# Laboratory Works

# Chapter 1: Sampling Distribution and Estimation

Project 1.1 For Ungrouped Data

Enter the following values in SPSS and calculate mean, s.d, ranges, mode, median

Weights: 25, 35, 45, 55, 65, 75

Solution:

1. Enter the data in data editor window.
2. Select **Analyze** → **Descriptive statistics** → **Descriptives**
3. Click the **Descriptives** → Move **Midvalue** into **Variable(s)**.
4. Click the **Option**. Seclect **Mean, s.d, ranges, mode, median**
5. Click **Ok**

Project 1.2  For grouped Data

Enter the following values in SPSS and calculate mean, s.d, ranges, mode, median

| Weight | Midvalue | Frequency |
|---|---|---|
| 20-30 | 25 | 4 |
| 30-40 | 35 | 6 |
| 40-50 | 45 | 7 |
| 50-60 | 55 | 21 |
| 60-70 | 65 | 23 |
| 70-80 | 75 | 2 |

Solution:

1. Enter the **Data Editor Window.**
2. Seclect **Data** ⟶ **Weight Cases.**
3. Move **Frequency** into **Frequency Variable.**
4. Click **Ok**. Seclect **Analyze** ⟶ **Descriptive statistics** ⟶ **Frequencies**
5. Click the **frequencies** ⟶ Move **Midvalue** into **Variable(s)**
6. Click the **Statistics**. Seclect **Mean.**
7. Click **Continue**. Click **Ok.**

Project1.3
Enter the following values in SPSS

| Weight | Midvalue | Frequency |
|---|---|---|
| 20-30 | 25 | 4 |
| 30-40 | 35 | 6 |
| 40-50 | 45 | 7 |
| 50-60 | 55 | 21 |
| 60-70 | 65 | 23 |
| 70-80 | 75 | 2 |

**Solution**: In this task, we will create four type of variables: Numeric, date, string and binary.

1. Click the **Type in data tab** .
2. Click the **Variable View** tab at the bottom of the window.
3. with the cursor in the Name column on the first row type: **Weight**, on the second row type: **Midvalue**, on the third row type: **Frequency.**
4. In the Type column, click the **Numeric** to open the Variable Type dialog box.
5. Select (Click) **String.**
6. Click **Ok.**
7. Press tab or Enter three times to move to **label column**.
8. Type “The weight of 63 students of a school”.
9. Click the **Data View** tab at the bottom of the window.
10. Enter the values as follows. Then save file.

Project 1.4 Confidence Interval for Population Mean $\mu$,($\sigma^2$ Unknown and large n)

Enter the following values in SPSS and create a confidence interval assuming normal distribution:

**Length:** 125, 120, 121, 123, 122, 130, 124, 122, 120, 122, 118, 119, 123, 124, 122, 124, 121, 122, 138, 149, 123, 128, 122, 130, 120, 122, 124, 134, 137, 128, 122, 121, 125, 120, 132, 130, 128, 130, 122, 124.

Solution:

1. Enter the data.
2. Seclect Analyze ⟶ Compare Means ⟶ One sample T test.
3. Click Options ⟶ Type % (90, 95, 99)confidence interval
4. Click on Continue and then Click OK.

# Chapter 2: Testing of Hypothesis

Project 2.1 Confidence Interval for Population Mean μ,($\sigma^2$ Unknown and large n)

The following values are the lengths of 40 steel rods selected for lab test from a factory.

**Length:** 125, 120, 121, 123, 122, 130, 124, 122, 120, 122, 118, 119, 123, 124, 122, 124, 121, 122, 138, 149, 123, 128, 122, 130, 120, 122, 124, 134, 137, 128, 122, 121, 125, 120, 132, 130, 128, 130, 122, 124.

Test Wether this sample of size 40 has come from a population whose mean length is 125 cm.

Solution: We wish to test the hypothesis that the samples differs significantly from a hypothesized population mean height of 125 cm. So we have

$$H_0 : \mu = 125 \quad \text{Versus } H_1 : \mu \neq 125$$

1. Enter the data in the data editor.
2. Select Analyze ⟶ Compare Means ⟶ One sample T test . Type in Test Value box.
3. Click Options ⟶ Type 95 in confidence interval percentages box.
4. Click on Continue and then Ok.

test statistic (t) = .....

p- value of test statistics (sig. (2-tailed)) = ..... and compare with α

If $P > \alpha$ accept $H_0$

Project 2.2 **Hypothesis Testing between two population Means for Matched Paired Samples**

The sales of a product of a company after and before advertisement are as follows:

Is advertisement effective at 5 % ?

| Month | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Before X | 120 | 140 | 160 | 140 | 180 | 190 |
| After Y | 200 | 210 | 150 | 200 | 220 | 240 |

Solution: Hypothesis, $H_0 : \mu_x = \mu_y$ versus $H_1 : \mu_x < \mu_y$

1. Enter the data into Data Editor
2. Select Analyze ⟶ Compare Means ⟶ Paired- Samples T test .
3. Click Options ⟶ Continue ⟶ Ok

Project 2.3 **Hypothesis Testing When raw data for Independent Samples is given**

The monthely advertising cost of a company for two products X and Y were as follows during 6 month period:

Is there sufficient evidence to conclude that average cost on adverstising on product Y is more than on product X.

| Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Cost I (X) | 220 | 240 | 160 | 240 | 280 | 290 | - |
| Cost II (Y) | 100 | 110 | 150 | 100 | 120 | 140 | 145 |

Solutions :

$H_0 : \mu_1 = \mu_2$ vs $H_1 : \mu_1 < \mu_2$

1. Enter the data into Data editor.
2. Select Analyze ⟶ Compare means ⟶ Independent samples T Test
3. Move value into Test variable(s) and type into grouping variable
4. Click Define groups and type 1 and 2 into group 2
5. Click Options ⟶ Continue ⟶ Ok.

# Chapter 3: Nonparametric Test

## 3.1 Run Test

In 30 toss of a coin the following sequence of heads (H) and tail (T) is obtained.

H T T H T H H H T H H T T H T H T H H T H T T H T H H T H T

Test at 0.05 level of significance level whether the sequence is random.

Solutions:

$H_0$ : Sample Observation is random.

$H_1$ : Sample Observation is not random.

1.Enter the data in data editor window.

2. Analyze/ Nonparametric test / Legacy Dialogs / Runs

3. Click Options Select Descriptive and continue

4. Click OK

Conclusion : P value (Sig. (2-tailed)) > α Accept $H_0$

**Project 3.2 Binomial Test**

Test whether the coin is unbiased from following observations.

Tail Tail Head Head Tail Head Tail Head Head Tail

Head Head Head Tail Head Head Head Head Head Head

Tail Tail Tail Tail Head Tail Tail Tail Tail Tail

Tail Tail Head Tail Tail Tail Head Tail Tail Tail

Tail Head Tail Tail Head Tail Head Tail Tail Tail

**Solutions:**

$H_0 : P = P_0 = \frac{1}{2}$ vs $H_1 : P_0 \neq \frac{1}{2}$

1.Enter the data in data editor window.

2. Analyze/ Nonparametric test / Legacy Dialogs / Binomial test

3. Click Options Select Descriptive and continue

4. Click OK

If p - value > $\alpha$ then accept $H_0$

**Project 3.3 One samples K-S test**

The number of disease infected tomato plants in 10 different plots of equal size are given below. Test whether the disease infected plants are uniformly distributed over the entire area use Kolmogrov Smirnov Test.

| Plot no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| No. of infected plants | 8 | 10 | 9 | 12 | 15 | 7 | 5 | 12 | 13 | 9 |

Solutions:

$H_0$ : The disease infected plants are uniformly distributed over the entire area.

$H_1$ : The disease infected plants are not uniformly distributed over the entire area.

1. Start the SPSS program. In the Data editor window, type in the data
2. Select Analyze ⟶ Nonparametric tests ⟶ Legacy Dialogs ⟶ 1-Samples K-S
3. Move X into Test Variable List. Then, Click OK

Conclusion : P value (Sig. (2-tailed)) > α  Accept $H_0$