###Drive import

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

###Importing...

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
pd.set_option('display.max_colwidth',1000)
```

```
mobile = pd.read_csv('/content/drive/MyDrive/STUDY2/DATA ANALYSIS LAB/LABCYCLE/DATASETS/Mobile phone price_6thQuestion.csv',dtype=str)
mobile.head(3)
```

	Brand	Model	Storage	RAM	Screen Size (inches)	Camera (MP)	Battery Capacity (mAh)	Price ($)
0	Apple	iPhone 13 Pro	128 GB	6 GB	6.1	12 + 12 + 12	3095	999
1	Samsung	Galaxy S21 Ultra	256 GB	12 GB	6.8	108 + 10 + 10 + 12	5000	1199
2	OnePlus	9 Pro	128 GB	8 GB	6.7	48 + 50 + 8 + 2	4500	899

```
mobile.columns
```

```
Index(['Brand', 'Model', 'Storage ', 'RAM ', 'Screen Size (inches)',
       'Camera (MP)', 'Battery Capacity (mAh)', 'Price ($)'],
      dtype='object')
```

###Cleaning

```
mobile['Storage '] = mobile['Storage '].str.replace(' GB', '')
mobile['Storage '] = mobile['Storage '].str.replace('GB', '')
mobile['RAM '] = mobile['RAM '].str.replace(' GB','')
mobile['RAM '] = mobile['RAM '].str.replace('GB','')
mobile['Price ($)'] = mobile['Price ($)'].str.replace('$','')
mobile['Price ($)'] = mobile['Price ($)'].str.replace(',','')
mobile['Price ($)'] = mobile['Price ($)'].str.replace(' ','')
mobile['Storage '] = pd.to_numeric(mobile['Storage '], errors='coerce')
mobile['RAM '] = pd.to_numeric(mobile['RAM '], errors='coerce')
mobile['Battery Capacity (mAh)'] = pd.to_numeric(mobile['Battery Capacity (mAh)'], errors='coerce')
mobile['Price ($)'] = pd.to_numeric(mobile['Price ($)'], errors='coerce')
mobile['Screen Size (inches)'] = pd.to_numeric(mobile['Screen Size (inches)'], errors='coerce')
mobile
```

```
<ipython-input-6-b11b8d906581>:5: FutureWarning: The default value of regex will change from True to False in a future version. In addition,
single character regular expressions will *not* be treated as literal strings when regex=True.
  mobile['Price ($)'] = mobile['Price ($)'].str.replace('$','')
```

	Brand	Model	Storage	RAM	Screen Size (inches)	Camera (MP)	Battery Capacity (mAh)	Price ($)
0	Apple	iPhone 13 Pro	128	6	6.10	12 + 12 + 12	3095	999
1	Samsung	Galaxy S21 Ultra	256	12	6.80	108 + 10 + 10 + 12	5000	1199
2	OnePlus	9 Pro	128	8	6.70	48 + 50 + 8 + 2	4500	899
3	Xiaomi	Redmi Note 10 Pro	128	6	6.67	64 + 8 + 5 + 2	5020	279
4	Google	Pixel 6	128	8	6.40	50 + 12.2	4614	799
...	...	...	...	...	...	...	...	...
402	Samsung	Galaxy Note20 5G	128	8	6.70	12+64+12	4300	1049
403	Xiaomi	Mi 10 Lite 5G	128	6	6.57	48+8+2+2	4160	349
404	Apple	iPhone 12 Pro Max	128	6	6.70	12+12+12	3687	1099
405	Oppo	Reno3	128	8	6.40	48+13+8+2	4025	429
406	Samsung	Galaxy S10 Lite	128	6	6.70	48+12+5	4500	649

407 rows × 8 columns

```
mobile.dtypes
```

```
Brand                      object
Model                      object
Storage                     int64
RAM                         int64
Screen Size (inches)      float64
Camera (MP)                object
Battery Capacity (mAh)      int64
Price ($)                   int64
dtype: object
```

###a. Identify the models & the price released by each brand.

```
modelscount=mobile.groupby(['Brand','Model','Price ($)']).nunique().reset_index()
models = pd.pivot_table(mobile, values=['Price ($)'],
                                index=['Brand','Model'])
models
#print(modelscount[['Brand','Model','Price ($)']])
```

]:

		Price ($)
Brand	Model	
Apple	iPhone 11	661.500000
	iPhone 11 Pro Max	1099.000000
	iPhone 12	799.000000
	iPhone 12 Mini	699.000000
	iPhone 12 Pro	999.000000
...	...	...
Xiaomi	Redmi Note 10S	245.666667
	Redmi Note 7	159.000000
	Redmi Note 8	179.000000
	Redmi Note 9 Pro Max	279.000000
	Redmi Note 9S	239.000000

239 rows × 1 columns

###b. Identify the correlation between Battery Capacity and price.

]:

```
correlation = mobile['Battery Capacity (mAh)'].corr(mobile['Price ($)'])
print("The correlation between Battery Capacity and Price is ",round(correlation,3))
```

]:

```
The correlation between Battery Capacity and Price is  -0.397
```

###c. Find how many models are there per each Battery capacity with same price.

]:

```
models_per_battery_price = mobile.groupby(['Battery Capacity (mAh)', 'Price ($)'])['Model'].nunique().reset_index()
models_per_battery_price
```

]:

	Battery Capacity (mAh)	Price ($)	Model
0	1821	399	2
1	1821	449	1
2	2227	699	1
3	2227	899	1
4	2691	699	1
...	...	...	...
174	6000	349	1
175	6000	379	1
176	6000	999	1
177	7000	429	1
178	7000	449	1

179 rows × 3 columns

###d. Count the number of models in each brand with highest storage. Draw the graph

]:

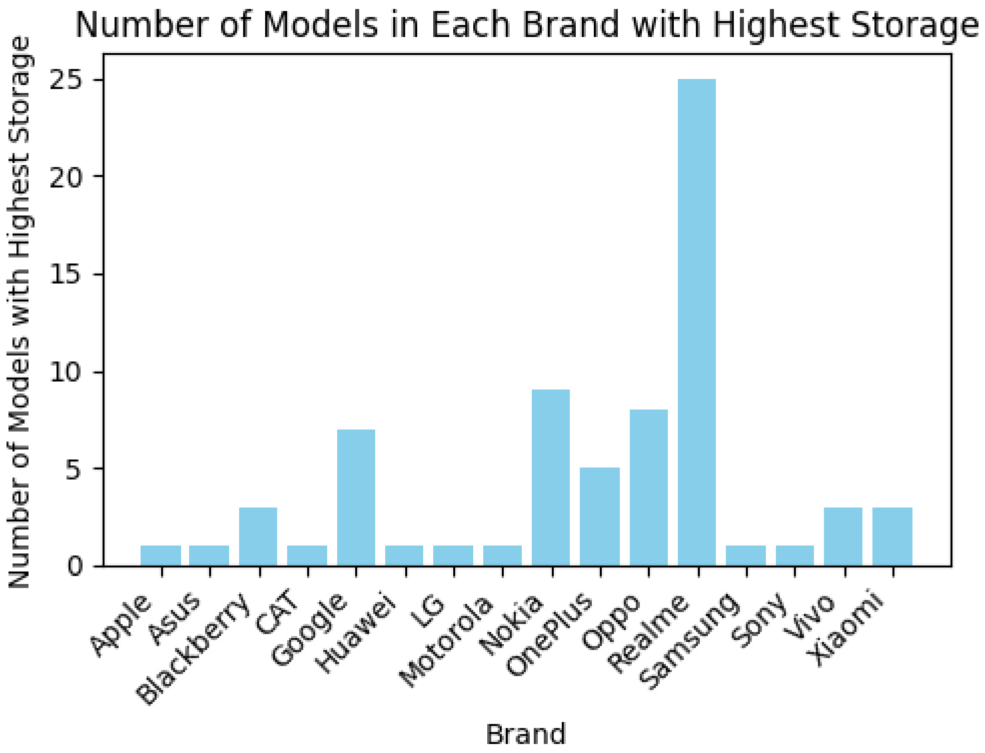
```
max_storage_per_brand = mobile.groupby('Brand')['Storage '].max().reset_index()
merged_df = pd.merge(mobile, max_storage_per_brand, on=['Brand', 'Storage '])
models_count_per_brand = merged_df.groupby(['Brand','Storage '])['Model'].count().reset_index()
print(models_count_per_brand)

plt.figure(figsize=(5, 4))
plt.bar(models_count_per_brand['Brand'], models_count_per_brand['Model'], color='skyblue')
plt.xlabel('Brand')
plt.ylabel('Number of Models with Highest Storage')
plt.title('Number of Models in Each Brand with Highest Storage')
plt.xticks(rotation=45, ha='right')
plt.tight_layout()
plt.show()
```

]:

```
         Brand  Storage   Model
0        Apple       512      1
1         Asus       256      1
2   Blackberry        64      3
3          CAT        32      1
4       Google       128      7
5       Huawei       512      1
6           LG       256      1
7     Motorola       256      1
8        Nokia       128      9
9      OnePlus       256      5
10        Oppo       256      8
11      Realme       128     25
12     Samsung       512      1
13        Sony       128      1
14        Vivo       256      3
15      Xiaomi       256      3
```

]:



###e. Identify how many models are released by each brand.

]:

```
models_released_by_each_brand = mobile.groupby('Brand')['Model'].nunique().reset_index()
models_released_by_each_brand
```

]:

	Brand	Model
0	Apple	15
1	Asus	3
2	Blackberry	3
3	CAT	1
4	Google	4
5	Huawei	10
6	LG	3
7	Motorola	19
8	Nokia	17
9	OnePlus	10
10	Oppo	33
11	Realme	24
12	Samsung	42
13	Sony	1
14	Vivo	21
15	Xiaomi	33

###f. Find the RAM capacity of all models of every brand.

]:

```
ram_capacity = pd.pivot_table(mobile, values=['RAM '],
                              index=['Brand','Model'])
ram_capacity
```

]:

		RAM
Brand	Model	
Apple	iPhone 11	4.0
	iPhone 11 Pro Max	4.0
	iPhone 12	4.0
	iPhone 12 Mini	4.0
	iPhone 12 Pro	6.0
...	...	...
Xiaomi	Redmi Note 10S	6.0
	Redmi Note 7	4.0
	Redmi Note 8	4.0
	Redmi Note 9 Pro Max	6.0
	Redmi Note 9S	6.0

239 rows × 1 columns

###g. same as b

###h. Find how many models are there per each Battery capacity.

]:

```
models_battery = mobile.groupby('Battery Capacity (mAh)')['Model'].nunique().reset_index()
models_battery.head(6)
```

]:

	Battery Capacity (mAh)	Model
0	1821	2
1	2227	2
2	2691	1
3	2800	1
4	2815	3
5	2942	1

###i. Calculate average price of each brand.

]:

```
avg_price_brand = mobile.groupby('Brand')['Price ($)'].mean().reset_index()
avg_price_brand
```

]:

	Brand	Price ($)
0	Apple	745.666667
1	Asus	874.000000
2	Blackberry	499.000000
3	CAT	299.000000
4	Google	699.000000
5	Huawei	783.166667
6	LG	615.666667
7	Motorola	278.130435
8	Nokia	244.714286
9	OnePlus	644.333333
10	Oppo	376.142857
11	Realme	206.906977
12	Samsung	480.405063
13	Sony	1299.000000
14	Vivo	323.000000
15	Xiaomi	282.880597

###j. Find which mobile brand has highest price.

]:

```
highest_price = mobile[['Brand','Price ($)']].max()
highest_price
```

]:

```
Brand        Xiaomi
Price ($)      1999
dtype: object
```

###k. Identify any missing values are there in mobile phone price dataset.

]:

```
m=mobile[mobile.isnull().any(axis=1)]
m
```

]:

	Brand	Model	Storage	RAM	Screen Size (inches)	Camera (MP)	Battery Capacity (mAh)	Price ($)
88	LG	Wing	256	8	NaN	64MP + 13MP + 12MP	4000	999
373	Samsung	Galaxy Z Fold2 5G	256	12	NaN	12+12+12	4500	1999

###l. Display all models associated with apple brand.

]:

```
apple_brand = mobile[mobile['Brand'] == 'Apple'][['Model']]
apple_brand
```

]:

	Model
0	iPhone 13 Pro
5	iPhone 13
13	iPhone 12 Mini
25	iPhone 11
32	iPhone SE (2nd Gen)
39	iPhone XR
45	iPhone 12 Mini
51	iPhone 11 Pro Max
57	iPhone 13 Pro Max
62	iPhone SE (2020)
68	iPhone XR
74	iPhone 11
77	iPhone 13
289	iPhone SE (2020)
297	iPhone 11 Pro Max
305	iPhone 13

	Model
308	iPhone XR
318	iPhone 12
326	iPhone 11
333	iPhone SE (2020)
338	iPhone XS Max
347	iPhone 8 Plus
355	iPhone XR
362	iPhone 11 Pro Max
369	iPhone 12 mini
379	iPhone SE (2020)
384	iPhone 12 Pro
388	iPhone 11
396	iPhone XR
404	iPhone 12 Pro Max

###m. Find the mobile prices based on Camera (MP).

```
#mobile['Camera (sum)'] = mobile['Camera (MP)'].str.extractall('(\d+)').astype(float).groupby(level=0).sum()
camera_price_sum = mobile.groupby('Camera (MP)', as_index=False)['Price ($)'].mean()
camera_price_sum['Price ($)'] = camera_price_sum['Price ($)'].round(2)
camera_price_sum
```

	Camera (MP)	Price ($)
0	108 + 10 + 10 + 12	1199.00
1	108 + 8 + 5 + 2	279.00
2	108+10+10+12	1199.00
3	108+12+12	1299.00
4	108+13+5	649.00
...	...	...
138	64MP + 8MP + 5MP	325.67
139	64MP + 8MP + 5MP + 2MP	296.50
140	64MP + 8MP + 5MP + 5MP	274.00
141	8MP	99.00
142	8MP + 2MP	107.57

143 rows × 2 columns

###n. List the models along with brands which have highest storage.

```
brands_with_highstorage = mobile.groupby('Brand')['Model','Storage '].max()
brands_with_highstorage
```

```
<ipython-input-133-b4bf9ff77405>:1: FutureWarning: Indexing with multiple keys (implicitly converted to a tuple of keys) will be deprecated, use
a list instead.
  brands_with_highstorage = mobile.groupby('Brand')['Model','Storage '].max()
```

	Model	Storage
Brand		
Apple	iPhone XS Max	512
Asus	Zenfone 8 Flip	256
Blackberry	KEY2 LE	64
CAT	S42	32
Google	Pixel 6	128
Huawei	Y7p	512
LG	Wing	256
Motorola	Moto G9 Power Lite	256
Nokia	XR20	128
OnePlus	Nord N10 5G	256
Oppo	Reno6 Z 5G	256
Realme	Narzo 50i	128
Samsung	Galaxy Z Fold2 5G	512
Sony	Xperia 5 III	128
Vivo	Y72 5G	256
Xiaomi	Redmi Note 9S	256

###o. How many models in each brand having RAM>6.

```
ram_6 = mobile[mobile['RAM ']>6]
models_count_per_brand = ram_6.groupby('Brand')['Model'].count().reset_index()
models_count_per_brand
```

	Brand	Model
0	Asus	3
1	Google	5

	Brand	Model
2	Huawei	10
3	LG	1
4	Motorola	1
5	Nokia	2
6	OnePlus	12
7	Oppo	25
8	Realme	11
9	Samsung	19
10	Sony	1
11	Vivo	21
12	Xiaomi	10

###p. List the models having price >600 and Storage between 100 and 200.

```
price_storage = mobile[(mobile['Price ($)']>600) & (mobile['Storage '].between(100,200))]
price_storage[['Model','Storage ','Price ($)']]
```

	Model	Storage	Price ($)
0	iPhone 13 Pro	128	999
2	9 Pro	128	899
4	Pixel 6	128	799
5	iPhone 13	128	799
8	Reno6 Pro+ 5G	128	699
16	Galaxy S21	128	799
23	9	128	729
60	Reno6 Pro 5G	128	659
77	iPhone 13	128	799
78	Galaxy S21	128	799
80	Pixel 6	128	699
87	Xperia 5 III	128	1299
99	Zenfone 8	128	699
102	Galaxy Z Flip 3	128	999
108	Galaxy S20 FE 5G	128	699
112	ROG Phone 5	128	999
123	Zenfone 8 Flip	128	899
291	Pixel 5	128	699
301	Nova 8 Pro 5G	128	699
305	iPhone 13	128	799
315	Pixel 4	128	799
318	iPhone 12	128	799
322	Galaxy S10 Lite	128	649
332	Pixel 5	128	699
343	Galaxy S20 FE 5G	128	699
371	9	128	729
377	Galaxy S20 FE 5G	128	699
384	iPhone 12 Pro	128	999
387	Galaxy S21	128	799
388	iPhone 11	128	749
390	Pixel 5	128	699
392	Galaxy S20 Ultra 5G	128	1199
393	8T	128	749
402	Galaxy Note20 5G	128	1049
404	iPhone 12 Pro Max	128	1099
406	Galaxy S10 Lite	128	649