Q1.

It is a specified observed numerical value used to estimate an unknown population parameter.

Point Estimate : - Single numerical value used to estimate an unknown population.

Interval Estimate : - Range of values used to estimate the unknown population parameter.

Q2.

In [1]:
```
import math

def estimate_population_mean(sample_mean, sample_std, sample_size, confidence_le

    margin_of_error = 1.96 * (sample_std / math.sqrt(sample_size))

    lower_bound = sample_mean - margin_of_error
    upper_bound = sample_mean + margin_of_error

    return lower_bound, upper_bound

sample_mean = 25.5
sample_std = 4.2
sample_size = 30
confidence_level = 0.95

lower_bound, upper_bound = estimate_population_mean(sample_mean, sample_std, sam

print(f"Estimated population mean: {sample_mean:.2f}")
print(f"Confidence Interval: ({lower_bound:.2f}, {upper_bound:.2f})")
```

```
Estimated population mean: 25.50
Confidence Interval: (24.00, 27.00)
```

Q3.

- Hypothesis testing is a statistical method used to make inferences about population parameters based on a sample of data.

Importance :

```
- Statistical Inference
- Scientific Research
- Decision-Making in Business
- Quality control
- Medicine and Healthcare.
```

Q4.

Null Hypothesis :

- assumes no effect . stated as ,
population mean weight of male college students is less than
population mean weight of female college students.

Alternate Hypothesis :

- suggests that the average weight of male college students is
greater than the average weight of female college students.

Q5.

In [2]:
```
import numpy as np
from scipy import stats

def two_sample_t_test(sample1, sample2, alpha=0.05):
    test_statistic, p_value = stats.ttest_ind(sample1, sample2, equal_var=False)

    return test_statistic, p_value

np.random.seed(42)
sample_size = 30
male_weights = np.random.normal(loc=175, scale=10, size=sample_size)
female_weights = np.random.normal(loc=160, scale=8, size=sample_size)
test_statistic, p_value = two_sample_t_test(male_weights, female_weights)


print("Test Statistic:", test_statistic)
print("P-value:", p_value)

if p_value < 0.05:
    print("Reject the null hypothesis. There is evidence of a significant differ
else:
    print("Fail to reject the null hypothesis. There is no significant differenc
```

```
Test Statistic: 6.6048146907673155
P-value: 1.5484535940556787e-08
Reject the null hypothesis. There is evidence of a significant difference.
```

Q6.

Null Hypothesis :

- The assumption you are beginning with.

Alternative Hypothesis :

- opposite of null hypothesis.

Q7.

Steps :

- Formulate Hypothesis
- Collect Data
- Choose significance Level
- Conduct Test
- Make a Decision
- Draw Conclusions.

Q8.

- a number calculated from a statistical test , describes how likely you are to have found a particular set of observations if null hypothesis were true. Used in hypothesis testing to help decide whether to reject the null hypothesis.

Q9.

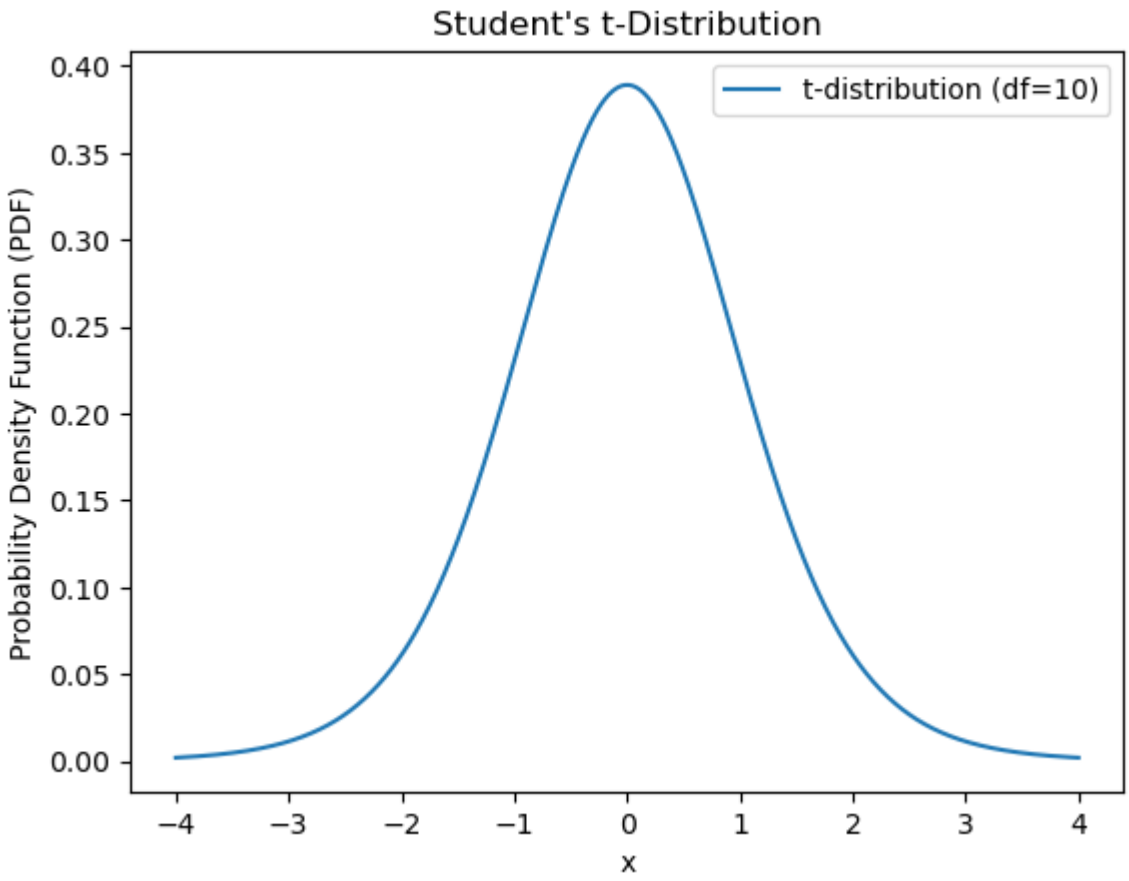
In [3]:
```
import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import t

degrees_of_freedom = 10

x_values = np.linspace(-4, 4, 1000)

pdf_values = t.pdf(x_values, df=degrees_of_freedom)


plt.plot(x_values, pdf_values, label=f"t-distribution (df={degrees_of_freedom})"
plt.title("Student's t-Distribution")
plt.xlabel("x")
plt.ylabel("Probability Density Function (PDF)")
plt.legend()
plt.show()
```



Q10.

In [4]:
```
import numpy as np
from scipy.stats import ttest_ind

def two_sample_t_test(sample1, sample2, alpha=0.05):
    test_statistic, p_value = ttest_ind(sample1, sample2)

    return test_statistic, p_value

np.random.seed(42)
sample_size = 30
sample1 = np.random.normal(loc=10, scale=2, size=sample_size)
sample2 = np.random.normal(loc=12, scale=2, size=sample_size)

test_statistic, p_value = two_sample_t_test(sample1, sample2)

print("Test Statistic:", test_statistic)
print("P-value:", p_value)

if p_value < 0.05:
    print("Reject the null hypothesis. There is evidence of a significant differ
else:
    print("Fail to reject the null hypothesis. There is no significant differenc
```

```
Test Statistic: -4.512913234547555
P-value: 3.176506547470154e-05
Reject the null hypothesis. There is evidence of a significant difference.
```

Q11.

- is a probability distribution that arises in the context of statistical inference.

Use :

```
- Unknown Population Standard Deviation
- Small Sample Size.
```

Q12.

- is a measure used in hypothesis testing to assess the evidence against the null hypothesis.

t = ((sample mean) - (population mean))/ ((sample standard deviation) / (math.sqrt(n))

Q13.

degree_of_freedom = n - 1 = 50 - 1 = 49.

In [5]:
```
import math

sample_mean = 500
sample_std = 50
sample_size = 50
confidence_level = 0.95

df = sample_size - 1

t_critical = 2.009

margin_of_error = t_critical * (sample_std / math.sqrt(sample_size))

confidence_interval_lower = sample_mean - margin_of_error
confidence_interval_upper = sample_mean + margin_of_error

print(f"95% Confidence Interval: (${confidence_interval_lower:.2f}, ${confidence
```

```
95% Confidence Interval: ($485.79, $514.21)
```

Q14.

In [6]:
```
import math

hypothesized_mean = 10
sample_mean = 8
sample_std = 3
sample_size = 100
```

```
significance_level = 0.05

df = sample_size - 1

t_statistic = (sample_mean - hypothesized_mean) / (sample_std / math.sqrt(sample

critical_value_lower = -1.984
critical_value_upper = 1.984

if t_statistic < critical_value_lower or t_statistic > critical_value_upper:
    print("Reject the null hypothesis. There is evidence of a significant differ
else:
    print("Fail to reject the null hypothesis. There is no significant differenc
```

```
Reject the null hypothesis. There is evidence of a significant difference.
```

Q15.

H0 : true mean = 5 pounds H1 : true mean < 5 pounds

t = 4.8 - 5/((0.5)/math.sqrt(25)) = -2

If t < t(critical) , you reject the null hypothesis. If t >= t(critical) , you fail to reject the null hypothesis.

Q16.

t- stat for a two-sample t-test is given by : t = 2.25

If t < t(critical) , you reject the null hypothesis. If t >= t(critical) , you fail to reject the null hypothesis.

Q17.

Confidence Interval = 4 +/- 2.576 * 0.212

Margin of Error = 2.576 * 0.212 = 0.546

Confidence Interval = (3.454,4.546)

So, with 99% confidence, the population mean number of ads watched by viewers during a TV program is estimated to be between 3.454 and 4.546.