# Quiz Solution - BSDSF22A

## Question 1: Paired T-Test on Productivity

To conduct a paired t-test, calculate the differences between 'After' and 'Before' values:

d\_i = After\_i - Before\_i

Mean of differences (d̄): d̄ = Σd / n

Standard deviation of differences (s): s = sqrt[ Σ(di - d̄)² / (n - 1) ]

t-Statistic: t = d̄ / (s / sqrt(n))

Before data: [30, 35, 40, 42, 38, 41, 36]

After data: [33, 37, 42, 45, 41, 44, 40]

Differences (After - Before): [3, 2, 2, 3, 3, 3, 4]

Mean of differences: 2.857142857142857

Standard deviation of differences: 0.6900655593423543

Sample size (n): 7

t-Statistic: 10.95445115010332

p-Value: 3.436402807612153e-05

Conclusion: Reject the null hypothesis. There is a significant difference.

## Question 2: PDF Validation and Probability Calculation

Given PDF: f(x) = 3x² for 0 ≤ x ≤ 1

To validate, ensure that ∫(0 to 1) f(x) dx = 1:

∫(0 to 1) 3x² dx = [x³] from 0 to 1 = 1. This confirms f(x) is a valid PDF.

Calculate P(0.4 ≤ X ≤ 0.9):

P(a ≤ X ≤ b) = ∫(a to b) f(x) dx = [x³] from a to b

P(0.4 ≤ X ≤ 0.9) = (0.9)³ - (0.4)³ = 0.6650

## Question 3: Hypothesis Test for Mean Sodium Content

t-Statistic Formula:

t = (x̄ - μ) / (s / sqrt(n))

Here, x̄ = 220.0, μ = 220, s = 1.8586407545691703, n = 12

Calculated t = 0.0000, p-Value = 1.0000

Conclusion: Fail to reject the null hypothesis.

## Question 4: Uniform Distribution CDF and Probability

For uniform distribution over [a, b], CDF F(x) is given by:

F(x) = (x - a) / (b - a), for a ≤ x ≤ b

With a = 0 and b = 5, to find P(2 ≤ X ≤ 4):

P(2 ≤ X ≤ 4) = F(4) - F(2) = [(4 - a) / (b - a)] - [(2 - a) / (b - a)]

Result: P(2 ≤ X ≤ 4) = 0.4

## Question 5: Proportion Hypothesis Test for Voter Support

Z-Statistic Formula for Proportion:

Z = (p̂ - p₀) / sqrt[(p₀(1 - p₀)) / n]

With p̂ = 0.6333333333333333, p₀ = 0.7, n = 150

Calculated Z = -1.7817, p-Value = 0.0748

Conclusion: Fail to reject the null hypothesis.