Exploratory Data Analysis (EDA) – Findings Report

1. Data Overview

- Dataset contains **32 observations** and **11 columns**.
- Variables include **continuous numeric features** (e.g., mpg, disp, hp, wt) and **categorical-like numeric features** (cyl, vs, am, gear, carb).
- No missing values detected; no duplicate rows present.

2. Key Descriptive Insights

- **MPG (Fuel Efficiency)**: Mean ~20.1 MPG, ranging from ~10 to 33 MPG.
- **Cylinders**: Majority of cars have 8 cylinders, followed by 4 cylinders, and fewer with 6.
- **Horsepower**: Wide range from 52 to 335 HP.
- **Weight**: Mostly between 1.5–5.4 (1000 lbs).

3. Relationships & Trends

- **Weight (wt) vs MPG**: **Strong negative** correlation (~-0.87). Heavier cars are less fuel efficient.
- **Displacement (disp) vs MPG**: **Strong negative** correlation (~-0.85). Bigger engines → lower MPG.
- **Horsepower (hp) vs MPG**: **Strong negative** correlation (~-0.78). More powerful engines → lower MPG.
- **Cylinders (cyl)**: Cars with **4 cylinders** have the highest average MPG; 8-cylinder cars have the lowest.
- **Transmission (am)**: Manual (am=1) cars generally achieve higher MPG than automatic (am=0).
- **Engine shape (vs)**: Straight engines (vs=1) tend to be more fuel-efficient than V-shaped (vs=0).
- **Quarter-mile time (qsec)**: Slight positive relationship with MPG — slower acceleration often linked to lighter, more efficient cars.

4. Correlation Insights

- **Top Positive Correlations**:
  - hp ↔ disp (~0.79) — bigger engines produce more power.
  - cyl ↔ hp (~0.83) — more cylinders mean higher horsepower.

- **Top Negative Correlations**:
    - mpg ↔ wt (~-0.87)
    - mpg ↔ disp (~-0.85)
    - mpg ↔ hp (~-0.78)

5. Observations from Visuals

- **Histograms** show that mpg, disp, hp, and wt are skewed, suggesting potential outliers (e.g., very heavy or high-horsepower cars).
- **Boxplots** reveal that cars with extremely high horsepower or weight are outliers in performance metrics.
- **Scatterplots** confirm strong downward trends of MPG with weight, horsepower, and displacement.
- **Pairplot & Heatmap** reinforce the relationships found in correlation analysis.

6. Summary

- **Fuel efficiency** is largely determined by **weight**, **engine size**, and **horsepower**.
- **Transmission type** and **number of cylinders** play a key role in efficiency.
- The dataset reflects a **clear trade-off between performance and fuel economy**.
- Potential predictive model: mpg could be well-predicted by wt + hp + cyl.