📄 Airbnb Dynamic Pricing Engine Project Report

1. ***Introduction***
   Airbnb is a leading platform for short-term rentals. Hosts often struggle to set the right price for their listings due to fluctuating market conditions, seasonality, and listing quality. This project aims to analyse historical Airbnb data to develop a data-driven pricing strategy based on key factors like location, seasonality, property type, and user reviews.

2. ***Abstract***
   Using Python and Power BI, we analysed historical Airbnb listings data to uncover patterns influencing listing prices. A regression model was developed to predict optimal pricing, and a dynamic dashboard was built to allow users to explore pricing insights. The outcome is a pricing engine that suggests optimal listing prices and a visual dashboard with interactive filters and sliders for data exploration.

3. Tools Used

- Python (Pandas, NumPy, Matplotlib, Seaborn, scikit-learn): Data preprocessing, analysis, modeling
- Power BI: Interactive data visualization dashboard
- Excel: Initial data exploration and cleaning
- VS Code: Development environment

4. Steps Involved in Building the Project

Step 1: Data Collection and Cleaning

- Loaded dataset Airbnb_dataset.csv
- Checked for nulls, duplicates, and data types
- Cleaned and normalized columns like price, date, and review scores

Step 2: Exploratory Data Analysis (EDA)

- Analysed price distribution by city, room type, and number of reviews
- Visualized seasonal trends using calendar date fields
- Correlation heatmaps between price and variables (e.g., reviews, location, amenities)

Step 3: Regression Model (Pricing Engine)

- Selected features: location, room type, availability, review scores, etc.
- Applied label encoding and scaling where necessary
- Built and evaluated Linear Regression and Random Forest Regressor
- Selected best model based on RMSE or R^2 score

Step 4: Dashboard Development in Power BI

- Imported clean dataset

- Created charts for:
    - Total last review by year (Ribbon chart)
    - Price by Neighbourhood (Clustered bar chart)
    - Total review by months (Stacked column chart)
    - Total Neighbourhood by group (Donut Chart)
    - Availability by season (Pie chart)
    - Price by room type (Funnel chart)
- Key Performance Indicators (KPIs)
    - Sum of number of reviews (3M)
    - Sum of reviews per month (116.26K)
    - Count of neighbourhood (225)
    - Count of host id (100.22K)
- Implemented slicers:
    - Neighbourhood Group
    - Room Type
- Created a dynamic pricing suggestion slider

5. ***Conclusion***
   This project successfully identified key predictors of Airbnb pricing. The model can suggest optimized prices for new listings, helping hosts stay competitive. The Power BI dashboard allows stakeholders to explore trends interactively. Future enhancements could include using deep learning or integrating external data such as local events or weather.