Daffodil International University

Department of Computer Science and Engineering (CSE)
Faculty of Science and Information Technology (FSIT)

Z-Test and T-Test Examples Lecture Sheet

Semester: Spring 2024
Course Code and Title: CSE315 – Introduction to Data Science
Course Teacher and Initial: Fahim Faisal (FF)
Section: 61_L

Z-Test Example

Problem: Samuel, an amusement park owner, wants guests to spend more time in the park. The average time spent by 20 guests who visit the park is estimated to be 190 minutes. Samuel decides to install new rides for increasing the average visiting time of guests. After installing the new rides, Samuel wants to verify whether the average visiting time has increased. For the test, the significance threshold is set at 5%, the sample mean is 200 minutes and the standard deviation is 200 minutes. Based on the given data, conduct a Z-Test for Samuel. For calculation, an appropriate portion of the Z-Table is given below.

Z	0.00	0.01	0.02	0.03	0.04
0.2	0.57926	0.58317	0.58706	0.59095	0.59483

Solution:

Given,

$\mu = 190$ minutes
$n = 20$
$H_0 = \mu = 190$ minutes before installing new rides
$H_a = \mu > 190$ minutes after installing new rides
$\alpha = 5\%$ or 0.05
$\bar{x} = 200$ minutes
$\sigma = 200$ minutes

We know,

$$Z = \frac{\bar{x} - \mu}{\sigma \div \sqrt{n}}$$

$$Or, Z = \frac{200 - 190}{200 \div \sqrt{20}}$$

$$Or, Z = \frac{10}{44.721360}$$

$$Or, Z = 0.223607$$

P-Value obtained for 0.223607 or 0.22 from the given Z-Table is 0.58706
Now, 0.58706 > 0.05, i.e., P-Value > α, therefore, the null hypothesis (H_0) is valid and cannot be rejected.

T-Test Example

Problem: Imagine a battery manufacturer wants to test the claim that their batteries last more than 40 hours. Using a simple random sample of 15 batteries yielded a mean of 44.9 hours, with a standard deviation of 8.9 hours. T-Test this claim using a significance level of 0.05. For calculation, an appropriate portion of the T-Table is given below.

df	0.20	0.15	0.10	0.05	0.025
14	0.868	1.076	1.345	1.761	2.145

Solution:

Given,

$\mu = 40$ hours
$n = 15$
$H_0 = \mu = 40$ hours
$H_a = \mu > 40$ hours
$\alpha = 0.05$
$\bar{x} = 44.9$ hours
$s = 8.9$ hours
$df = n - 1 = 15 - 1 = 14$

We know,

$$t = \frac{\bar{x} - \mu}{s \div \sqrt{n}}$$

$$Or, t = \frac{44.9 - 40}{8.9 \div \sqrt{15}}$$

$$Or, t = \frac{4.9}{2.297970}$$

$$Or, t = 2.132317$$

P-Value obtained for 2.132317 or 2.132 from the given T-Table is $0.025 < P < 0.05$
Now, $P < 0.05$, i.e., P-Value $< \alpha$, therefore, the null hypothesis (H_0) is invalid and can be rejected.