

```
In [12]: #Importing libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import plotly.express as px
import plotly.graph_objects as go

In [3]: dataframe = pd.read_csv('apple_products.csv')

In [4]: dataframe.head()

Out[4]:
   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  MOBEXRGVTEHHTGUH  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  MOBEXRGVACETJT4F  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  MOBEXRGVPK7PEJZ  4.5  2 GB

In [5]: dataframe.tail()

Out[5]:
   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  96909  8161  MOBFWQGBR3MKTALG  4.5  4 GB
58  APPLE iPhone 11 (Purple, 64 GB)  https://www.flipkart.com/apple-iphone-11-purpl...  Apple  46999  54900  14  43470  3331  MOBFWQGB7TFJKGKE  4.6  4 GB
59  APPLE iPhone 11 (White, 64 GB)  https://www.flipkart.com/apple-iphone-11-white...  Apple  46999  54900  14  43470  3331  MOBFWQGBRVVWVHXE  4.6  4 GB
60  APPLE iPhone 11 (Black, 64 GB)  https://www.flipkart.com/apple-iphone-11-black...  Apple  46999  54900  14  43470  3331  MOBFWQGBXGJCCEYNY  4.6  4 GB
61  APPLE iPhone 11 (Red, 64 GB)  https://www.flipkart.com/apple-iphone-11-red-6...  Apple  46999  54900  14  43470  3331  MOBFWQGB9YYVFCU7  4.6  4 GB

Checking null values

In [7]: dataframe.isnull().sum()

Out[7]:
Product Name      0
Product URL       0
Brand             0
Sale Price        0
Mrp               0
Discount Percentage  0
Number Of Ratings  0
Number Of Reviews  0
Upc              0
Star Rating       0
Ram              0
dtype: int64

The dataset doesn't have any null values. Now, lets have a look at the descriptive statistics of the data

In [38]: dataframe.describe()

Out[38]:
   Sale Price      Mrp  Discount Percentage  Number Of Ratings  Number Of Reviews  Star Rating
count  62.000000    62.000000    62.000000    62.000000    62.000000    62.000000
mean    80073.887097    88058.064516    9.951613    22420.403226    1861.677419    4.575806
std    34310.446132    34728.825597    7.608079    33768.589550    2855.883830    0.059190
min    29999.000000    39900.000000    0.000000    542.000000    42.000000    4.500000
25%   49900.000000    54900.000000    6.000000    740.000000    94.000000    4.500000
50%   75900.000000    79900.000000    10.000000    2101.000000    180.000000    4.600000
75%   117100.000000    120950.000000    14.000000    43470.000000    3331.000000    4.600000
max   140900.000000    149900.000000    29.000000    95909.000000    8161.000000    4.700000

In [91]: dataframe.head()

Out[91]:
   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  MOBEXRGVTEHHTGUH  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  MOBEXRGVACETJT4F  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  MOBEXRGVPK7PEJZ  4.5  2 GB

In [9]: dataframe.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(10), object(1)
memory usage: 5.5+ KB

Top 10 highest rated iPhones on flipkart

In [14]: dataframe.head()

Out[14]:
   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  MOBEXRGVTEHHTGUH  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  MOBEXRGVACETJT4F  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  MOBEXRGVPK7PEJZ  4.5  2 GB
```

iphone sales Analysis in India

Now i will create a new dataframe by storing all the data about the Top 10 highest-rated iPhones in India on flipkart. It will help in understanding what kind of iPhones are liked the most in India

```
In [7]: highest_rated = dataframe.sort_values(by = ['Star Rating'], ascending = False)

In [8]: highest_rated = highest_rated.head(10)

In [9]: highest_rated['Product Name']

Out[9]:
20  APPLE iPhone 11 Pro Max (Midnight Green, 64 GB)
17  APPLE iPhone 11 Pro Max (Space Grey, 64 GB)
16  APPLE iPhone 11 Pro Max (Midnight Green, 256 GB)
15  APPLE iPhone 11 Pro Max (Gold, 64 GB)
14  APPLE iPhone 11 Pro Max (Gold, 256 GB)
0  APPLE iPhone 8 Plus (Gold, 64 GB)
29  APPLE iPhone 12 (White, 128 GB)
32  APPLE iPhone 12 Pro Max (Graphite, 128 GB)
35  APPLE iPhone 12 (Black, 128 GB)
36  APPLE iPhone 12 (Blue, 128 GB)
Name: Product Name, dtype: object

In [24]: print(highest_rated)

   Product Name \
20  APPLE iPhone 11 Pro Max (Midnight Green, 64 GB)
17  APPLE iPhone 11 Pro Max (Space Grey, 64 GB)
16  APPLE iPhone 11 Pro Max (Midnight Green, 256 GB)
15  APPLE iPhone 11 Pro Max (Gold, 64 GB)
14  APPLE iPhone 11 Pro Max (Gold, 256 GB)
0  APPLE iPhone 8 Plus (Gold, 64 GB)
29  APPLE iPhone 12 (White, 128 GB)
32  APPLE iPhone 12 Pro Max (Graphite, 128 GB)
35  APPLE iPhone 12 (Black, 128 GB)
36  APPLE iPhone 12 (Blue, 128 GB)

   Product URL  Brand  Sale Price \
20  https://www.flipkart.com/apple-iphone-11-pro-m...  Apple  117100
17  https://www.flipkart.com/apple-iphone-11-pro-m...  Apple  117100
16  https://www.flipkart.com/apple-iphone-11-pro-m...  Apple  131900
15  https://www.flipkart.com/apple-iphone-11-pro-m...  Apple  117100
14  https://www.flipkart.com/apple-iphone-11-pro-m...  Apple  117100
0  https://www.flipkart.com/apple-iphone-8-plus-g...  Apple  49900
29  https://www.flipkart.com/apple-iphone-12-white...  Apple  75900
32  https://www.flipkart.com/apple-iphone-12-pro-m...  Apple  120900
35  https://www.flipkart.com/apple-iphone-12-black...  Apple  75900
36  https://www.flipkart.com/apple-iphone-12-blue...  Apple  75900

   Mrp  Discount Percentage  Number Of Ratings  Number Of Reviews \
20  117100  0  1078  101
17  117100  0  1078  101
16  131900  0  1078  101
15  117100  0  1078  101
14  131900  0  1078  101
0  49900  0  3431  356
29  84900  10  2101  180
32  129900  6  580  45
35  84900  10  2101  180
36  84900  10  2101  180

   Upc  Star Rating  Ram
20  MOBEXRGTSTPQZNY  4.7  4 GB
17  MOBEXRGTSTPQZNY  4.7  4 GB
16  MOBEXRGTSTPQZNY  4.7  4 GB
15  MOBEXRGTSTPQZNY  4.7  4 GB
14  MOBEXRGTSTPQZNY  4.7  4 GB
0  MOBEXRGVTEHHTGUH  4.6  2 GB
29  MOBEXRGVTEHHTGUH  4.6  2 GB
32  MOBEXRGVTEHHTGUH  4.6  2 GB
35  MOBEXRGVTEHHTGUH  4.6  2 GB
36  MOBEXRGVTEHHTGUH  4.6  2 GB
```

How many ratings do the highest-rated iPhones on flipkart have ?

```
In [25]: dataframe.head()

Out[25]:
   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  MOBEXRGVTEHHTGUH  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  MOBEXRGVACETJT4F  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  MOBEXRGVPK7PEJZ  4.5  2 GB

In [31]: iphones = highest_rated['Product Name'].value_counts()
label = iphones.index
counts = highest_rated['Number Of Ratings']
figure = px.bar(highest_rated, x = label, y = counts)
figure.show()

number of reviews of Highest Rated iPhones

APPLE iPhone 8 Plus (Gold, 64 GB) is also leading in the highest number of reviews on flipkart among the highest rated iPhone in India.
```

what is the relationship between the sale price of iPhones and number of ratings on flipkart ?

```
In [17]: dataframe.head()

Out[17]:
   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  MOBEXRGVTEHHTGUH  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  MOBEXRGVACETJT4F  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  MOBEXRGVPK7PEJZ  4.5  2 GB

In [29]: figure = px.scatter(dataframe = dataframe, x = 'Number Of Ratings',
                             y = 'Sale Price', size = 'Discount Percentage',
                             trendline = 'ols',
                             title = 'Relationship Between Sale Price and Number of Ratings of iPhones')
figure.show()

Relationship Between Sale Price and Number of Ratings of iPhones
```

There is negative linear relationship between the sale price of iPhones and the numbers of ratings. It means iPhones with lower sale prices are sold more in India. Now lets have a look at the relationship between the discount percentage on iPhones on flipkart and the number of ratings:

what is the relationship between discount percentage and number of ratings on flipkart ?

```
In [32]: figure = px.scatter(dataframe = dataframe, x = 'Number Of Ratings',
                             y = 'Discount Percentage', size = 'Sale Price',
                             trendline = 'ols',
                             title = 'Relationship Between Sale Price and Number of Ratings of iPhones')
figure.show()

Relationship Between Sale Price and Number of Ratings of iPhones
```

Most expensive and least expensive iPhones

```
In [34]: dataframe.head()

Out[34]:
   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  MOBEXRGVTEHHTGUH  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  MOBEXRGVACETJT4F  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  MOBEXRGVPK7PEJZ  4.5  2 GB

In [37]: most_expensive = dataframe.loc[dataframe['Sale Price'].idxmax()]
least_expensive = dataframe.loc[dataframe['Sale Price'].idxmin()]

#Display the results
print('Most expensive : ', most_expensive)
print('Least expensive : ', least_expensive)

Most expensive : Product Name      APPLE iPhone 12 Pro (Silver, 512 GB)
Product URL      https://www.flipkart.com/apple-iphone-12-pro-s...
Brand            Apple
Sale Price       140900
Mrp              39900
Discount Percentage  6
Number Of Ratings  542
Number Of Reviews  42
Upc              HCBFWQGB7TFJKGKE
Star Rating      4.5
Ram              4 GB
Name: 24, dtype: object

Least expensive : Product Name      APPLE iPhone SE (White, 64 GB)
Product URL      https://www.flipkart.com/apple-iphone-se-white...
Brand            Apple
Sale Price       29999
Mrp              39900
Discount Percentage  24
Number Of Ratings  95907
Number Of Reviews  8154
Upc              MOBFWQGB7TFJKGKE
Star Rating      4.5
Ram              2 GB
Name: 52, dtype: object

Summary

APPLE iPhone 8 Plus (Gold, 64 GB) was the most appreciated iPhone in India iPhone with lower sale prices are sold more in India iPhone with higher discounts are sold more in India
```