Hypothesis Testing (Z-Test):

Question: Suppose you work at a chocolate factory and you're responsible for ensuring the quality of chocolate bars. The company claims that the average weight of their chocolate bars is 100 grams with a standard deviation of 5 grams. You suspect that the actual average weight might be different. To test this, you collect a sample of 25 chocolate bars and find that their average weight is 98 grams. Perform a Z-test to determine if there's a significant difference between the sample mean and the claimed population mean.

```python
In [1]: import numpy as np
        from scipy import stats
        from statsmodels.stats import weightstats as states
        import warnings
        warnings.filterwarnings('ignore')
```

```python
In [2]: sample_mean= 98
        pop_std_deviation= 5
        pop_mean= 100
        sample_size_n= 25
        sample_data = np.random.normal(loc=sample_mean, scale=pop_std_deviation, size=sample_size_n)
```

```python
In [3]: np.mean(sample_data)
```

Out[3]: 98.29756134782616

```python
In [4]: z= (sample_mean-pop_mean)/(pop_std_deviation/np.sqrt(sample_size_n))
```

```python
In [5]: z
```

Out[5]: -2.0

```
In [28]: z_statistic, p_value= states.ztest(sample_data,value=pop_mean,ddof=0,alternative='two-sided')
```

```
In [29]: z_statistic, (p_value).round(5)
```

Out[29]: (-1.8095823983644386, 0.07036)

```
In [8]: # Accept And Reject H0 by P_value And significance level
        if p_value > 0.05:
            print('Test Successfully completed.Result:Null Hypothesis Accepted')
        else:
            print('Test Successfully completed.Result:Null Hypothesis Rejected')
```

Test Successfully completed.Result:Null Hypothesis Accepted

Question: The manufacturer of a smartphone claims that the average battery life of their latest model is 28 hours with a standard deviation of 2 hours. A consumer organization tests 40 randomly selected smartphones and finds that their average battery life is 27 hours. Perform a Z-test at a 5% significance level to determine if there's a significant difference between the consumer organization's findings and the manufacturer's claim.

```
In [9]: sample_mean= 27
        pop_std_deviation= 2
        pop_mean= 28
        sample_size_n= 40
        sample_data = np.random.normal(loc=sample_mean, scale=pop_std_deviation, size=sample_size_n)
```

```
In [10]: z= (sample_mean-pop_mean)/(pop_std_deviation/np.sqrt(sample_size_n))
```

```
In [11]: z
```

Out[11]: -3.162277660168379

```
In [12]: z_statistic, p_value= states.ztest(sample_data,value=pop_mean,ddof=0,alternative='smaller')
```

```
In [13]: z_statistic,p_value
```

Out[13]: (-2.6085644853223227, 0.004546143932439909)

```
In [14]:   # Accept And Reject H0 by P_value And significance level
           if p_value > 0.05:
               print('Test Successfully completed.Result:Null Hypothesis Accepted')
           else:
               print('Test Successfully completed.Result:Null Hypothesis Rejected')
```

```
Test Successfully completed.Result:Null Hypothesis Rejected
```

Question: A clothing retailer wants to test if a new line of T-shirts has a different average length compared to their standard T-shirts. The average length of their standard T-shirts is 29 inches with a standard deviation of 1.5 inches. They measure 30 T-shirts from the new line and find that their average length is 28.5 inches. Conduct a Z-test at a 5% significance level to determine if there's a significant difference in average length between the two types of T-shirts.

```
In [15]:   sample_mean= 28.5
           pop_std_deviation=1.5
           pop_mean= 29
           sample_size_n= 30
           sample_data = np.random.normal(loc=sample_mean, scale=pop_std_deviation, size=sample_size_n)
```

```
In [16]:   z_score= (sample_mean-pop_mean)/(pop_std_deviation/np.sqrt(sample_size_n))
           z_score
```

```
Out[16]:   -1.8257418583505538
```

```
In [17]:   z_statistic,p_value=states.ztest(x1= sample_data,value= pop_mean,ddof=1, alternative='two-sided')
```

```
In [18]:   z_statistic,p_value
```

```
Out[18]:   (-1.7791670826320334, 0.07521237333009302)
```

```
In [19]:   # Accept And Reject H0 by P_value And significance level
           if p_value > 0.05:
               print('Test Successfully completed.Result:Null Hypothesis Accepted')
           else:
               print('Test Successfully completed.Result:Null Hypothesis Rejected')
```

```
Test Successfully completed.Result:Null Hypothesis Accepted
```