In [3]:
```python
import numpy as np
import pandas as pd
```

In [4]:
```python
df=pd.read_csv('laptop_data.csv')
df.head()
```

Out[4]:

	Unnamed: 0	Company	TypeName	Inches	ScreenResolution	Cpu	Ram	Memory	Gpu	OpSys	Weight	Price
0	0	Apple	Ultrabook	13.3	IPS Panel Retina Display 2560x1600	Intel Core i5 2.3GHz	8GB	128GB SSD	Intel Iris Plus Graphics 640	macOS	1.37kg	71378.6832
1	1	Apple	Ultrabook	13.3	1440x900	Intel Core i5 1.8GHz	8GB	128GB Flash Storage	Intel HD Graphics 6000	macOS	1.34kg	47895.5232
2	2	HP	Notebook	15.6	Full HD 1920x1080	Intel Core i5 7200U 2.5GHz	8GB	256GB SSD	Intel HD Graphics 620	No OS	1.86kg	30636.0000
3	3	Apple	Ultrabook	15.4	IPS Panel Retina Display 2880x1800	Intel Core i7 2.7GHz	16GB	512GB SSD	AMD Radeon Pro 455	macOS	1.83kg	135195.3360
4	4	Apple	Ultrabook	13.3	IPS Panel Retina Display 2560x1600	Intel Core i5 3.1GHz	8GB	256GB SSD	Intel Iris Plus Graphics 650	macOS	1.37kg	96095.8080

In [5]:
```python
df.shape
```

Out[5]:
```
(1303, 12)
```

In [6]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1303 entries, 0 to 1302
Data columns (total 12 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   Unnamed: 0        1303 non-null   int64  
 1   Company           1303 non-null   object 
 2   TypeName          1303 non-null   object 
 3   Inches            1303 non-null   float64
 4   ScreenResolution  1303 non-null   object 
 5   Cpu               1303 non-null   object 
 6   Ram               1303 non-null   object 
 7   Memory            1303 non-null   object 
 8   Gpu               1303 non-null   object 
 9   OpSys             1303 non-null   object 
 10  Weight            1303 non-null   object 
 11  Price             1303 non-null   float64
dtypes: float64(2), int64(1), object(9)
memory usage: 122.3+ KB
```

In [7]:
```python
df.duplicated().sum()
```

Out[7]:
```
0
```

In [8]:
```python
df.isnull().sum()
```

Out[8]:
```
Unnamed: 0          0
Company             0
TypeName            0
Inches              0
ScreenResolution    0
Cpu                 0
Ram                 0
Memory              0
Gpu                 0
OpSys               0
Weight              0
Price               0
dtype: int64
```

In [9]:
```python
#PreProcessing
df.drop(columns=['Unnamed: 0'],inplace=True)
```

In [10]:
```python
df['Ram']=df['Ram'].str.replace('GB','')
df['Weight']=df['Weight'].str.replace('kg','')
```

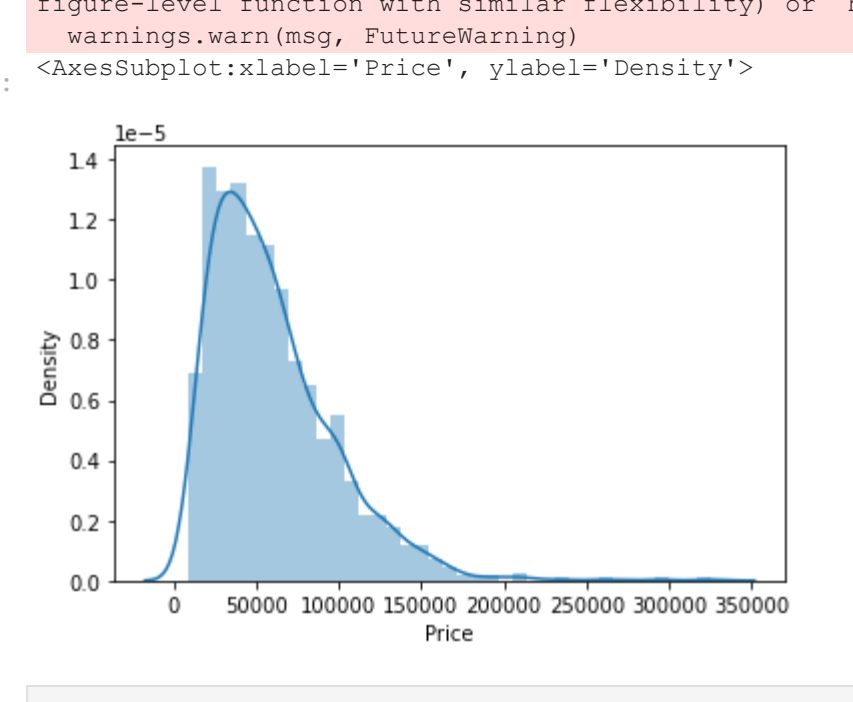
In [11]:
```python
df['Ram']=df['Ram'].astype('int32')
df['Weight']=df['Weight'].astype('float32')
```

In [12]:
```python
#EDA
import seaborn as sns
```

In [13]:
```python
sns.distplot(df['Price'])
```

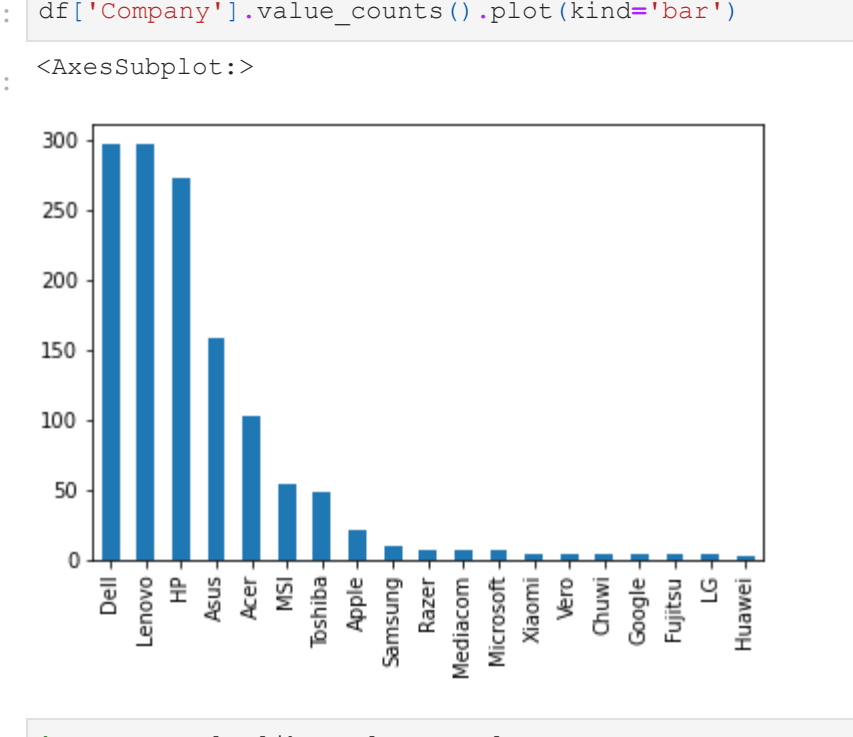
```
C:\Users\syed.mehmaam\Anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[13]:
```
<AxesSubplot:xlabel='Price', ylabel='Density'>
```

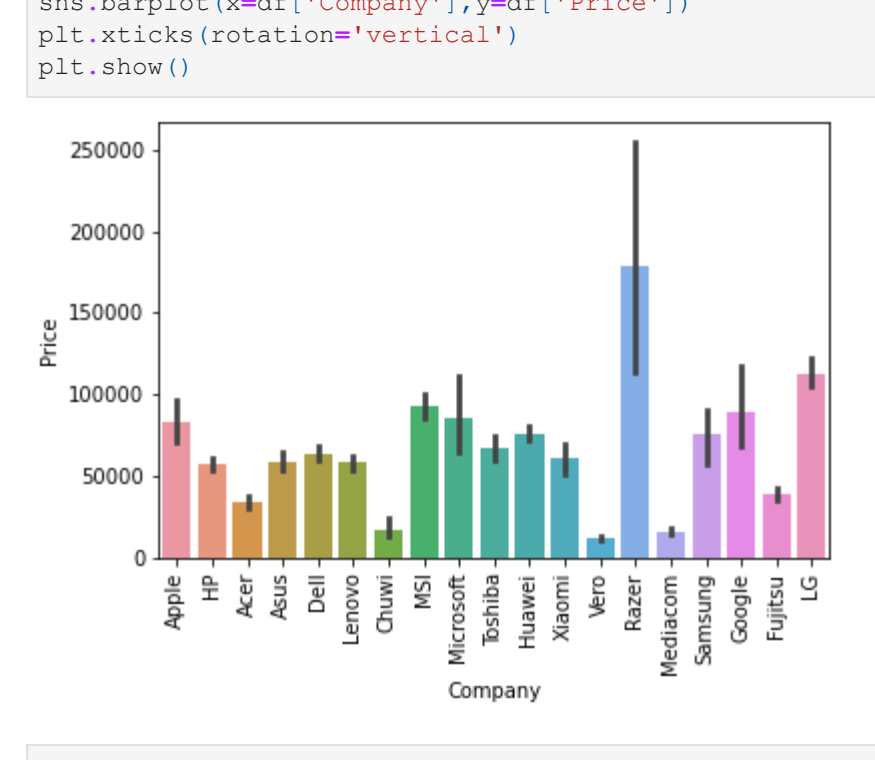


In [14]:
```python
df['Company'].value_counts().plot(kind='bar')
```

Out[14]:
```
<AxesSubplot:>
```

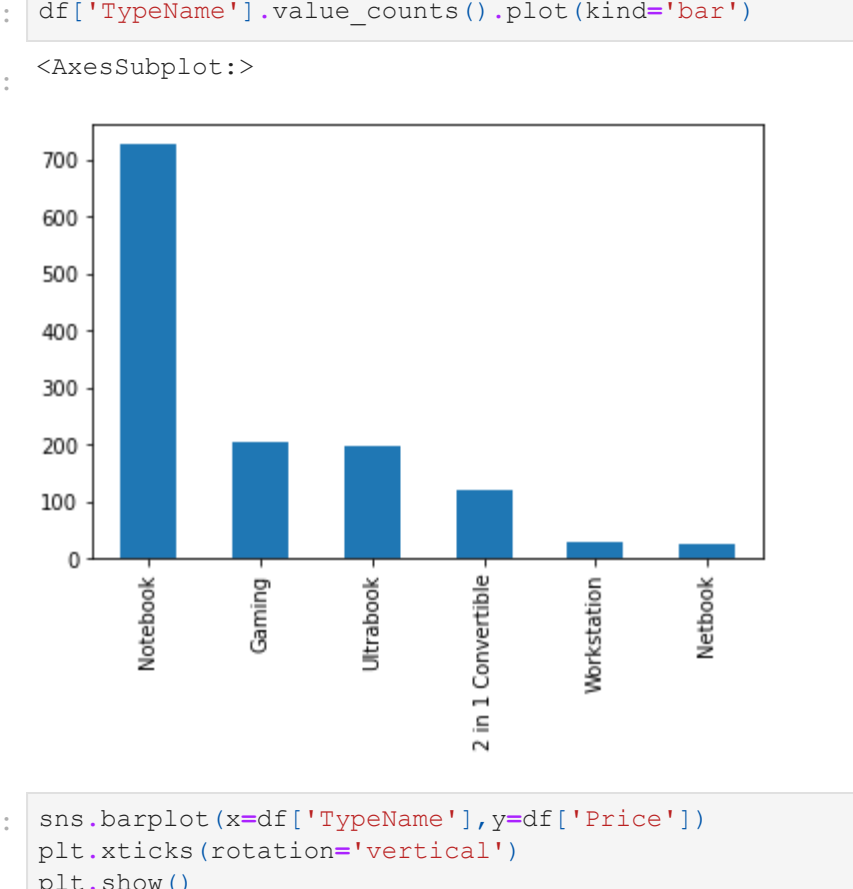


In [15]:
```python
import matplotlib.pyplot as plt
sns.barplot(x=df['Company'],y=df['Price'])
plt.xticks(rotation='vertical')
plt.show()
```

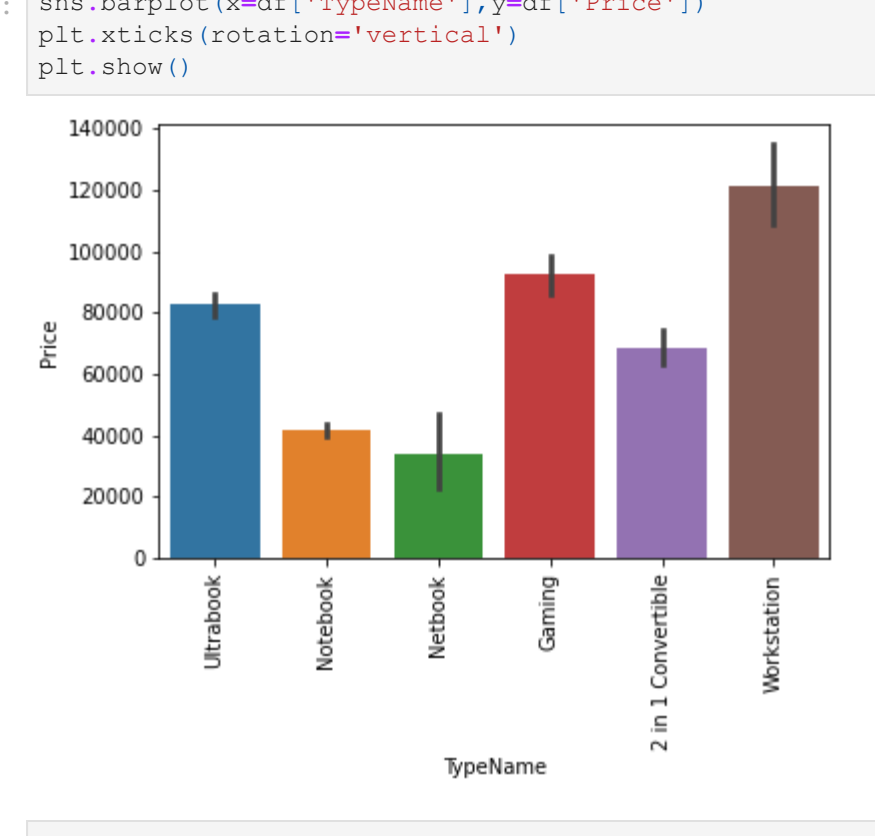


In [16]:
```python
df['TypeName'].value_counts().plot(kind='bar')
```

Out[16]:
```
<AxesSubplot:>
```



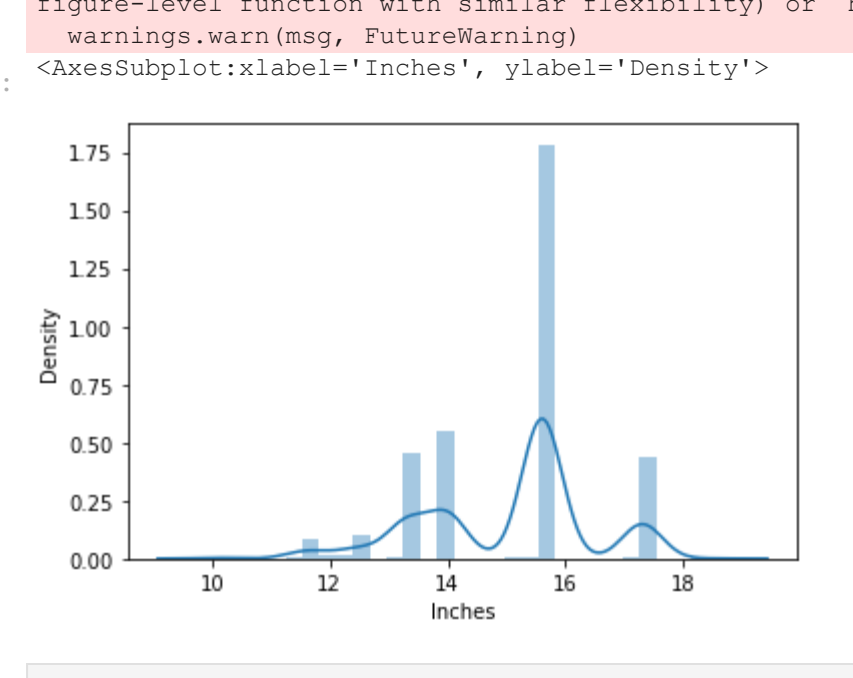
In [17]:
```python
sns.barplot(x=df['TypeName'],y=df['Price'])
plt.xticks(rotation='vertical')
plt.show()
```



In [18]:
```python
sns.distplot(df['Inches'])
```

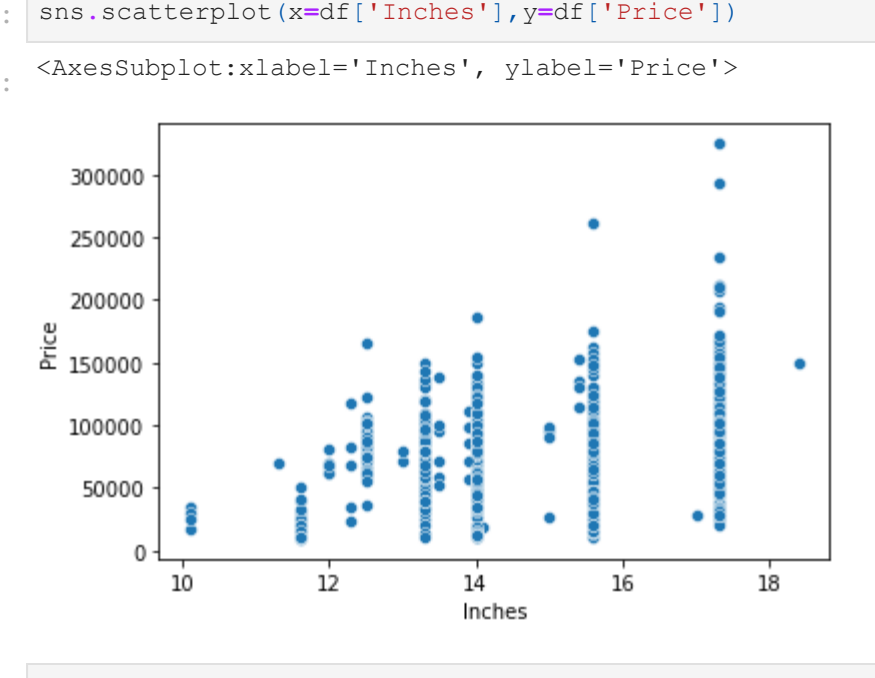
```
C:\Users\syed.mehmaam\Anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[18]:
```
<AxesSubplot:xlabel='Inches', ylabel='Density'>
```



In [19]:
```python
sns.scatterplot(x=df['Inches'],y=df['Price'])
```

Out[19]:
```
<AxesSubplot:xlabel='Inches', ylabel='Price'>
```



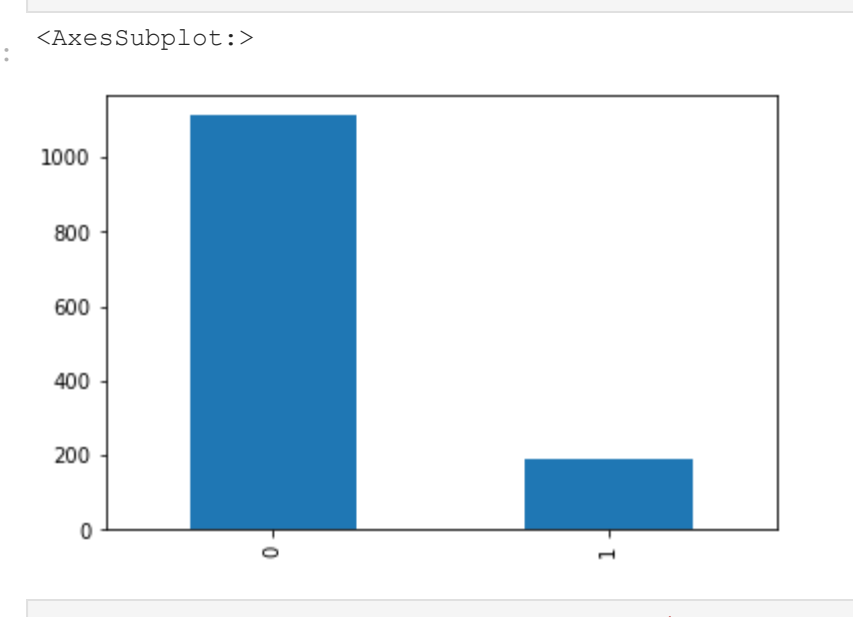
In [20]:
```python
df['ScreenResolution'].value_counts()
```

Out[20]:
```
Full HD 1920x1080                                507
1366x768                                         281
IPS Panel Full HD 1920x1080                      230
IPS Panel Full HD / Touchscreen 1920x1080         53
Full HD / Touchscreen 1920x1080                   47
1600x900                                          23
Touchscreen 1366x768                              16
Quad HD+ / Touchscreen 3200x1800                  15
IPS Panel 4K Ultra HD 3840x2160                   12
IPS Panel 4K Ultra HD / Touchscreen 3840x2160     11
4K Ultra HD / Touchscreen 3840x2160               10
4K Ultra HD 3840x2160                              7
Touchscreen 2560x1440                              7
IPS Panel 1366x768                                 7
IPS Panel Quad HD+ / Touchscreen 3200x1800         6
IPS Panel Retina Display 2560x1600                 6
IPS Panel Retina Display 2304x1440                 6
Touchscreen 2256x1504                              6
IPS Panel Touchscreen 2560x1440                    5
IPS Panel Retina Display 2880x1800                 4
IPS Panel Touchscreen 1920x1200                    4
1440x900                                           4
IPS Panel 2560x1440                                4
IPS Panel Quad HD+ 2560x1440                       3
Quad HD+ 3200x1800                                 3
1920x1080                                          3
Touchscreen 2400x1600                              3
2560x1440                                          3
IPS Panel Touchscreen 1366x768                     3
IPS Panel Touchscreen / 4K Ultra HD 3840x2160      2
IPS Panel Full HD 2160x1440                        2
IPS Panel Quad HD+ 3200x1800                       2
IPS Panel Retina Display 2736x1824                 1
IPS Panel Full HD 1920x1200                        1
IPS Panel Full HD 2560x1440                        1
IPS Panel Full HD 1366x768                         1
Touchscreen / Full HD 1920x1080                    1
Touchscreen / Quad HD+ 3200x1800                   1
Touchscreen / 4K Ultra HD 3840x2160                1
IPS Panel Touchscreen 2400x1600                    1
Name: ScreenResolution, dtype: int64
```

In [21]:
```python
df['Touchscreen']=df['ScreenResolution'].apply(lambda x:1 if 'Touchscreen' in x else 0)
```

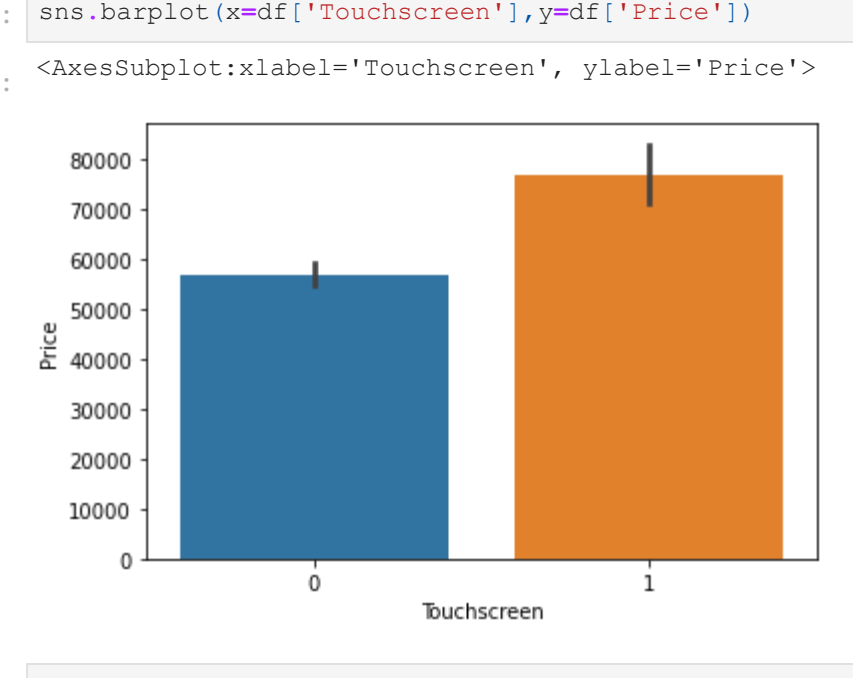
In [22]:
```python
df['Touchscreen'].value_counts().plot(kind='bar')
```

Out[22]:
```
<AxesSubplot:>
```



In [23]:
```python
sns.barplot(x=df['Touchscreen'],y=df['Price'])
```

Out[23]:
```
<AxesSubplot:xlabel='Touchscreen', ylabel='Price'>
```



In [24]:
```python
df['IPS']=df['ScreenResolution'].apply(lambda x:1 if 'IPS' in x else 0)
```

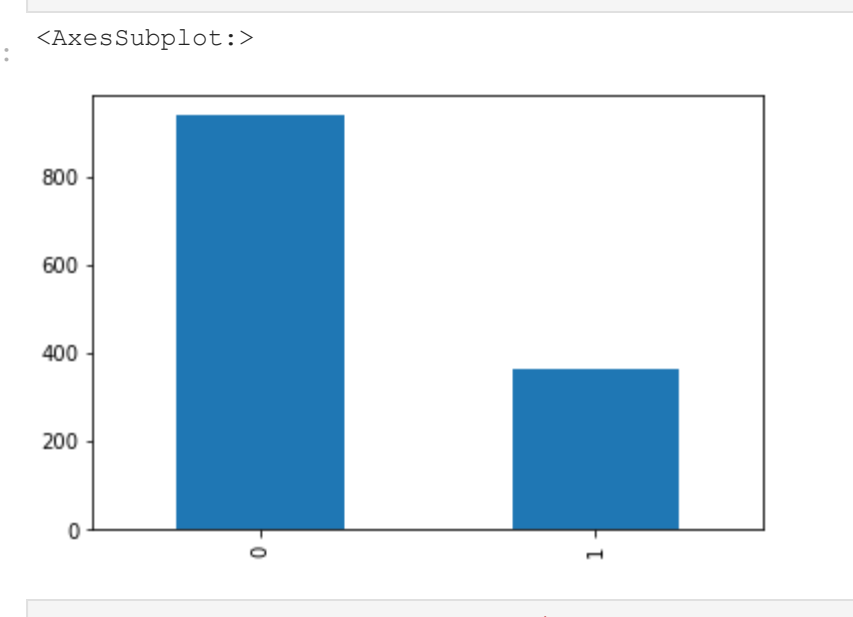
In [25]:
```python
df.head()
```

Out[25]:

	Company	TypeName	Inches	ScreenResolution	Cpu	Ram	Memory	Gpu	OpSys	Weight	Price	Touchscreen	IPS
0	Apple	Ultrabook	13.3	IPS Panel Retina Display 2560x1600	Intel Core i5 2.3GHz	8	128GB SSD	Intel Iris Plus Graphics 640	macOS	1.37	71378.6832	0	1
1	Apple	Ultrabook	13.3	1440x900	Intel Core i5 1.8GHz	8	128GB Flash Storage	Intel HD Graphics 6000	macOS	1.34	47895.5232	0	0
2	HP	Notebook	15.6	Full HD 1920x1080	Intel Core i5 7200U 2.5GHz	8	256GB SSD	Intel HD Graphics 620	No OS	1.86	30636.0000	0	0
3	Apple	Ultrabook	15.4	IPS Panel Retina Display 2880x1800	Intel Core i7 2.7GHz	16	512GB SSD	AMD Radeon Pro 455	macOS	1.83	135195.3360	0	1
4	Apple	Ultrabook	13.3	IPS Panel Retina Display 2560x1600	Intel Core i5 3.1GHz	8	256GB SSD	Intel Iris Plus Graphics 650	macOS	1.37	96095.8080	0	1

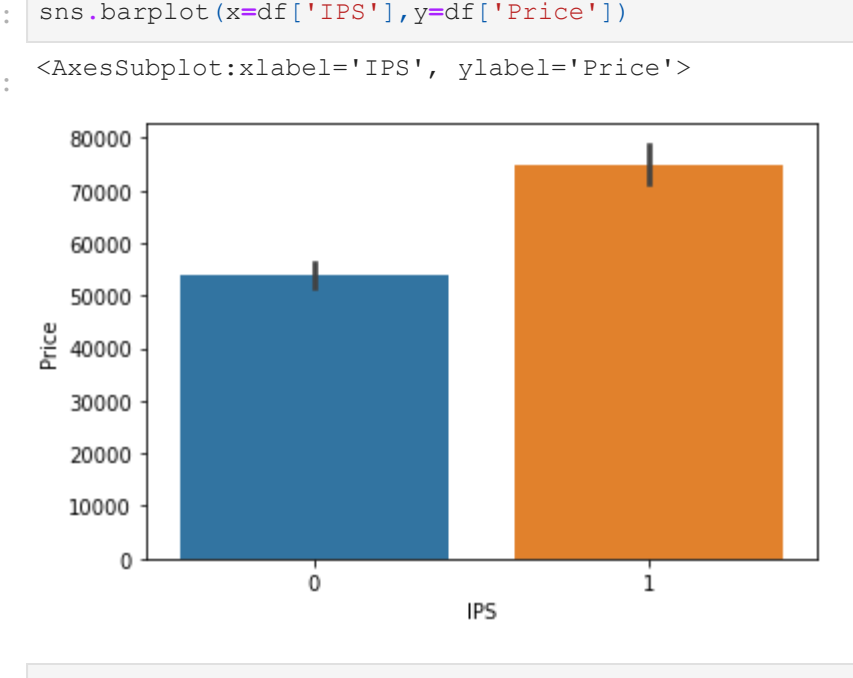
In [26]:
```python
df['IPS'].value_counts().plot(kind='bar')
```

Out[26]:
```
<AxesSubplot:>
```



In [27]:
```python
sns.barplot(x=df['IPS'],y=df['Price'])
```

Out[27]:
```
<AxesSubplot:xlabel='IPS', ylabel='Price'>
```



In [28]:
```python
new = df['ScreenResolution'].str.split('x',n=1,expand=True)
```

In [29]:
```python
df['X_res'] = new[0]
df['Y_res'] = new[1]
```

In [30]:
```python
df['X_res'] = df['X_res'].str.replace(',','').str.findall(r'(\d+\.?\d+)').apply(lambda x:x[0])
```

In [31]:
```python
df['X_res'] = df['X_res'].astype('int')
df['Y_res'] = df['Y_res'].astype('int')
```

In [32]:
```python
df.corr()['Price']
```

Out[32]:
```
Inches         0.068197
Ram            0.743007
Weight         0.210370
Price          1.000000
Touchscreen    0.191226
IPS            0.252208
X_res          0.556529
Y_res          0.552809
Name: Price, dtype: float64
```

In [33]:
```python
df['ppi'] = (((df['X_res']**2) + (df['Y_res']**2))**0.5/df['Inches']).astype('float')
```

In [34]:
```python
df.corr()['Price']
```

Out[34]:
```
Inches         0.068197
Ram            0.743007
Weight         0.210370
Price          1.000000
Touchscreen    0.191226
IPS            0.252208
X_res          0.556529
Y_res          0.552809
ppi            0.473487
Name: Price, dtype: float64
```

In [35]:
```python
df.drop(columns=['ScreenResolution'],inplace=True)
```

In [36]:
```python
df.drop(columns=['Inches','X_res','Y_res'],inplace=True)
```

In [37]:
```python
df['Cpu'].value_counts()
```

Out[37]:
```
Intel Core i5 7200U 2.5GHz       190
Intel Core i7 7700HQ 2.8GHz      146
Intel Core i7 7500U 2.7GHz       134
Intel Core i7 8550U 1.8GHz        73
Intel Core i5 8250U 1.6GHz        72
                                ... 
Intel Core M M3-6Y30 0.9GHz        1
AMD A9-Series 9420 2.9GHz          1
Intel Core i3 6006U 2.2GHz         1
AMD A6-Series 7310 2GHz            1
Intel Xeon E3-1535M v6 3.1GHz      1
Name: Cpu, Length: 118, dtype: int64
```

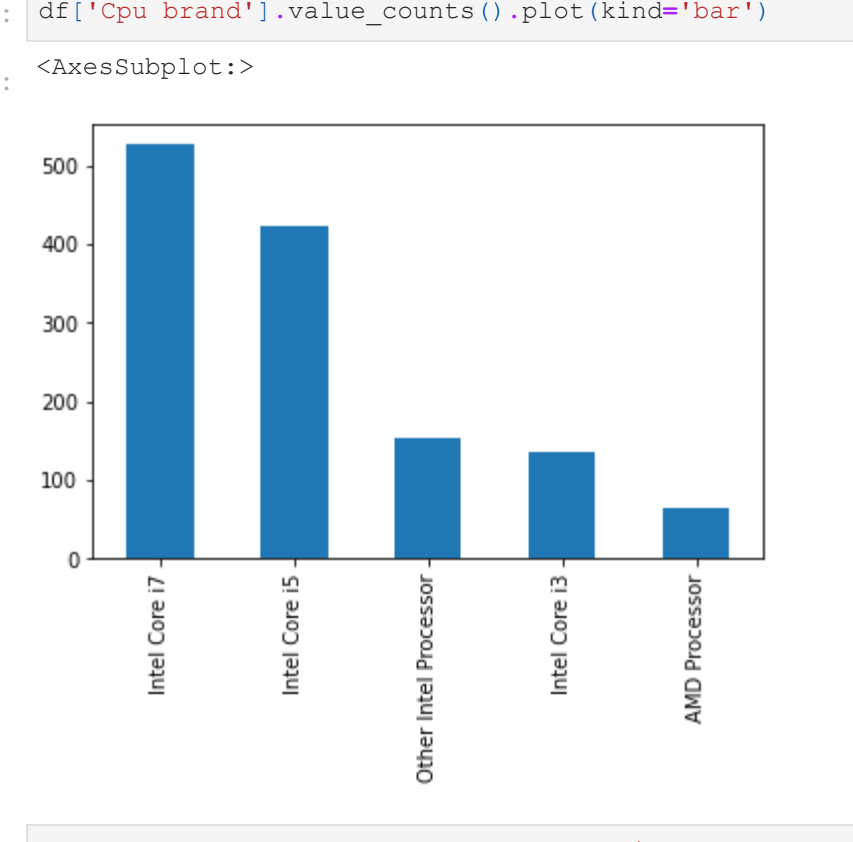
In [38]:
```python
df['Cpu Name'] = df['Cpu'].apply(lambda x:" ".join(x.split()[0:3]))
```

In [39]:
```python
def fetch_processor(text):
    if text == 'Intel Core i7' or text == 'Intel Core i5' or text == 'Intel Core i3':
        return text
    else:
        if text.split()[0] == 'Intel':
            return 'Other Intel Processor'
        else:
            return 'AMD Processor'
```

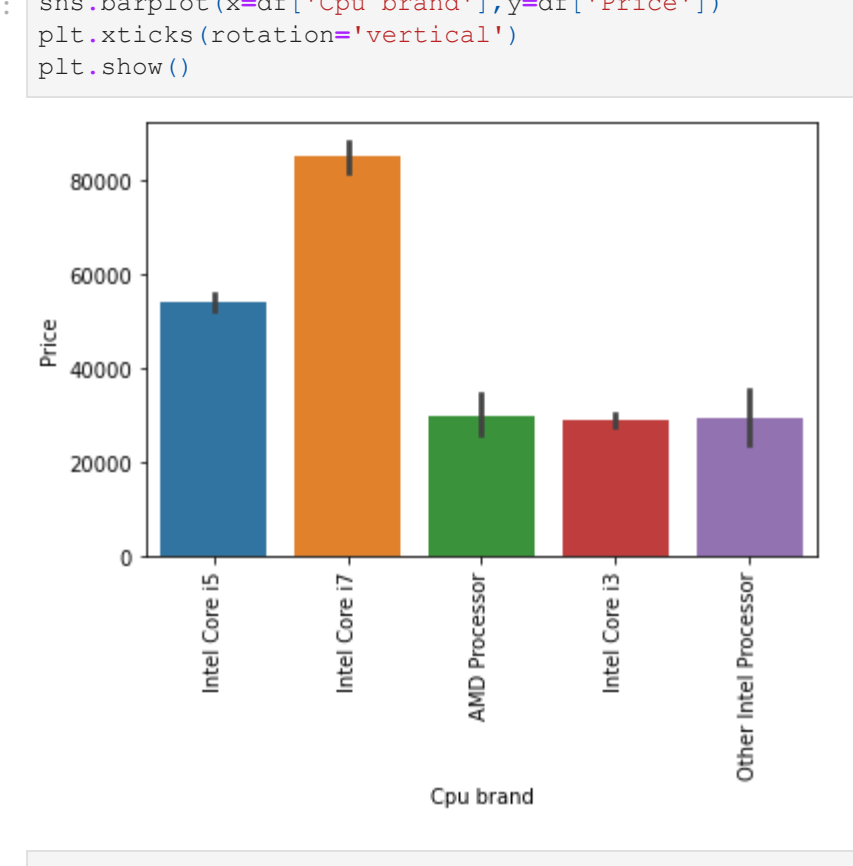
In [40]:
```python
df['Cpu brand'] = df['Cpu Name'].apply(fetch_processor)
```

In [41]:
```python
df['Cpu brand'].value_counts().plot(kind='bar')
```

Out[41]:
```
<AxesSubplot:>
```



In [42]:
```python
sns.barplot(x=df['Cpu brand'],y=df['Price'])
plt.xticks(rotation='vertical')
plt.show()
```



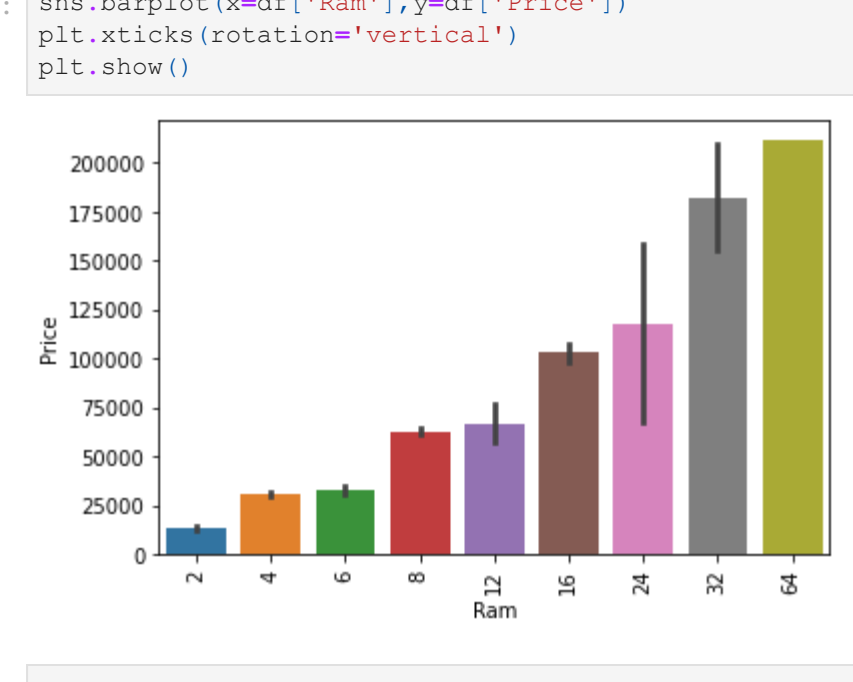
In [43]:
```python
df.drop(columns=['Cpu','Cpu Name'],inplace=True)
```

In [44]:
```python
df.head()
```

Out[44]:

	Company	TypeName	Ram	Memory	Gpu	OpSys	Weight	Price	Touchscreen	IPS	ppi	Cpu brand
0	Apple	Ultrabook	8	128GB SSD	Intel Iris Plus Graphics 640	macOS	1.37	71378.6832	0	1	226.983005	Intel Core i5
1	Apple	Ultrabook	8	128GB Flash Storage	Intel HD Graphics 6000	macOS	1.34	47895.5232	0	0	127.677940	Intel Core i5
2	HP	Notebook	8	256GB SSD	Intel HD Graphics 620	No OS	1.86	30636.0000	0	0	141.211998	Intel Core i5
3	Apple	Ultrabook	16	512GB SSD	AMD Radeon Pro 455	macOS	1.83	135195.3360	0	1	220.534624	Intel Core i7
4	Apple	Ultrabook	8	256GB SSD	Intel Iris Plus Graphics 650	macOS	1.37	96095.8080	0	1	226.983005	Intel Core i5

In [45]:
```python
sns.barplot(x=df['Ram'],y=df['Price'])
plt.xticks(rotation='vertical')
plt.show()
```



In [46]:
```python
df['Memory'].value_counts()
```

Out[46]:
```
256GB SSD                        412
1TB HDD                          223
500GB HDD                        132
512GB SSD                        118
128GB SSD +  1TB HDD              94
128GB SSD                         76
256GB SSD +  1TB HDD              73
32GB Flash Storage                38
2TB HDD                           16
64GB Flash Storage                15
512GB SSD +  1TB HDD              14
1TB SSD                           14
256GB SSD +  2TB HDD              10
1.0TB Hybrid                       9
256GB Flash Storage                8
16GB Flash Storage                 7
32GB SSD                           6
180GB SSD                          5
128GB Flash Storage                4
512GB SSD +  2TB HDD               3
16GB SSD                           3
512GB Flash Storage                2
1TB SSD +  1TB HDD                 2
256GB SSD +  500GB HDD             2
128GB SSD +  2TB HDD               2
256GB SSD +  256GB SSD             2
512GB SSD +  256GB SSD             1
512GB SSD +  512GB SSD             1
64GB Flash Storage +  1TB HDD      1
1TB HDD +  1TB HDD                 1
32GB HDD                           1
64GB SSD                           1
128GB HDD                          1
240GB SSD                          1
8GB SSD                            1
508GB Hybrid                       1
1.0TB HDD                          1
512GB SSD +  1.0TB Hybrid          1
256GB SSD +  1.0TB Hybrid          1
Name: Memory, dtype: int64
```

In [47]:
```python
df['Memory'] = df['Memory'].astype(str).replace('\.0', '', regex=True)
df["Memory"] = df["Memory"].str.replace('GB', '')
df["Memory"] = df["Memory"].str.replace('TB', '000')
new = df["Memory"].str.split("+", n = 1, expand = True)

df["first"]= new[0]
df["first"]=df["first"].str.strip()

df["second"]= new[1]

df["Layer1HDD"] = df["first"].apply(lambda x: 1 if "HDD" in x else 0)
df["Layer1SSD"] = df["first"].apply(lambda x: 1 if "SSD" in x else 0)
df["Layer1Hybrid"] = df["first"].apply(lambda x: 1 if "Hybrid" in x else 0)
df["Layer1Flash_Storage"] = df["first"].apply(lambda x: 1 if "Flash Storage" in x else 0)

df['first'] = df['first'].str.replace(r'\D', '')

df["second"].fillna("0", inplace = True)

df["Layer2HDD"] = df["second"].apply(lambda x: 1 if "HDD" in x else 0)
df["Layer2SSD"] = df["second"].apply(lambda x: 1 if "SSD" in x else 0)
df["Layer2Hybrid"] = df["second"].apply(lambda x: 1 if "Hybrid" in x else 0)
df["Layer2Flash_Storage"] = df["second"].apply(lambda x: 1 if "Flash Storage" in x else 0)

df['second'] = df['second'].str.replace(r'\D', '')

df["first"] = df["first"].astype(int)
df["second"] = df["second"].astype(int)

df["HDD"]=(df["first"]*df["Layer1HDD"]+df["second"]*df["Layer2HDD"])
df["SSD"]=(df["first"]*df["Layer1SSD"]+df["second"]*df["Layer2SSD"])
df["Hybrid"]=(df["first"]*df["Layer1Hybrid"]+df["second"]*df["Layer2Hybrid"])
df["Flash_Storage"]=(df["first"]*df["Layer1Flash_Storage"]+df["second"]*df["Layer2Flash_Storage"])

df.drop(columns=['first', 'second', 'Layer1HDD', 'Layer1SSD', 'Layer1Hybrid',
       'Layer1Flash_Storage', 'Layer2HDD', 'Layer2SSD', 'Layer2Hybrid',
       'Layer2Flash_Storage'],inplace=True)
```

```
C:\Users\syed.mehmaam\AppData\Local\Temp\ipykernel_9820\4023190604.py:16: FutureWarning: The default value of r
egex will change from True to False in a future version.
  df['first'] = df['first'].str.replace(r'\D', '')
C:\Users\syed.mehmaam\AppData\Local\Temp\ipykernel_9820\4023190604.py:25: FutureWarning: The default value of r
egex will change from True to False in a future version.
  df['second'] = df['second'].str.replace(r'\D', '')
```

In [48]:
```python
df.sample(5)
```

Out[48]:

	Company	TypeName	Ram	Memory	Gpu	OpSys	Weight	Price	Touchscreen	IPS	ppi	Cpu brand	HDD	SSD	Hy
864	Dell	Ultrabook	16	512 SSD	Intel Iris Plus Graphics 640	Windows 10	1.29	119347.2000	1	0	276.053530	Intel Core i7	0	512	
1078	Lenovo	Notebook	4	500 HDD	Intel HD Graphics 520	Windows 10	2.10	28771.2000	0	0	100.454670	Intel Core i5	500	0	
1155	HP	Notebook	4	256 SSD	AMD Radeon 520	Windows 10	1.91	25515.2592	0	0	141.211998	AMD Processor	0	256	
657	Dell	Notebook	16	256 SSD + 2000 HDD	AMD Radeon 530	Windows 10	2.20	60472.8000	0	0	141.211998	Intel Core i7	2000	256	
796	Asus	Notebook	4	32 Flash Storage	Intel HD Graphics 500	Windows 10	1.63	15930.7200	0	0	111.935204	Other Intel Processor	0	0	

In [49]:
```python
df.drop(columns=['Memory'],inplace=True)
```

In [50]:
```python
df.head()
```

Out[50]:

	Company	TypeName	Ram	Gpu	OpSys	Weight	Price	Touchscreen	IPS	ppi	Cpu brand	HDD	SSD	Hybrid	Flash_Storage
0	Apple	Ultrabook	8	Intel Iris Plus Graphics 640	macOS	1.37	71378.6832	0	1	226.983005	Intel Core i5	0	128	0	0
1	Apple	Ultrabook	8	Intel HD Graphics 6000	macOS	1.34	47895.5232	0	0	127.677940	Intel Core i5	0	0	0	128
2	HP	Notebook	8	Intel HD Graphics 620	No OS	1.86	30636.0000	0	0	141.211998	Intel Core i5	0	256	0	0
3	Apple	Ultrabook	16	AMD Radeon Pro 455	macOS	1.83	135195.3360	0	1	220.534624	Intel Core i7	0	512	0	0
4	Apple	Ultrabook	8	Intel Iris Plus Graphics 650	macOS	1.37	96095.8080	0	1	226.983005	Intel Core i5	0	256	0	0

In [51]:
```python
df.drop(columns=['Hybrid','Flash_Storage'],inplace=True)
```

In [52]:
```python
df['Gpu'].value_counts()
```

Out[52]:
```
Intel HD Graphics 620      281
Intel HD Graphics 520      185
Intel UHD Graphics 620      68
Nvidia GeForce GTX 1050     66
Nvidia GeForce GTX 1060     48
                          ... 
AMD Radeon R5 520            1
AMD Radeon R7                1
Intel HD Graphics 540        1
AMD Radeon 540               1
ARM Mali T860 MP4            1
Name: Gpu, Length: 110, dtype: int64
```

In [53]:
```python
df['Gpu brand'] = df['Gpu'].apply(lambda x:x.split()[0])
```

In [54]:
```python
df['Gpu brand'].value_counts()
```

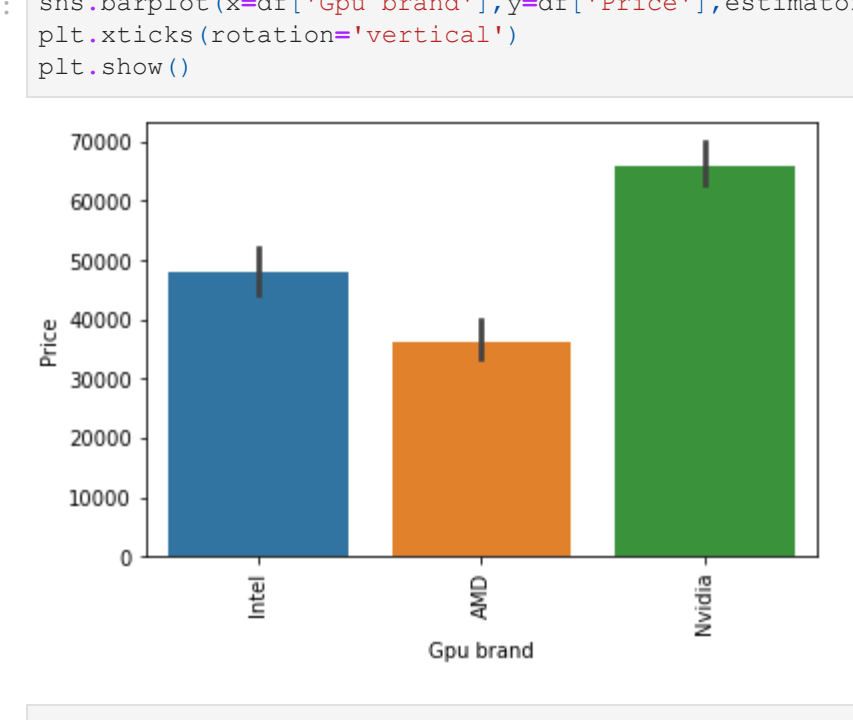
Out[54]:
```
Intel     722
Nvidia    400
AMD       180
ARM         1
Name: Gpu brand, dtype: int64
```

In [55]:
```python
df = df[df['Gpu brand'] != 'ARM']
```

In [56]:
```python
df['Gpu brand'].value_counts()
```

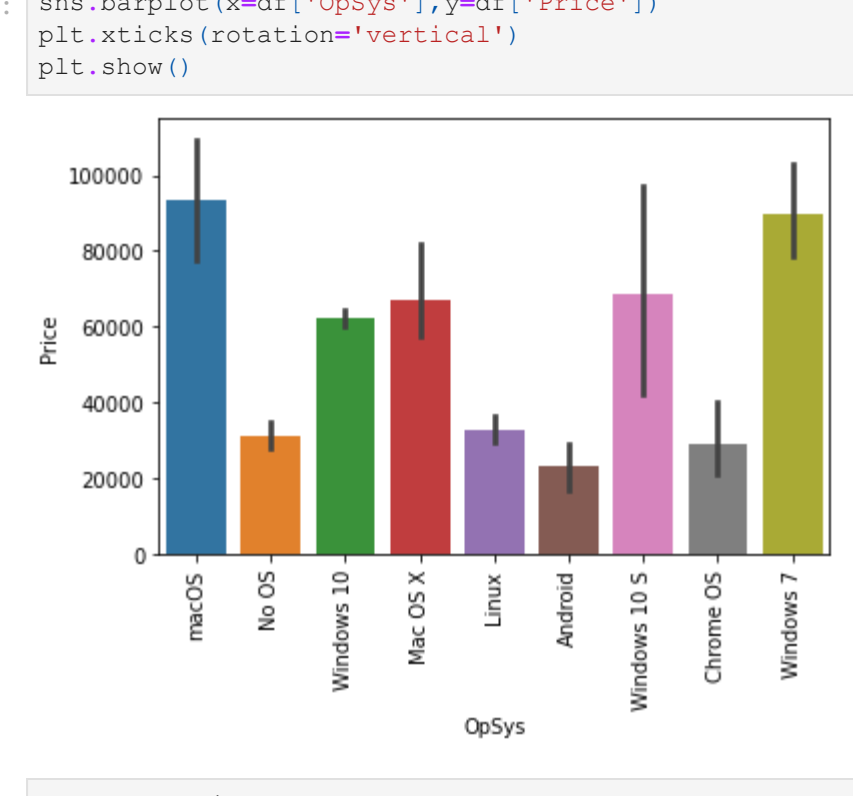
Out[56]:
```
Intel     722
Nvidia    400
AMD       180
Name: Gpu brand, dtype: int64
```

In [57]:
```python
sns.barplot(x=df['Gpu brand'],y=df['Price'],estimator=np.median)
plt.xticks(rotation='vertical')
plt.show()
```



In [58]:
```python
df.drop(columns=['Gpu'],inplace=True)
```

In [59]:
```python
sns.barplot(x=df['OpSys'],y=df['Price'])
plt.xticks(rotation='vertical')
plt.show()
```



In [60]:
```python
def cat_os(inp):
    if inp == 'Windows 10' or inp == 'Windows 7' or inp == 'Windows 10 S':
        return 'Windows'
    elif inp == 'macOS' or inp == 'Mac OS X':
        return 'Mac'
    else:
        return 'Others/No OS/Linux'
```

In [61]:
```python
df['os'] = df['OpSys'].apply(cat_os)
```

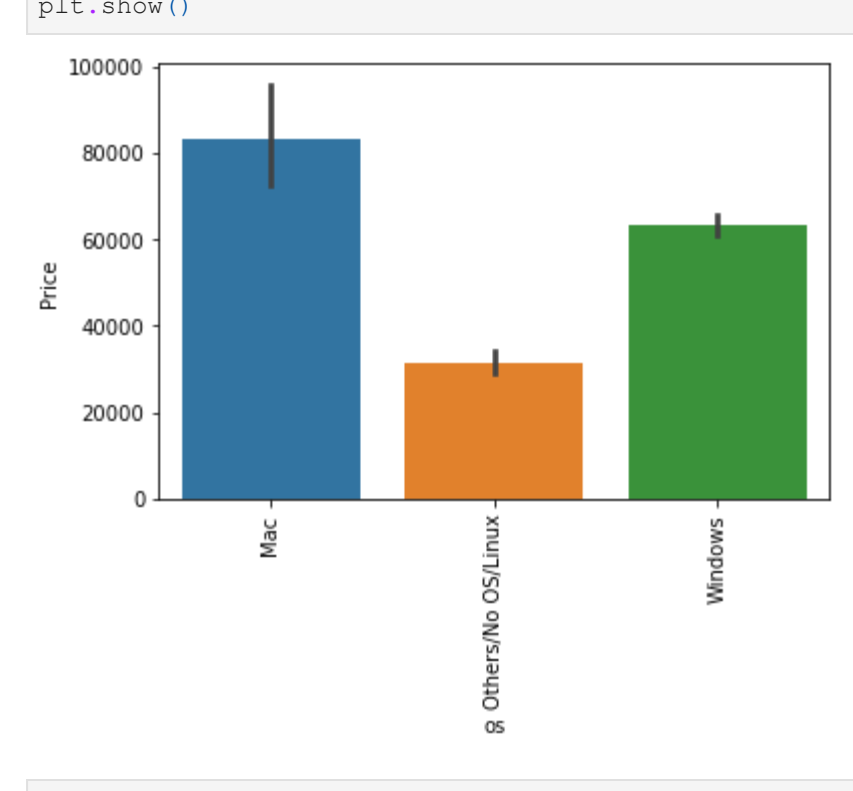
In [62]:
```python
df.head()
```

Out[62]:

	Company	TypeName	Ram	OpSys	Weight	Price	Touchscreen	IPS	ppi	Cpu brand	HDD	SSD	Gpu brand	os
0	Apple	Ultrabook	8	macOS	1.37	71378.6832	0	1	226.983005	Intel Core i5	0	128	Intel	Mac
1	Apple	Ultrabook	8	macOS	1.34	47895.5232	0	0	127.677940	Intel Core i5	0	0	Intel	Mac
2	HP	Notebook	8	No OS	1.86	30636.0000	0	0	141.211998	Intel Core i5	0	256	Intel	Others/No OS/Linux
3	Apple	Ultrabook	16	macOS	1.83	135195.3360	0	1	220.534624	Intel Core i7	0	512	AMD	Mac
4	Apple	Ultrabook	8	macOS	1.37	96095.8080	0	1	226.983005	Intel Core i5	0	256	Intel	Mac

In [63]:
```python
df.drop(columns=['OpSys'],inplace=True)
```

In [64]:
```python
sns.barplot(x=df['os'],y=df['Price'])
plt.xticks(rotation='vertical')
plt.show()
```



In [65]:
```python
sns.distplot(df['Weight'])
```