```
import numpy as np
import scipy.stats as stats
```

Q1. Suppose an automobile battery manufacturer claims that the mean lifetime of their battery is 60 months

with a standard deviation of 6 months. Suppose the distribution of battery life is approximately normal.

Find the probability that the mean lifetime of 40 randomly sampled batteries will be less than 58 months.

```
mean_lifetime = 60
std_dev = 6
n = 40
sample_mean = 58
se = std_dev / np.sqrt(n)
z = (sample_mean - mean_lifetime) / se
probability = stats.norm.cdf(z)
print(f"Q1: The probability that the mean lifetime of 40 randomly sampled batteries is l
print("\n")
```

```
Q1: The probability that the mean lifetime of 40 randomly sampled batteries is less
```

Q2. A random sample of 40 households was selected, and the number of kilowatt-hours (kWh) was recorded.

The average usage was 310 kWh with a standard deviation of 89 kWh. Provide an expression for calculating

a 95% confidence interval for the mean usage in the first quarter of 2019.

```
n = 40
mean_usage = 310
std_dev_usage = 89
confidence_level = 0.95
```

```
se_usage = std_dev_usage / np.sqrt(n)
z_critical = stats.norm.ppf(1 - (1 - confidence_level) / 2)
margin_of_error = z_critical * se_usage
confidence_interval = (mean_usage - margin_of_error, mean_usage + margin_of_error)
print(f"Q2: The 95% confidence interval for the mean usage is: {confidence_interval}")
print("\n")
```

```
Q2: The 95% confidence interval for the mean usage is: (282.419121062447, 337.58087
```

Q3. A manager of a Chinese restaurant wants to determine whether the mean waiting time to place an order

has changed in the past month from its previous population mean value of 4.5 minutes.

Null hypothesis (H0): The mean waiting time is 4.5 minutes.

Alternative hypothesis (H1): The mean waiting time is different from 4.5 minutes (two-tailed test).

```
population_mean = 4.5
sample_mean = 5.0
std_dev_waiting_time = 1.2
n = 50
alpha = 0.05
se_waiting_time = std_dev_waiting_time / np.sqrt(n)
z_stat_waiting_time = (sample_mean - population_mean) / se_waiting_time
p_value_waiting_time = 2 * (1 - stats.norm.cdf(abs(z_stat_waiting_time)))
print(f"Q3: The z-statistic is {z_stat_waiting_time:.4f}, and the p-value is {p_value_w

if p_value_waiting_time < alpha:
    print("Conclusion: Reject the null hypothesis. The mean waiting time has changed.")
else:
    print("Conclusion: Fail to reject the null hypothesis. There is no sufficient evide
```

```
Q3: The z-statistic is 2.9463, and the p-value is 0.0032
Conclusion: Reject the null hypothesis. The mean waiting time has changed.
```

Q4. What is the p-value in a two-tailed z-test for one sample, where the computed test statistic (z-stat) is equal to +2.00?

```
z_stat = 2.00
p_value_q4 = 2 * (1 - stats.norm.cdf(abs(z_stat)))
```

```
print(f"Q4: The p-value for a two-tailed z-test with z-stat of +2.00 is: {p_value_q4:.4
print("\n")
```

```
Q4: The p-value for a two-tailed z-test with z-stat of +2.00 is: 0.0455
```

Q5. Samy, the product manager of K2 Jeans, wants to launch a product line into a new market area.

A survey of a random sample of 400 households showed a mean income per household of 30000 rupees,

with a standard deviation of 8000 rupees. Samy believes the product will be profitable only if the mean household income

is greater than 29000 rupees. Perform statistical analysis and draw a conclusion at a 5% significance level.

Double-click (or enter) to edit

```
sample_size_q5 = 400
sample_mean_q5 = 30000
population_mean_q5 = 29000
std_dev_q5 = 8000
alpha = 0.05
se_q5 = std_dev_q5 / np.sqrt(sample_size_q5)
z_stat_q5 = (sample_mean_q5 - population_mean_q5) / se_q5
p_value_q5 = 1 - stats.norm.cdf(z_stat_q5)

print(f"Q5: The z-statistic is {z_stat_q5:.4f}, and the p-value is {p_value_q5:.4f}")

if p_value_q5 < alpha:
    print("Conclusion: Reject the null hypothesis. Samy should launch the product line
else:
    print("Conclusion: Fail to reject the null hypothesis. Samy should not launch the p
```

```
Q5: The z-statistic is 2.5000, and the p-value is 0.0062
Conclusion: Reject the null hypothesis. Samy should launch the product line in this
```

Start coding or generate with AI.