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**BT23ECE120**

**Code :**

```
import math
from scipy.stats import norm

def hypothesis_test_cv(mu, xbar, sigma, n, alpha=0.05, tail=1):
    # Standard error
    se = sigma / math.sqrt(n)

    # TWO-TAILED
    if tail == 1:
        zc = norm.ppf(1 - alpha/2)
        LCV = mu - zc * se
        UCV = mu + zc * se

        decision = (
            "Fail to Reject H0"
            if LCV <= xbar <= UCV
            else "Reject H0"
        )

        return {
            "Test": "Two-tailed",
            "z_critical": zc,
            "LCV": LCV,
            "UCV": UCV,
            "xbar": xbar,
            "Decision": decision
        }

    # RIGHT-TAILED
    elif tail == 2:
        zc = norm.ppf(1 - alpha)
        UCV = mu + zc * se

        decision = (
            "Fail to Reject H0"
            if xbar <= UCV
            else "Reject H0"
        )
```

```

    )

    return {
        "Test": "Right-tailed",
        "z_critical": zc,
        "UCV": UCV,
        "xbar": xbar,
        "Decision": decision
    }

# LEFT-TAILED
elif tail == 3:
    zc = norm.ppf(1 - alpha)
    LCV = mu - zc * se

    decision = (
        "Fail to Reject H0"
        if xbar >= LCV
        else "Reject H0"
    )

    return {
        "Test": "Left-tailed",
        "z_critical": zc,
        "LCV": LCV,
        "xbar": xbar,
        "Decision": decision
    }

else:
    raise ValueError("tail must be 1 (two), 2 (right), or 3 (left)")

# Example: Critical Value Test

# Suppose we have:
# Population mean  $\mu_0 = 50$ 
# Population std  $\sigma = 5$ 
# Sample mean  $\bar{x} = 52$ 
# Sample size  $n = 25$ 
# Significance level  $\alpha = 0.05$ 
# Two-tailed test ( $H_1: \mu \neq \mu_0$ )

mu = 50
xbar = 52

```

```
sigma = 5
n = 25
alpha = 0.05
tail = 1 # Two-tailed

result = hypothesis_test_cv(mu, xbar, sigma, n, alpha, tail)

print("Hypothesis Testing using Critical Value Method\n")
for k, v in result.items():
    print(f"{k}: {v}")
```

**Output :**

```
Hypothesis Testing using Critical Value Method

Test: Two-tailed
z_critical: 1.959963984540054
LCV: 48.04003601545995
UCV: 51.95996398454005
xbar: 52
Decision: Reject H0
```