1. Suppose we want to test whether the mean weight of apples in a grocery store is 150 grams. We randomly sample 20 apples from the store and measure their weights, getting the following data:

   Apple_weights = [145, 155, 160, 146, 142, 152, 150, 147, 148, 149, 148, 152, 153, 155, 154, 148, 151, 147, 153, 146]

   - What test should we use and why?
   - State the null and alternative hypotheses.
   - Choose a significance level (α) (the probability of rejecting the null hypothesis when it is actually true).
   - Determine the degrees of freedom (df) of the sample.
   - Determine the critical value of t based on the significance level and degrees of freedom. For a two-tailed test with α = 0.05 and df = 19, the critical values are -2.093 and 2.093.
   - Compare and interpret the results of the test to the critical value

2. Suppose we want to test whether the mean height of all men in a population is 180 cm assuming that the population standard deviation = 2. We randomly sample 50 men from the population and measure their heights, getting the following data:

   Men_height = [177, 180, 182, 179, 178, 181, 176, 183, 179, 180, 178, 181, 177, 178, 180, 179, 182, 180, 183, 181, 179, 177, 180, 181, 178, 180, 182, 179, 177, 182, 178, 181, 183, 179, 180, 181, 183, 178, 177, 181, 179, 182, 180, 181, 178, 180, 179, 181, 183, 179]

   - What test should we use and why?
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   - Compare and interpret the results of the test to the critical value

3. Suppose we want to test whether the mean weight of a population of cats is different from 4 kg. We randomly sample 50 cats from the population and measure their weights, getting the following data:

   Cats_weights = [3.9, 4.2, 4.5, 4.1, 4.3, 3.8, 4.6, 4.2, 3.7, 4.3, 3.9, 4.0, 4.1, 4.5, 4.2, 3.8, 3.9, 4.3, 4.1, 4.0, 4.4, 4.2, 4.1, 4.6, 4.4, 4.2, 4.1, 4.3, 4.0, 4.4, 4.3, 3.8, 4.1, 4.5, 4.2, 4.3, 4.0, 4.1, 4.2, 3.9, 4.3, 3.7, 4.1, 4.5, 4.2, 4.0, 4.2, 4.4, 4.1, 4.5]

- Perform one sample two tailed Z-Test to determine whether the mean weight of the sampled cats is significantly different from 4 kg.
- State the null and alternative hypotheses.
- Choose a significance level (α) (the probability of rejecting the null hypothesis when it is actually true).
- Calculate the z-score using the formula:

$$Z = \frac{\overline{x} - \mu_0}{\sigma/\sqrt{n}}$$

- Assuming that the standard deviation is equal to the sample mean
- Look up the critical z-value at the chosen significance level (α) using a z-table.
- Compare the calculated z-score to the critical z-values. If the calculated z-score falls outside the range between the critical z-values, we reject the null hypothesis in favor of the alternative hypothesis.