Week 09 Quiz: One-sample Normal Tests

Problem 1

The primary goal of a one-sample Z-test is to:
a) Estimate the population mean.
b) Test whether a sample mean is significantly different from a hypothesized population mean.
c) Compare the means of two independent samples.
d) Calculate the probability of observing the sample data.

Answer: B

Problem 2.

For a large one-sample Z-test with unknown population variance, the test statistic is calculated as:
a) $(\bar{x} - \mu_0) / (s/\sqrt{n})$
b) $(\bar{x} - \mu_0) / (\sigma/\sqrt{n})$
c) $(\mu - \mu_0) / (\sigma/\sqrt{n})$
d) $(\bar{x} - \mu) / (s/\sqrt{n})$

Answer: A

Problem 3

A sample of size n=25 taken from a normal population has a mean of 110. The hypothesized population mean is 100, and the population standard deviation is known to be 15. What is the Z-test statistic?
a) 3.33
b) 0.67
c) 10.0
d) 1.67

Answer: A

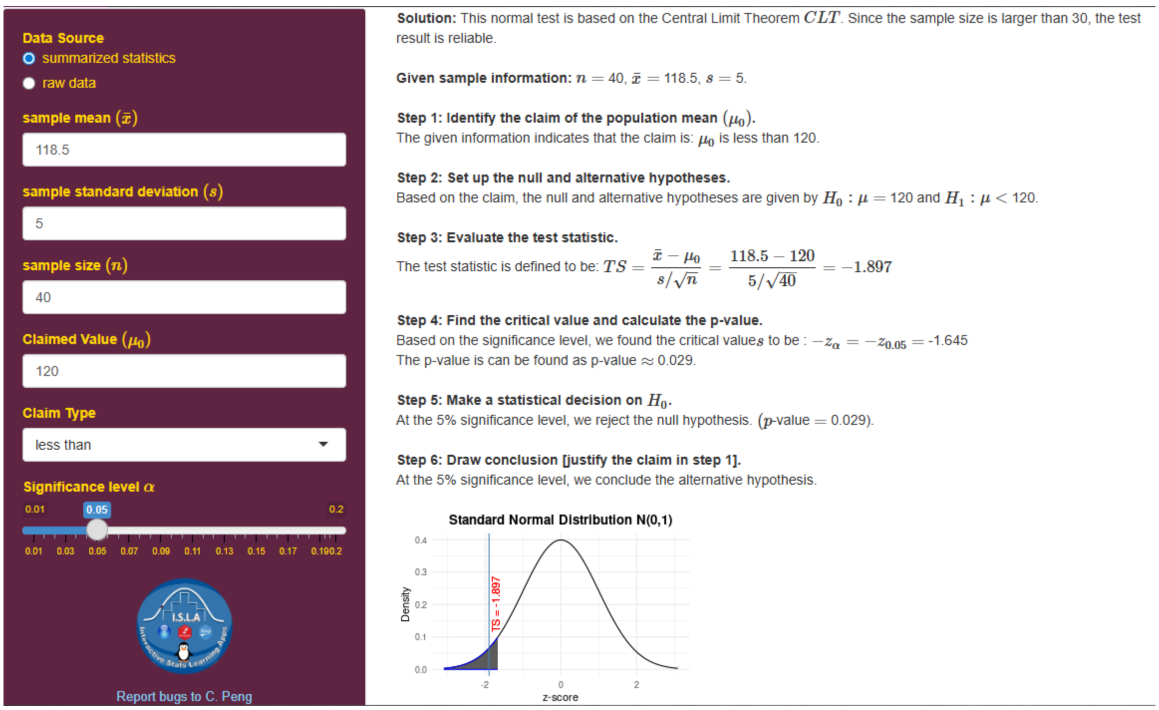
Problem 4

A factory process produces steel bars with a mean length of 120 cm and a known σ=5 cm. A new process is tested on 40 bars, yielding a sample mean

of 118.5 cm. What is the calculated z-test statistic for H_0: μ=120 vs. H_1: μ<120?

a) 1.5
b) -1.5
c) -1.897
d) -0.237

Answer: C



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Problem 5

For a two-tailed one-sample z-test at α=0.05, what are the critical values that define the rejection region?

a) z = ±1.96
b) z = ±1.645
c) z = +1.96
d) z = +1.645

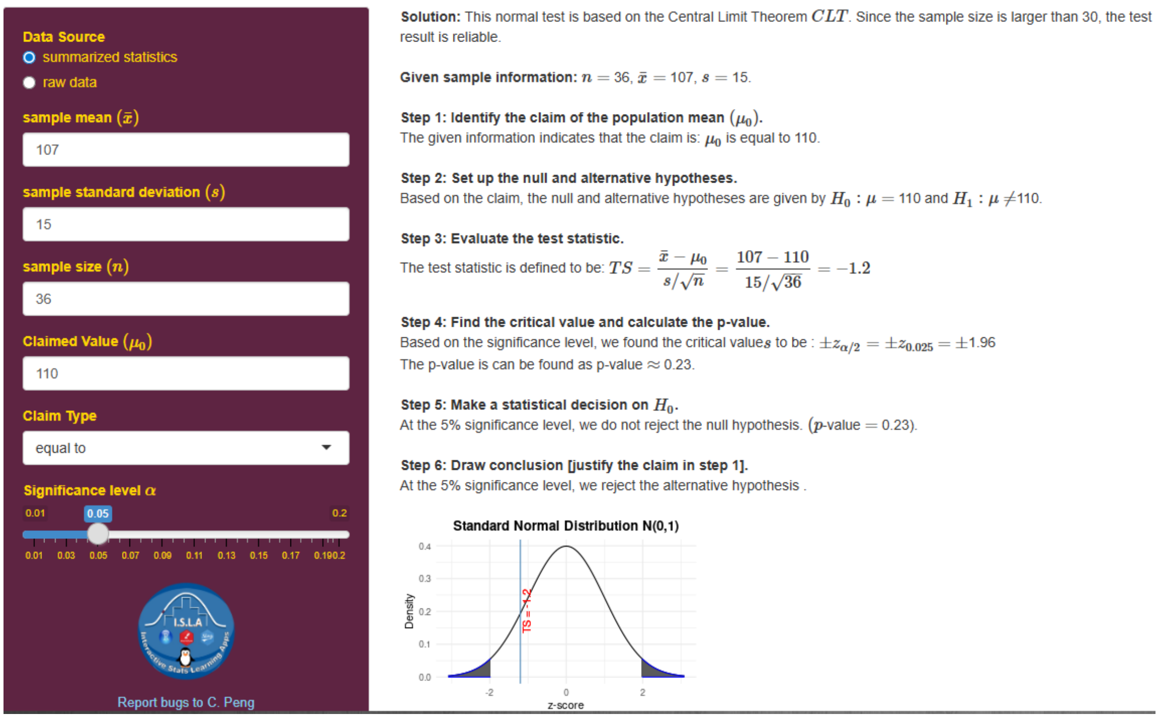
Answer: A

Problem 6

The principal claims the mean IQ of students at a school is 110. A psychologist tests 36 random students, finding a mean of 107. The population standard deviation is known to be 15. If the p-value for the two-sided test is 0.27, what is the correct conclusion at α=0.05?

a) Reject H_0; the mean IQ is significantly different from 110.
b) Fail to reject H_0; there is not enough evidence that the mean IQ is different from 110.
c) Reject H_0; the mean IQ is less than 110.
d) Accept H_0; the mean IQ is exactly 110.

Answer: D

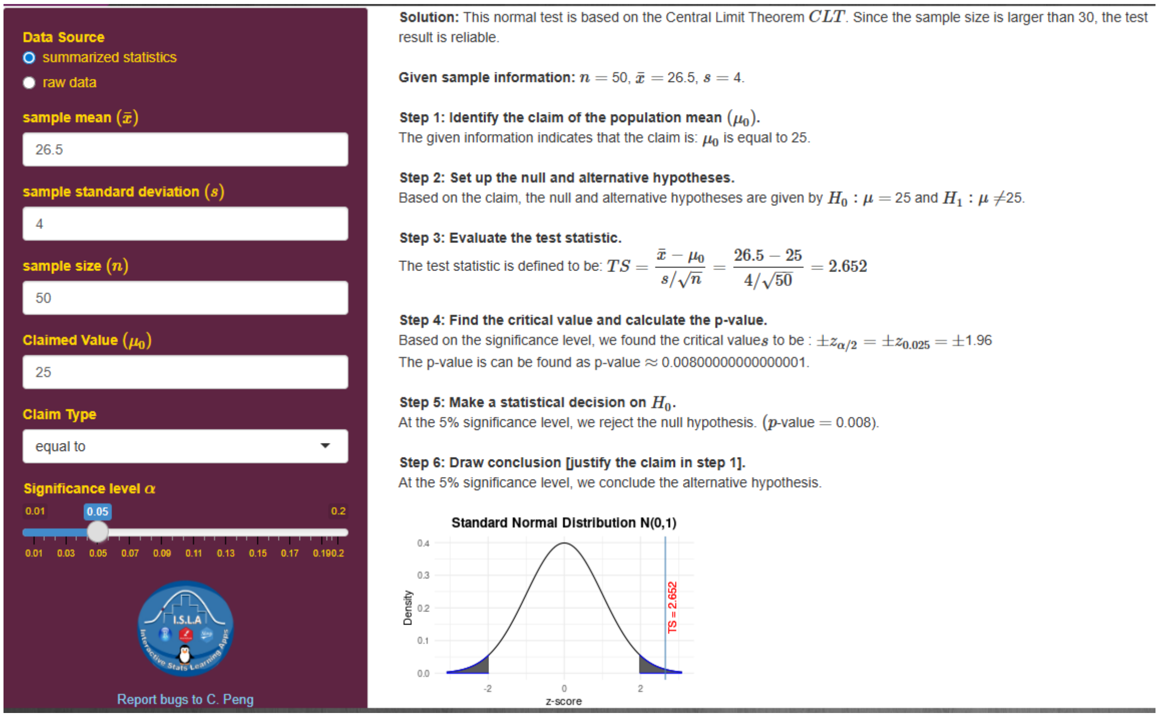


Problem 7

A pizza restaurant advertises a mean delivery time of 25 minutes. A manager collects a sample of 50 deliveries, finding a mean time of 26.5 minutes with a standard deviation of 4 minutes. The test statistic is 2.65. What is the approximate p-value for this two-tailed test?

a) 0.004
b) 0.008
c) 0.05
d) 0.02

Answer: B

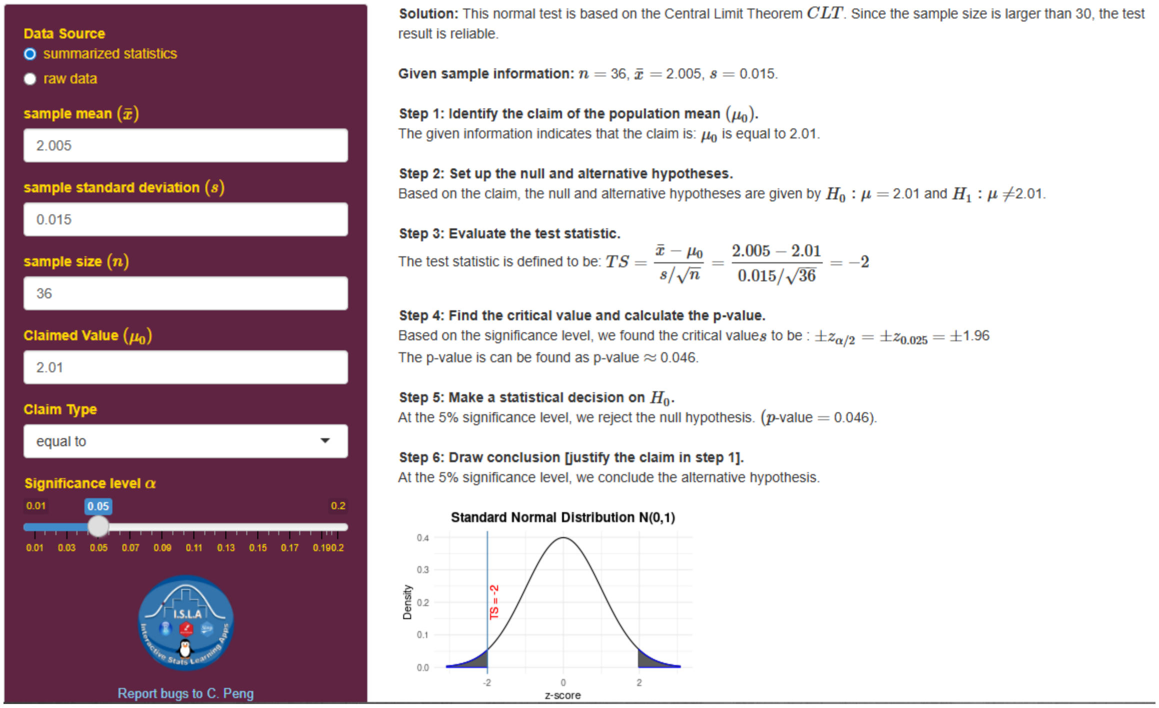


Problem 8

A bottling plant claims its 2-liter bottles contain a mean of 2.01 liters. A regulator measures 36 bottles, finding a mean volume of 2.005 liters with a standard deviation of 0.015 liters. For a two-tailed test at α=0.05, what is the correct statistical decision?

a) Reject H_0 because the sample mean is less than 2.01.
b) Fail to reject H_0 because the test statistic is within the critical region.
c) Reject H_0 because the p-value is less than 0.05.
d) Fail to reject H_0 because the p-value is greater than 0.05.

Answer: C



Problem 9

An ISP guarantees mean network latency is below 50 ms. A user runs 35 speed tests, finding a mean latency of 52 ms with a known population standard deviation of 6 ms. What is the z-test statistic for H_1: $\mu > 50$?

a) 1.75
b) 1.97
c) 2.36
d) 2.08

Answer: B
(52-50/(6/sqrt(35))=1.972

Problem 10

A car model is rated at 30 mpg highway. A magazine tests 45 cars and finds a mean of 29.2 mpg with a standard deviation of 1.5 mpg. They perform a one-sample Z-test. What is the critical value for a two-tailed test at α=0.10?

a) ±1.761

b) ±1.645
c) ±1.345
d) ±1.753

Answer: B

Problem 11

A hotel claims its average check-in time is under 2 minutes. A mystery guest records 40 check-ins. The sample mean is 2.1 minutes with a known population standard deviation of 0.4 minutes. For H_1: $\mu < 2$, what is the p-value?

a) 0.9429
b) 0.0571
c) 0.1142
d) 0.8858

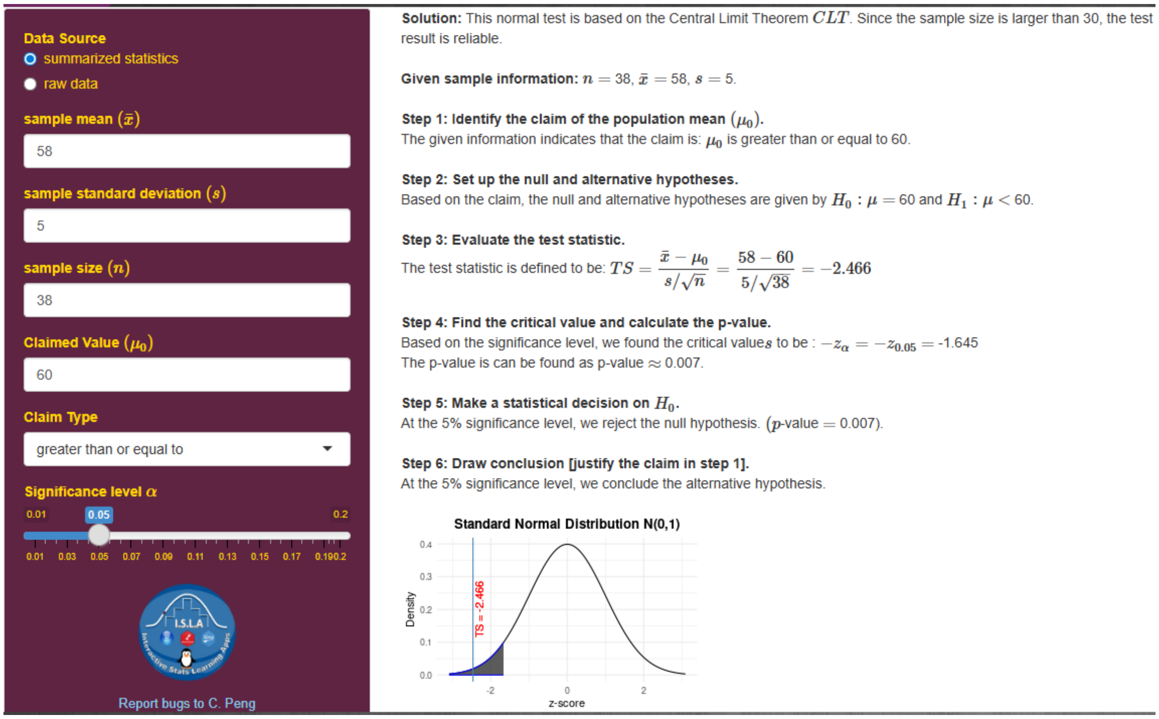
Answer: A

Problem 12

A company requires data entry clerks to have a mean speed of 60 words per minute (wpm). A supervisor tests 38 new clerks, finding a mean of 58 wpm and a standard deviation of 5 wpm. For a one-tailed test (H_1: $\mu < 60$) at α=0.05, what is the decision?

a) Reject H_0; clerks are too slow.
b) Fail to reject H_0; cannot prove clerks are too slow.
c) Accept H_0; clerks are fast enough.
d) The result is inconclusive.

Answer: A



Problem 13

An environmental standard states a river's pH should be 7.0. A researcher takes 36 water samples, finding a mean pH of 6.9 with a standard deviation of 0.15. What is the standard error of the mean?

a) 0.15
b) 0.025
c) 0.06
d) 0.003

Answer: B

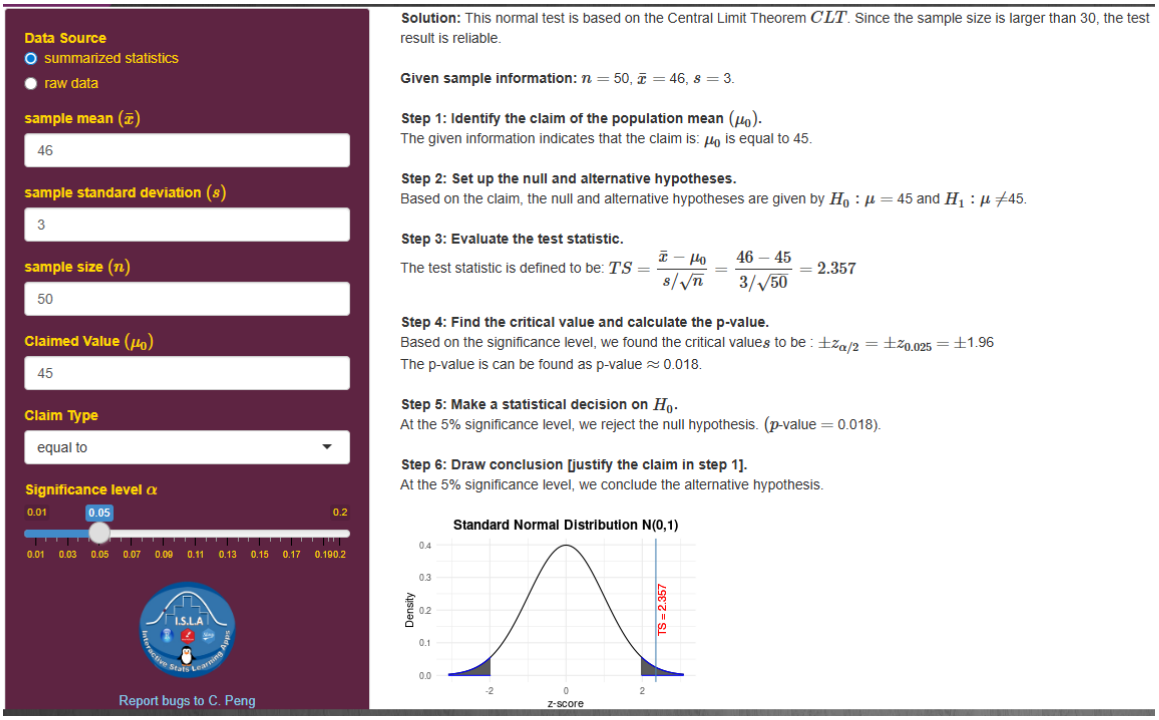
Problem 14

An assembly line is designed to produce one item every 45 seconds. A time-motion study on 50 items finds a mean time of 46 seconds with a known standard deviation of 3 seconds. What is the z-test statistic for H_1: $\mu \neq 45$?

a) 1.67
b) 2.36

c) 3.12
d) 4.01

Answer: B

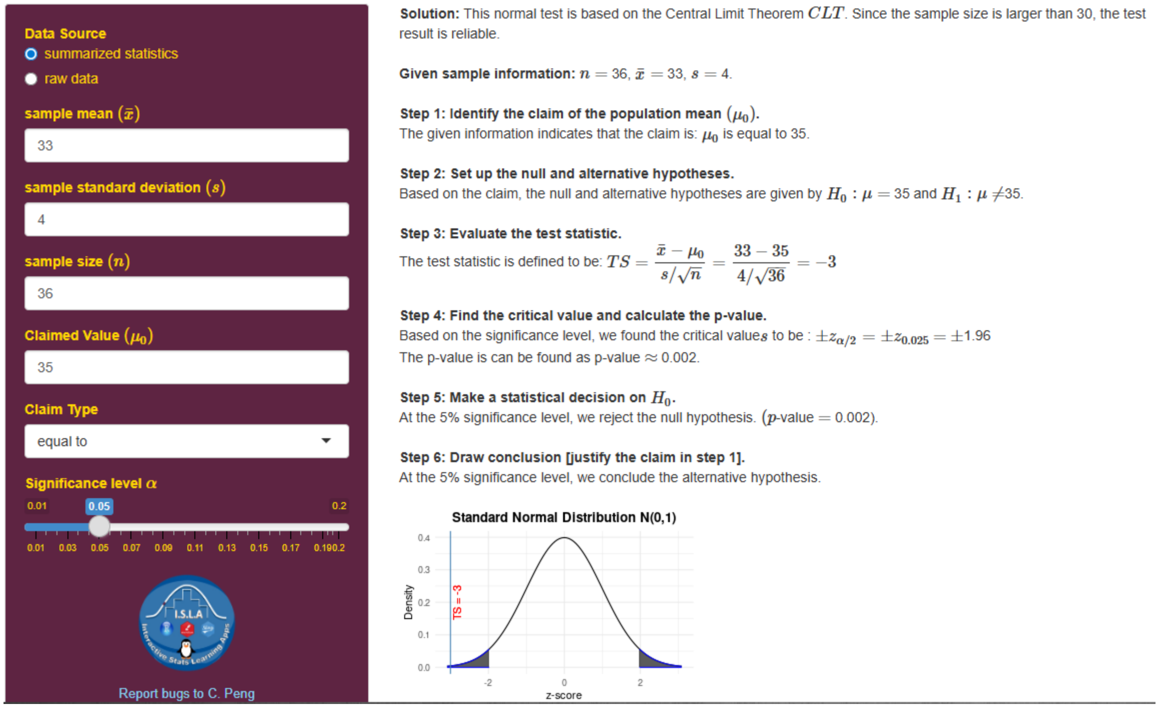


Problem 15

A coffee franchise standard requires milk to be steamed for 35 seconds. A regional manager times 36 baristas, finding a mean time of 33 seconds with a standard deviation of 4 seconds. The test is H_1: $\mu \neq 35$. What is the correct conclusion at α=0.10? (The critical value is 1.96)

a) Reject H_0 because |t| > 196.
b) Fail to reject H_0 because |t| < 1.96.
c) Reject H_0 because the sample mean is less than 35.
d) Accept H_0 because the p-value is large.

Answer: A



Summary of Weekly Quiz #9

1. Five Number Summary :

The five-number summary is use used to describe the shape of the distribution of a given numerical data. It consists of five numbers: minimum data value, first quartile, median, the third quartile, and the maximum data value.

The five-number summary of this given data set is:

stats	value
Min.	60.00
1st Qu.	80.00
Median	85.00
3rd Qu.	95.00
Max.	95.00

2. Boxplot :

The boxplot is a geometric representation of the five-number summary. The boxplot of the given data set is given below.