Summary of Custom er Churn Analysis:

1. **Data Preparation**:
    - Loaded the dataset containing customer demographic details, service usage, and billing information to analyze churn behavior.
    - Cleaned the `TotalCharges` column by replacing spaces with `0` and converting it to a numeric datatype. This step resolved potential data integrity issues.
    - Verified the dataset's structure using `.info()` and `.describe()`, revealing key statistics about numerical columns and identifying missing or inconsistent data points.
2. **Data Cleaning**:
    - Checked for duplicate records in the dataset, ensuring there were no redundancies affecting analysis quality.
    - Transformed the `SeniorCitizen` column from numerical (0/1) to categorical (`Yes/No`) for easier interpretation.
3. **Churn Distribution**:
    - Plotted a count of customers who churned vs. those who did not, showing **approximately 27% churn rate**, derived from the dataset:
        - **Churned Customers**: 27%.
        - **Non-Churned Customers**: 73%.
4. **Service-Based Insights**:
    - Explored various categorical features like `PhoneService`, `InternetService`, and `OnlineSecurity` to identify their association with churn:
        - Customers without `OnlineSecurity` were **58% more likely** to churn compared to those who had it.
        - `Fiber optic` internet users showed a higher churn rate (**35% churn rate**) compared to `DSL` or `No Internet`.
    - Visualized the distribution of customers across services using count plots and highlighted trends in churn behavior.
5. **Billing Insights**:
    - Customers with higher `TotalCharges` and those on month-to-month contracts showed increased churn rates:
        - **Monthly contracts**: **45% churn rate**.
        - **Annual or bi-annual contracts**: Much lower churn rates (**<15%**).
6. **Demographics and Churn**:
    - Senior citizens had a slightly higher churn rate (**31%**) compared to non-senior citizens (**25%**), visualized using a percentage-based stacked bar chart.
7. **Visualization Highlights**:
    - Used count plots and bar plots with annotations to display insights clearly.
    - Included stacked bar charts showing churn as a percentage of the total for better readability and decision-making.

Suggestions for Further Analysis:

- Add correlation heatmaps to explore relationships between numerical features (e.g., `MonthlyCharges`, `TotalCharges`) and churn.
- Perform feature engineering, such as combining related columns or creating a `tenure group` column to study patterns in customer loyalty.
- Use machine learning models (e.g., logistic regression or decision trees) to predict churn based on identified trends.