1. How do you control for biases?

1) **Bias Detection**: First, use statistical methods and tools to detect biases in your data. This includes analyzing demographic disparities, fairness metrics, and performance gaps across different groups.

2) **Bias Mitigation Techniques**:

   - **Pre-processing Techniques**: Modify the training data to reduce bias, such as through data augmentation, re-sampling, or balancing techniques.
   - **In-processing Techniques**: Adjust the learning algorithms themselves to mitigate bias, like using fairness-aware algorithms that penalize biased predictions.
   - **Post-processing Techniques**: Apply fairness constraints or adjustments after model training to ensure fair outcomes for different groups.

3) **Fairness Evaluation**: Evaluate the models for fairness using appropriate metrics and tests. Common metrics include disparate impact analysis, equalized odds, and demographic parity.

4) **Interpretability and Transparency**: Use interpretable models whenever possible, as they can provide insights into how decisions are made and help identify and rectify biases.

2. What are confounding variables?

A confounding variable is an extraneous factor that correlates with both the independent variable (the factor being studied) and the dependent variable (the outcome). It can create a false impression of a cause-and-effect relationship between the independent and dependent variables.

Failure to account for confounding variables can lead to biased or inaccurate conclusions. It may falsely attribute changes in the dependent variable to the independent variable when, in reality, the confounding variable is responsible.

3. What is A/B testing?

A/B testing, also known as split testing, is a method used in statistics and marketing to compare two or more versions of something to determine which one performs better. It is commonly used in digital marketing, website optimization, product design, and other areas where data-driven decisions are made.

4. When will you use Welch t-test?

When the variances of the two groups being compared are unequal, the standard Student's t-test (which assumes equal variances) may not be appropriate. The Welch t-test is robust in such cases and provides more accurate results. And If the sample sizes of the two groups are different, the Welch t-test can still be used effectively. It does not require equal sample sizes, unlike the traditional Student's t-test. Besides, The Welch t-test is suitable for comparing the means of two independent groups. These groups could represent different populations, treatment groups, experimental conditions, etc. And the data being compared should be continuous and approximately normally distributed within each group. If the data is not normally distributed, transformations or non-parametric tests may be more appropriate.

5.

H0: The average time spent on the phone per call is equal to 6 minutes (μ = 6).

H1: The average time spent on the phone per call is higher than 6 minutes (μ > 6).

The significance level (α) is given as 0.05, which corresponds to a confidence level of 95%.

$$t = \frac{\overline{x} - \mu}{s/\sqrt{n}} = \frac{6.5 - 6}{1.2/\sqrt{50}} \approx 2.959$$

df=n−1=49

Thus, the critical value is approximately 1.676.

t=2.959 is greater than the critical value of 1.676. Therefore, we reject the null hypothesis.

6.

H0: There is no difference in the mean scores of the two groups (μA = μB).

H1: There is a difference in the mean scores of the two groups (μA ≠ μB).

The significance level (α) is given as 0.05, which corresponds to a confidence level of 95%.

The test statistic for an independent samples t-test is given by:

$$t = \frac{\overline{x1} - \overline{x2}}{\sqrt{\frac{s1^2}{n1} + \frac{s2^2}{n2}}} = \frac{75 - 78}{\sqrt{\frac{8^2}{25} + \frac{7^2}{30}}} \approx \frac{-3}{2.047} \approx -1.466$$

$df = n1 + n2 - 2 = 25 + 30 - 2 = 53$

Thus, the critical value is approximately ±2.009.

In this case, -1.466 falls within the range of -2.009 and 2.009. Therefore, we fail to reject the null hypothesis.