HYPOTHESIS TESTING – CRITICAL VALUE METHOD

Name: Parth Chaudhary
Roll No: BT23ECI045
Subject: Digital Image Processing

Problem Statement

A factory claims that the average lifetime of its batteries is **at least 500 hours**.
A quality control engineer selects a random sample of **36 batteries** and finds a mean lifetime of **485 hours**.
The population standard deviation is known to be **60 hours**.

At a **5% level of significance**, test the manufacturer's claim using the **critical value method**.

```
"""
Hypothesis Testing using Critical Value Method
Left-tailed Z-test

Name    : Parth Chaudhary
Roll No : BT23ECI045
Subject : Digital Image Processing
"""

PYTHON PROGRAM-

import math
from scipy.stats import norm

# Given data
mu0 = 500       # Claimed mean battery life
xbar = 485      # Sample mean
sigma = 60      # Population standard deviation
```

```
n = 36          # Sample size
alpha = 0.05    # Level of significance

# Step 1: Calculate standard error
standard_error = sigma / math.sqrt(n)

# Step 2: Calculate Z-test statistic
z_statistic = (xbar - mu0) / standard_error

# Step 3: Determine critical Z value (left-tailed test)
z_critical = norm.ppf(alpha)

# Step 4: Calculate lower critical value
lower_critical_value = mu0 + z_critical * standard_error

# Step 5: Decision rule
if xbar < lower_critical_value:
   decision = "Reject H0"
else:
   decision = "Fail to Reject H0"

# Step 6: Output results
print("HYPOTHESIS TESTING - CRITICAL VALUE METHOD\n")
print("Z-test statistic          =", round(z_statistic, 4))
print("Critical Z value          =", round(z_critical, 4))
print("Lower Critical Value (LCV) =", round(lower_critical_value, 4))
print("Decision                  =", decision)
```

Output

```
HYPOTHESIS TESTING - CRITICAL VALUE METHOD
```

```
Z-test statistic           = -1.5000
Critical Z value           = -1.6449
Lower Critical Value (LCV) = 483.5515
Decision                   = Fail to Reject H0
```

Conclusion

At the **5% level of significance**, the calculated Z-test statistic (−1.50) is greater than the critical Z value (−1.645). Hence, the test statistic does not lie in the rejection region. Therefore, there is **insufficient evidence** to conclude that the average battery life is less than 500 hours, and the manufacturer's claim that the average battery life is **at least 500 hours** is **not rejected**.