Ch 9.5 part 2 Hypothesis Test for Population Mean

Ch 9.5-part 2 Full Hypothesis Test for Mean

Terms: Population mean: μ

Sample mean: $\bar{x}$

sample standard deviation: s

sample size: n

Population standard deviation: σ (given or unknown)

significant Level: α (probability of unlikely)

1) Write claim, H0 and Ha in symbolic form.

Identify σ, n, $\bar{x}$, s   or input sample data in one column of statdisk sample editor.

2) Determine significant level and type of test (left-ail, right tail or two-tail test based on Ha), the sampling distribution for mean is z if σ is known, the sampling distribution for mean is t if σ is not given.

3) Use Statdisk/Analysis/Hypothesis Testing/ Mean one sample:

- If n, $\bar{x}$, s is available, use summary statistic tab,
- If sample data is available, use “Data” tab.
- Select Alternative Hypothesis: “not equal” for two-tail test, “<” for left tail test, “>” for right tail test.
- Enter significance, claimed mean, population SD if known. Select data column or enter n, $\bar{x}$, s. Evaluate.
- Output: Test stat z or t, p-value.

4) Make conclusion about H0.

If p-value ≤ α, reject H0. Sample is significant.

If p-value > α, fail to reject H0

5) Conclusion about the claim:

There is (sufficient or not sufficient) evidence to

(support /reject) the claim that ……

Use table or flow chart to make conclusion.

6) Make inference from the conclusion.

Conditions for Hypothesis Testing of mean:

1) Sample is SRS.

2) The population is normally distributed or n >30.

Use Normal quantile plot to check for normality if data is given.

Ex1: Test the claim that mean amount of adult sleep is less than 7 hours. A sample 12 adults gives $\bar{x}$ = 6.82 hr., s = 1.99 hr. Use a significant level of 0.05. Given that hours of sleep are normally distributed.

Answer:

1) Claim: μ < 7, H0: μ = 7 , Ha: μ < 7

n = 12, $\bar{x}$ = 6.82, s = 1.99

2) α = 0.05, Left-tail test and use t-distribution

3) Use Statdisk/Analysis/Hypothesis Test/ Mean one sample/ Use summary statistics tab.

Select Alternative Hypothesis Test: select "<"

Enter significance = 0.05, n, $\bar{x}$, s. calculate.

Output: Test statistic t = - 0.31, p-value = 0.3799.

4) Since p-value > 0.05, Fail to reject H0. Sample is not significant.

5) There is no sufficient evidence to support the claim that mean sleep hour is less than 7 hours.

b) Public Health guideline for hours of sleep per night is 7 hours or more. Does the public follow the guideline from Public Health?

Yes, the result concludes that the mean is not less than 7 hours so it is plausible to be 7 hours or more.

Ex2: Given below are the measured radiation emissions (in W/kg) corresponding to a sample of 11 most popular brand of cell phones. Use a 0.05 significant level to test the claim that cell phones have a mean radiation level that is greater than 0.7 W/kg.

0.38 0.55 1.54 1.55 0.50 0.60 0.92 0.96 1.00 0.86 1.46

Answer:

1) Claim: μ > 0.7, H0: μ = 0.7 , Ha: μ > 0.7

Input data to a column in statdisk.

2) α = 0.05, Right-tail test and use t-distribution.

3) Use Statdisk/Analysis/Hypothesis Test/ Mean one sample/ Use data tab.

Select Alternative Hypothesis Test for ">"

Enter significance = 0.05, select data column, Evaluate.

Output: Test statistic = 1.868, p-value = 0.0456.

4) Since p-value = 0.0456 < 0.05 Reject H0

5) Because we reject H0, use sufficient evidence statement. The claim is in Ha, use "support the claim" statement.

There is sufficient evidence to support the claim that the mean radiation for cell phones is greater than 0.7 W/kg.

b) Is this result useful for all cell phones in use?

- No, the sample is not a random sample. The sample are from each of the top selling cell phone so it is not useful for all cell phones in use.

c) Discuss if the condition for hypothesis test for mean is satisfied or not.

- A normal quantile plot and boxplot shows the points are close to a straight line and there is no outliers. So the requirement for Normal distribution is satisfied.

Ex3: Output from a Minitab software shows the following after inputting a sample that have $\bar{x}$ = 9.81 km , s = 5.01km and n=50.

MINITAB

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Test of mu = 10 vs not = 10

 N    Mean   StDev  SE Mean        95% CI           T      P
50   9.810   5.010    0.709   (8.386, 11.234)   -0.27  0.790
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Use the output to test the claim that mean depth of all earthquakes is equal to 10 km at α = 0.05.

Answer:

1) Claim: $\mu = 10$, H0: $\mu = 10$, Ha: $\mu \neq 10$.

2) test statistic = t = -0.27, p value = 0.790 from above.

3) Since p-value 0.790 > 0.05, fail to reject H0

4) Use “not sufficient evidence” statement and

Use “reject the claim” statement (because claim is in H0)

Not sufficient evidence to reject the claim that mean depth is 10 km, so claim is true the mean depth of all earthquakes are 10km.

Flowchart: Claim is H0, fail to reject H0, Box 2

Claim is true.
