**Hypothesis Testing: t-test**

**Consider the following example:**

Engelbert Humperdinck would like to place an investment in stock markets. He decided to do this investment in Sony International stocks. But, he wonders if rate of return on these stocks will be at least 5% per annum. Thus, he instructed his manager to go and analyze the performance of Sony International stocks.

His manager gathered daily stock prices of SONY and calculated their rate of return for the last 20 years and found the following:

N = 20  
Average annual rate of return = 5.6%  
Standard deviation of annual rates of return = 1.2%

So, having this limitation of 5%, what should his manager advise to Engelbert Humperdinck? Are the rates of return on SONY stocks significantly going to be at least 5%?

**Solution:**

Hypothesis:

H₀: μ < 5%  
H₁: μ ≥ 5%

\[ t = \frac{\bar{x} - \mu}{s / \sqrt{n}} = \frac{5.6 - 5.0}{1.2 / \sqrt{20}} = \frac{0.6}{0.268} = 2.24 \]

From the null hypothesis, we see that the hypothesis to be applied for this case is one-tailed as can be seen from the figure below.

1. As a first step, we will start to test the hypothesis at \( \alpha = 0.01 \)

Critical value of \( t \) from appendix is: 2.861 (\( \alpha = 0.01 \))

So this shows that, we cannot reject the null hypothesis at \( \alpha = 0.01 \)

2. Since we couldn`t reject our hypothesis at \( \alpha = 0.01 \), now, we will look at \( \alpha = 0.05 \).
Critical value of t from appendix is: 2.093 ($\alpha = 0.05$)

So, since computed t value (2.24) is greater than critical t value (2.093), we can reject the null hypothesis at $\alpha = 0.05$. Thus, there is no need to look at $\alpha = 0.10$ level of error.

But, critical t value at $\alpha = 0.10$ would be 1.729, so we would again reject the hypothesis.

Therefore, final decision is that we reject the null hypothesis and accept the alternative hypothesis at $\alpha = 0.05$ that rate of return on Sony stocks will be at least 5%.

1. $\alpha = 0.01$

2. $\alpha = 0.05$
3. $\alpha = 0.10$

t-computed: 2.24