Hypothesis Testing - Population Mean - Lower Tailed Test

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### An automatic machine fills an aerated drink in 2000 cc bottles.

### A tester needs to test Ho that the average amount being filled in a bottle is at least 2000 cc

### He selects a random sample of 40 bottles and records the exact content of the bottles and finds the sample mean to be 1999.6 cc

### Considers the population standard deviation as 1.30 cc

### Let’s test the null hypothesis at the significance level of 5%.

### Solution

## Step 1:

### Set up null hypothesis and alternative hypothesis

### H0 = μ >= 2000 # Null Hypothesis

### H1 = μ < 2000 # Alternative Hypothesis - Lower tailed test

α = 0.05 # level of significance  
n = 40 # Sample Size

## Step 2: Compute Test Statistics

### Sample size is more than 30. So, need to calculate Z statistics

μ = 2000 # Population mean  
Xbar = 1999.6 # Sample mean  
sigma = 1.3 # Population Std Dev  
SE = sigma/sqrt(n) # Sample std deviation: 0.0422  
Z = (Xbar - μ)/SE # Z score  
Z

## [1] -1.946017

## Step 3: Compute critical value for significance level = 0.05 or Confidence Interval = 95%

Zα = qnorm(1-α, lower.tail = FALSE)  
Zα # Critical value for 95% confidence- -1.64

## [1] -1.644854

## Step 4: Compare Test statistic with critical value and conclude the test

### Decision

### if | Z |< Zα, Z is not significant and the null hypothesis may, therefore, be accepted.

### if | Z |≥ Zα, Z is significant and the null hypothesis is rejected

if ( abs(Z) <Zα){  
 print (" Z is not significant and the null hypothesis may, therefore, be accepted")  
} else {  
 print(" Z is significant and the null hypothesis is rejected")  
}

## [1] " Z is significant and the null hypothesis is rejected"

# Conclusion - Reject the Null Hypothesis