1)

Assume that the differences are normally distributed. Complete parts **(a)** through **(d)** below.

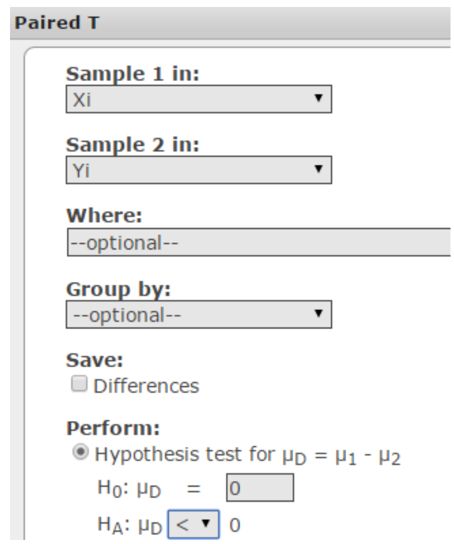
Observation	1	2	3	4	5	6	7	8
X_i	43.4	53.4	43.2	41.8	45.5	53.4	40.7	50.7
Y_i	48.3	52.9	45.3	46.1	48.1	53.8	45.1	53.3

(a) Determine $d_i = X_i - Y_i$ for each pair of data.

ENTER D_1 INTO STATCRUNCH, OPEN IN NEW WINDOW

Observation	1	2	3	4	5	6	7	8
d_i	−4.9	.5	−2.1	−4.3	−2.6	−.4	−4.4	−2.6

(Type integers or decimals.)



(b) Compute $\bar{d}$ and s_d.

$\bar{d}$ = −2.6 (Round to three decimal

s_d = 1.932 (Round to three decima

SUMMARY STATS-COLUMNS - COMPUTE MEAN AND Std Dev.

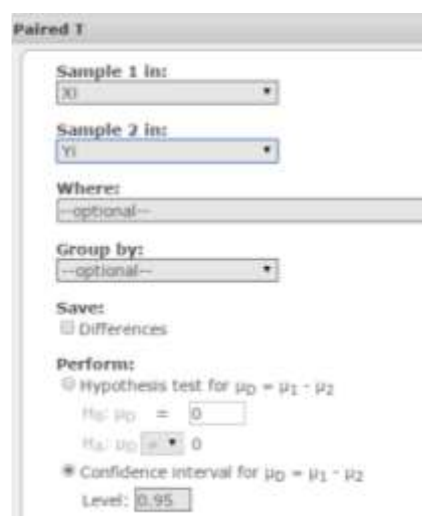
(c) Test if $\mu_d < 0$ at the $\alpha = 0.05$ level of significance.

What are the correct null and alternative hypotheses?

- A. H_0: $\mu_d > 0$; H_1: $\mu_d < 0$
- B. H_0: $\mu_d < 0$; H_1: $\mu_d > 0$
- C. H_0: $\mu_d < 0$; H_1: $\mu_d = 0$
- D. H_0: $\mu_d = 0$; H_1: $\mu_d < 0$ ✔

P-value = .003 (Round to three decimal

STATS – T-STATS – WITH DATA



Choose the correct conclusion below.

- A. Do not reject the null hypothesis. There is sufficient evidence that $\mu_d < 0$ at the $\alpha = 0.05$ level of significance.
- B. Reject the null hypothesis. There is sufficient evidence that $\mu_d < 0$ at the $\alpha = 0.05$ level of significance. ✔

2) In an experiment, 19 babies were asked to watch a climber attempt to ascend a hill. On two occasions, the baby witnesses the climber fail to make the climb. Then, the baby witnesses either a helper toy push the climber up the hill, or a hinderer toy preventing the climber from making the ascent. The toys were shown to each baby in a random fashion. A second part of this experiment showed the climber approach the helper toy, which is not a surprising action, and then the climber approached the hinderer toy, which is a surprising action. The amount of time the baby watched the event was recorded. The mean difference in time spent watching the climber approach the hinderer toy versus watching the climber approach the helper toy was 1.17 seconds with a standard deviation of 1.73 seconds. Complete parts a through c.

(a) State the null and alternative hypotheses to determine if babies tend to look at the hinderer toy longer than the helper toy. Let $\mu_d = \mu_{hinderer} - \mu_{helper}$, where $\mu_{hinderer}$ is the population mean time babies spend watching the climber approach the hinderer toy and μ_{helper} is the population mean time babies spend watching the climber approach the helper toy.

- ✔ A. $H_0: \mu_d = 0$, $H_1: \mu_d > 0$
- B. $H_0: \mu_d < 0$, $H_1: \mu_d = 0$
- C. $H_0: \mu_d \neq 0$, $H_1: \mu_d = 0$
- D. $H_0: \mu_d > 0$, $H_1: \mu_d = 0$
- E. $H_0: \mu_d = 0$, $H_1: \mu_d < 0$

STATCRUNCH
STAT – T-STATS – ONE SAMPLE-WITH SUM

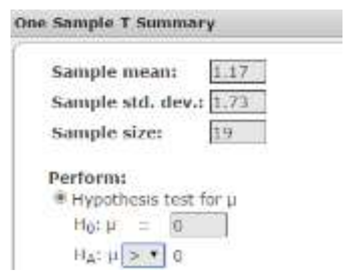
(b) Assuming the differences are normally distributed with no outliers, test if the difference in the amount of time the baby will watch the hinderer toy versus the helper toy is greater than 0 at the 0.01 level of significance.

Find the test statistic for this hypothesis test.

2.95 (Round to two decimal places as needed.)

Determine the P-value for this hypothesis test.

0.004 (Round to three decimal places as needed.)



State the conclusion for this hypothesis test.

If P-value < α, reject the null hypothesis.

- A. Do not reject H_0. There is not sufficient evidence at the $\alpha = 0.01$ level of significance to conclude that the difference is greater than 0.
- ✔ B. Reject H_0. There is sufficient evidence at the $\alpha = 0.01$ level of significance to conclude that the difference is greater than 0.

(c) What do you think the results of this experiment imply about babies' ability to assess surprising behavior?

- A. There is not sufficient evidence that babies do not have the ability to assess surprising behavior.
- B. The experiment does not imply anything about babies' ability to assess surprising behavior.
- C. There is sufficient evidence that babies do not have the ability to assess surprising behavior.
- D. There is not sufficient evidence that babies have the ability to assess surprising behavior.
- ✔ E. There is sufficient evidence that babies have the ability to assess surprising behavior.

3) The following data represent the muzzle velocity (in feet per second) of rounds fired from a 155-mm gun. For each round, two measurements of the velocity were recorded using two different measuring devices, resulting in the following data. Complete parts (a) through (d) below.

Observation	1	2	3	4	5	6
A	793.4	791.1	793.7	791.8	794.4	790.1
B	797.2	789.8	802.3	788.4	803.5	786.8

STATS – T-STATS – PAIRED

*check differences

(a) Why are these matched-pairs data?

- A. All the measurements came from rounds fired from the same gun.
- ✔ B. Two measurements (A and B) are taken on the same round.
- C. The same round was fired in every trial.
- D. The measurements (A and B) are taken by the same instrument.

(b) Is there a difference in the measurement of the muzzle velocity between device A and device B at the $\alpha = 0.01$ level of significance? **Note:** A normal probability plot and boxplot of the data indicate that the differences are approximately normally distributed with no outliers.

Let $d_i = A_i - B_i$. Identify the null and alternative hypotheses.

$H_0: \mu_d = 0$

$H_1: \mu_d \neq 0$

(b) Construct a 99% confidence interval about the population mean difference. Compute the difference as device A minus device B. Interpret your results.

Confidence 99%

The lower bound is −11.71.

The upper bound is 7.21.

(Round to two decimal places as needed.)

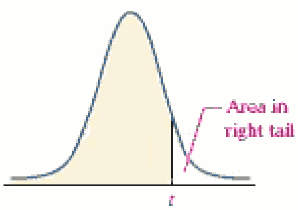
Interpret the confidence interval. Choose the correct answer below.

- A. One can be 1% confident that the mean difference in measurement lies in the interval found above.
- ✔ B. One can be 99% confident that the mean difference in measurement lies in the interval found above.

Critical values: Open critical value table: (USE degrees of freedom) – 1

Then us α, if it is two tailed (≠) divide α by 2

t-Distribution Critical Values Table



***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

4) A researcher studies water clarity at the same location in a lake on the same dates during the course of a year and repeats the measurements on the same dates 5 years later. The researcher immerses a weighted disk painted black and white and measures depth (in inches) at which it is no longer visible. The collected data is given in the table below. Complete parts (a) through (c) belo

Observation	1	2	3	4	5	6
Date	1/25	3/19	5/30	7/3	9/13	11/7
Initial Depth, X_i	59.4	35.9	64.9	55.1	46.2	44.4
Depth Five Years Later, Y_i	68.2	35.5	69.1	58.3	52.9	46.6

STATS – T-STATS – PAIRED

*check differences

a) Why is it important to take the measurements on the same date?

A. Using the same dates maximizes the difference in water clarity.
B. Using the same dates makes it easier to remember to take samples.
C. Those are the same dates that all biologists use to take water clarity samples.
D. Using the same dates makes the second sample dependent on the first and reduces variability in water clarity attributable date.

b) Does the evidence suggest that the clarity of the lake is improving at the $\alpha = 0.05$ level of significance? Note that the normal probability plot and boxplot of the data indicate that the differences are approximately normally distributed with no outliers.

Let $d_i = X_i - Y_i$. Identify the null and alternative hypotheses.

Determine the test statistic for this hypothesis test.

−3.08 (Round to two decimal places as needed.)

Find the P-value for this hypothesis test.

P-value = .014 (Round to three decimal places as needed.)

What is your conclusion regarding H_0?

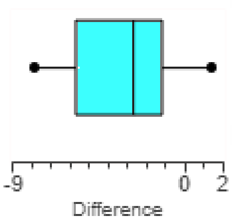
D. Reject H_0. There is sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that the clarity of the lake is improving.

c) Draw a boxplot of the differenced data. Does this visual evidence support the results obtained in part b)?

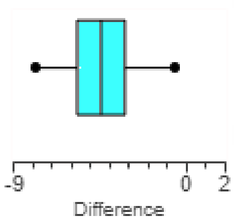
Choose the correct graph below.

BOX PLOT (the difference column) Draw boxed horizontally

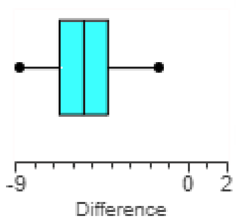
A.



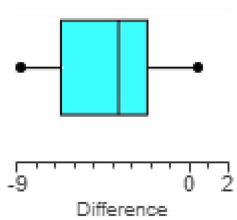
B.



C.



D.



Does this visual evidence support the results obtained in part b)?

D. Yes because the boxplot supports that the lake is becoming more clear, since most differences are negative.

IT MAY BE THIS SECOND ANSWER. HAVE TO LOOK AT THE DIFFERENCE COLUMN.

D. Yes because the boxplot supports that the lake is not becoming more clear, since most differences are positive or near 0.

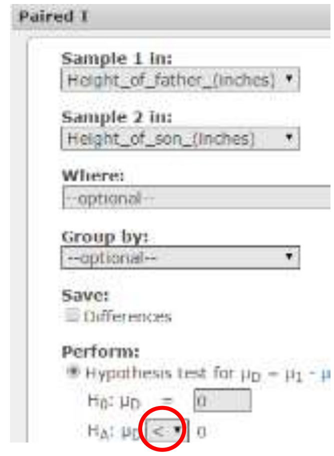
5) To test the belief that sons are taller than their fathers, a student randomly selects 13 fathers who have adult male children. She records the height of both the father and son in inches and obtains the following data. Are sons taller than their fathers? Use the $\alpha = 0.10$ level of significance. Note: A normal probability plot and boxplot of the data indicate that the differences are approximately normally distributed with no outliers.

Click the icon to view the table of data.

STATS – T-STATS – PAIRED

Which conditions must be met by the sample for this test? Select all that apply.

- [ ] A. The sampling method results in an independent sample.
- [x] B. The sampling method results in a dependent sample.
- [ ] C. The sample size must be large.
- [x] D. The differences are normally distributed or the sample size is large.
- [x] E. The sample size is no more than 5% of the population size.



Let $d_i = X_i - Y_i$. Write the hypotheses for the test.

H_0: $\mu_d = 0$

H_1: $\mu_d < 0$

Calculate the P-value.

P-value = .478 (Round to three decimal places as needed.)

Should the null hypothesis be rejected?

Do not reject H_0 because the P-value is greater than the level of significance. There is not sufficient evidence to conclude that sons are taller than their fathers at the 0.10 level of significance.

6) The manufacturer of hardness testing equipment uses steel-ball indenters to penetrate metal that is being tested. However, the manufacturer thinks it would be better to use a diamond indenter so that all types of metal can be tested. Because of differences between the two types of indenters, it is suspected that the two methods will produce different hardness readings. The metal specimens to be tested are large enough s that two indentions can be made. Therefore, the manufacturer uses both indenters on each specimen and compares the hardness readings. Construct a 95% confidence interval to judge whether the two indenters result in different measurements.
Note: A normal probability plot and boxplot of the data indicate that the differences are approximately normally distributed with no outliers.

Click the icon to view the data table.

Construct a 95% confidence interval to judge whether the two indenters result in different measurements, where the differences are computed 'diamond minus steel ball'.

The 95% confidence interval to judge whether the two indenters result in different measurements is (.2 , 2.7). (Round to the nearest tenth as needed.)

State the appropriate conclusion. Choose the correct answer below.

- (x) There is sufficient evidence to conclude that the two indenters produce different hardness readings.
- ( ) There is insufficient evidence to conclude that the two indenters produce different hardness readings.

STAT – TSTATS –PAIRED and put Diamond in top box and Streetball in second option box and 95% confidence

7) Some people believe that higher-octane fuels result in better gas mileage for their car. To test this claim, a researcher randomly select
11 individuals to participate in the study. Each participant received 10 gallons of gas and drove his car on a closed course. The numbe
miles driven until the car ran out of gas was recorded. A coin flip was used to determine whether the car was filled up with 87-octane o
92-octane first, and the driver did not know which fuel was in the tank. Complete parts (a) through (e).

Click here to view the data, probability plots, and technology output.

Click here to view the table of critical values for the correlation coefficient.

(a) Why is it important that the matching be done by driver and car?

- ✔ A. How someone drives and the car they drive result in different fuel consumption.
- B. It allows each driver to determine which fuel is best for their car.
- C. It cuts the cost of doing the research.
- D. It allows all of the trials to be done at the same time.

(b) Why is it important to conduct the study on a closed track?

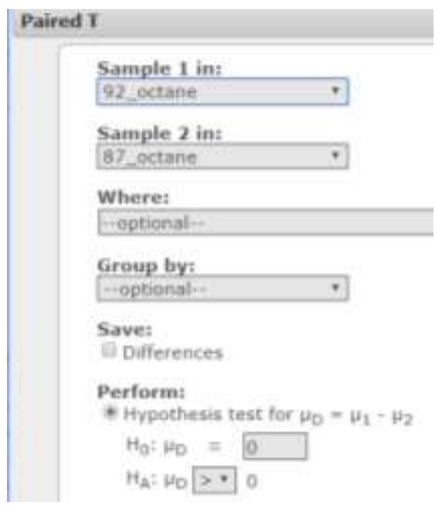
- A. So that each car uses the same amount of gas
- B. So that the researcher can watch the drivers
- C. So that each car travels the same distance
- ✔ D. So that all drivers and cars have similar driving conditions

(c) The normal probability plots and linear correlation coefficients for miles on 87-octane and miles on 92-octane are given. The correlation between 87 octane and the expected z-scores is 0.876. The correlation between 92 octane and the expected z-scores is 0.880. Are either of these variables normally distributed?

- ✔ A. No, neither variable is normally distributed.
- B. Yes, 92-octane is normally distributed.
- C. Yes, 87-octane is normally distributed.
- D. Yes, both variables are normally distributed.

(d) The differences are computed as 92-octane minus 87-octane. The normal probability plot of the differences is shown. The correlation between the differenced data and the expected z-scores is 0.962. Is there reason to believe that the differences are normally distributed?

Yes, since the correlation coefficient is greater than the critical value.



STAT – TSTATS –PAIRED Put 92 Octane top and 87 Octane bottom

(e) The researchers used a statistical software package to determine whether the mileage from 92-octane is greater than the mileage from 87-octane. What do you conclude at $\alpha = 0.05$? Why? Begin by writing the hypotheses.

H_0: The difference in mileage for 92-octane and 87-octane equals zero.
H_1: The difference in mileage for 92-octane and 87-octane is greater than zero.

The test statistic is 1.18.
(Do not round.)

Round to two decimal places

The P-value is 0.133.
(Do not round.)

Round to 3 decimal places

Therefore, there is not sufficient evidence that the mileage from 92-octane is greater than the mileage from 87-octane.