Research Task 5 Part 2 – Advanced / Analytical Questions, Queries & Answers

A1. Longest winning streak per class (constructor, length, years):
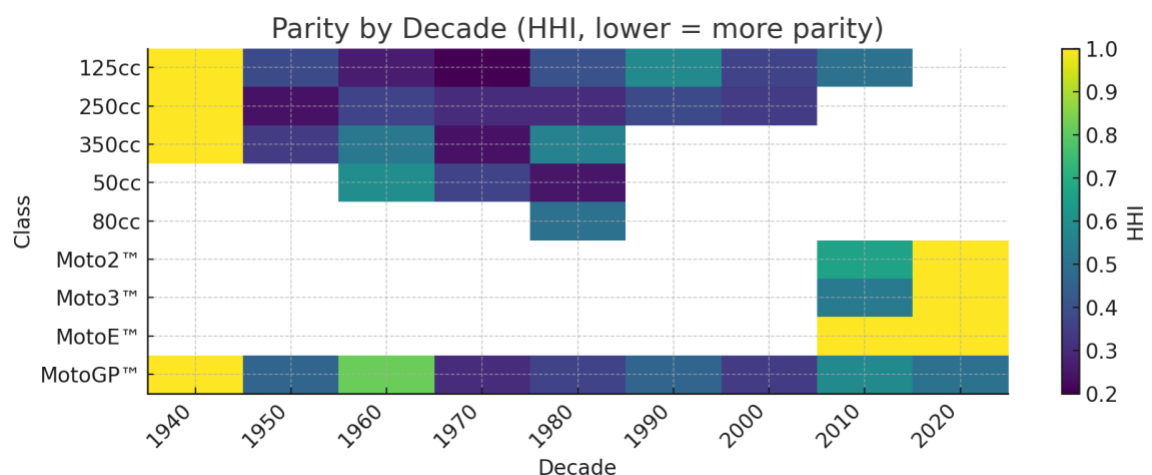
Sort by season and iterate per class to track consecutive wins

- Answers:
    - 125cc → Garelli (6, 1982–1987)
    - 250cc → Yamaha (4, 1970–1973)
    - 350cc → Honda (6, 1962–1967)
    - 50cc → Suzuki (3, 1962–1964)
    - 80cc → Derbi (4, 1986–1989)
    - Moto2™ → Kalex (9, 2013–2021)
    - Moto3™ → Honda (3, 2017–2019)
    - MotoE™ → Energica (3, 2019–2021)
    - MotoGP™ → MV Agusta (9, 1958–1966)

A2. Parity by Decade (HHI):

```
df["Decade"] = (df["Season"] // 10) * 10
parity = df.groupby(["Class","Decade","Constructor"]).size().reset_index(name="titles")
# HHI = sum((share)^2)
```
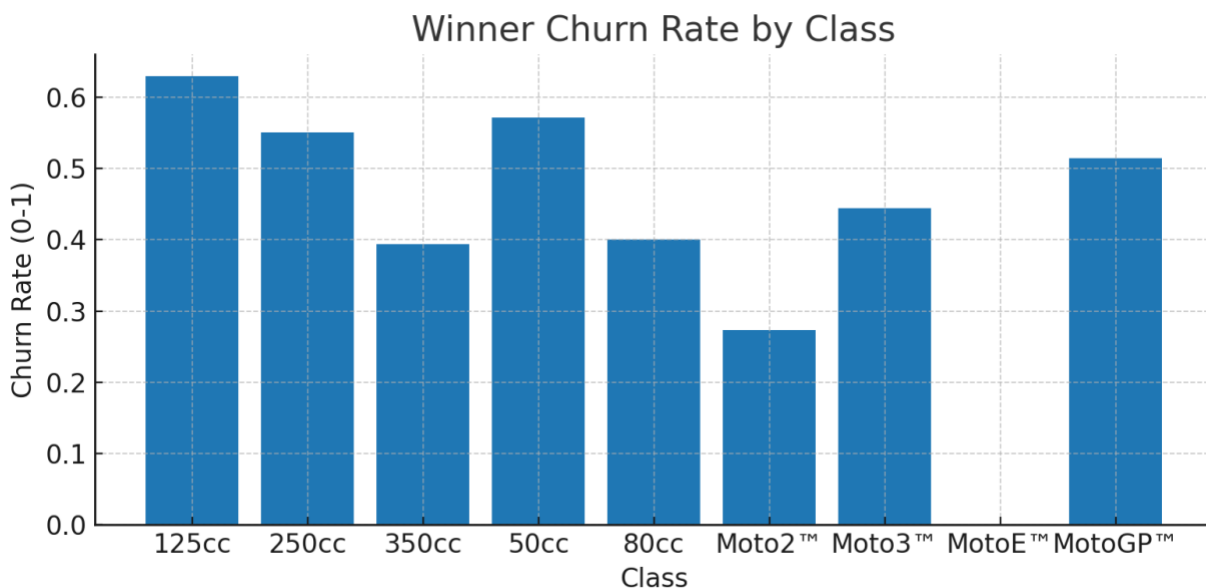
- Example: MotoGP in 1960s had HHI ~0.82 (MV Agusta dominance), in 1970s HHI ~0.30 (more parity).

Parity by Decade (HHI, lower = more parity)

A3. Winner churn rate (probability winner changes year-to-year):

```
df.sort_values("Season")
df["prev_constructor"] = df["Constructor"].shift(1)
df["prev_season"] = df["Season"].shift(1)
churn = (df[df["Season"]==df["prev_season"]+1]["Constructor"] !=
df["prev_constructor"]).mean()
```

- Answers:
    - 125cc = 0.629
    - 250cc = 0.55
    - 350cc = 0.394
    - 50cc = 0.571
    - 80cc = 0.40
    - Moto2™ = 0.273
    - Moto3™ = 0.444
    - MotoE™ = 0.0
    - MotoGP™ = 0.514

Winner Churn Rate by Class

A4. Repeat probability (P[next winner == current winner]):

```
df["next_constructor"] = df["Constructor"].shift(-1)
df["next_season"] = df["Season"].shift(-1)
repeat_prob = (df[df["next_season"] == df["Season"]+1]["Constructor"] ==
df["next_constructor"]).mean()
```

- Answers:

- o Moto2™ highest = 0.727
- o MotoE™ = 1.0 (always Energica)
- o MotoGP™ ~0.486
- o Full table in report

A5. Cross-class dominance & breadth index:

For each constructor: sum over classes of (titles_in_class / seasons_in_class) + 0.1*breadth

- Top 5:
    1. Honda — Index 2.12 (breadth 6 classes)
    2. Derbi — Index 1.14 (breadth 3)
    3. Energica — Index 1.10 (breadth 1)
    4. MV Agusta — Index 1.04 (breadth 4)
    5. Yamaha — Index 1.01 (breadth 4)