IMPORTING LIBRARIES

In [2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import scipy.stats as stats
```

Step2 : Create the Dataset

In [4]:
```
np.random.seed(42)
data={
    'product_id':range(1,21),
    'product_name':[f'product{i}' for i in range(1,21)],
    'category':np.random.choice(['Electronics','Clothing','Home','Sports'],20),
    'units_sold':np.random.poisson(lam=20,size=20),
    'sale_data':pd.date_range(start='2023-01-01',periods=20,freq='D')}
sales_data=pd.DataFrame(data)
print('Sales_data:')
print(sales_data)
```

```
Sales_data:
    product_id product_name     category  units_sold  sale_data
0            1     product1         Home          25 2023-01-01
1            2     product2       Sports          15 2023-01-02
2            3     product3  Electronics          17 2023-01-03
3            4     product4         Home          19 2023-01-04
4            5     product5         Home          21 2023-01-05
5            6     product6       Sports          17 2023-01-06
6            7     product7  Electronics          19 2023-01-07
7            8     product8  Electronics          16 2023-01-08
8            9     product9         Home          21 2023-01-09
9           10    product10     Clothing          21 2023-01-10
10          11    product11         Home          17 2023-01-11
11          12    product12         Home          22 2023-01-12
12          13    product13         Home          14 2023-01-13
13          14    product14         Home          17 2023-01-14
14          15    product15       Sports          17 2023-01-15
15          16    product16  Electronics          21 2023-01-16
16          17    product17       Sports          21 2023-01-17
17          18    product18       Sports          13 2023-01-18
18          19    product19       Sports          18 2023-01-19
19          20    product20         Home          25 2023-01-20
```

In [5]:
```
sales_data.to_csv('sales_data.csv',index=False)
```

In [6]:
```
import os
os.getcwd()
```

Out[6]:
```
'C:\\Users\\Jan Saida'
```

STEP3 : DESCRIPTIVE STATISTICS

In [8]:
```
# Descriptive statistics
descriptive_stats = sales_data['units_sold'].describe()

# Display descriptive statistics
print("\nDescriptive Statistics for Units Sold:")
print(descriptive_stats)

# Additional statistics
mean_sales = sales_data['units_sold'].mean()
median_sales = sales_data['units_sold'].median()
mode_sales = sales_data['units_sold'].mode()[0]
variance_sales = sales_data['units_sold'].var()
std_deviation_sales = sales_data['units_sold'].std()

# Group by category and calculate total and average sales
category_stats = sales_data.groupby('category')['units_sold'].agg(['sum', 'mean', 'std']).reset_index()
category_stats.columns = ['Category', 'Total Units Sold', 'Average Units Sold', 'Std Dev of Units Sold']

# Display the results
print("\nStatistical Analysis:")
print(f"Mean Units Sold: {mean_sales}")
print(f"Median Units Sold: {median_sales}")
```

```
print(f"Mode Units Sold: {mode_sales}")
print(f"Variance of Units Sold: {variance_sales}")
print(f"Standard Deviation of Units Sold: {std_deviation_sales}")
print("\nCategory Statistics:")
print(category_stats)
```

```
Descriptive Statistics for Units Sold:
count    20.000000
mean     18.800000
std       3.302312
min      13.000000
25%      17.000000
50%      18.500000
75%      21.000000
max      25.000000
Name: units_sold, dtype: float64

Statistical Analysis:
Mean Units Sold: 18.8
Median Units Sold: 18.5
Mode Units Sold: 17
Variance of Units Sold: 10.90526315789474
Standard Deviation of Units Sold: 3.3023117899275864

Category Statistics:
      Category  Total Units Sold  Average Units Sold  Std Dev of Units Sold
0     Clothing                21           21.000000                    NaN
1  Electronics                73           18.250000               2.217356
2         Home               181           20.111111               3.723051
3       Sports               101           16.833333               2.714160
```

STEP4 : INFERENTIAL STATISTICS

95 CONFIDENCE LEVEL

In [11]:
```
# Confidence Interval for the mean of units sold
confidence_level = 0.95
degrees_freedom = len(sales_data['units_sold']) - 1
sample_mean = mean_sales
sample_standard_error = std_deviation_sales / np.sqrt(len(sales_data['units_sold']))

# t-score for the confidence level
t_score = stats.t.ppf((1 + confidence_level) / 2, degrees_freedom)
margin_of_error = t_score * sample_standard_error

confidence_interval = (sample_mean - margin_of_error, sample_mean + margin_of_error)
print("\nConfidence Interval for the Mean of Units Sold:")
print(confidence_interval)
```

```
Confidence Interval for the Mean of Units Sold:
(17.254470507823573, 20.34552949217643)
```

99 CONFIDENCE LEVEL

In [13]:
```
# Confidence Interval for the mean of units sold
confidence_level = 0.99
degrees_freedom = len(sales_data['units_sold']) - 1
sample_mean = mean_sales
sample_standard_error = std_deviation_sales / np.sqrt(len(sales_data['units_sold']))

# t-score for the confidence level
t_score = stats.t.ppf((1 + confidence_level) / 2, degrees_freedom)
margin_of_error = t_score * sample_standard_error

confidence_interval = (sample_mean - margin_of_error, sample_mean + margin_of_error)
print("\nConfidence Interval for the Mean of Units Sold:")
print(confidence_interval)
```

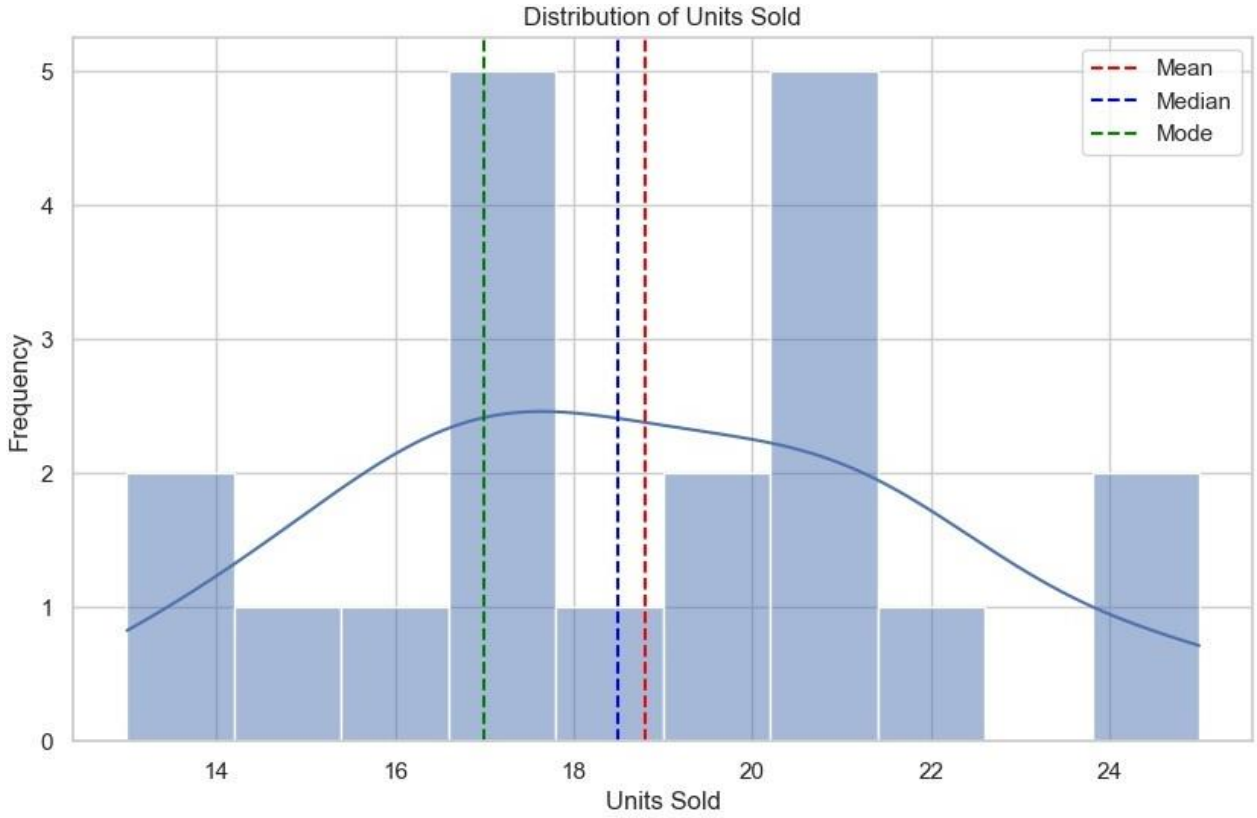
```
Confidence Interval for the Mean of Units Sold:
(16.687430485978535, 20.912569514021467)
```

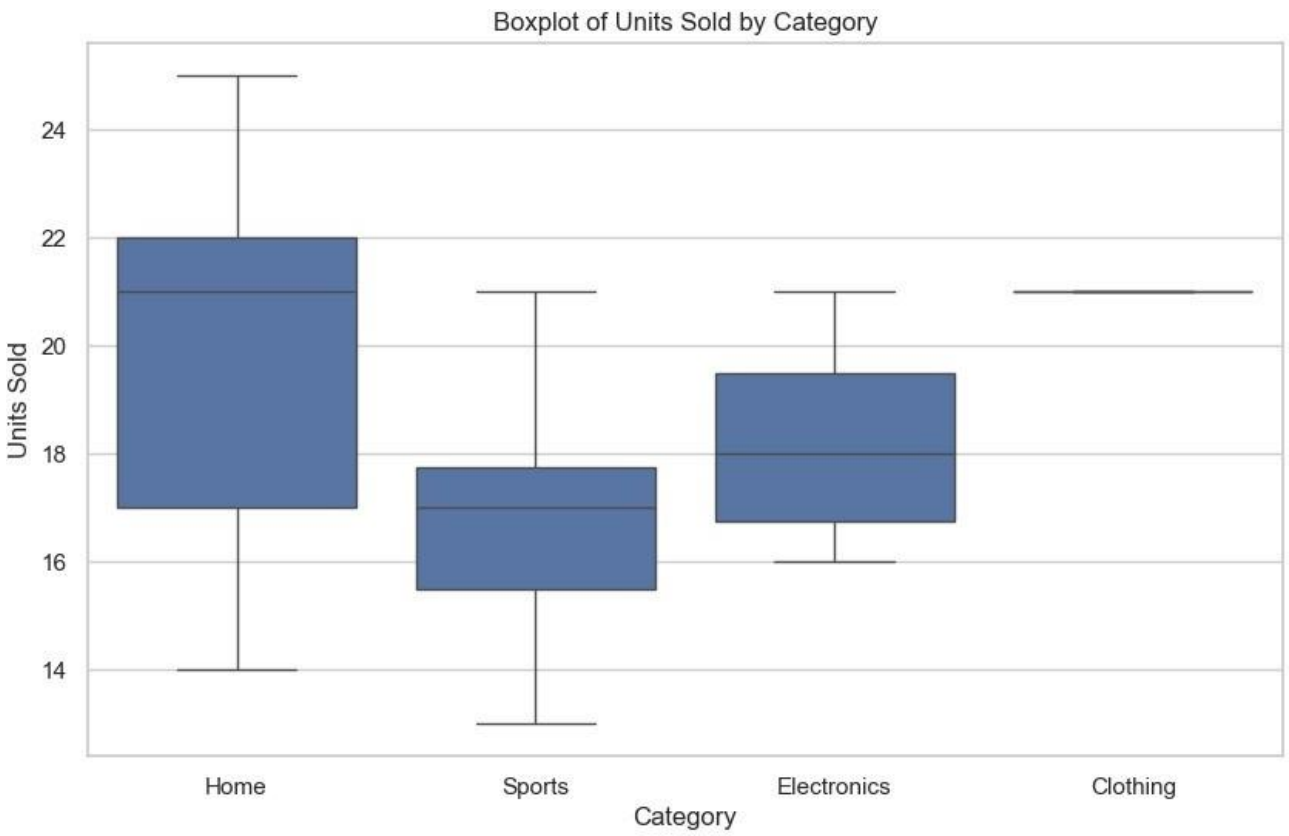
In [14]:
```
# Hypothesis Testing (t-test)
# Null hypothesis: Mean units sold is equal to 20
# Alternative hypothesis: Mean units sold is not equal to 20

t_statistic, p_value = stats.ttest_1samp(sales_data['units_sold'], 20)

print("\nHypothesis Testing (t-test):")
print(f"T-statistic: {t_statistic}, P-value: {p_value}")
```

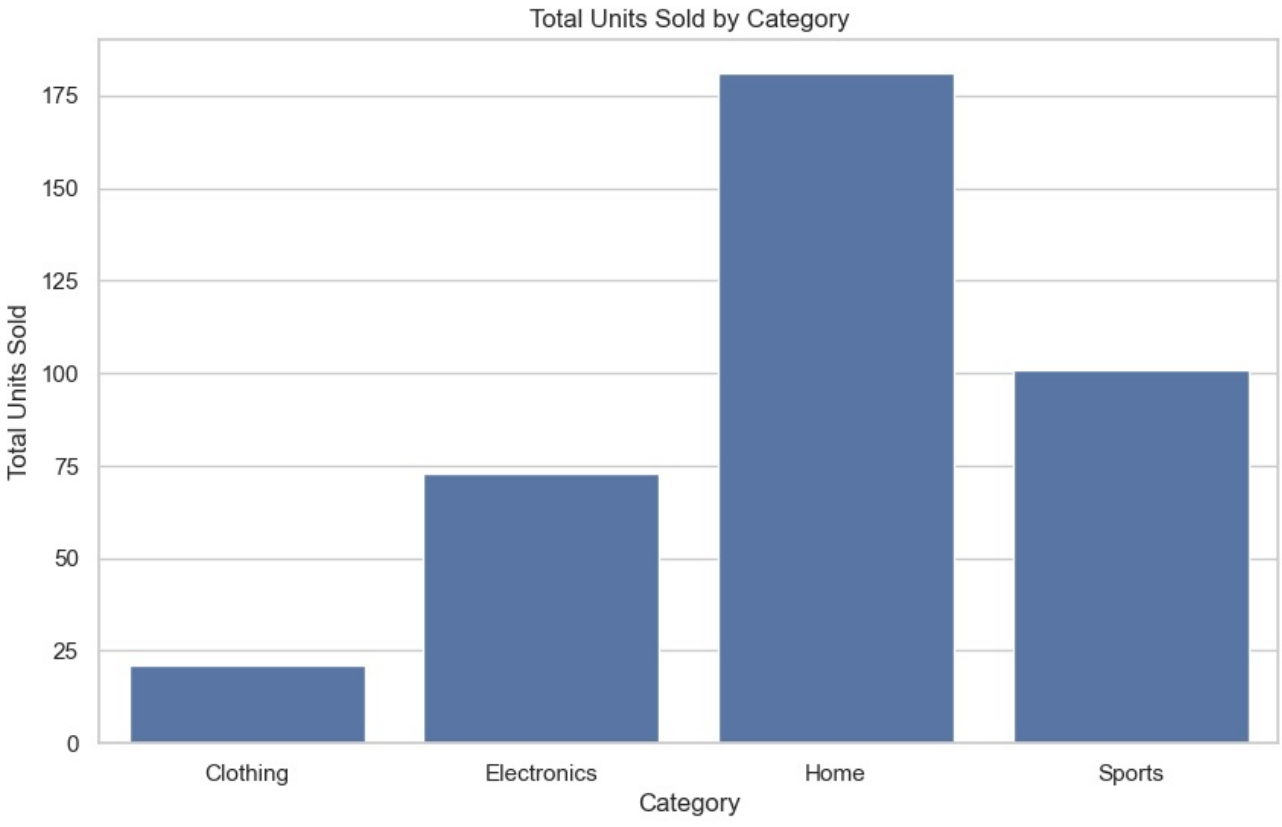
```
if p_value < 0.05:
    print("Reject the564 null hypothesis: The mean units sold is significantly different from 20.")
else:
    print("Fail to reject the null hypothesis: The mean units sold is not significantly different from 20.")
```

```
Hypothesis Testing (t-test):
T-statistic: -1.6250928099424466, P-value: 0.12061572226781002
Fail to reject the null hypothesis: The mean units sold is not significantly different from 20.
```

In [15]:
```
# Visualizations
sns.set(style="whitegrid")

# Plot distribution of units sold
plt.figure(figsize=(10, 6))
sns.histplot(sales_data['units_sold'], bins=10, kde=True)
plt.title('Distribution of Units Sold')
plt.xlabel('Units Sold')
plt.ylabel('Frequency')
plt.axvline(mean_sales, color='red', linestyle='--', label='Mean')
plt.axvline(median_sales, color='blue', linestyle='--', label='Median')
plt.axvline(mode_sales, color='green', linestyle='--', label='Mode')
plt.legend()
plt.show()

# Boxplot for units sold by category
plt.figure(figsize=(10, 6))
sns.boxplot(x='category', y='units_sold', data=sales_data)
plt.title('Boxplot of Units Sold by Category')
plt.xlabel('Category')
plt.ylabel('Units Sold')
plt.show()

# Bar plot for total units sold by category
plt.figure(figsize=(10, 6))
sns.barplot(x='Category', y='Total Units Sold', data=category_stats)
plt.title('Total Units Sold by Category')
plt.xlabel('Category')
plt.ylabel('Total Units Sold')
plt.show()
```







In [ ]:

Streamlit\RSD_app.py

```python
import streamlit as st
import pandas as pd
import numpy as np
import scipy.stats as stats
import matplotlib.pyplot as plt
import seaborn as sns

# Set up the title and description of the app
st.title("Sales Data Analysis for Retail Store")
st.write("This application analyzes sales data for various product categories.")

# Generate synthetic sales data
def generate_data():
    np.random.seed(42)
    data = {
        'product_id': range(1, 21),
        'product_name': [f'Product {i}' for i in range(1, 21)],
        'category': np.random.choice(['Electronics', 'Clothing', 'Home', 'Sports'], 20),
        'units_sold': np.random.poisson(lam=20, size=20),
        'sale_date': pd.date_range(start='2023-01-01', periods=20, freq='D')
    }
    return pd.DataFrame(data)

sales_data = generate_data()

# Display the sales data
st.subheader("Sales Data")
st.dataframe(sales_data)

# Descriptive Statistics
st.subheader("Descriptive Statistics")
descriptive_stats = sales_data['units_sold'].describe()
st.write(descriptive_stats)

mean_sales = sales_data['units_sold'].mean()
median_sales = sales_data['units_sold'].median()
mode_sales = sales_data['units_sold'].mode()[0]

st.write(f"Mean Units Sold: {mean_sales}")
st.write(f"Median Units Sold: {median_sales}")
st.write(f"Mode Units Sold: {mode_sales}")

# Group statistics by category
category_stats = sales_data.groupby('category')['units_sold'].agg(['sum', 'mean', 'std']).reset_index()
category_stats.columns = ['Category', 'Total Units Sold', 'Average Units Sold', 'Std Dev of Units Sold']
st.subheader("Category Statistics")
st.dataframe(category_stats)

# Inferential Statistics
confidence_level = 0.95
```

```
degrees_freedom = len(sales_data['units_sold']) - 1
sample_mean = mean_sales
sample_standard_error = sales_data['units_sold'].std() /
np.sqrt(len(sales_data['units_sold']))

# t-score for the confidence level
t_score = stats.t.ppf((1 + confidence_level) / 2, degrees_freedom)
margin_of_error = t_score * sample_standard_error
confidence_interval = (sample_mean - margin_of_error, sample_mean + margin_of_error)

st.subheader("Confidence Interval for Mean Units Sold")
st.write(confidence_interval)

# Hypothesis Testing
t_statistic, p_value = stats.ttest_1samp(sales_data['units_sold'], 20)

st.subheader("Hypothesis Testing (t-test)")
st.write(f"T-statistic: {t_statistic}, P-value: {p_value}")

if p_value < 0.05:
    st.write("Reject the null hypothesis: The mean units sold is significantly different
from 20.")
else:
    st.write("Fail to reject the null hypothesis: The mean units sold is not significantly
different from 20.")

# Visualizations
st.subheader("Visualizations")

# Histogram of units sold
plt.figure(figsize=(10, 6))
sns.histplot(sales_data['units_sold'], bins=10, kde=True)
plt.axvline(mean_sales, color='red', linestyle='--', label='Mean')
plt.axvline(median_sales, color='blue', linestyle='--', label='Median')
plt.axvline(mode_sales, color='green', linestyle='--', label='Mode')
plt.title('Distribution of Units Sold')
plt.xlabel('Units Sold')
plt.ylabel('Frequency')
plt.legend()
st.pyplot(plt)

# Boxplot for units sold by category
plt.figure(figsize=(10, 6))
sns.boxplot(x='category', y='units_sold', data=sales_data)
plt.title('Boxplot of Units Sold by Category')
plt.xlabel('Category')
plt.ylabel('Units Sold')
st.pyplot(plt)

# Bar plot for total units sold by category
plt.figure(figsize=(10, 6))
sns.barplot(x='Category', y='Total Units Sold', data=category_stats)
plt.title('Total Units Sold by Category')
plt.xlabel('Category')
```

```
plt.ylabel('Total Units Sold')
st.pyplot(plt)
```

Sales Data Analysis for Retail Store

This application analyzes sales data for various product categories.

Sales Data

	product_id	product_name	category	units_sold	sale_date
0	1	Product 1	Home	25	2023-01-01 00:00:00
1	2	Product 2	Sports	15	2023-01-02 00:00:00
2	3	Product 3	Electronics	17	2023-01-03 00:00:00
3	4	Product 4	Home	19	2023-01-04 00:00:00
4	5	Product 5	Home	21	2023-01-05 00:00:00
5	6	Product 6	Sports	17	2023-01-06 00:00:00
6	7	Product 7	Electronics	19	2023-01-07 00:00:00
7	8	Product 8	Electronics	16	2023-01-08 00:00:00
8	9	Product 9	Home	21	2023-01-09 00:00:00
9	10	Product 10	Clothing	21	2023-01-10 00:00:00

Descriptive Statistics

	units_sold
count	20
mean	18.8
std	3.3023
min	13
25%	17
50%	18.5
75%	21
max	25

Mean Units Sold: 18.8

Median Units Sold: 18.5

Mode Units Sold: 17

Category Statistics

	Category	Total Units Sold	Average Units Sold	Std Dev of Units Sold
0	Clothing	21	21	None
1	Electronics	73	18.25	2.2174
2	Home	181	20.1111	3.7231
3	Sports	101	16.8333	2.7142

Confidence Interval for Mean Units Sold

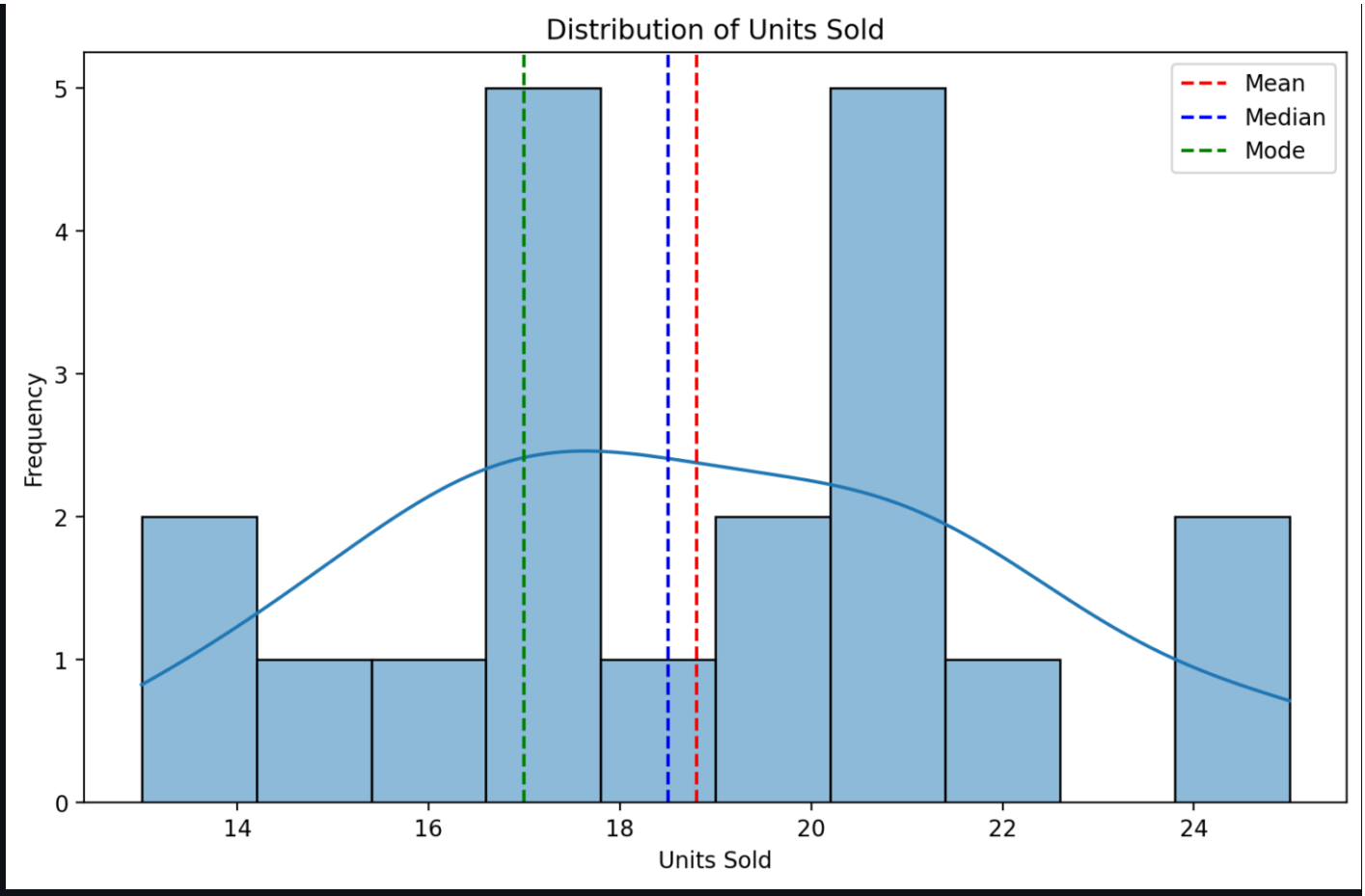
```
(np.float64(17.254470507823573), np.float64(20.34552949217643))
```

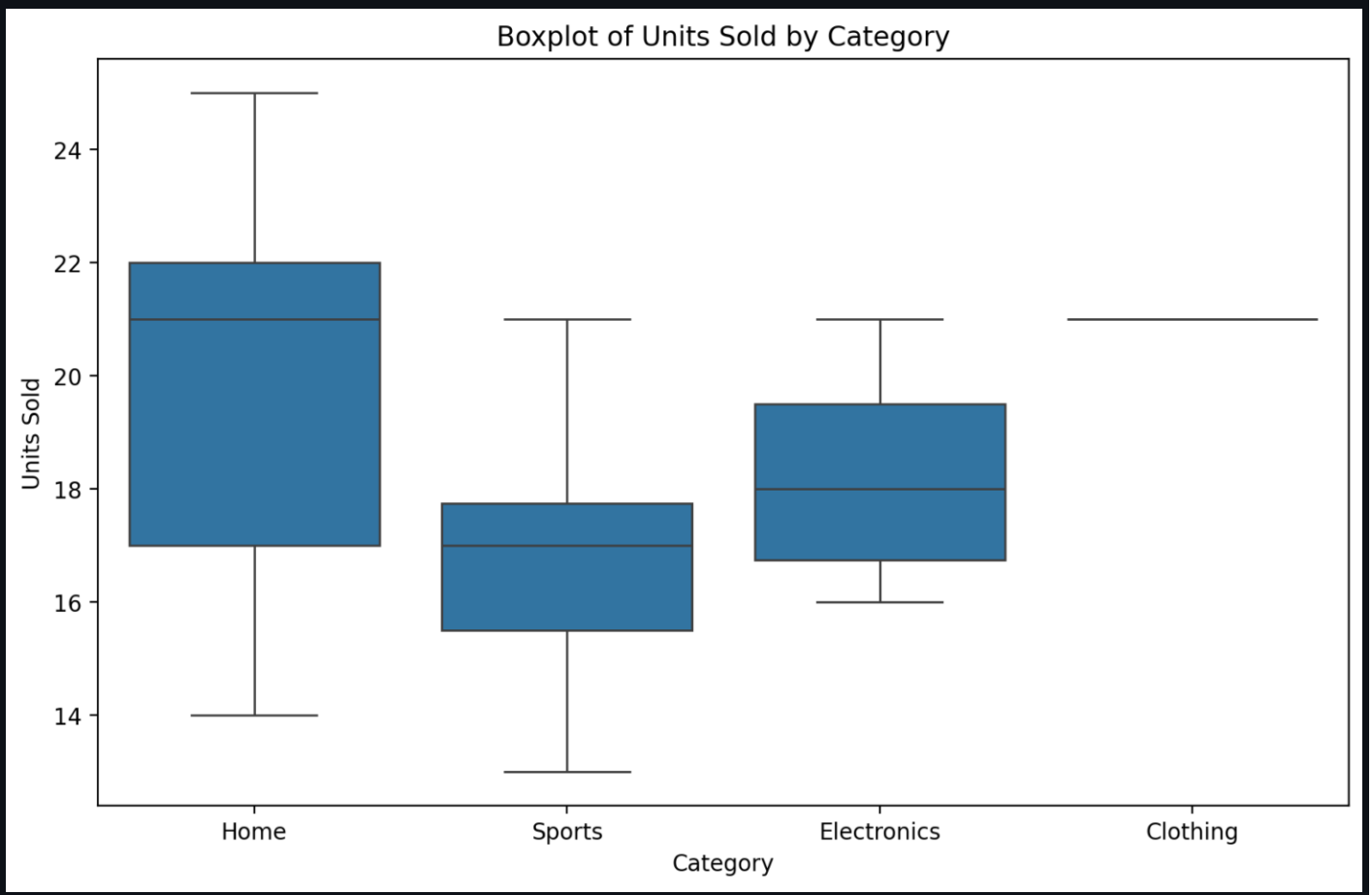
Hypothesis Testing (t-test)

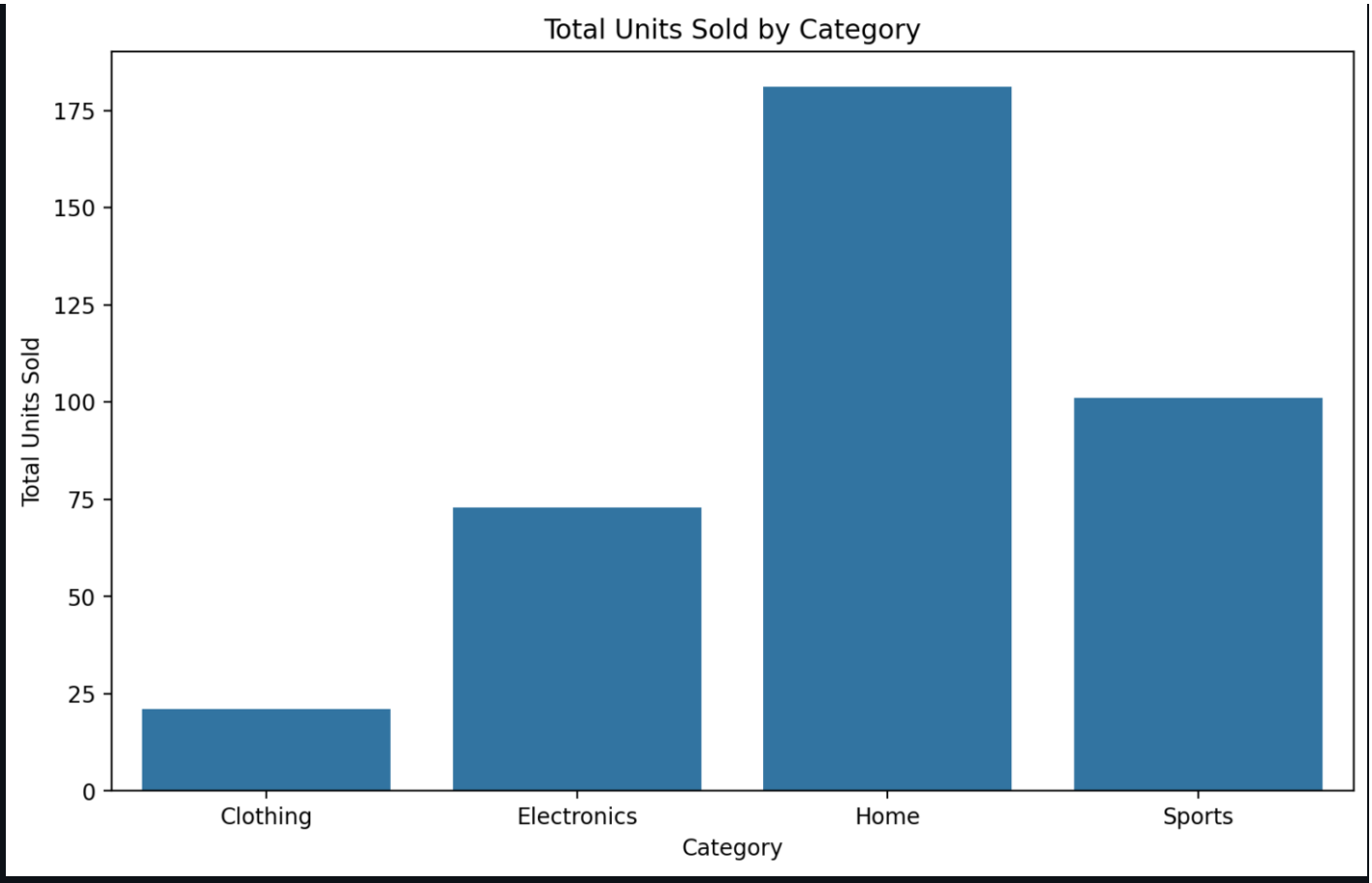
T-statistic: -1.6250928099424466, P-value: 0.12061572226781002

Fail to reject the null hypothesis: The mean units sold is not significantly different from 20.

Visualizations


Distribution of Units Sold
Mean
Median
Mode
Frequency
Units Sold
0
1
2
3
4
5
14
16
18
20
22
24


Boxplot of Units Sold by Category
Units Sold
Category
14
16
18
20
22
24
Home
Sports
Electronics
Clothing


Total Units Sold by Category
Total Units Sold
0
25
50
75
100
125
150
175
Clothing
Electronics
Home
Sports
Category