

[iPhone Sales Analysis]

```
In [109]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
plt.style.use("seaborn-v0_8")

In [111]: df = pd.read_csv("apple_products.csv")
df.head()
```

	Product Name	Product URL	Brand	Sale Price	Mrp	Discount Percentage	Number Of Ratings	Number Of Reviews	Upc	Star Rating	Ram
0	APPLE iPhone 8 Plus (Gold, 64 GB)	https://www.flipkart.com/apple-iphone-8-plus-g...	Apple	49900	49900	0	3431	356	MOBEXRGV7EHHTGUH	4.6	2 GB
1	APPLE iPhone 8 Plus (Space Grey, 256 GB)	https://www.flipkart.com/apple-iphone-8-plus-s...	Apple	84900	84900	0	3431	356	MOBEXRGVAC6TJT4F	4.6	2 GB
2	APPLE iPhone 8 Plus (Silver, 256 GB)	https://www.flipkart.com/apple-iphone-8-plus-s...	Apple	84900	84900	0	3431	356	MOBEXRGVGETABXWZ	4.6	2 GB
3	APPLE iPhone 8 (Silver, 256 GB)	https://www.flipkart.com/apple-iphone-8-silver...	Apple	77000	77000	0	11202	794	MOBEXRGVMZWUHCBA	4.5	2 GB
4	APPLE iPhone 8 (Gold, 256 GB)	https://www.flipkart.com/apple-iphone-8-gold-2...	Apple	77000	77000	0	11202	794	MOBEXRGVKP7FEJZ	4.5	2 GB

```
In [113]: df.columns = {
df.columns
    .str.strip()
    .str.lower()
    .str.replace(" ", "_")
}

df.columns

Out[113]: Index(['product_name', 'product_url', 'brand', 'sale_price', 'mrp',
'discount_percentage', 'number_of_ratings', 'number_of_reviews', 'upc',
'star_rating', 'ram'],
      dtype='object')
```

```
In [115]: num_cols = {
    "sale_price", "mrp", "discount_percentage",
    "number_of_ratings", "number_of_reviews", "star_rating"
}

df[num_cols] = df[num_cols].apply(pd.to_numeric, errors="coerce")
df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 62 entries, 0 to 61
Data columns (total 11 columns):
 #   Column                Non-Null Count  Dtype
---  --
 0   product_name          62 non-null     object
 1   product_url           62 non-null     object
 2   brand                 62 non-null     object
 3   sale_price            62 non-null     int64
 4   mrp                  62 non-null     int64
 5   discount_percentage   62 non-null     int64
 6   number_of_ratings     62 non-null     int64
 7   number_of_reviews     62 non-null     int64
 8   upc                  62 non-null     object
 9   star_rating          62 non-null     float64
10   ram                  62 non-null     object
dtypes: float64(1), int64(5), object(5)
memory usage: 5.5+ KB
```

Q1: Top 10 Highest-Rated iPhones on Flipkart (India)

```
In [118]: df.sort_values(by="star_rating", ascending=False).head(10)
[{"product_name", "star_rating", "sale_price"}]
```

	product_name	star_rating	sale_price
20	APPLE iPhone 11 Pro Max (Midnight Green, 64 GB)	4.7	117100
17	APPLE iPhone 11 Pro Max (Space Grey, 64 GB)	4.7	117100
16	APPLE iPhone 11 Pro Max (Midnight Green, 256 GB)	4.7	131900
15	APPLE iPhone 11 Pro Max (Gold, 64 GB)	4.7	117100
14	APPLE iPhone 11 Pro Max (Gold, 256 GB)	4.7	131900
0	APPLE iPhone 8 Plus (Gold, 64 GB)	4.6	49900
29	APPLE iPhone 12 (White, 128 GB)	4.6	75900
32	APPLE iPhone 12 Pro Max (Graphite, 128 GB)	4.6	120900
35	APPLE iPhone 12 (Black, 128 GB)	4.6	75900
36	APPLE iPhone 12 (Blue, 128 GB)	4.6	75900

Q2: How Many Ratings Do the Highest-Rated iPhones Have?

```
In [121]: df.sort_values(by="star_rating", ascending=False).head(10)
[{"product_name", "star_rating", "number_of_ratings"}]
```

	product_name	star_rating	number_of_ratings
20	APPLE iPhone 11 Pro Max (Midnight Green, 64 GB)	4.7	1078
17	APPLE iPhone 11 Pro Max (Space Grey, 64 GB)	4.7	1078
16	APPLE iPhone 11 Pro Max (Midnight Green, 256 GB)	4.7	1078
15	APPLE iPhone 11 Pro Max (Gold, 64 GB)	4.7	1078
14	APPLE iPhone 11 Pro Max (Gold, 256 GB)	4.7	1078
0	APPLE iPhone 8 Plus (Gold, 64 GB)	4.6	3431
29	APPLE iPhone 12 (White, 128 GB)	4.6	2101
32	APPLE iPhone 12 Pro Max (Graphite, 128 GB)	4.6	580
35	APPLE iPhone 12 (Black, 128 GB)	4.6	2101
36	APPLE iPhone 12 (Blue, 128 GB)	4.6	2101

Q3: iPhone With Highest Reviews

```
In [124]: df.sort_values(by="number_of_reviews", ascending=False).head(1)
[{"product_name", "number_of_reviews", "star_rating", "sale_price"}]
```

	product_name	number_of_reviews	star_rating	sale_price
23	Apple iPhone SE (White, 256 GB) (Includes EarP...	8161	4.5	44999

Q4: Sale Price vs Number of Ratings

```
sns.scatterplot(data=df, x="sale_price", y="number_of_ratings")
plt.title("Sale Price vs Number of Ratings")
plt.show()

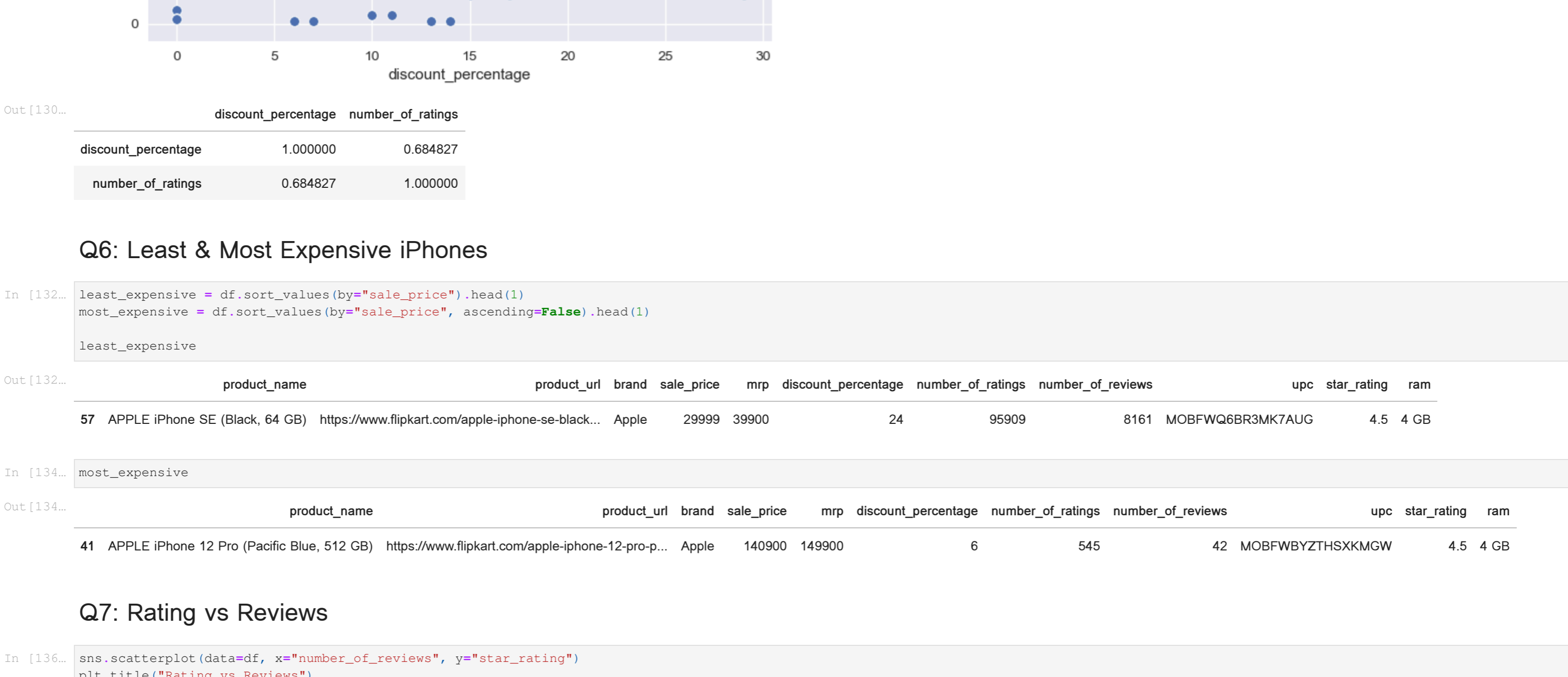
df[["sale_price", "number_of_ratings"]].corr()
```



Q5: Discount % vs Number of Ratings

```
In [130]: sns.scatterplot(data=df, x="discount_percentage", y="number_of_ratings")
plt.title("Discount % vs Number of Ratings")
plt.show()

df[["discount_percentage", "number_of_ratings"]].corr()
```



Q6: Least & Most Expensive iPhones

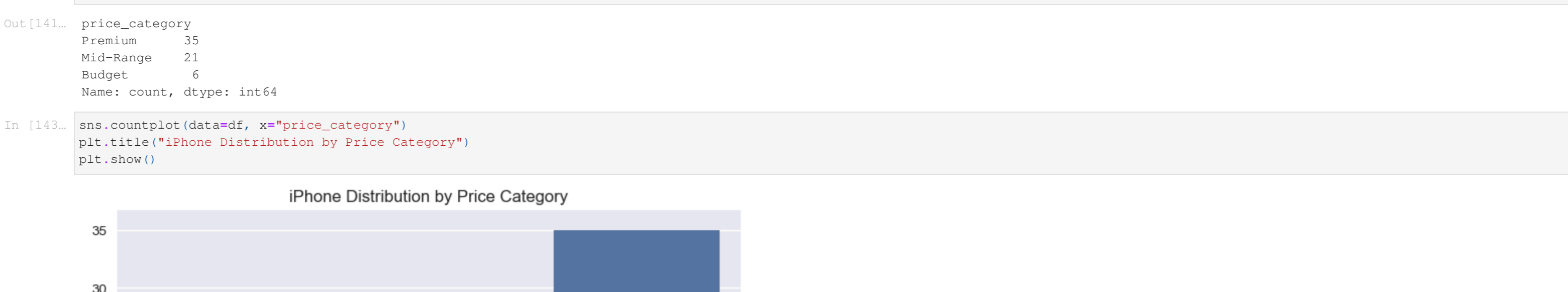
```
In [132]: least_expensive = df.sort_values(by="sale_price").head(1)
most_expensive = df.sort_values(by="sale_price", ascending=False).head(1)
least_expensive
```

	product_name	product_url	brand	sale_price	mrp	discount_percentage	number_of_ratings	number_of_reviews	upc	star_rating	ram
57	APPLE iPhone SE (Black, 64 GB)	https://www.flipkart.com/apple-iphone-se-black...	Apple	29999	39900		24	95909	8161	MOBFWQ6BR3MK7AUG	4.5 4 GB

	most_expensive
41	APPLE iPhone 12 Pro (Pacific Blue, 512 GB)

Q7: Rating vs Reviews

```
In [136]: sns.scatterplot(data=df, x="number_of_reviews", y="star_rating")
plt.title("Rating vs Reviews")
plt.show()
```

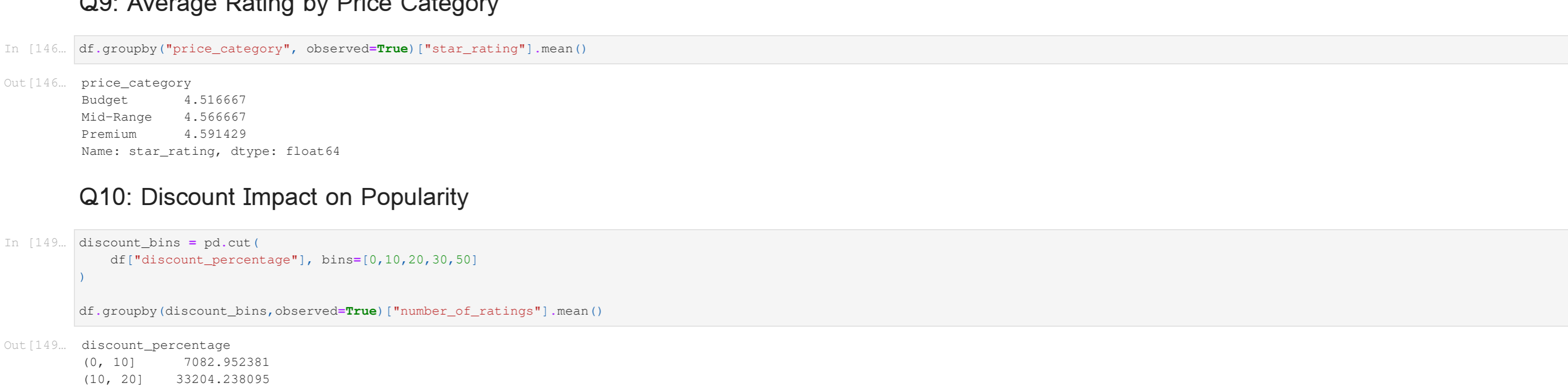


Q8: Price Category Analysis

```
In [141]: bins = [0, 40000, 70000, 200000]
labels = ["Budget", "Mid-Range", "Premium"]
df["price_category"] = pd.cut(df["sale_price"], bins=bins, labels=labels)
df["price_category"].value_counts()
```

	price_category
35	Premium
21	Mid-Range
6	Budget
	Name: count, dtype: int64

```
In [143]: sns.countplot(data=df, x="price_category")
plt.title("iPhone Distribution by Price Category")
plt.show()
```



Q9: Average Rating by Price Category

```
In [146]: df.groupby("price_category", observed=True)["star_rating"].mean()

Out[146]: price_category
Budget      4.516667
Mid-Range   4.546667
Premium     4.591429
Name: star_rating, dtype: float64
```

Q10: Discount Impact on Popularity

```
In [149]: df.groupby("discount_bins", observed=True)["number_of_ratings"].mean()

Out[149]: discount_percentage
(0, 10]      7082.952381
(10, 20]    33294.238095
(20, 30]    81071.500000
Name: number_of_ratings, dtype: float64
```

Q11: Best Value-for-Money iPhones

```
In [152]: df["value_score"] = (
    df["star_rating"] * df["discount_percentage"] / df["sale_price"]
)

df.sort_values(by="value_score", ascending=False).head(10)
[{"product_name", "sale_price", "star_rating", "discount_percentage"}]
```

	product_name	sale_price	star_rating	discount_percentage
52	APPLE iPhone SE (White, 64 GB)	29999	4.5	24
57	APPLE iPhone SE (Black, 64 GB)	29999	4.5	24
53	APPLE iPhone SE (Black, 128 GB)	34999	4.5	22
55	APPLE iPhone SE (Red, 128 GB)	34999	4.5	22
54	APPLE iPhone SE (White, 128 GB)	34999	4.5	22
11	Apple iPhone XR (Coral, 128 GB) (Includes EarP...	41999	4.6	20
12	Apple iPhone XR (Black, 128 GB) (Includes EarP...	41999	4.6	20
13	Apple iPhone XR (White, 128 GB) (Includes EarP...	41999	4.6	20
9	Apple iPhone XR ((PRODUCT)RED, 128 GB) (Includ...	41999	4.6	20
10	Apple iPhone XR (Black, 64 GB) (Includes EarPo...	39999	4.6	16

Q12: RAM Variant Analysis

```
In [155]: df["ram"].value_counts()
```

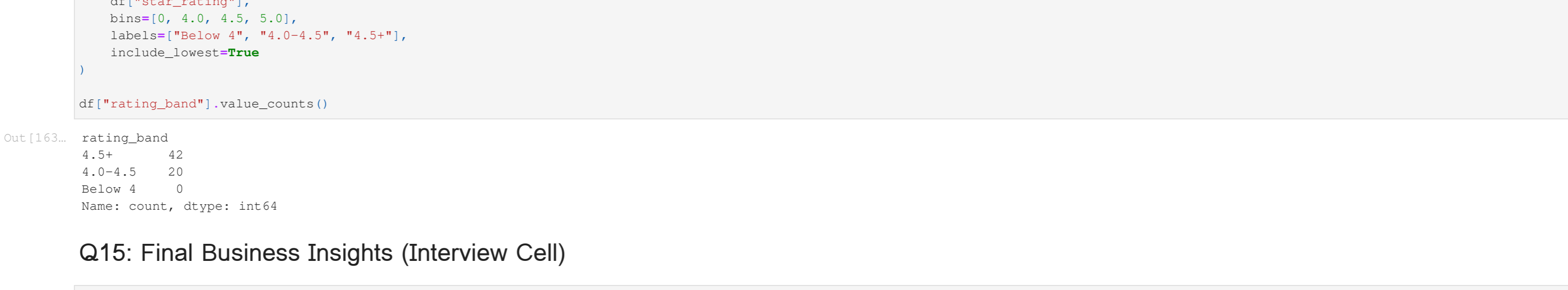
	ram
4 GB	29
6 GB	19
2 GB	13
3 GB	1
	Name: count, dtype: int64

```
In [157]: sns.countplot(data=df, x="ram")
plt.title("Popularity by RAM Variant")
plt.show()
```



Q13: Outlier Detection (Price)

```
In [160]: sns.boxplot(x=df["sale_price"])
plt.title("Sale Price Outliers")
plt.show()
```



Q14: Rating Bands Analysis

```
In [163]: df["rating_band"] = pd.cut(
    df["star_rating"],
    bins=[0, 4.0, 4.5, 5.0],
    labels=["Below 4", "4.0-4.5", "4.5+"],
    include_lowest=True
)

df["rating_band"].value_counts()
```

	rating_band
42	4.5+
20	4.0-4.5
0	Below 4
	Name: count, dtype: int64

Q15: Final Business Insights (Interview Cell)

```
In [166]: pd.DataFrame({
    "Insight": [
        "Higher discounts significantly increase popularity",
        "Premium price does not guarantee higher ratings",
        "Mid-range iPhones dominate customer engagement",
        "High reviews build trust more than star rating",
        "Value-for-money models drive maximum sales"
    ]
})

Out[166]: Insight
0    Higher discounts significantly increase popula...
1    Premium price does not guarantee higher ratings
2    Mid-range iPhones dominate customer engagement
3    High reviews build trust more than star rating
4    Value-for-money models drive maximum sales
```