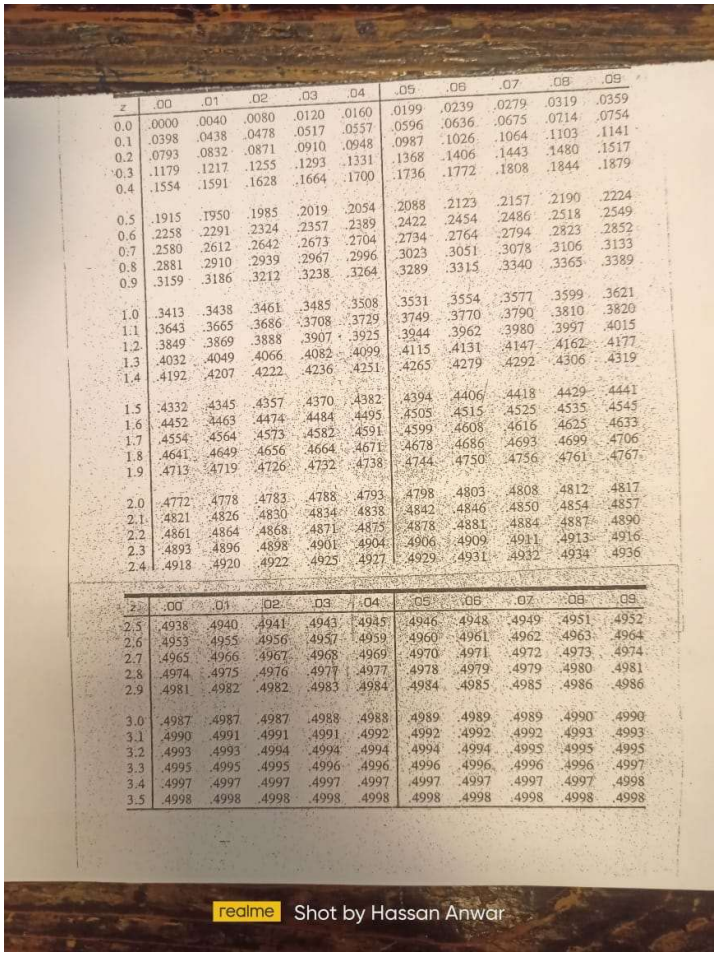
Task1

Probability Distributions

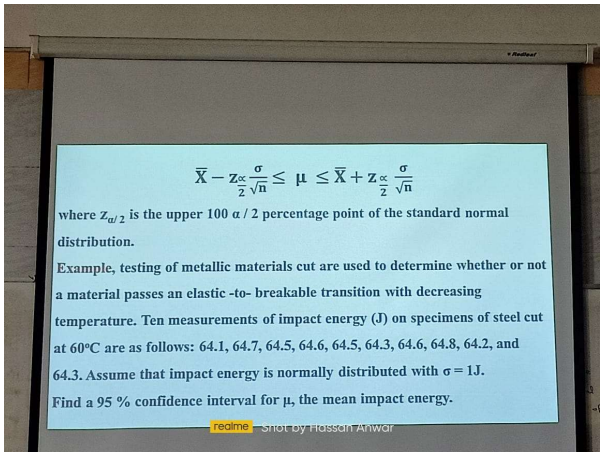
Discrete Distribution	Continuous Distribution
1. Binomial Distribution: Quality Control 2. Geometric Distribution: Insurance Claims 3. Poisson Distribution: Customer Arrivals 4. Uniform Distribution: Random Number Generation 5. Bernoulli Distribution: Success or Failure Trials	1. Normal Distribution: Heights of Adults 2. Student's t-Distribution: Hypothesis Testing 3. Chi-Squared Distribution: Goodness-of-Fit Test 4. Exponential Distribution: Product Lifetimes 5. Logistic Distribution: Population Growth

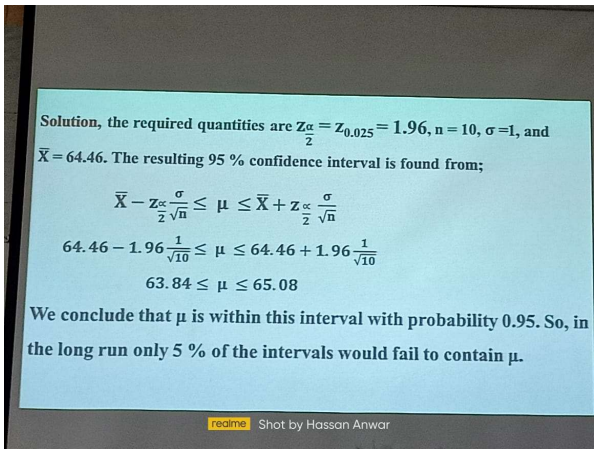
Task2

Z Squares



Task3





Task4

Statistical Tests

1. T-Test:
- Purpose: Used to compare means between two groups to determine if there is a significant difference.
- Variants: Independent samples t-test, paired samples t-test.

2. Chi-Squared Test:
- Purpose: Used to determine if there is a significant association between two categorical variables.
- Variants: Pearson's chi-squared test, Fisher's exact test.

3. Analysis of Variance (ANOVA):
- Purpose: Used to compare means across multiple groups to determine if there is a significant difference.
- Variants: One-way ANOVA, factorial ANOVA.

4. Mann-Whitney U Test:
- Purpose: Used to compare the medians between two independent groups when the assumption of normality is violated.
- Variants: Wilcoxon rank-sum test.

5. Kruskal-Wallis Test:
- Purpose: Used to compare the medians across multiple independent groups when the assumption of normality is violated.
- Variants: Friedman test (non-parametric equivalent of repeated measures ANOVA).

6. Regression Analysis:
- Purpose: Used to determine the relationship between variables and make predictions.
- Variants: Linear regression, logistic regression, multiple regression, etc.

7. Mann-Kendall Test:
- Purpose: Used to detect trends in time series data and determine if there is a significant upward or downward trend.

8. Wilcoxon Signed-Rank Test:
- Purpose: Used to compare two related samples and determine if there is a significant difference between them.

9. Fisher's Exact Test:
- Purpose: Used to determine if there is a significant association between two categorical variables in a 2x2 contingency table when the sample size is small.

10. Kolmogorov-Smirnov Test:
- Purpose: Used to test the goodness of fit between a sample and a hypothesized distribution.

Task5

Mathematical Proofs

1. Direct Proof
2. Proof by Contradiction
3. Proof by Contrapositive
4. Proof by Mathematical Induction
5. Proof by Exhaustion
6. Proof by Counterexample

Task6

These are the important uses of differentiation and integration in various fields.

Differentiation:

1. Rates of Change: Determines the rate of change of quantities in physics, biology, finance, and other fields.

2. Optimization: Helps find maximum or minimum values of functions in various applications.

3. Tangent Lines and Approximations: Provides tangent lines and approximations for curves in physics, engineering, and computer graphics.

4. Signal Processing: Analyzes and filters signals to identify changes and spikes.

5. Economics and Business: Calculates marginal cost, marginal revenue, and optimizes production processes.

Integration:

1. Area and Volume Calculations: Calculates areas, volumes, and surface areas of irregular shapes in engineering, architecture, and physics.

2. Accumulation and Total Value: Measures total distance traveled, total cost, or total revenue over time.

3. Probability and Statistics: Computes probabilities, expected values, and confidence intervals.

4. Physics and Engineering: Solves problems related to work, energy, fluid mechanics, and electrical circuits.

5. Economics and Finance: Models economic quantities, evaluates economic indicators, and computes present and future values.