Certainly! Let's go through examples of formulating hypothesis statements, conducting hypothesis tests, and understanding concepts like Type-I and Type-II errors, P-value, Level of Significance, as well as examples of parametric and non-parametric tests using Python and its libraries.

1. Formulating a Hypothesis Statement:

Example:

Suppose we want to test whether the mean value of a population is equal to 30.

Null Hypothesis (H0): The population mean is equal to 30. $H_0: \mu = 30$

Alternate Hypothesis (H1): The population mean is not equal to 30. $H_1: \mu \neq 30$

2. Type-I and Type-II Errors, P-Value, Level of Significance:

```
pythonCopy code
import numpy as np from scipy.stats import ttest_1samp # Generate sample data
np.random.seed(42) data = np.random.normal(loc=29.5, scale=5, size=100) # Perform one-sample t-
test t_stat, p_value = ttest_1samp(data, popmean=30) # Define the significance level (alpha) alpha =
0.05 # Check for Type-I error (rejecting a true null hypothesis) if p_value < alpha: print("Reject the null
hypothesis (Type-I error may have occurred).") else: print("Fail to reject the null hypothesis.") # Check
for Type-II error (failing to reject a false null hypothesis) beta = 1 - power if beta < alpha: print("Fail to
reject the null hypothesis (Type-II error may have occurred).") else: print("Reject the null
hypothesis.")
```

3. Parametric Tests: One Sample T Test:

```
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from scipy.stats import ttest_1samp # Generate sample data np.random.seed(42) data =
np.random.normal(loc=29.5, scale=5, size=100) # Perform one-sample t-test t_stat, p_value =
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p_value < alpha: print("Reject the null hypothesis.") else: print("Fail to reject the null hypothesis.")
```

4. Parametric Tests: Two Samples T Test:

```
pythonCopy code
from scipy.stats import ttest_ind # Generate two sets of sample data np.random.seed(42) data1 =
np.random.normal(loc=30, scale=5, size=100) data2 = np.random.normal(loc=35, scale=5, size=100)
# Perform two-sample t-test t_stat, p_value = ttest_ind(data1, data2) # Check the p-value against the
significance level alpha = 0.05 if p_value < alpha: print("Reject the null hypothesis.") else: print("Fail
to reject the null hypothesis.")
```

5. Parametric Tests: Paired T Test:

```
pythonCopy code
from scipy.stats import ttest_rel # Generate paired sample data np.random.seed(42) before = np.random.normal(loc=30, scale=5, size=100) after = before + np.random.normal(loc=2, scale=1, size=100) # Perform paired t-test t_stat, p_value = ttest_rel(before, after) # Check the p-value against the significance level alpha = 0.05 if p_value < alpha: print("Reject the null hypothesis.") else: print("Fail to reject the null hypothesis.")
```

6. Parametric Tests: One-Way ANOVA:

```
pythonCopy code
from scipy.stats import f_oneway # Generate three sets of sample data np.random.seed(42) group1 = np.random.normal(loc=30, scale=5, size=100) group2 = np.random.normal(loc=35, scale=5, size=100) group3 = np.random.normal(loc=40, scale=5, size=100) # Perform one-way ANOVA f_stat, p_value = f_oneway(group1, group2, group3) # Check the p-value against the significance level alpha = 0.05 if p_value < alpha: print("Reject the null hypothesis.") else: print("Fail to reject the null hypothesis.")
```

7. Parametric Tests: Chi-Squared Test:

```
pythonCopy code
from scipy.stats import chi2_contingency # Create a contingency table observed = np.array([[30, 20], [15, 25]]) # Perform chi-squared test chi2_stat, p_value, dof, expected = chi2_contingency(observed) # Check the p-value against the significance level alpha = 0.05 if p_value < alpha: print("Reject the null hypothesis.") else: print("Fail to reject the null hypothesis.")
```

8. Non-Parametric Tests: One Sample Sign Test:

```
pythonCopy code
from scipy.stats import wilcoxon # Generate paired sample data np.random.seed(42) before = np.random.normal(loc=30, scale=5, size=100) after = before + np.random.normal(loc=2, scale=1, size=100) # Perform one sample sign test stat, p_value = wilcoxon(before - after) # Check the p-value against the significance level alpha = 0.05 if p_value < alpha: print("Reject the null hypothesis.") else: print("Fail to reject the null hypothesis.")
```

9. Non-Parametric Tests: Mann-Whitney Test:

```
pythonCopy code
from scipy.stats import mannwhitneyu # Generate two sets of sample data np.random.seed(42) data1 = np.random.normal(loc=30, scale=5, size=100) data2 = np.random.normal(loc=35, scale=5, size=100) # Perform Mann-Whitney U test stat, p_value = mannwhitneyu(data1, data2) # Check the p-value against the significance level alpha = 0.05 if p_value < alpha: print("Reject the null hypothesis.") else: print("Fail to reject the null hypothesis.")
```

10. Non-Parametric Tests: Kruskal-Wallis Test:

```
pythonCopy code
from scipy.stats import kruskal # Generate three sets of sample data np.random.seed(42) group1 = np.random.normal(loc=30, scale=5, size=100) group2 = np.random.normal(loc=35, scale=5, size=100) group3 = np.random.normal(loc=4
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Certainly! Let's go through examples of formulating hypothesis statements, conducting hypothesis tests, and understanding concepts like Type-I and Type-II errors, P-value, Level of Significance, as well as examples of parametric and non-parametric tests using Python and its libraries.

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```
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```

These examples demonstrate how to formulate hypothesis statements, conduct hypothesis tests, and interpret results using Python and its libraries, particularly SciPy. Customize the code as needed for your specific use case and data

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