In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:

```
import io
%cd "C:\Users\deepe\OneDrive\Desktop\Python Datasets\Car Dekh"
```

```
C:\Users\deepe\OneDrive\Desktop\Python Datasets\Car Dekh
```

In [3]:

```
cardata=pd.read_csv("Car details v3.csv")
```

In [4]:

```
# About the data
cardata.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8128 entries, 0 to 8127
Data columns (total 13 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   name           8128 non-null   object 
 1   year           8128 non-null   int64  
 2   selling_price  8128 non-null   int64  
 3   km_driven      8128 non-null   int64  
 4   fuel           8128 non-null   object 
 5   seller_type    8128 non-null   object 
 6   transmission   8128 non-null   object 
 7   owner          8128 non-null   object 
 8   mileage        7907 non-null   float64
 9   engine         7907 non-null   float64
 10  max_power      7913 non-null   object 
 11  torque         7640 non-null   object 
 12  seats          7907 non-null   float64
dtypes: float64(3), int64(3), object(7)
memory usage: 825.6+ KB
```

In [5]:

```
# Columns of data
cardata.columns
```

Out[5]:

```
Index(['name', 'year', 'selling_price', 'km_driven', 'fuel', 'seller_typ
e',
       'transmission', 'owner', 'mileage', 'engine', 'max_power', 'torqu
e',
       'seats'],
      dtype='object')
```

In [6]:

```
cardata.head()
```

Out[6]:

	name	year	selling_price	km_driven	fuel	seller_type	transmission	owner	mileag
0	Maruti Swift Dzire VDI	2014	450000	145500	Diesel	Individual	Manual	First Owner	23.4
1	Skoda Rapid 1.5 TDI Ambition	2014	370000	120000	Diesel	Individual	Manual	Second Owner	21.1
2	Honda City 2017-2020 EXi	2006	158000	140000	Petrol	Individual	Manual	Third Owner	17.7
3	Hyundai i20 Sportz Diesel	2010	225000	127000	Diesel	Individual	Manual	First Owner	23.0
4	Maruti Swift VXI BSIII	2007	130000	120000	Petrol	Individual	Manual	First Owner	16.1

In [7]:

```
# Finding the missing values percentage in each column
cardata.isnull().sum().sort_values(ascending=False)/cardata.shape[0]
```

Out[7]:

```
torque           0.060039
mileage          0.027190
engine           0.027190
seats            0.027190
max_power        0.026452
name             0.000000
year             0.000000
selling_price    0.000000
km_driven        0.000000
fuel             0.000000
seller_type      0.000000
transmission     0.000000
owner            0.000000
dtype: float64
```

In [8]:

```
# Creating new column car_age in the data
cardata["car_age"]=2023-cardata.year
```

In [9]:

```
# Removing the column year from the data
cardata=cardata.drop(["year"],axis=1)
```

In [10]:

```
cardata.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8128 entries, 0 to 8127
Data columns (total 13 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   name           8128 non-null   object 
 1   selling_price  8128 non-null   int64  
 2   km_driven      8128 non-null   int64  
 3   fuel           8128 non-null   object 
 4   seller_type    8128 non-null   object 
 5   transmission   8128 non-null   object 
 6   owner          8128 non-null   object 
 7   mileage        7907 non-null   float64
 8   engine         7907 non-null   float64
 9   max_power      7913 non-null   object 
 10  torque         7640 non-null   object 
 11  seats          7907 non-null   float64
 12  car_age        8128 non-null   int64  
dtypes: float64(3), int64(3), object(7)
memory usage: 825.6+ KB
```

In [11]:

```
cardata.columns
```

Out[11]:

```
Index(['name', 'selling_price', 'km_driven', 'fuel', 'seller_type',
       'transmission', 'owner', 'mileage', 'engine', 'max_power', 'torqu
e',
       'seats', 'car_age'],
      dtype='object')
```

In [12]:

```
# Splitting the data into numeric and object columns
numcols=cardata[['car_age' ,'selling_price', 'km_driven','max_power', 'torque','mileage'
```

In [13]:

```
numcols.describe()
# Here we are not finding the 'max_power' and 'torque' due to the datatypes
```

Out[13]:

	car_age	selling_price	km_driven	mileage	engine
count	8128.000000	8.128000e+03	8.128000e+03	7907.000000	7907.000000
mean	9.195989	6.382718e+05	6.981951e+04	19.418783	1458.625016
std	4.044249	8.062534e+05	5.655055e+04	4.037145	503.916303
min	3.000000	2.999900e+04	1.000000e+00	0.000000	624.000000
25%	6.000000	2.549990e+05	3.500000e+04	16.780000	1197.000000
50%	8.000000	4.500000e+05	6.000000e+04	19.300000	1248.000000
75%	12.000000	6.750000e+05	9.800000e+04	22.320000	1582.000000
max	40.000000	1.000000e+07	2.360457e+06	42.000000	3604.000000

In [14]:

```
numcols['torque']=pd.to_numeric(numcols.torque,errors='coerce')
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\3664150394.py:1: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  numcols['torque']=pd.to_numeric(numcols.torque,errors='coerce')
```

In [15]:

```
numcols['max_power']=pd.to_numeric(numcols.max_power,errors='coerce')
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\3198012263.py:1: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  numcols['max_power']=pd.to_numeric(numcols.max_power,errors='coerce')
```

In [16]:

```
numcols.describe()
# here we are finding the 'max_power' and 'torque' by changing the data type
```

Out[16]:

	car_age	selling_price	km_driven	max_power	torque	mileage	
count	8128.000000	8.128000e+03	8.128000e+03	7912.000000	7634.000000	7907.000000	79
mean	9.195989	6.382718e+05	6.981951e+04	91.517919	3089.943673	19.418783	14
std	4.044249	8.062534e+05	5.655055e+04	35.822499	923.452758	4.037145	5
min	3.000000	2.999900e+04	1.000000e+00	0.000000	500.000000	0.000000	6
25%	6.000000	2.549990e+05	3.500000e+04	68.050000	2500.000000	16.780000	11
50%	8.000000	4.500000e+05	6.000000e+04	82.000000	3000.000000	19.300000	12
75%	12.000000	6.750000e+05	9.800000e+04	102.000000	4000.000000	22.320000	15
max	40.000000	1.000000e+07	2.360457e+06	400.000000	21800.000000	42.000000	36

In [17]:

```
objcols=cardata[['fuel', 'seller_type','seats','transmission', 'owner']]
```

In [18]:

```
# missing values in numcols
numcols.isnull().sum().sort_values(ascending=False)/numcols.shape[0]
```

Out[18]:

```
torque           0.060778
mileage          0.027190
engine           0.027190
max_power        0.026575
car_age          0.000000
selling_price    0.000000
km_driven        0.000000
dtype: float64
```

In [19]:

```
# fill in the missing values by using the median
for col in numcols.columns:
    numcols[col]=numcols[col].fillna(numcols[col].median())
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\2985587695.py:3: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  numcols[col]=numcols[col].fillna(numcols[col].median())
```

In [20]:

```
# finding the frequency of objcols and finding the missing values
for col in objcols.columns:
    freq=objcols[col].value_counts(dropna=False)
    print(freq)
```

```
Diesel    4402
Petrol    3631
CNG         57
LPG         38
Name: fuel, dtype: int64
Individual          6766
Dealer              1126
Trustmark Dealer     236
Name: seller_type, dtype: int64
5.0     6254
7.0     1120
8.0      236
NaN      221
4.0      133
9.0       80
6.0       62
10.0      19
2.0        2
14.0       1
Name: seats, dtype: int64
Manual       7078
Automatic    1050
Name: transmission, dtype: int64
First Owner             5289
Second Owner            2105
Third Owner              555
Fourth & Above Owner     174
Test Drive Car             5
Name: owner, dtype: int64
```

In [21]:

```
# Merging of the levels due to very few no.
objcols.fuel=objcols.fuel.replace(["Petrol","CNG","LPG"],"PCL")
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\2720792656.py:2: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols.fuel=objcols.fuel.replace(["Petrol","CNG","LPG"],"PCL")
```

In [22]:

```
objcols.seats=objcols.seats.replace([4.0,9.0,6.0,10.0,2.0,14.0],24691014)
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\992892221.py:1: SettingW
ithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols.seats=objcols.seats.replace([4.0,9.0,6.0,10.0,2.0,14.0],2469101
4)
```

In [23]:

```
objcols.owner=objcols.owner.replace(["Third Owner","Fourth & Above Owner","Test Drive Ca
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\1184832894.py:1: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols.owner=objcols.owner.replace(["Third Owner","Fourth & Above Owne
r","Test Drive Car"],"3&4 Test")
```

In [24]:

```
objcols.isnull().sum().sort_values(ascending=False)/numcols.shape[0]
```

Out[24]:

```
seats           0.02719
fuel            0.00000
seller_type     0.00000
transmission    0.00000
owner           0.00000
dtype: float64
```

In [25]:

```
for col in objcols.columns:
    objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\1716936729.py:2: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\1716936729.py:2: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\1716936729.py:2: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\1716936729.py:2: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\1716936729.py:2: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
```

In [26]:

```
# combining the numcols and objcols
cardatadf=pd.concat([numcols,objcols],axis=1)
```

In [27]:

```
cardatadf.columns
```

Out[27]:

```
Index(['car_age', 'selling_price', 'km_driven', 'max_power', 'torque',
       'mileage', 'engine', 'fuel', 'seller_type', 'seats', 'transmissio
n',
       'owner'],
      dtype='object')
```

In [28]:

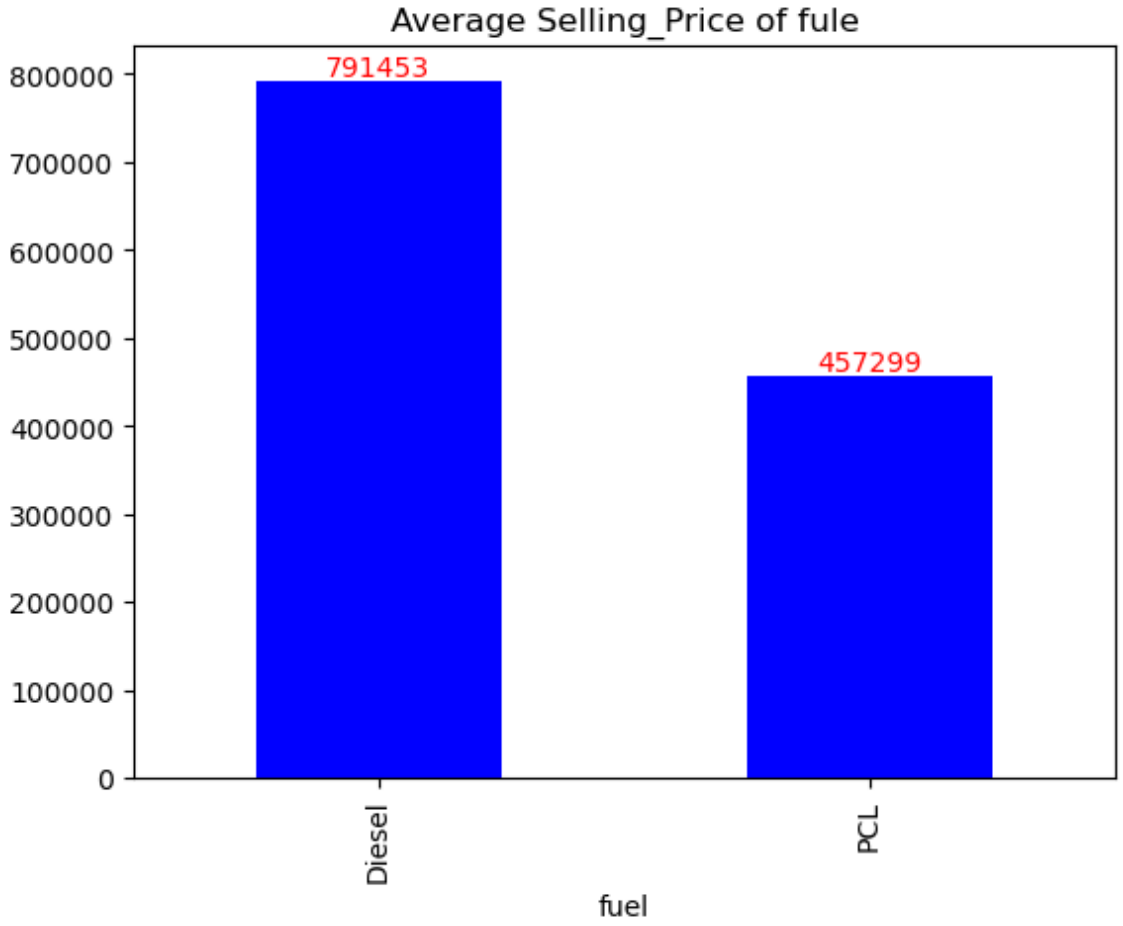
```
# EDA
# average selling price of fuel
cardatadf.selling_price.groupby(cardatadf.fuel).mean()
```

Out[28]:

```
fuel
Diesel    791452.921627
PCL       457299.380569
Name: selling_price, dtype: float64
```

In [29]:

```
ax=cardatadf.selling_price.groupby(cardatadf.fuel).mean().plot(kind="bar",color="blue",t
for i in ax.containers:
 ax.bar_label(i,fontsize=10,color="Red")
```

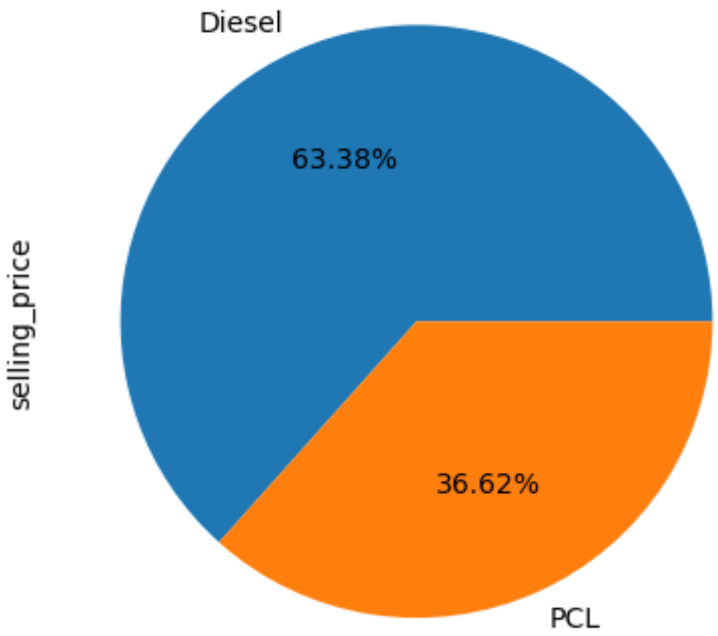


In [30]:

```
cardatadf.selling_price.groupby(cardatadf.fuel).mean().plot(kind="pie",autopct="%.2f%%")
```

Out[30]:

```
<Axes: ylabel='selling_price'>
```



In [31]:

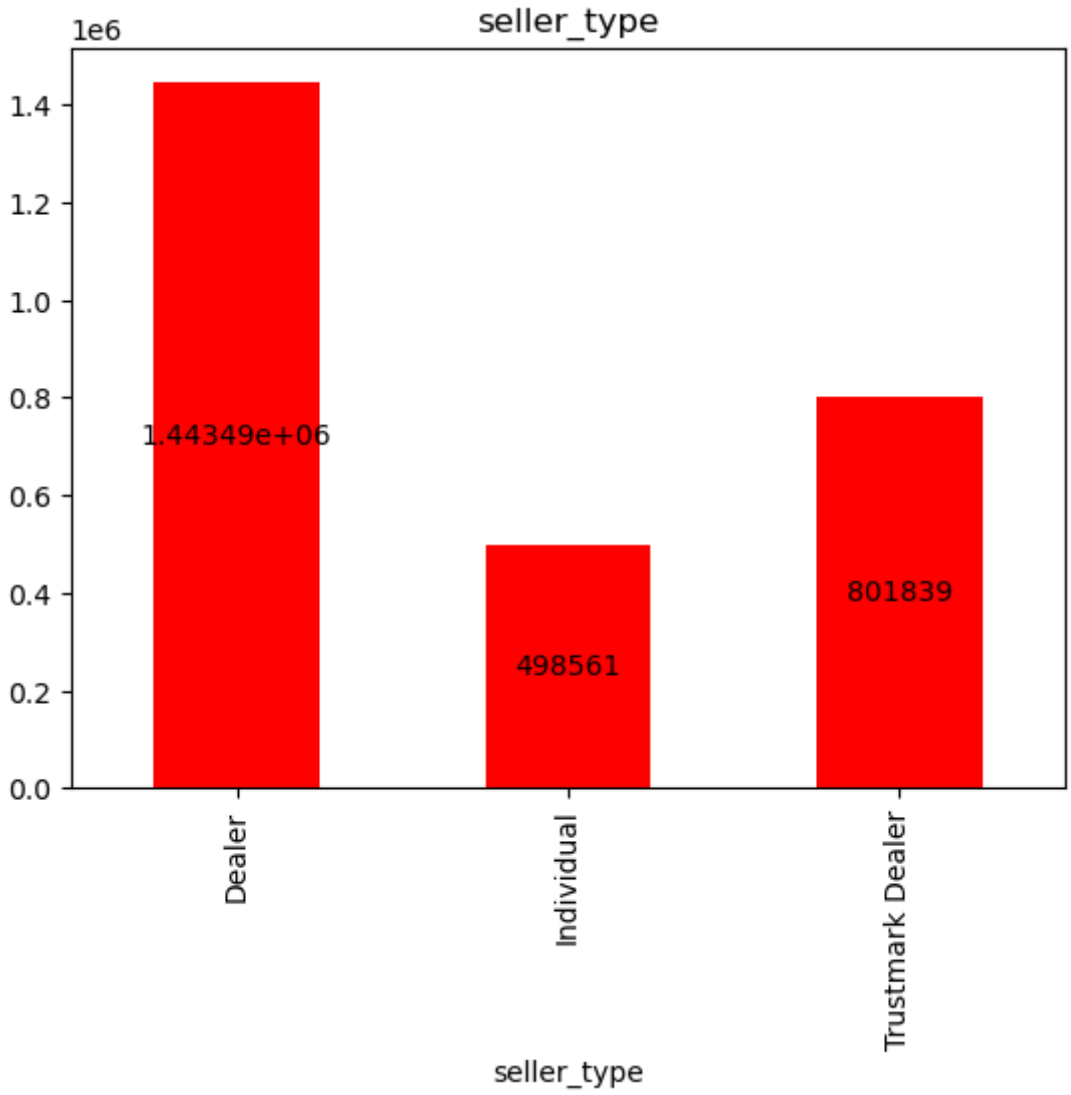
```
#  Average selling_price of seller-type
cardatadf.selling_price.groupby(cardatadf.seller_type).mean()
```

Out[31]:

```
seller_type
Dealer              1.443494e+06
Individual          4.985612e+05
Trustmark Dealer    8.018390e+05
Name: selling_price, dtype: float64
```

In [32]:

```
ax=cardatadf.selling_price.groupby(cardatadf.seller_type).mean().plot(kind="bar",color="
for i in ax.containers:
 ax.bar_label(i,fontsize=10,color="black",label_type="center")
```

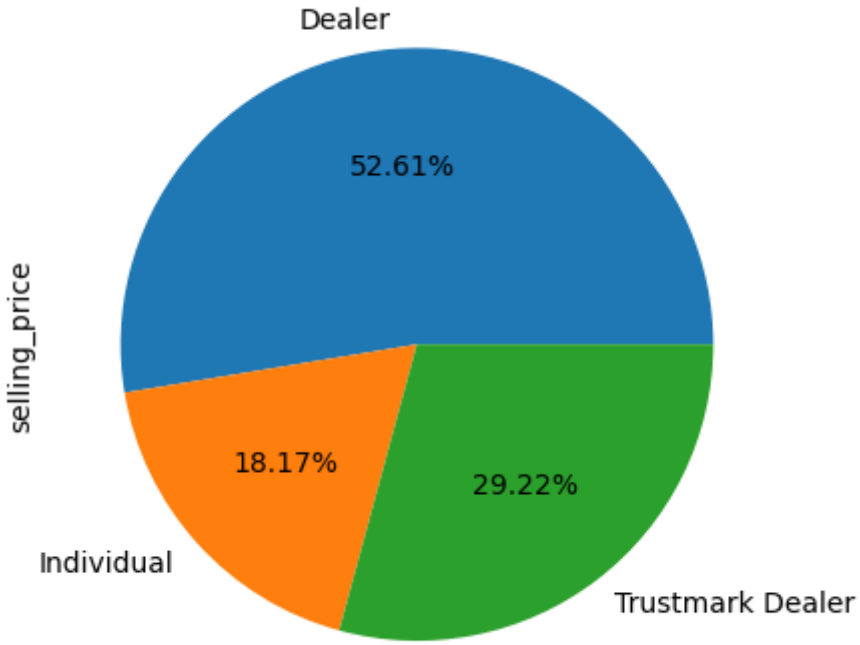


In [33]:

```
cardatadf.selling_price.groupby(cardatadf.seller_type).mean().plot(kind="pie",autopct="%
```

Out[33]:

```
<Axes: ylabel='selling_price'>
```



In [34]:

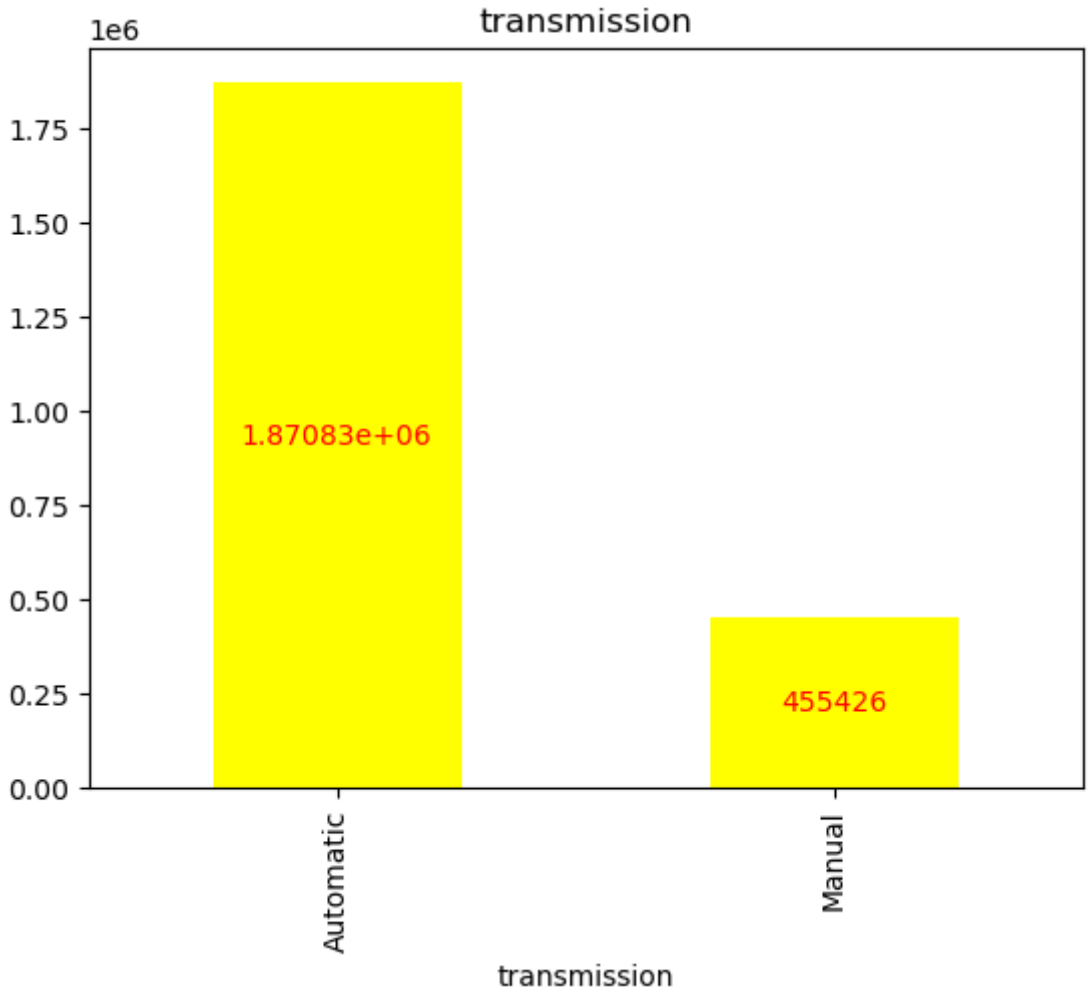
```
# Average selling_price of transmission
cardatadf.selling_price.groupby(cardatadf.transmission).mean()
```

Out[34]:

```
transmission
Automatic    1.870828e+06
Manual       4.554259e+05
Name: selling_price, dtype: float64
```

In [35]:

```
ax=cardatadf.selling_price.groupby(cardatadf.transmission).mean().plot(kind="bar",color=
for i in ax.containers:
 ax.bar_label(i,fontsize=10,color="red",label_type="center")
```

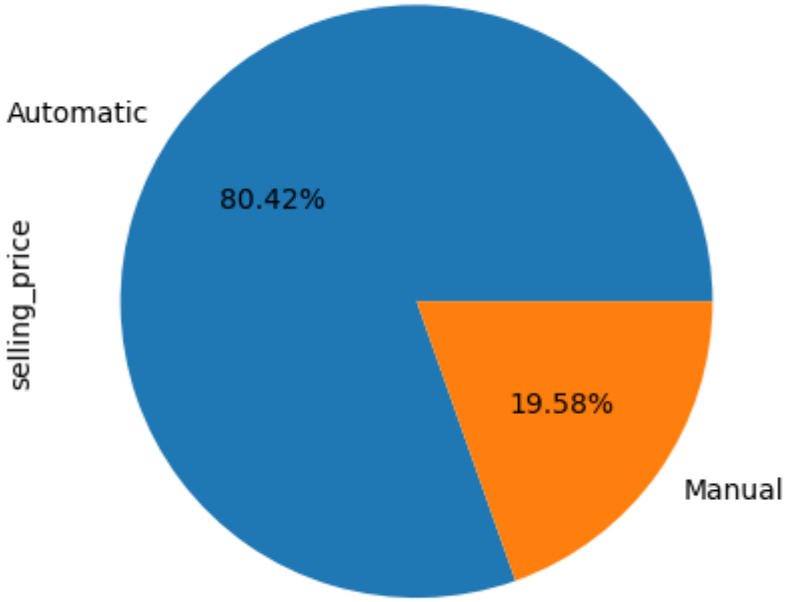


In [36]:

```
cardatadf.selling_price.groupby(cardatadf.transmission).mean().plot(kind="pie",autopct="
```

Out[36]:

```
<Axes: ylabel='selling_price'>
```



In [37]:

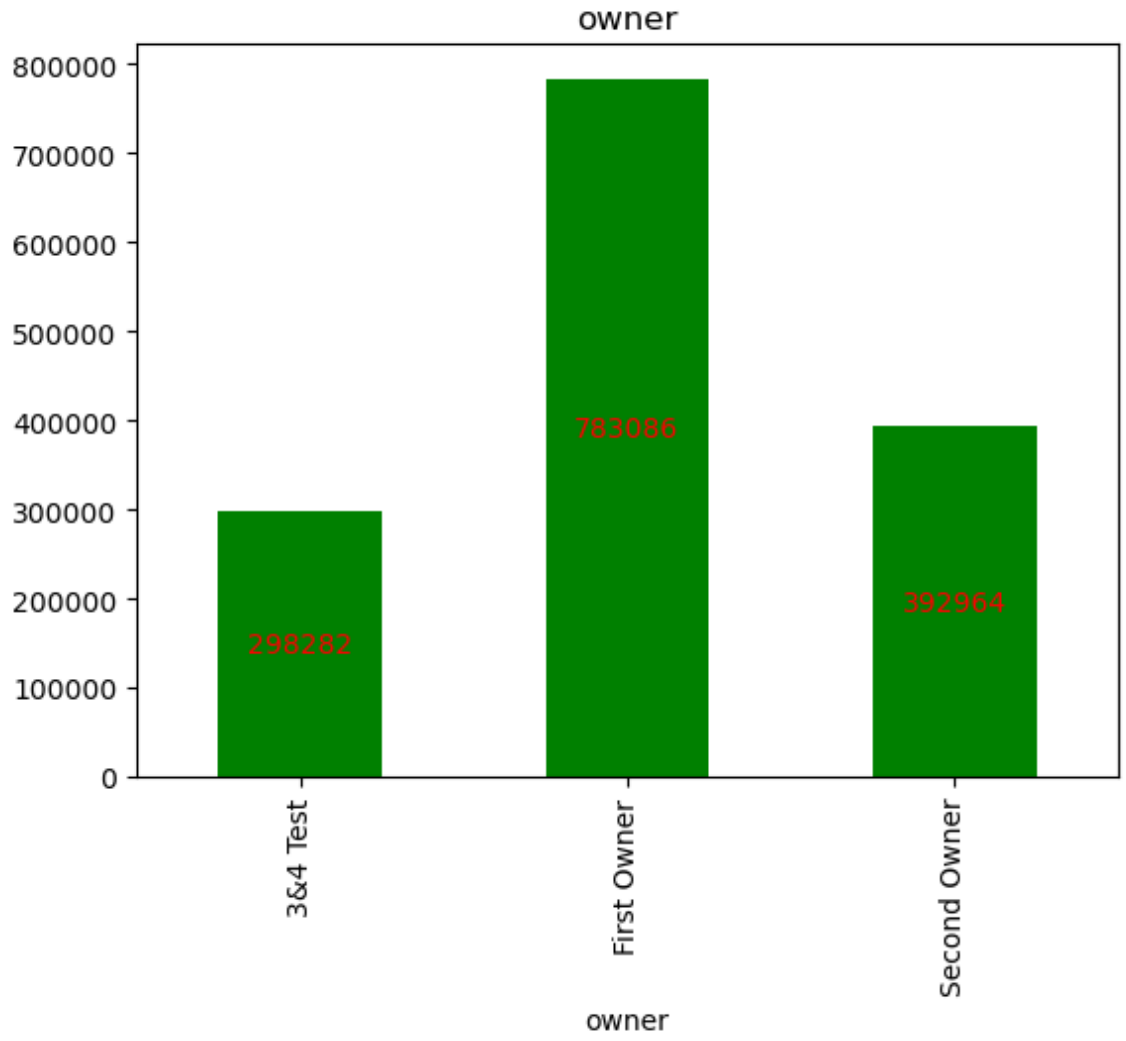
```
# Average selling_price of owner
cardatadf.selling_price.groupby(cardatadf.owner).mean()
```

Out[37]:

```
owner
3&4 Test         298282.017711
First Owner      783086.414445
Second Owner     392964.468409
Name: selling_price, dtype: float64
```

In [38]:

```
ax=cardatadf.selling_price.groupby(cardatadf.owner).mean().plot(kind="bar",color="green"
for i in ax.containers:
 ax.bar_label(i,fontsize=10,color="red",label_type="center")
```

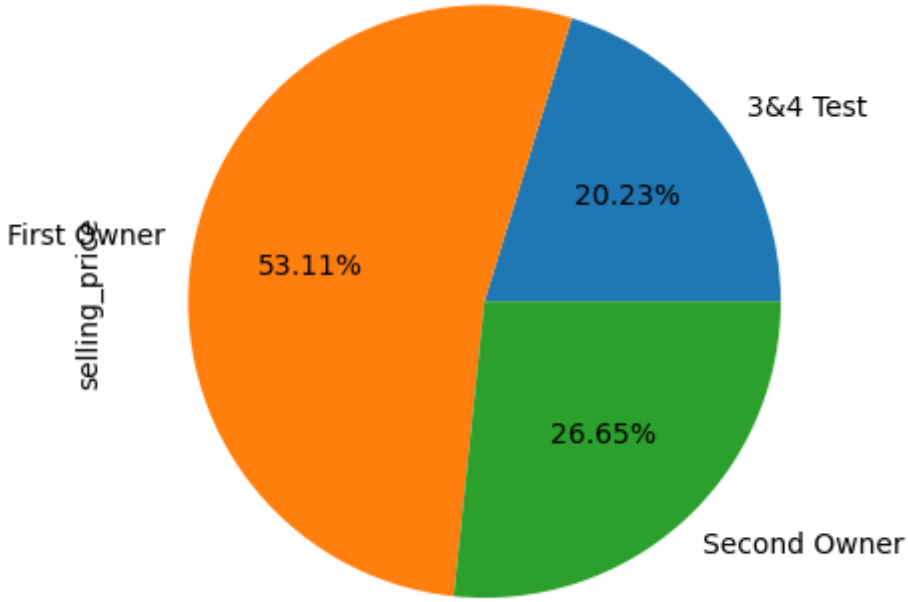


In [39]:

```
cardatadf.selling_price.groupby(cardatadf.owner).mean().plot(kind="pie",autopct="%.2f%%"
```

Out[39]:

```
<Axes: ylabel='selling_price'>
```



In [40]:

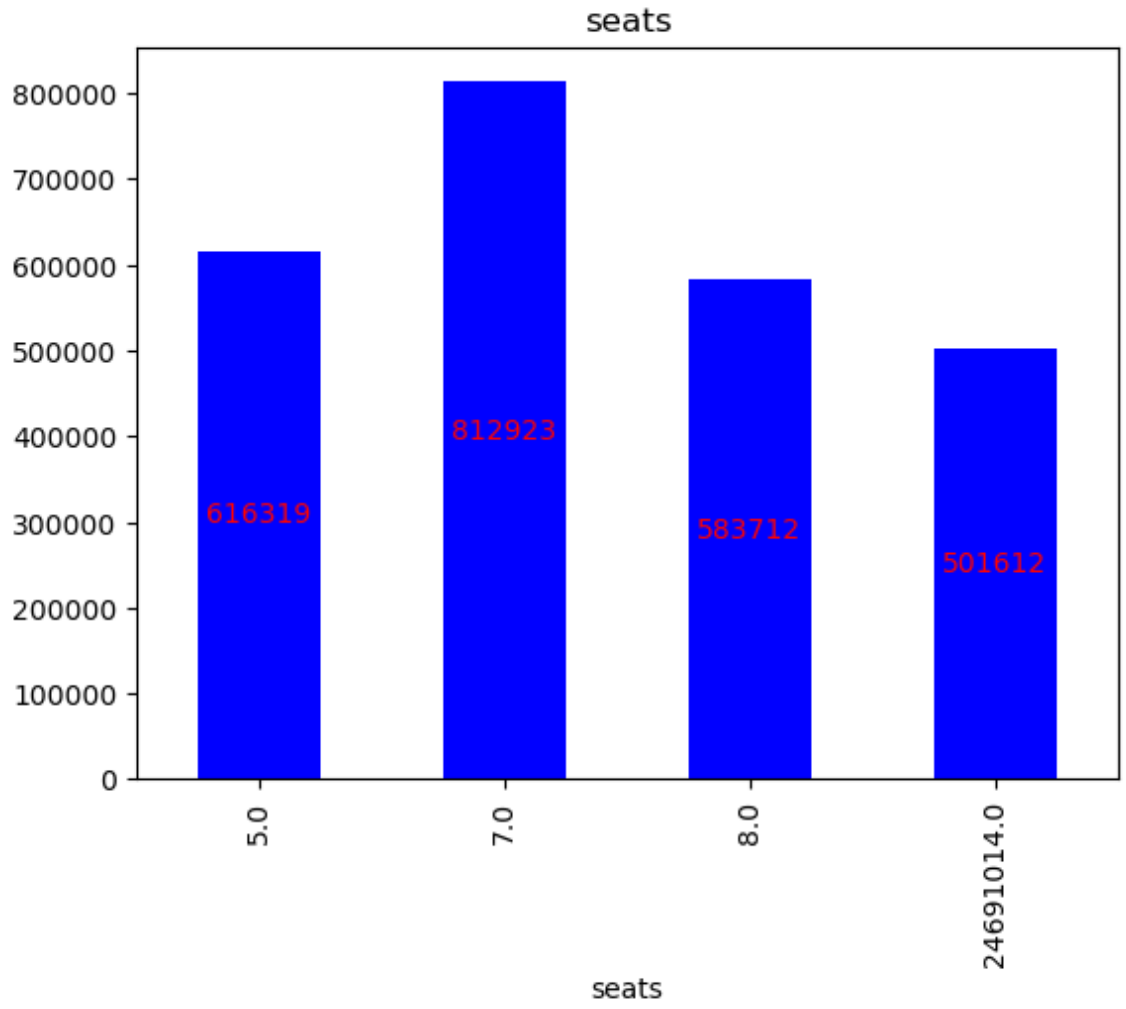
```
# Average selling_price of seats
cardatadf.selling_price.groupby(cardatadf.seats).mean()
```

Out[40]:

```
seats
5.0           616318.857606
7.0           812923.184821
8.0           583711.826271
24691014.0    501611.757576
Name: selling_price, dtype: float64
```

In [41]:

```
ax=cardatadf.selling_price.groupby(cardatadf.seats).mean().plot(kind="bar",color="blue",
for i in ax.containers:
 ax.bar_label(i,fontsize=10,color="red",label_type="center")
```

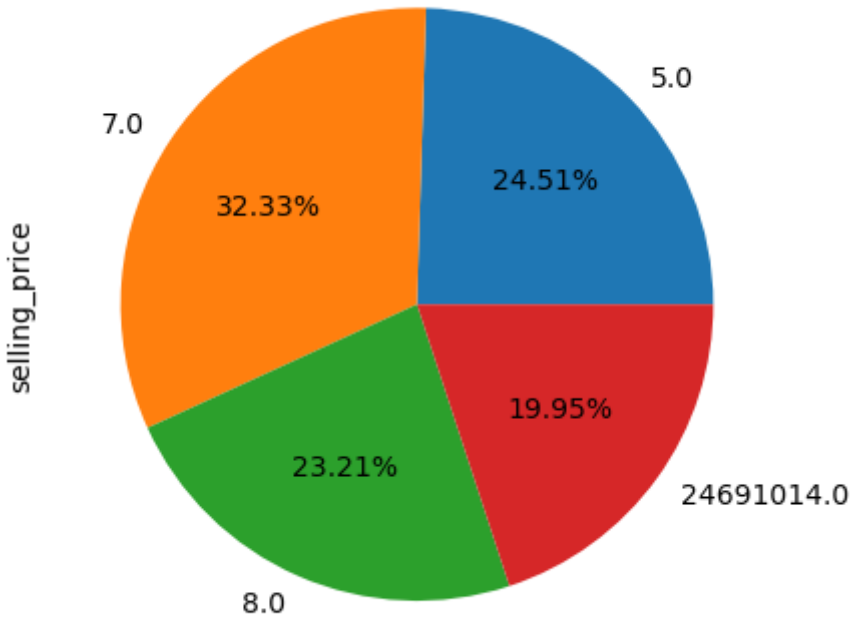


In [42]:

```
cardatadf.selling_price.groupby(cardatadf.seats).mean().plot(kind="pie",autopct="%.2f%%"
```

Out[42]:

```
<Axes: ylabel='selling_price'>
```



In [43]:

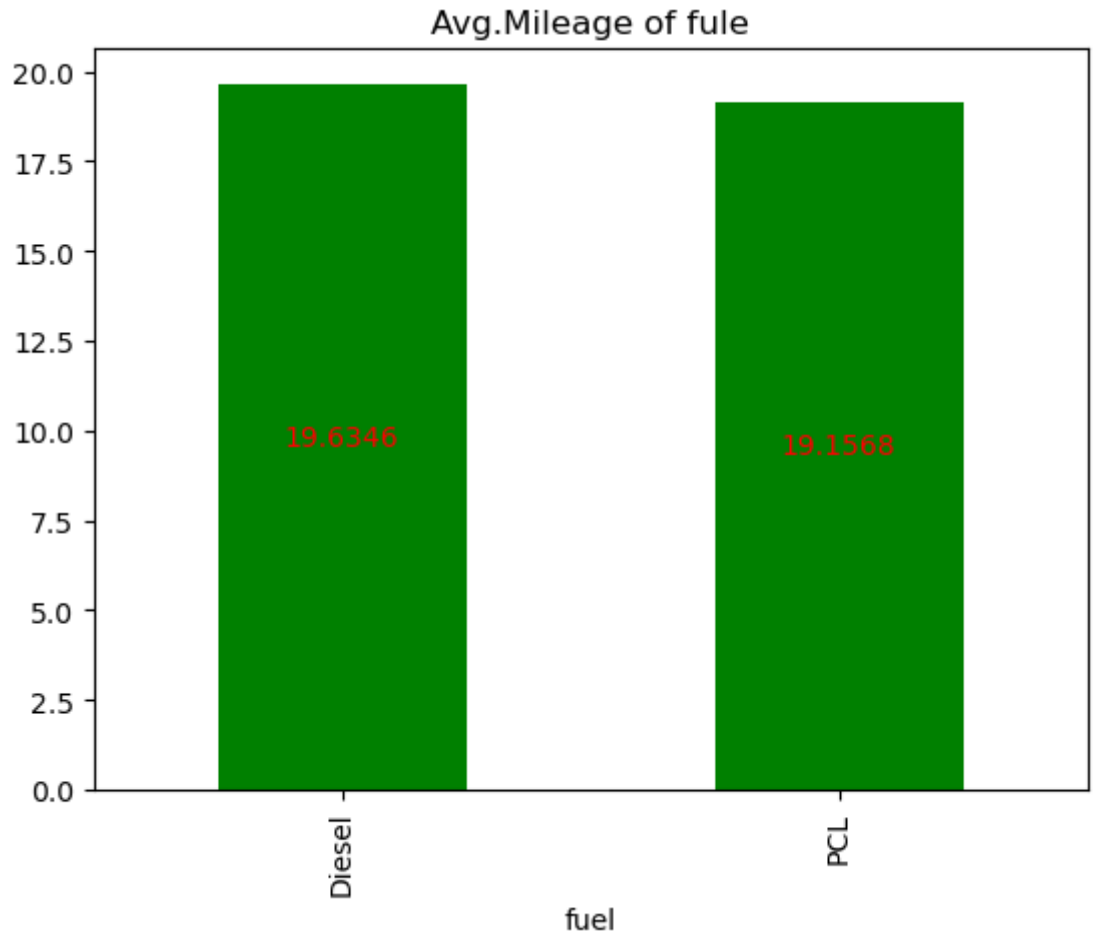
```
# avg maileage of fule
cardatadf.mileage.groupby(cardatadf.fuel).mean()
```

Out[43]:

```
fuel
Diesel    19.634607
PCL       19.156758
Name: mileage, dtype: float64
```

In [44]:

```
ax=cardatadf.mileage.groupby(cardatadf.fuel).mean().plot(kind="bar",color="green",title=
for i in ax.containers:
 ax.bar_label(i,fontsize=10,color="red",label_type="center")
```

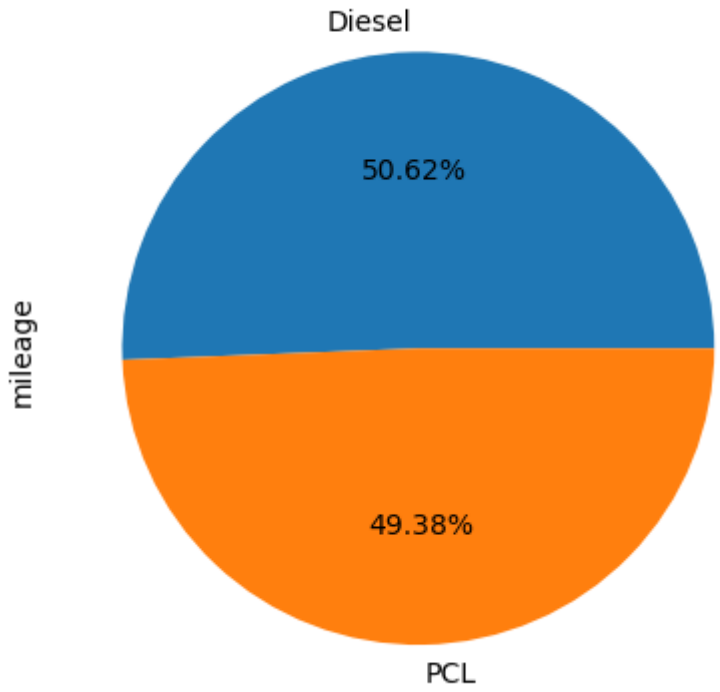


In [45]:

```
cardatadf.mileage.groupby(cardatadf.fuel).mean().plot(kind="pie",autopct="%.2f%%")
```

Out[45]:

```
<Axes: ylabel='mileage'>
```



In [46]:

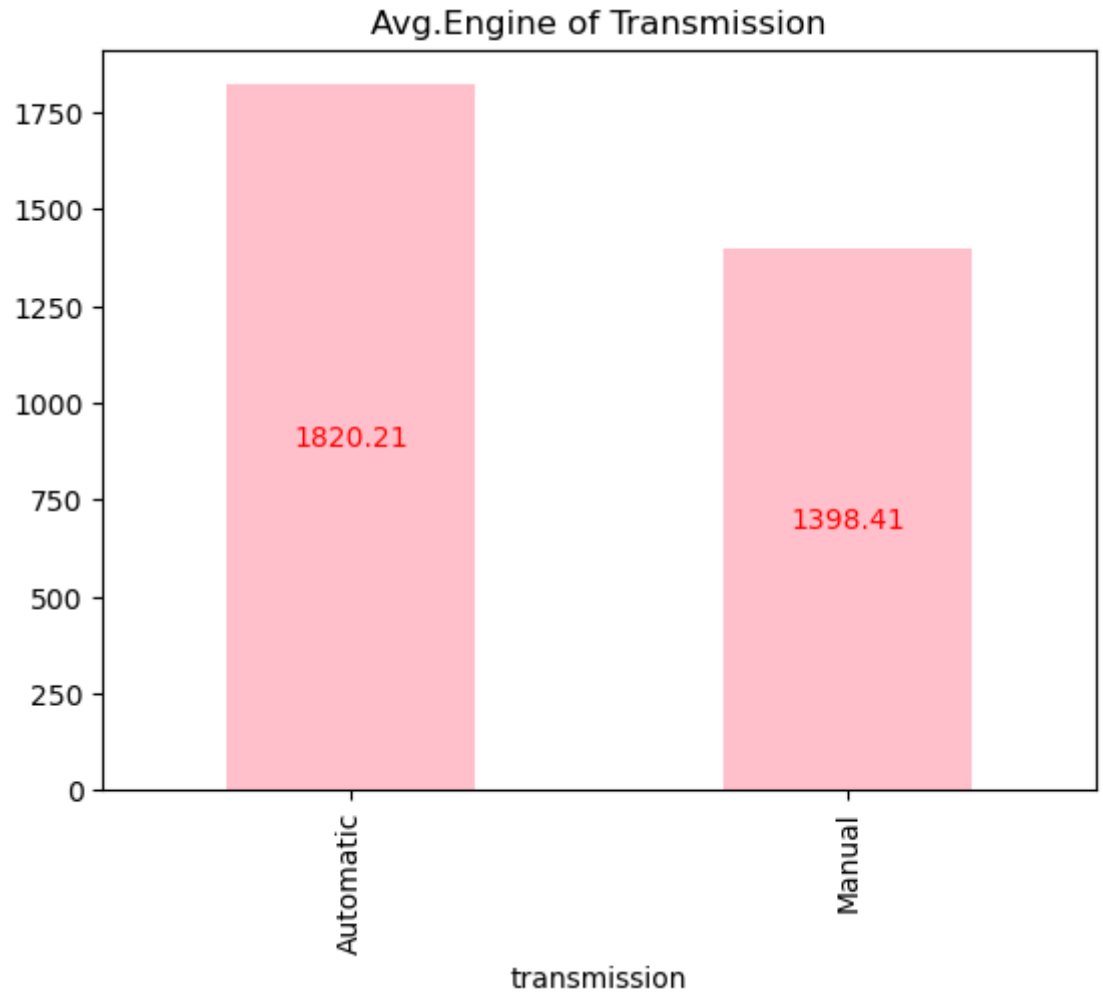
```
# what is avg engine of transmission
cardatadf.engine.groupby(cardatadf.transmission).mean()
```

Out[46]:

```
transmission
Automatic    1820.206667
Manual       1398.409014
Name: engine, dtype: float64
```

In [47]:

```
ax=cardatadf.engine.groupby(cardatadf.transmission).mean().plot(kind="bar",color="pink",
for i in ax.containers:
 ax.bar_label(i,fontsize=10,color="red",label_type="center")
```

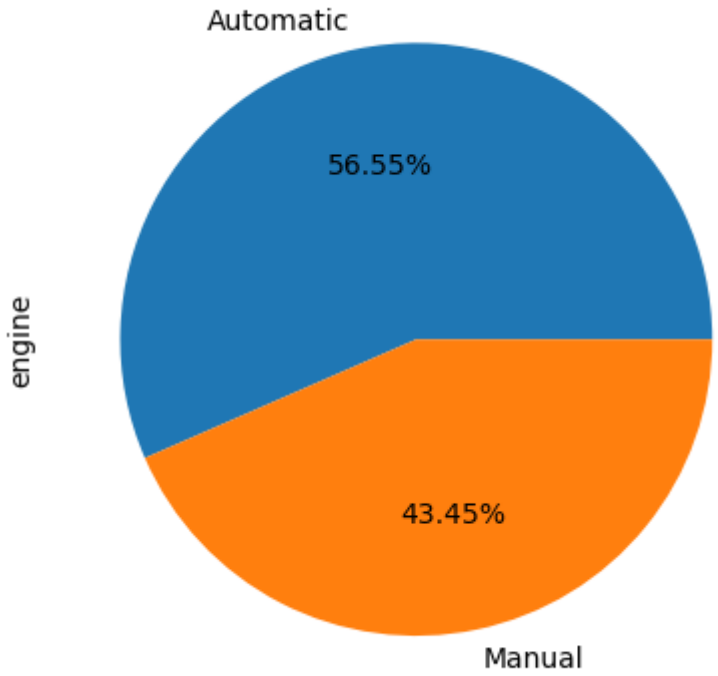


In [48]:

```
cardatadf.engine.groupby(cardatadf.transmission).mean().plot(kind="pie",autopct="%.2f%%"
```

Out[48]:

```
<Axes: ylabel='engine'>
```



In [49]:

```
# correlation
cardatadf.corr()
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\1947867239.py:2: FutureW
arning: The default value of numeric_only in DataFrame.corr is deprecated.
In a future version, it will default to False. Select only valid columns o
r specify the value of numeric_only to silence this warning.
  cardatadf.corr()
```

Out[49]:

	car_age	selling_price	km_driven	max_power	torque	mileage	engine
car_age	1.000000	-0.414092	0.418006	-0.224704	-0.073480	-0.311657	-0.035851
selling_price	-0.414092	1.000000	-0.225534	0.747935	-0.034770	-0.125040	0.458345
km_driven	0.418006	-0.225534	1.000000	-0.040599	-0.206214	-0.171746	0.198911
max_power	-0.224704	0.747935	-0.040599	1.000000	-0.010493	-0.372897	0.703612
torque	-0.073480	-0.034770	-0.206214	-0.010493	1.000000	-0.186292	-0.178529
mileage	-0.311657	-0.125040	-0.171746	-0.372897	-0.186292	1.000000	-0.574128
engine	-0.035851	0.458345	0.198911	0.703612	-0.178529	-0.574128	1.000000
seats	0.132600	-0.033012	0.014551	-0.107845	-0.124052	-0.104514	0.053855

In [50]:

```
import seaborn as sns
```

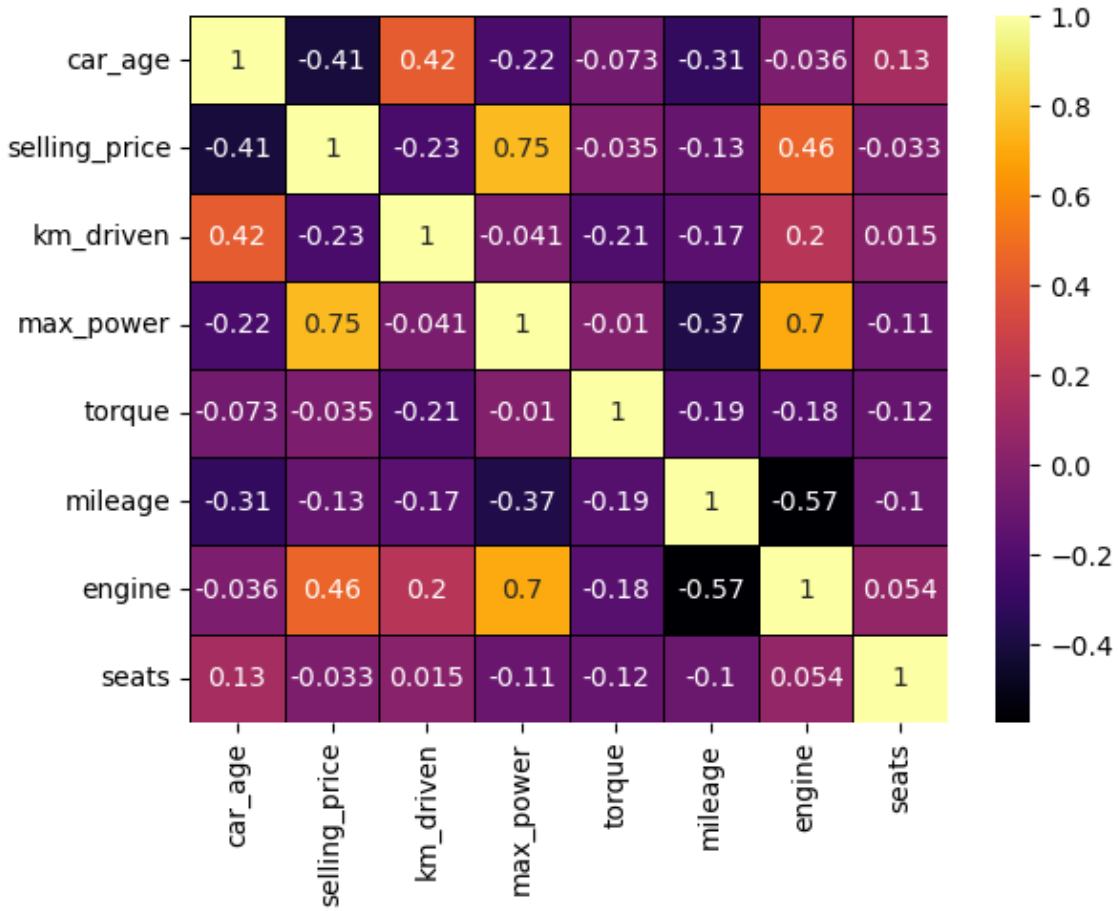
In [51]:

```
sns.heatmap(data=cardatadf.corr(),annot=True,cmap="inferno",linecolor="black",linewidths
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\680232014.py:1: FutureWa
rning: The default value of numeric_only in DataFrame.corr is deprecated.
In a future version, it will default to False. Select only valid columns o
r specify the value of numeric_only to silence this warning.
  sns.heatmap(data=cardatadf.corr(),annot=True,cmap="inferno",linecolor="b
lack",linewidths=0.5)
```

Out[51]:

```
<Axes: >
```



In [52]:

```
# Relation between selling_price and max_power
cardatadf[["selling_price","max_power"]].corr()
```

Out[52]:

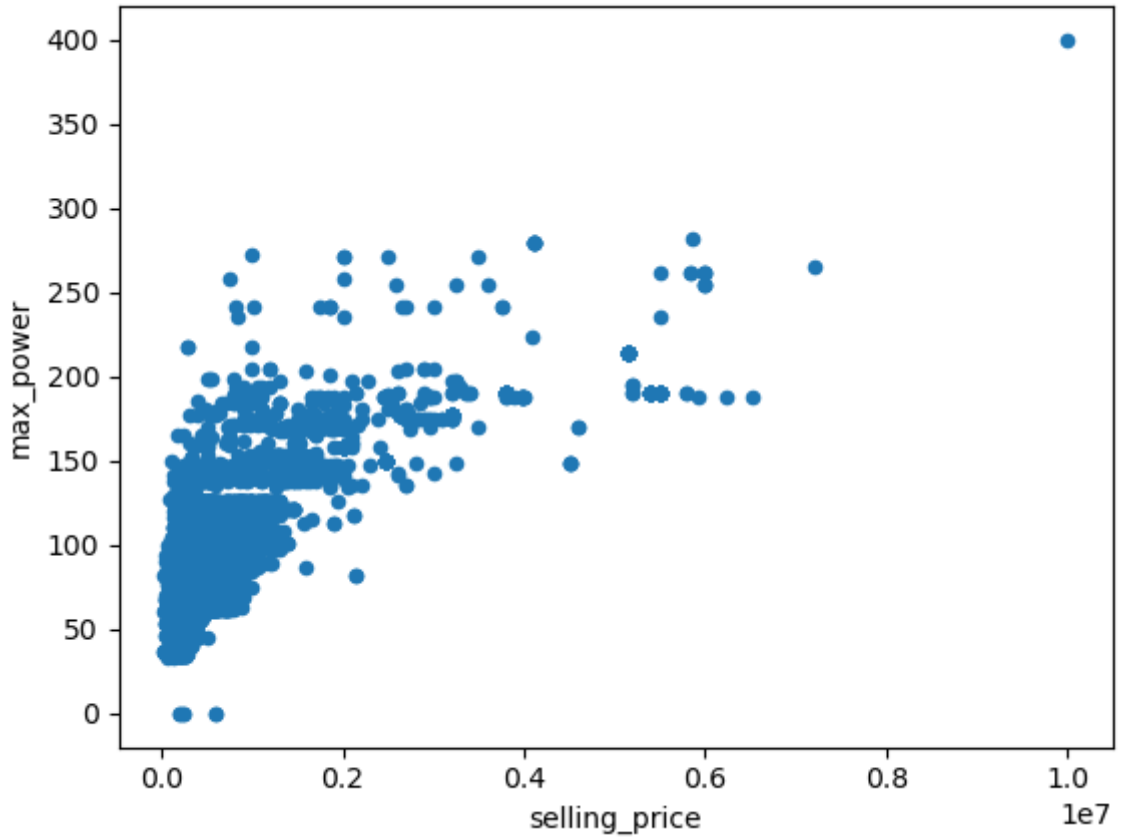
	selling_price	max_power
selling_price	1.000000	0.747935
max_power	0.747935	1.000000

In [53]:

```
cardatadf.plot(x="selling_price",y="max_power",kind="scatter")
```

Out[53]:

```
<Axes: xlabel='selling_price', ylabel='max_power'>
```



In [54]:

```
# Relation between age_car and km_driven
cardatadf[["car_age","km_driven"]].corr()
```

Out[54]:

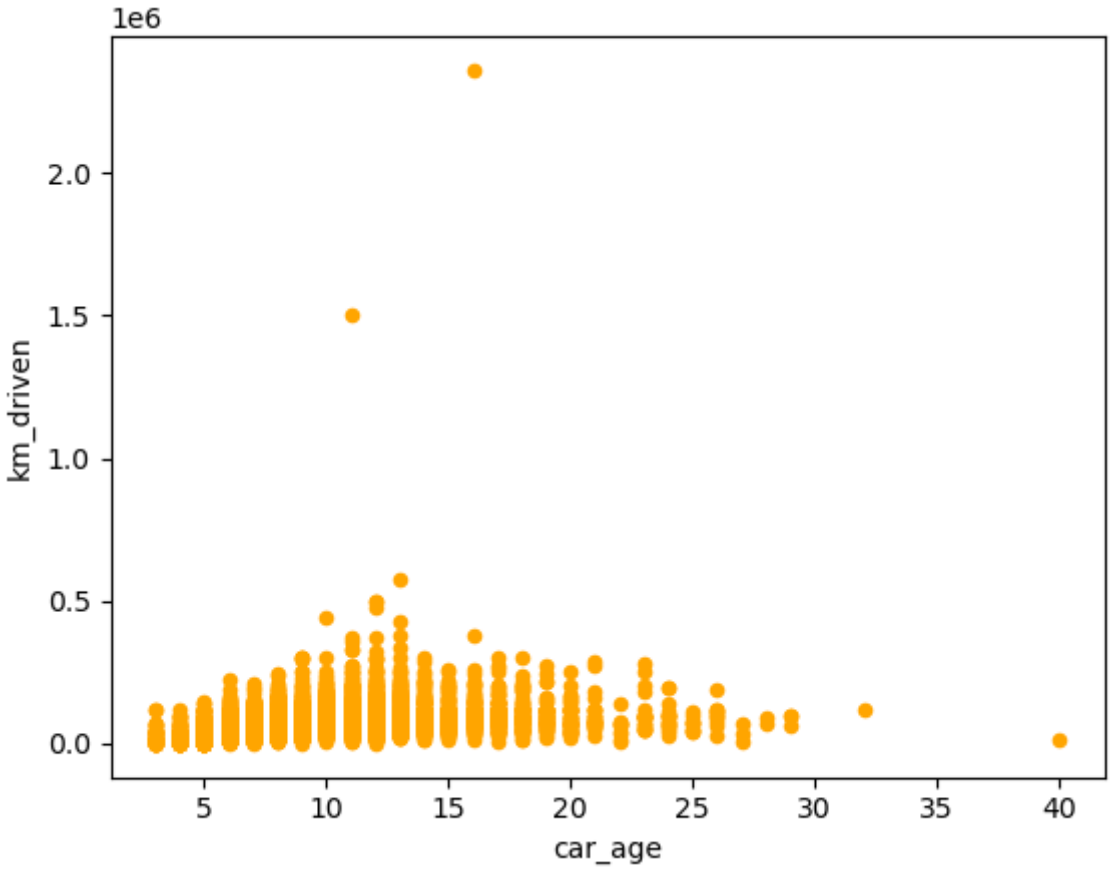
	car_age	km_driven
car_age	1.000000	0.418006
km_driven	0.418006	1.000000

In [55]:

```
cardatadf.plot(x="car_age",y="km_driven",kind="scatter",color="orange")
```

Out[55]:

```
<Axes: xlabel='car_age', ylabel='km_driven'>
```



In [56]:

```
# Hypothis Testing
from scipy.stats import ttest_ind
```

In [57]:

```
cardatadf.selling_price.groupby(cardatadf.transmission).mean()
```

Out[57]:

```
transmission
Automatic    1.870828e+06
Manual       4.554259e+05
Name: selling_price, dtype: float64
```

In [58]:

```
# Spliting data
transmissionA=cardatadf[cardatadf.transmission=="Automatic"]
transmissionM=cardatadf[cardatadf.transmission=="Manual"]
```

In [59]:

```
ttest_ind(transmissionA.selling_price,transmissionM.selling_price,equal_var=False)
```

Out[59]:

```
Ttest_indResult(statistic=27.888813193478946, pvalue=8.531946079710315e-12
9)
```

In [60]:

```
# What is null avg. Selling_price and fule
cardatadf.selling_price.groupby(cardatadf.fuel).mean()
```

Out[60]:

```
fuel
Diesel    791452.921627
PCL       457299.380569
Name: selling_price, dtype: float64
```

In [61]:

```
fuleDiesel=cardatadf[cardatadf.fuel=="Diesel"]
fulePCL=cardatadf[cardatadf.fuel=="PCL"]
```

In [62]:

```
ttest_ind(fuleDiesel.selling_price,fulePCL.selling_price,equal_var=False)
```

Out[62]:

```
Ttest_indResult(statistic=19.618295786057498, pvalue=1.1099823034116554e-8
3)
```

In [63]:

```
from scipy.stats import f_oneway
```

In [64]:

```
cardatadf.selling_price.groupby(cardatadf.seats).mean()
```

Out[64]:

```
seats
5.0           616318.857606
7.0           812923.184821
8.0           583711.826271
24691014.0    501611.757576
Name: selling_price, dtype: float64
```

In [65]:

```
seats5=cardatadf[cardatadf.seats==5.0]
seats7=cardatadf[cardatadf.seats==7.0]
seats8=cardatadf[cardatadf.seats==8.0]
seats24=cardatadf[cardatadf.seats==24691014.0]
```

In [66]:

```
f_oneway(seats5.selling_price,seats7.selling_price,seats8.selling_price,seats24.selling_
```

Out[66]:

```
F_onewayResult(statistic=22.50039628849741, pvalue=1.6749292345739754e-14)
```

In [67]:

```
cardatadf.selling_price.groupby(cardatadf.seller_type).mean()
```

Out[67]:

```
seller_type
Dealer              1.443494e+06
Individual          4.985612e+05
Trustmark Dealer    8.018390e+05
Name: selling_price, dtype: float64
```

In [68]:

```
dea=cardatadf[cardatadf.seller_type=="Dealer"]
ind=cardatadf[cardatadf.seller_type=="Individual"]
tru=cardatadf[cardatadf.seller_type=="Trustmark Dealer"]
```

In [69]:

```
f_oneway(dea.selling_price,ind.selling_price,tru.selling_price)
```

Out[69]:

```
F_onewayResult(statistic=799.2183234565078, pvalue=1.3789446e-317)
```

In [70]:

```
# Cross Tabulation
# Test null no Association between seller_type and seats
pd.crosstab(cardatadf.seller_type,cardatadf.seats)
```

Out[70]:

seats	5.0	7.0	8.0	24691014.0
seller_type				
Dealer	987	107	17	15
Individual	5283	982	219	282
Trustmark Dealer	205	31	0	0

In [71]:

```
from scipy.stats import chi2_contingency
```

In [72]:

```
chi2_contingency(pd.crosstab(cardatadf.seller_type,cardatadf.seats))
```

Out[72]:

```
Chi2ContingencyResult(statistic=77.45365977478873, pvalue=1.19829679202214
5e-14, dof=6, expected_freq=array([[ 897.00418307,  155.15748031,   32.693
89764,   41.14443898],
       [5389.9913878 ,  932.32283465,  196.45374016,  247.2320374 ],
       [ 188.00442913,   32.51968504,    6.8523622 ,    8.62352362]]))
```

In [73]:

```
# Test null no Association between seller_type and Transmission
pd.crosstab(cardatadf.seller_type,cardatadf.transmission)
```

Out[73]:

transmission seller_type	Automatic	Manual
Dealer	459	667
Individual	492	6274
Trustmark Dealer	99	137

In [74]:

```
chi2_contingency(pd.crosstab(cardatadf.seller_type,cardatadf.transmission))
```

Out[74]:

```
Chi2ContingencyResult(statistic=1144.671970176008, pvalue=2.73930179206477
04e-249, dof=2, expected_freq=array([[ 145.4601378 ,  980.5398622 ],
       [ 874.05265748, 5891.94734252],
       [  30.48720472,  205.51279528]]))
```

In [75]:

```
cardatadf.selling_price.kurt()
```

Out[75]:

```
21.081289012186755
```

In [76]:

```
cardatadf.selling_price.skew()
```

Out[76]:

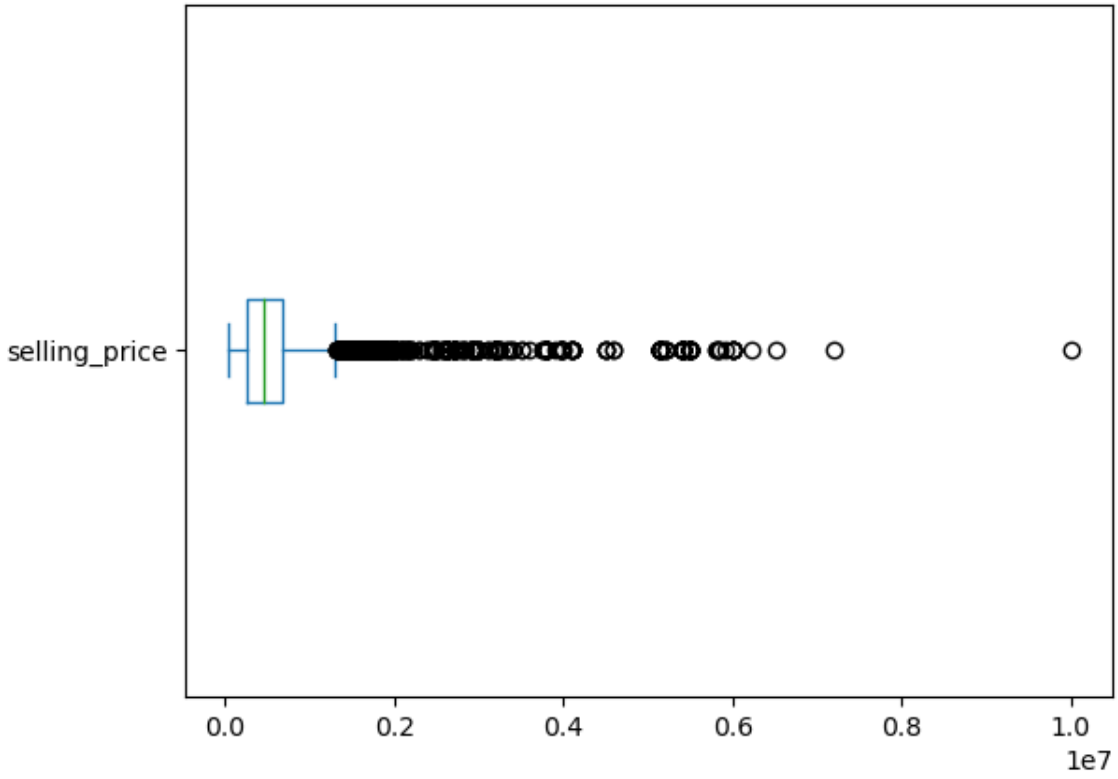
```
4.193533440675855
```

In [77]:

```
cardatadf.selling_price.plot(kind="box",vert=False)
```

Out[77]:

<Axes: >

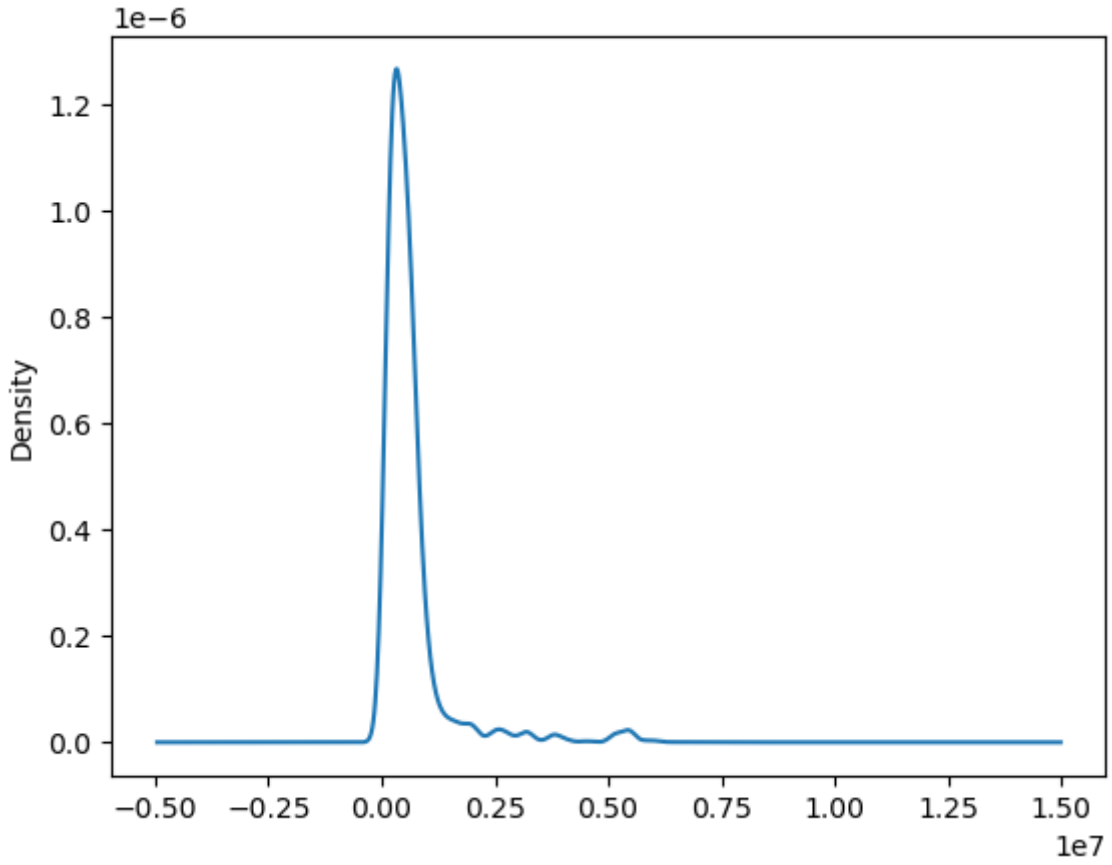


In [78]:

```
cardatadf.selling_price.plot(kind="density")
```

Out[78]:

```
<Axes: ylabel='Density'>
```

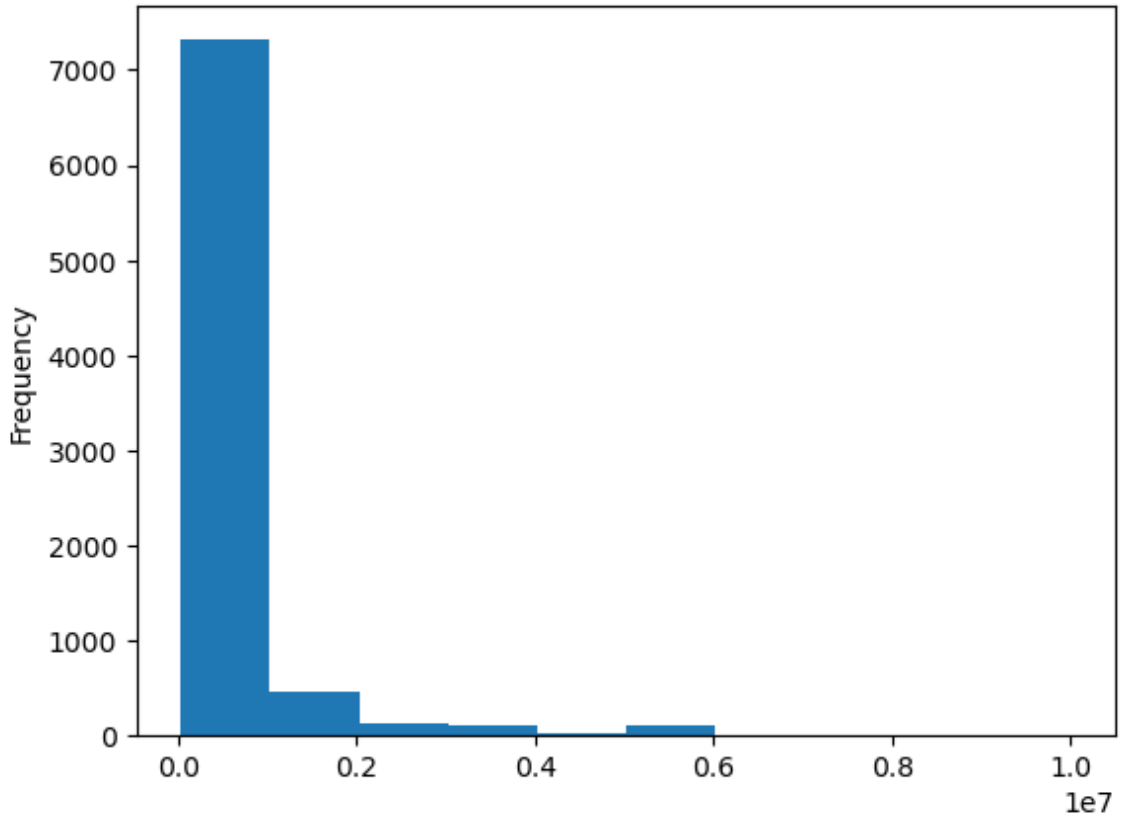


In [79]:

```
cardatadf.selling_price.plot(kind="hist")
```

Out[79]:

```
<Axes: ylabel='Frequency'>
```

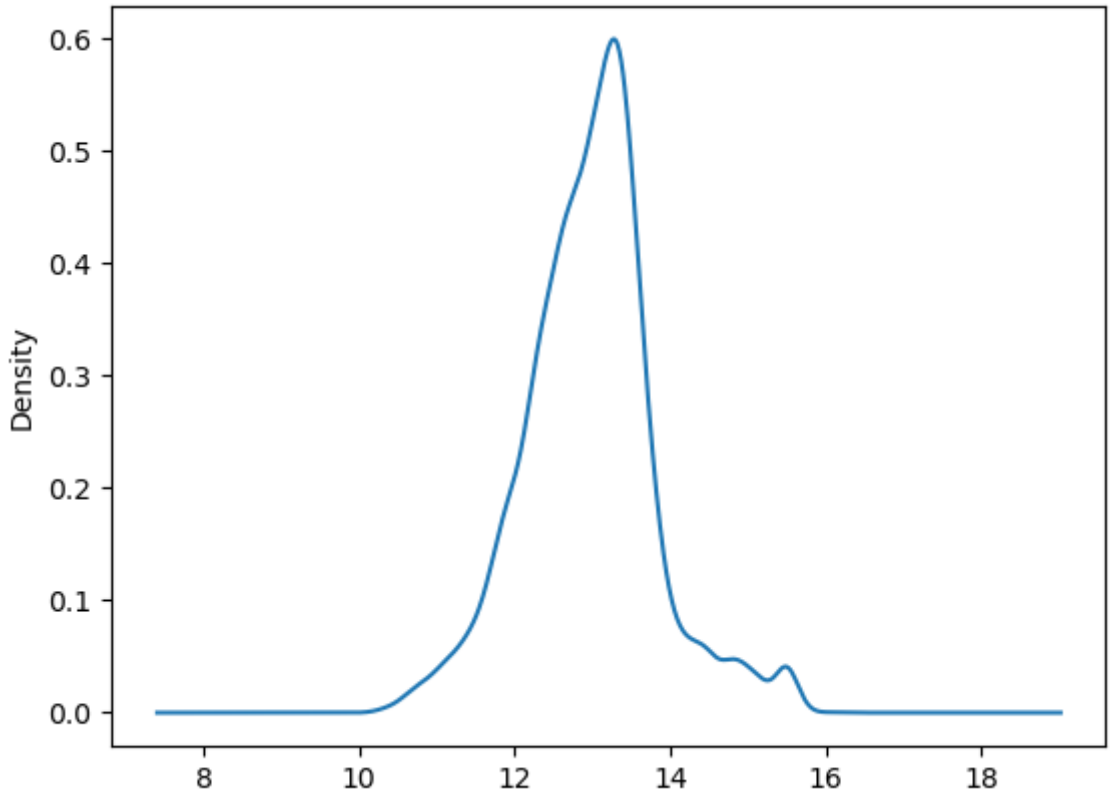


In [80]:

```
np.log(cardatadf.selling_price).plot(kind='density')
```

Out[80]:

```
<Axes: ylabel='Density'>
```



In [81]:

```
 # Here we are dropping the dependent variable
numcols=numcols.drop(["selling_price"],axis=1)
```

In [82]:

```
numcols.head()
```

Out[82]:

	car_age	km_driven	max_power	torque	mileage	engine
0	9	145500	74.00	2000.0	23.40	1248.0
1	9	120000	103.52	2500.0	21.14	1498.0
2	17	140000	78.00	2700.0	17.70	1497.0
3	13	127000	90.00	3000.0	23.00	1396.0
4	16	120000	88.20	4500.0	16.10	1298.0

In [83]:

```
# Dummy Encoding and Scaling
from sklearn.preprocessing import StandardScaler
```

In [84]:

```
car_stdsca=StandardScaler()
```

In [85]:

```
numcols_stdsc=car_stdsca.fit_transform(numcols)
```

In [86]:

```
numcols_stdsc=pd.DataFrame(numcols_stdsc,columns=numcols.columns)
```

In [87]:

```
numcols_stdsc.head()
```

Out[87]:

	car_age	km_driven	max_power	torque	mileage	engine
0	-0.048464	1.338363	-0.488067	-1.211504	1.000696	-0.411305
1	-0.048464	0.887411	0.346439	-0.652938	0.433095	0.090536
2	1.929775	1.241098	-0.374990	-0.429512	-0.430862	0.088528
3	0.940656	1.011202	-0.035760	-0.094372	0.900235	-0.114215
4	1.682495	0.887411	-0.086645	1.581325	-0.832703	-0.310937

In [88]:

```
from sklearn.preprocessing import RobustScaler
```

In [89]:

```
car_rus=RobustScaler()
```

In [90]:

```
numcols_Rus=car_rus.fit_transform(numcols)
```

In [91]:

```
numcols_Rus=pd.DataFrame(numcols_Rus,columns=numcols.columns)
```

In [92]:

```
numcols_Rus.head()
```

Out[92]:

	car_age	km_driven	max_power	torque	mileage	engine
0	0.166667	1.357143	-0.241327	-0.666667	0.748517	0.000000
1	0.166667	0.952381	0.649170	-0.333333	0.335920	0.649351
2	1.500000	1.269841	-0.120664	-0.200000	-0.292104	0.646753
3	0.833333	1.063492	0.241327	0.000000	0.675491	0.384416
4	1.333333	0.952381	0.187029	1.000000	-0.584208	0.129870

In [93]:

```
objcols.columns
```

Out[93]:

```
Index(['fuel', 'seller_type', 'seats', 'transmission', 'owner'], dtype='ob
ject')
```

In [94]:

```
objcols_dummy=pd.get_dummies(objcols,columns=['fuel', 'seller_type', 'transmission', 'ow
```

In [95]:

```
objcols_dummy.head()
```

Out[95]:

	fuel_Diesel	fuel_PCL	seller_type_Dealer	seller_type_Individual	seller_type_Trustmark Dealer	trai
0	1	0	0	1	0	
1	1	0	0	1	0	
2	0	1	0	1	0	
3	1	0	0	1	0	
4	0	1	0	1	0	

In [96]:

```
car_clean_data=pd.concat([numcols_stdsc,objcols_dummy,cardatadf.selling_price],axis=1)
```

In [97]:

```
car_clean_data.shape
```

Out[97]:

```
(8128, 21)
```

In [98]:

```
# split data X=car_claen_data
X=car_clean_data.drop("selling_price",axis=1)
y=car_clean_data.selling_price
```

In [99]:

```
# Linear Regression
from sklearn.linear_model import LinearRegression
```

In [100]:

```
le=LinearRegression()
```

In [101]:

```
leregmodel=le.fit(X,y)
```

In [102]:

```
leregmodel.score(X,y)
```

Out[102]:

```
0.6886651745932868
```

In [103]:

```
predict=leregmodel.predict(X)
```

In [104]:

```
pd.DataFrame(np.exp(predict)).to_csv("reg.csv")
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\2257968620.py:1: Runtime
Warning: overflow encountered in exp
  pd.DataFrame(np.exp(predict)).to_csv("reg.csv")
```

In [105]:

```
leregmodel=le.fit(X,np.log(y))
```

In [106]:

```
leregmodel.score(X,np.log(y))
```

Out[106]:

```
0.8685987228220362
```

In [107]:

```
predict=leregmodel.predict(X)
```

In [108]:

```
pd.DataFrame(np.exp(predict)).to_csv("reglog.csv")
```

In [109]:

```
# Decision Tree
from sklearn.tree import DecisionTreeRegressor
```

In [110]:

```
DTR=DecisionTreeRegressor(max_depth=4)
```

In [111]:

```
DTR_model=DTR.fit(X,y)
```

In [112]:

```
DTR_model.score(X,y)
```

Out[112]:

```
0.9035585844165369
```

In [113]:

```
predict1=DTR_model.predict(X)
```

In [114]:

```
pd.DataFrame(np.exp(predict1)).to_csv("cardtr.csv")
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\4088083815.py:1: Runtime
Warning: overflow encountered in exp
  pd.DataFrame(np.exp(predict1)).to_csv("cardtr.csv")
```

In [115]:

```
DTR_model=DTR.fit(X,np.log(y))
```

In [116]:

```
DTR_model.score(X,np.log(y))
```

Out[116]:

```
0.8170200025834815
```

In [117]:

```
predict1=DTR_model.predict(X)
```

In [118]:

```
pd.DataFrame(np.exp(predict1)).to_csv("cardtrlog.csv")
```

In [119]:

```
# Random Forest
from sklearn.ensemble import RandomForestRegressor
```

In [120]:

```
RFR=RandomForestRegressor(n_estimators=2000)
```

In [121]:

```
RFR_model=RFR.fit(X,y)
```

In [122]:

```
RFR_model.score(X,y)
```

Out[122]:

```
0.9956802695767057
```

In [123]:

```
predict2=RFR_model.predict(X)
```

In [124]:

```
pd.DataFrame(np.exp(predict2)).to_csv("car_random.csv")
```

```
C:\Users\deepe\AppData\Local\Temp\ipykernel_13108\3624464597.py:1: Runtime
Warning: overflow encountered in exp
  pd.DataFrame(np.exp(predict2)).to_csv("car_random.csv")
```

In [125]:

```
RFR_model=RFR.fit(X,np.log(y))
```

In [126]:

```
RFR_model.score(X,np.log(y))
```

Out[126]:

```
0.9902514165617993
```

In [127]:

```
predict2=RFR_model.predict(X)
```

In [128]:

```
pd.DataFrame(np.exp(predict2)).to_csv("car_randomlog.csv")
```

In [ ]:

```

```