University of Information Technology and Sciences

Lab Test 1 (Set A) [7B1]

Course Title: Simulation & Modeling Lab

Course Code: CSE 413 (Autumn 25)

Course Teacher: Audity Ghosh

Marks: 15 x 1 = 15 **Time: 30 minutes**

A study compared **reaction times (in milliseconds)** of two groups:

- **Group M (Experienced Gamers)**
- **Group N (Non-Gamers)**

Group M: 245, 238, 252, 247, 241, 243, 236, 249, 251, 240, 244, 237, 246, 248, 239, 242, 253, 250, 243, 247

Group N: 268, 272, 265, 270, 269, 274, 267, 271, 266, 268, 275, 269, 264, 273, 270, 272, 268, 266, 271, 267

1. Descriptive Statistics (2)

- Compute the mean, variance, and standard deviation of reaction times for both groups.
- Comment on the similarity/difference of variances (is pooled t-test appropriate?).

2. Data Visualization (2)

- Plot **histograms** for both groups to visually compare reaction time distributions.
- Highlight group differences with mean lines on the histograms.

3. Random Number Generation (3)

- Assume both groups follow normal distributions with their sample means and standard deviations.
- Generate 100 random reaction times per group using np.random.normal.
- Plot side-by-side histograms of simulated vs. original data for both groups.

5. Hypothesis Testing (Pooled t-test) (4)

- State the null and alternative hypothesis.
- Perform a pooled t-test: calculate pooled variance, t-statistic, degrees of freedom, p-value.
- Report whether to reject H_0 at $\alpha=0.05$ (why or why not).
- Provide a **visualization of group means with 95% confidence intervals**.

6. Unique Personalization (4)

- Adjust Group N's data by **adding**: {last two digits of your Student_ID} mod 5) to each value.
- Re-run the pooled t-test with the personalized dataset.
- Report whether your personal dataset changes the conclusion.

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Lab Test 1 (Set A) [7B2]

Course Title: Simulation & Modeling Lab

Course Code: CSE 413 (Autumn 25)

Course Teacher: Audity Ghosh

Marks: 15 x 1 = 15 **Time: 30 minutes**

A company measured the time (in minutes) that 25 different employees take to complete a standardized customer support ticket. They collected data from two departments:

Dept A (Remote Support): 12.5, 13.0, 11.8, 12.1, 13.4, 12.9, 13.2, 11.9, 12.6, 13.3, 12.0, 12.4, 13.1, 12.2, 12.7, 13.0, 12.8, 11.7, 12.3, 13.5, 12.5, 13.1, 12.6, 11.9, 13.2
Dept B (On-Site Support): 14.2, 14.8, 15.0, 13.9, 14.5, 14.7, 14.0, 13.8, 14.4, 14.9, 15.2, 13.7, 14.3, 14.6, 15.1, 14.1, 14.8, 15.0, 14.2, 14.6, 14.3, 14.7, 15.0, 14.4, 14.1

1. Descriptive Statistics (2 marks)

- Compute the mean, variance, and standard deviation for both departments.
- Comment on which department shows greater consistency in ticket completion time.

2. Data Visualization (2 marks)

- Plot histograms for both departments with mean lines shown.
- Comment on distribution shape and performance trend.

3. Monte Carlo Simulation (3 marks)

- Simulate 100,000 ticket completion times using np.random.normal(mean_A, std_A, 100000)
- Estimate the probability P(Time<12)

4. Hypothesis Testing (Pooled t-test) (4 marks)

- State the null and alternative hypotheses.
- Perform pooled t-test: Calculate Pooled variance, t-statistic, Degrees of freedom, p-value
- Decide whether to reject H_0 at $\alpha=0.05$ and justify.
- Include a mean comparison plot with 95% confidence intervals.

5. Unique Personalization (4 marks)

- Modify Dept B's data by adding:{Last digit of your Student_ID} mod 4 to each value.
- Recalculate pooled t-test using modified data.
- Report if the conclusion changed. Briefly explain why or why not the test result was affected.

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Lab Test 1 (Set A) [7A1]

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Marks: 15 x 1 = 15 **Time: 30 minutes**

Student_ID	Exam_Score
1	93
2	83
3	69
4	62
5	75
6	93
7	73
8	77
9	65
10	65
11	78
12	90
13	94
14	78
15	57
16	76
17	56
18	78
19	84
20	92

1. **Basic Stats**
    - Compute mean, variance, and standard deviation of scores.
    - Compare population variance vs. sample variance.
2. **Random Number Generation**

- Generate a random dataset of 20 exam scores using np.random.normal with μ = mean(scores), σ = std(scores).
- Plot both the real and generated data in histograms (side by side).

3. **Monte Carlo Simulation**
    - Estimate the probability that a random student scores ≥ 75 using **simulation with 100,000 samples** from the fitted normal distribution.
4. **Hypothesis Testing**
    - Test the null hypothesis: “The average exam score is your (last 3 digits of ID % 50) + 50.” (one-sample t-test).
    - Report p-value and conclusion with visualization and your unique interpretation.

University of Information Technology and Sciences

Lab Test 1 (Set A) [7A2]

Course Title: Simulation & Modeling Lab

Course Code: CSE 413 (Autumn 25)

Course Teacher: Audity Ghosh

Marks: 15 x 1 = 15 **Time: 30 minutes**

Customer_ID	Daily_Arrivals
1	8
2	12
3	10
4	15
5	9
6	13
7	11
8	14
9	7
10	16
11	10
12	12
13	9
14	15
15	11
16	13
17	14
18	8
19	12
20	10

1. Basic Statistics

- Compute the **mean, variance, and standard deviation** of daily customer arrivals.
- Compare **population variance vs. sample variance** and explain the difference.

2. Random Number Generation

- Assume **customer arrivals follow a uniform distribution**. Generate a **simulated dataset of 30 days** Plot **both the real and simulated data** in **side-by-side histograms** for comparison.

3. Monte Carlo Simulation

- Using **Monte Carlo simulation**, estimate the probability that **more than 15 customers arrive** on a given day. Use **100,000 simulated samples** from the uniform distribution.

4. Hypothesis Testing

- **Calculate your unique hypothesized mean** for the t-test using your Student ID:

\text{Hypothesized Mean} = (\text{last 3 digits of your Student_ID} \mod 10) + 10

- Test the null hypothesis: "The mean daily customer arrival is equal to your personalized hypothesized mean." Use a **one-sample t-test** and report the **t-statistic, p-value, and conclusion**.

- Include a **visualization** comparing your sample mean and hypothesized mean.

- Provide your **unique interpretation** of the result in context.