**Problem Statement 1**

Imagine we conduct a study to determine if MIT graduates are any smarter than an average human. To do so we choose a random sample and measure the IQ of every person in the sample. We then perform a one-sided (greater than) one-sample t-test (and calculate the associated p-value) to determine if there’s any significant difference when compared to human population average.

Let’s assume the following:

1. The distribution of IQ values is standard normal.
2. N = 30 (sample size)
3. That there is a true effect with m (mean) = 108 (We would not know this in a real-life study.)
4. The average human’s IQ is 100 and the accepted standard deviation of IQ is 15.
5. Use significance level α=0.05 (Type I error rate)

The goal is to calculate the post-facto **power** of this statistical study by simulating the study 10,000 times and testing our hypothesis. Also, plot the distribution of p-values of these simulations (bar graph of p-value vs frequency, take bin size=0.05).

Expected outputs: 1 number (power) and 1 graph

Hint: A simulation of a study is a randomly drawn sample from the true underlying distribution.

**Problem Statement 2**

You are provided with daily data of a bond index from 1st April 2020 to 30th April 2020 (business days).

Write a code in Python/R to compute below details:

1. Compute daily return/duration of bond index.
2. Plot a chart showing daily value of bond index if starting value is 100.
3. Identify the sectors with max and min returns at month end.
4. Compute maximum drawdown of bond index for the April month.
5. Create a portfolio of 20 bonds using given data and explain the rationale behind it.
6. Compute Information Ratio (IR) your portfolio at month end.

(BOM- Beginning of Month, MTD- Month to Date)