**1. Analysis of Results**

**Boxplot: Custom Accuracy by Dataset**

* **Insights:**
  + The **Iris dataset** shows the highest median accuracy, with a narrow range, indicating consistent performance.
  + The **Heart Disease dataset** has the lowest median accuracy, with a larger spread, indicating variability.
  + The **Wine Quality dataset** falls in between the other two, with moderate accuracy and spread.
* **Interpretation:**
  + Model performance differs significantly across datasets. The variability could be due to dataset-specific features, complexity, or noise.

**Residual Analysis: Residuals vs. Fitted Values**

* **Insights:**
  + The residuals are scattered without any clear pattern, indicating that the linear model assumptions (linearity and homoscedasticity) are reasonably met.
  + However, there is a noticeable spread of residuals, which might suggest slight heteroscedasticity in some areas.
* **Interpretation:**
  + The linear regression model fits the data reasonably well, but there might be room for improvement with a non-linear or more complex model.

**Interaction Plot: Train Size vs. Custom Accuracy**

* **Insights:**
  + The slopes for each dataset differ, indicating that **Train Size** interacts differently with accuracy depending on the dataset.
  + For the **Heart Disease dataset**, increasing the train size does not significantly improve accuracy, suggesting potential model saturation.
  + For the **Wine Quality dataset**, a slight improvement is observed with increasing train size.
  + The **Iris dataset** shows a downward trend, likely due to overfitting as train size increases.
* **Interpretation:**
  + The datasets respond differently to changes in train size, suggesting that dataset characteristics (e.g., complexity, feature distribution) play a significant role.

**Correlation Matrix**

* **Insights:**
  + A moderate positive correlation (0.21) exists between **Max Depth** and **Custom Accuracy**.
  + Other features, such as **Min Samples Split**, show negligible correlation with accuracy.
* **Interpretation:**
  + Depth of the tree impacts accuracy positively, but other hyperparameters have minimal direct influence in this context.

**ANOVA and Tukey’s Test**

* **Insights:**
  + ANOVA results indicate significant differences in both **Custom Accuracy** and **Training Time** across datasets (p < 0.05).
  + Tukey’s HSD test:
    - **Iris vs. Heart Disease:** Large accuracy difference (0.32), highly significant.
    - **Wine Quality vs. Heart Disease:** Moderate accuracy difference (0.12), significant.
    - **Wine Quality vs. Iris:** Negative accuracy difference (-0.19), significant.
* **Interpretation:**
  + The datasets exhibit significant differences in model performance, confirming that dataset characteristics impact model effectiveness.

**Density Plot of Accuracy**

* **Insights:**
  + The **Iris dataset** exhibits a high-density peak near 1.0, reflecting high and consistent accuracy.
  + The **Heart Disease dataset** shows a broader, flatter curve, indicating lower and more variable accuracy.
  + The **Wine Quality dataset** has a density concentrated near 0.75, indicating moderate performance.
* **Interpretation:**
  + Model performance is strongly dependent on dataset structure and feature quality.