In [3]:
```
#Project Title
#Do Actively Managed Mutual Funds Outperform Index Funds?
```

In [ ]:
```
1 Objective
To test whether the average annual returns of actively managed mutual funds are
significantly higher than those of index funds.

Hypotheses
H₀: There is no difference in mean annual returns between mutual funds and index funds

H₁: Mutual funds have higher mean annual returns than index funds.
(One-tailed independent t-test)

Statistical Test
Independent two-sample t-test

Assumptions: Normal distribution, equal variances (can check with Levene's test).
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In [6]:
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import pandas as pd
from scipy import stats
df=pd.read_csv("D://google//mutual_vs_index_funds_returns.csv")
```

In [9]:
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df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 3 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   fund_name      30 non-null     object
 1   fund_type      30 non-null     object
 2   annual_return  30 non-null     float64
dtypes: float64(1), object(2)
memory usage: 852.0+ bytes
```

In [11]:
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mutual_returns = df[df['fund_type'] == 'Mutual']['annual_return']
index_returns = df[df['fund_type'] == 'Index']['annual_return']
# 3 Hypotheses:
# H₀: mean(Mutual) <= mean(Index)
# H₁: mean(Mutual) > mean(Index)  (one-tailed)
```

In [13]:
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# Perform independent t-test (one-tailed: Mutual > Index)
t_stat, p_value = stats.ttest_ind(mutual_returns, index_returns, alternative='greater'
```

In [16]:
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# Convert two-tailed p-value to one-tailed
p_value = p_value / 2
```

In [17]:
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# 5 Print results
print("Mean Mutual Funds Return:", mutual_returns.mean())
print("Mean Index Funds Return:", index_returns.mean())
print("T-statistic:", t_stat)
print("One-tailed P-value:", p_value)
```

```
Mean Mutual Funds Return: 11.02
Mean Index Funds Return: 8.419333333333332
T-statistic: 4.366429208431472
One-tailed P-value: 3.906145073728336e-05
```

In [18]:

```python
# 6️⃣ Conclusion
if (t_stat > 0) and (p_value < 0.05):
    print("✅ Reject H₀ → Mutual funds have significantly higher returns.")
else:
    print("❌ Fail to reject H₀ → No evidence that mutual funds outperform index fund
```

```
✅ Reject H₀ → Mutual funds have significantly higher returns.
```

In [ ]:

```python

```