces. A random sample of n = 10 cans gave the following measurements in ounces: 16.1, 16.0, 16.2, 15.9, 16.0, 16.1, 16.1, 15.9, 16.1, 16.0. Do these data indicate that μ differs from 16.1 ounces?

C A manufacturer claims that, at most, 5% of the goods he produces are defective. If out of 200 items randomly selected from his production 14 are found to be defective. $H_0: p \leq .05$ $H_A: p > .5$ $n=200$ $x=14$

4. The following boxplots display the distributions of the 1993 governor's salaries according to the state's geographic region of the country. Region 1 is the Northeast, 2 the Midwest, 3 the South, and 4 the West.



a. Which region has the state with the highest governor's salary?

3 - The South

b. Which region has the state with the highest median governor's salary?

3 - The South

c. Which region has the state with the smallest interquartile range of governor's salaries?

1 - The Northeast

d. Estimate the median governor's salary for the Southern states.

~ $90000

5. In a study of city employee salaries, the distribution was found to be right skewed with several high outliers. What would be the appropriate measure of spread for this distribution?

A. The standard deviation because that is always the best measure of spread.
B. The IQR because that is always the best measure of spread.
C. The standard deviation because the data is skewed.
D. The IQR because the data is skewed.
E. Both standard deviation and IQR are appropriate.

Use the following information to answer questions 6 through 8

A long jump competition took place recently at a local high school. The coach is interested in performing as well as possible in the next competition, so he is looking at the relationship between height and distance jumped (both measured in inches). He uses height to predict distance. The data was analyzed to produce the following scatterplot and regression line:

$\widehat{distance\ jumped} = 6.4285 + 1.0534(height)$ R-squared = 89%

6. A certain runner jumped a distance of 85 inches and is 75 inches tall. What is the residual for this runner?

$y = 85$ $x = 75$ $e = ?$

① $\hat{y} = 6.4285 + 1.0534(75)$

$= 85.4335$

② $e = y - \hat{y}$

$= 85 - 85.4335 = \boxed{-.4335}$

7. What is the correlation coefficient?

$r = +\sqrt{.89} = \boxed{.9434}$

8. Interpret the slope.

For every 1 inch increase in height, distance jumped increases by 1.0534 inches.

Use the following information to answer 9 and 10

Suppose 54% of San Diego residents are in favor of building a new stadium for the Chargers. A random sample of 100 of the city's residents is taken.

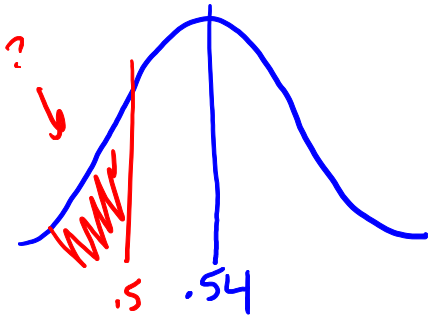
9. Which of the following correctly describes the sampling distribution of the **sample proportion**?

A. $X \sim AN(54, 4.9840)$
B. $\hat{p} \sim AN(0.54, 0.0498)$
C. $X \sim AN(54, 24.84)$
D. $X \sim AN(100, .54)$
E. $\hat{p} \sim AN(0.54, 0.0025)$

$\mu_{\hat{p}} = .54$

$\sigma_{\hat{p}} = \sqrt{\frac{(.54)(.46)}{100}} = .0498$

10. What is the probability that less than 50% of them are in favor of building a new stadium?



normalcdf(−9999, .5, .54, .0498)

$= \boxed{.2109}$

11. Which of the following will affect the width of a confidence interval for a mean where the population standard deviation is unknown?

I. The sample size. ← df
II. The confidence level used. ← t^*
III. The standard deviation for the sample. ← s

A. I only
B. II only
C. I and II only
D. I and III only
E. I, II, and III

12. In a packing plant, a machine packs cartons with jars. It is supposed that a new machine will pack faster on the average than the machine currently used. To test that hypothesis, the times it takes each machine to pack ten cartons are recorded. Which of the following would be the correct hypotheses to test this?

A. $H_o: p_{NEW} = p_{CURRENT}$ $H_A: p_{NEW} > p_{CURRENT}$
B. $H_o: \mu_{NEW} = \mu_{CURRENT}$ $H_A: \mu_{NEW} > \mu_{CURRENT}$
C. $H_o: \mu_{DIFF} = 0$ $H_A: \mu_{DIFF} > 0$
D. $H_o: p_{DIFF} = 0$ $H_A: p_{DIFF} > 0$

↓ Quantitative 2 groups

13. A simple random sample of front-seat occupants involved in car crashes was taken and 90% confidence interval for the difference between the population proportion of fatalities in cars equipped with airbags and the proportion of those not equipped with airbags was calculated to be (-0.0032, -0.0002)

Based on the confidence interval, what would you conclude about the effectiveness of airbags in an accident? Explain your reasoning with regards to the confidence interval for full points.

The CI implies that there is a difference in the proportion of fatalities in cars with airbags versus without because Ø isn't in the interval. Moreover, it appears airbags reduce fatalities.

14. A research team is interested in the difference between serum uric acid levels in patients with and without Down's syndrome. In a large hospital for the treatment of the mentally retarded, a sample of 12 individuals with Down's syndrome yielded a mean of $\overline{x_1} = 4.5$ mg/100 ml. In a general hospital a sample of 15 normal individuals of the same age and sex were found to have a mean value of $\overline{x_2} = 3.4$ mg/100 ml. If it is reasonable to assume that the two populations of values are normally distributed with variances equal to 1 and 1.5 they found the 95 percent confidence interval for the difference in means between patients with and without Down's syndrome to be (0.26, 1.94).

Is this evidence that there is a difference in the mean amount of serum uric acid levels in patients with and without Down's Syndrome? Why or why not?