WELCOME BACK

AGENDA

Realignment of Goals

Discussion

Consultation

2025

Construct a TIMELINE for finishing the semester – include methods and strategies for finishing your remaining tasks for the school year.

WHICH OF THESE DO YOU USE?

WHICH ONE IS THE BEST?

Dishwashing Liquid Commercial

Safeguard Commercial

Colgate Commercial

HYPOTHESIS TESTING

A statistical hypothesis test is a method of statistical inference used to decide whether the data sufficiently supports a particular hypothesis

KEY TERMS

Null Hypothesis	It states that *there is no relationship*. The null hypothesis might state that the means of the two populations are equal.
Alternative Hypothesis	It is essentially the statement that the null hypothesis is false. The alternative hypothesis would be that the means of the two populations are not equal.
Significance Level	It is a measure of the statistical strength of the hypothesis test. It is often characterized as the probability of incorrectly concluding that the null hypothesis is false. This is a probability that is fixed in advance of making the hypothesis test. If the observed p-value is smaller than the significance level then the null hypothesis is rejected.
p - value	The p-value represents the highest significance level at which your particular test statistic would justify rejecting the null hypothesis
Critical Value	It refers to the point in the test statistic distribution that gives the tails of the distribution an area (meaning probability) exactly equal to the chosen significance level.

GENERAL PROCEDURE

1. Write down the Null and Alternate hypotheses [$H0$ and HA or $H1$], using symbols and words.

2. Decide on the significance level.

3. Look at the information given, decide which test is appropriate for the data you have.

4. Find the distribution of this statistic assuming that $H0$ is true. Give μ,σ or x, $Sn{-}1$, d.f.

5. Calculate the test statistic from the sample [and the p-value]

6. Decide if the test statistic is sufficiently unlikely. Here you can compare the p-value to the significance level OR You can compare the test statistic to the critical value.

7. Determine the outcome of the test.

EXAMPLE 1

It is believed that the normal level of testosterone in blood is normally distributed with mean 24 nmol/l and standard deviation 6 nmol/l. Following a race, a sprinter gives a sample with 34 nmol/l. Is this sufficiently different (5% significance) to suggest that the sprinter's sample is being drawn from a population with a different level of blood testosterone?

a. Write down the Null and Alternate hypotheses [$H0$ and HA or $H1$], using symbols and words.

b. Decide on the significance level.

c. Look at the information given, decide which test is appropriate for the data you have.

a. H_0 =24, the sprinters testosterone level fits the normal pattern H_A ≠24, the sprinters testosterone level does not fit the normal parameters. We have a 2-tailed test.

b. 5% significance level was given

c. We have been given the population variance, so a z-test is appropriate.

EXAMPLE 1

It is believed that the normal level of testosterone in blood is normally distributed with mean 24 nmol/l and standard deviation 6 nmol/l. Following a race, a sprinter gives a sample with 34 nmol/l. Is this sufficiently different (5% significance) to suggest that the sprinter's sample is being drawn from a population with a different level of blood testosterone?

d. Find the distribution of this statistic assuming that $H0$ is true. Give μ,σ or x, Sn−1, d.f.

d. Under $H0$,X~N(24,62)

e. Calculate the test statistic from the sample [and the p-value]

e. We know from our work with the normal distribution, 95% of results lie within 2 standard deviations of the mean [or accurately 1.96 standard deviations] This is our critical value. Our test statistic uses the z-score formula 34−24 6 =1.67 which is within the 2 SD boundary, so it is in the fail to reject zone. The p-value is the probability of a z-score greater than 1.67 and less than – 1.67 [2 tailed] which according to the calculator is 0.0956.

f. Decide if the test statistic is sufficiently unlikely. Here you can compare the p-value to the significance level OR You can compare the test statistic to the critical value.

f. This is greater than the 5% significance level so again we fail to reject the Null hypothesis.

g. Determine the outcome of the test.

g. Because our p-value of 0.0956 is greater than the significance level of 5% [OR our test statistic of 1.67 is less than the critical value of 1.96], we fail to reject the null hypothesis, the sprinters testosterone's levels is not different to the general population.

EXAMPLE 2

The reaction time in catching a falling rod is believed to be normally distributed with mean 0.9 seconds and standard deviation 0.2 seconds. Xinyi believes that her reaction times are faster than this.

a. $H_0 = 0.9$, mean catching time is 0.9 seconds, not faster

$H_A < 0.9$, the claim is faster, so less than 0.09 seconds. We have a 1-tailed test.

b. 5% significance level was given

c. We have been given the population variance, so a z-test is appropriate.

d. Under $H_0, X \sim N(0.9, 0.2^2)$

e. Inverse normal (0.95, 0, 1) = $\pm$1.645. This is our critical value.

Our test statistic uses the z-score formula $\frac{0.6-0.9}{0.2} = -1.5$ which is greater than – 1.645 , so it is in the fail to reject zone.

The p-value is the probability of a z-score less than -1.5 according to the calculator is 0.0571.

f. This is greater than the 5% significance level so again we fail to reject the Null hypothesis.

g. Because or p-value of 0.0571 is greater than the significance level of 5% [OR our test statistic of -1.5 is greater than the critical value of -1.645], we fail to reject the null hypothesis, there is no evidence that Xinyi’s reaction times are faster than the general times.

1. WRITE NULL AND ALTERNATIVE HYPOTHESES FOR EACH OF THE FOLLOWING SITUATIONS:

i. The average IQ in a school (μ) over a long period of time has been 102. It is thought that changing the menu in the cafeteria might have an effect upon the average IQ.

ii. A consumer believes that steaks sold in portions of 250g are on average underweight.

iii. A careers advisor believes that the average extra amount earned by people with a degree is more than the $150,000 figure he has been told at a seminar.

iv. The mean breaking tension of a brake cable (μ_T) does not normally exceed 3000 N. A new brand claims that it regularly does exceed this value.

v. The average time taken to match a fingerprint (μ_t) is normally more than 28 minutes. A new computer program claims to be able to do better.

2. IF IT IS OBSERVED THAT X = 10, FIND THE TEST STATISTIC AND THE P-VALUE FOR EACH OF THE FOLLOWING HYPOTHESIS, AND HENCE DECIDE THE OUTCOME OF THE HYPOTHESIS TEST AT THE 5% SIGNIFICANCE LEVEL.

$a.\ X \sim N(\mu, 5);\ H_0: \mu = 15, \quad H_A: \mu \neq 15$

b. $X \sim N(\mu, 7);\ H_0: \mu = 4, \quad H_A: \mu > 4$

$c.\ X \sim N(\mu, 400);\ H_0: \mu = 40, \quad H_A: \mu < 40$

3. FIND THE ACCEPTANCE REGION FOR EACH OF THE FOLLOWING HYPOTHESIS TESTS WHEN A SINGLE VALUE IS OBSERVED.

a. $X \sim N(\mu, 5^2)$; H_0: $\mu = 2$, H_A: $\mu \neq 2$ 5% significance

b. $X \sim N(\mu, 5^2)$; H_0: $\mu = 2$, H_A: $\mu \neq 2$. 1% significance

c. $X \sim N(\mu, 5^2)$; H_0: $\mu = 2$, H_A: $\mu > 2$. 5% significance

d. $X \sim N(\mu, 5^2)$; H_0: $\mu = 2$, H_A: $\mu < 2$. 5% significance

4. THE NULL HYPOTHESIS $\mu = 30$ IS TESTED AND A VALUE OF X = 35 IS OBSERVED. WILL IT HAVE A GREATER *P*-VALUE IF THE ALTERNATIVE HYPOTHESIS IS $\mu \neq 30$ OR $\mu > 30$?

THANK YOU

Brita Tamm
502-555-0152
brita@firstupconsultants.com
www.firstupconsultants.com