```
from scipy.stats import binom
from scipy.stats import bernoulli
from scipy.stats import poisson
import numpy as np
```

```
k,n,p=2,50,0.3
print(binom.pmf(k,n,p))
```

```
4.046546345956635e-06
```

```
l=bernoulli(p)
print(l.pmf(k))
```

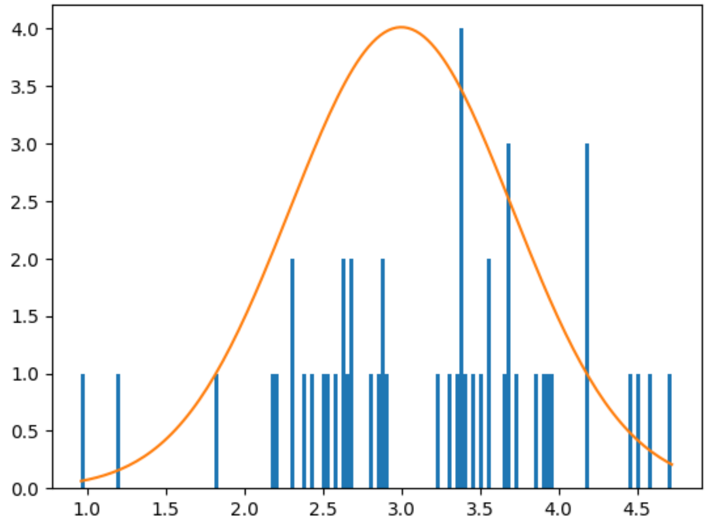
```
0.0
```

```
mu=3
print(poisson(mu).pmf(k))
```

```
0.22404180765538775
```

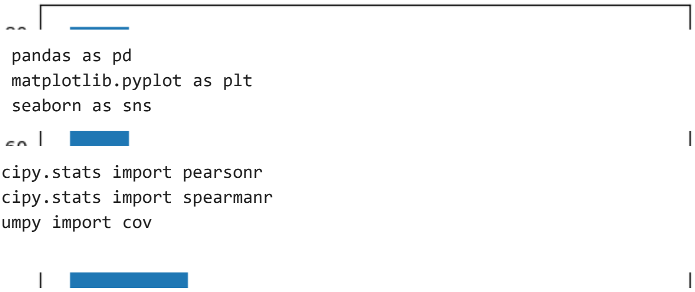
```
mu1,sigma=0.7,0.8
s=np.random.normal(mu,sigma,50)
count,bins,ignored=plt.hist(s,150)
plt.plot(bins,1/sigma*np.sqrt(2*np.pi)*np.exp(-(bins-mu)**2)*(2*sigma**2))
```

```
[<matplotlib.lines.Line2D at 0x7c47e099c2b0>]
```



```
exp=np.random.exponential(2.0,200)
plt.hist(exp)
```

```
(array([81., 53., 27., 17.,  9.,  7.,  1.,  3.,  1.,  1.]),
 array([8.81581120e-03, 1.16521308e+00, 2.32161034e+00, 3.47800761e+00,
        4.63440487e+00, 5.79080214e+00, 6.94719941e+00, 8.10359667e+00,
        9.25999394e+00, 1.04163912e+01, 1.15727885e+01]),
 <BarContainer object of 10 artists>)
```



```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

```
from scipy.stats import pearsonr
from scipy.stats import spearmanr
from numpy import cov
```

```
df=pd.read_csv("/content/2_2015 - 2_2015.csv")
df
```

	Country	Region	Happiness Rank	Happiness Score	Standard Error	Economy (GDP per Capita)	Family	Health (Life Expectancy)	Freedom	Trust (Government Corruption)	Generosity	Dystopia Residual
0	Switzerland	Western Europe	1	7.587	0.03411	1.39651	1.34951	0.94143	0.66557	0.41978	0.29678	2.51738
1	Iceland	Western Europe	2	7.561	0.04884	1.30232	1.40223	0.94784	0.62877	0.14145	0.43630	2.70201
2	Denmark	Western Europe	3	7.527	0.03328	1.32548	1.36058	0.87464	0.64938	0.48357	0.34139	2.49204
3	Norway	Western Europe	4	7.522	0.03880	1.45900	1.33095	0.88521	0.66973	0.36503	0.34699	2.46531
4	Canada	North America	5	7.427	0.03553	1.32629	1.32261	0.90563	0.63297	0.32957	0.45811	2.45176
...	...	...	...	...	...	...	...	...	...	...	...	...
153	Rwanda	Sub-Saharan Africa	154	3.465	0.03464	0.22208	0.77370	0.42864	0.59201	0.55191	0.22628	0.67042
154	Benin	Sub-Saharan Africa	155	3.340	0.03656	0.28665	0.35386	0.31910	0.48450	0.08010	0.18260	1.63328
155	Syria	Middle East and Northern Africa	156	3.006	0.05015	0.66320	0.47489	0.72193	0.15684	0.18906	0.47179	0.32858
156	Burundi	Sub-Saharan Africa	157	2.905	0.08658	0.01530	0.41587	0.22396	0.11850	0.10062	0.19727	1.83302

```
print("First 10 Rows:\n",df.head(10))
print("Last 7 Rows:\n",df.tail(7))
```

```
First 10 Rows:
        Country                     Region  Happiness Rank  Happiness Score  \
0  Switzerland             Western Europe               1            7.587   
1      Iceland             Western Europe               2            7.561   
2      Denmark             Western Europe               3            7.527   
3       Norway             Western Europe               4            7.522   
4       Canada              North America               5            7.427   
5      Finland             Western Europe               6            7.406   
6  Netherlands             Western Europe               7            7.378   
7       Sweden             Western Europe               8            7.364   
8  New Zealand  Australia and New Zealand               9            7.286   
9    Australia  Australia and New Zealand              10            7.284   

   Standard Error  Economy (GDP per Capita)   Family  \
0         0.03411                   1.39651  1.34951   
1         0.04884                   1.30232  1.40223   
2         0.03328                   1.32548  1.36058   
3         0.03880                   1.45900  1.33095   
```

```
4        0.03553                   1.32629  1.32261
5        0.03140                   1.29025  1.31826
6        0.02799                   1.32944  1.28017
7        0.03157                   1.33171  1.28907
8        0.03371                   1.25018  1.31967
9        0.04083                   1.33358  1.30923

   Health (Life Expectancy)  Freedom  Trust (Government Corruption)  \
0                   0.94143  0.66557                        0.41978
1                   0.94784  0.62877                        0.14145
2                   0.87464  0.64938                        0.48357
3                   0.88521  0.66973                        0.36503
4                   0.90563  0.63297                        0.32957
5                   0.88911  0.64169                        0.41372
6                   0.89284  0.61576                        0.31814
7                   0.91087  0.65980                        0.43844
8                   0.90837  0.63938                        0.42922
9                   0.93156  0.65124                        0.35637

   Generosity  Dystopia Residual
0     0.29678            2.51738
1     0.43630            2.70201
2     0.34139            2.49204
3     0.34699            2.46531
4     0.45811            2.45176
5     0.23351            2.61955
6     0.47610            2.46570
7     0.36262            2.37119
8     0.47501            2.26425
9     0.43562            2.26646
Last 7 Rows:
          Country                           Region  Happiness Rank  \
151  Burkina Faso               Sub-Saharan Africa             152
152   Afghanistan                    Southern Asia             153
153        Rwanda               Sub-Saharan Africa             154
154         Benin               Sub-Saharan Africa             155
155         Syria  Middle East and Northern Africa             156
156       Burundi               Sub-Saharan Africa             157
157          Togo               Sub-Saharan Africa             158
```

```
df.isna().sum()
```

```
Country                          0
Region                           0
Happiness Rank                   0
Happiness Score                  0
Standard Error                   0
Economy (GDP per Capita)         0
Family                           0
Health (Life Expectancy)         0
Freedom                          0
Trust (Government Corruption)    0
Generosity                       0
Dystopia Residual                0
dtype: int64
```

```
data=df[["Happiness Rank","Happiness Score"]]
print(data.sum())
print(data.median())
print("Mode:\n",df.mode().iloc[0])
```

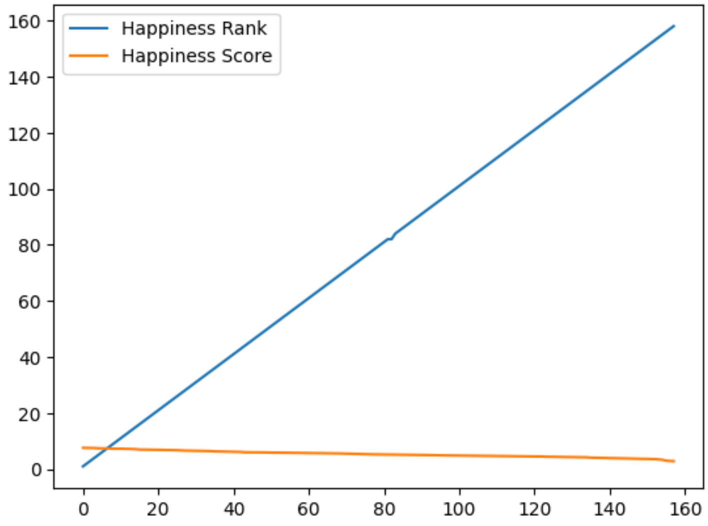
```
Happiness Rank     12560.000
Happiness Score      849.366
dtype: float64
Happiness Rank     79.5000
Happiness Score     5.2325
dtype: float64
Mode:
 Country                                  Afghanistan
Region                           Sub-Saharan Africa
Happiness Rank                                 82.0
Happiness Score                               5.192
Standard Error                              0.03751
Economy (GDP per Capita)                        0.0
Family                                          0.0
Health (Life Expectancy)                    0.92356
Freedom                                         0.0
Trust (Government Corruption)               0.32524
Generosity                                      0.0
Dystopia Residual                           0.32858
Name: 0, dtype: object
```

```
print("Shape:",df.shape)
print("Dimension:",df.ndim)
print("Size:",df.size)
print("Description:\n",df.describe())
```

```
Shape: (158, 12)
Dimension: 2
Size: 1896
Description:
        Happiness Rank  Happiness Score  Standard Error  \
count      158.000000       158.000000      158.000000
mean        79.493671         5.375734        0.047885
std         45.754363         1.145010        0.017146
min          1.000000         2.839000        0.018480
25%         40.250000         4.526000        0.037268
50%         79.500000         5.232500        0.043940
75%        118.750000         6.243750        0.052300
max        158.000000         7.587000        0.136930

       Economy (GDP per Capita)      Family  Health (Life Expectancy)  \
count                158.000000  158.000000                158.000000
mean                   0.846137    0.991046                  0.630259
std                    0.403121    0.272369                  0.247078
min                    0.000000    0.000000                  0.000000
25%                    0.545808    0.856823                  0.439185
50%                    0.910245    1.029510                  0.696705
75%                    1.158448    1.214405                  0.811013
max                    1.690420    1.402230                  1.025250

          Freedom  Trust (Government Corruption)  Generosity  \
count  158.000000                     158.000000  158.000000
mean     0.428615                       0.143422    0.237296
std      0.150693                       0.120034    0.126685
min      0.000000                       0.000000    0.000000
25%      0.328330                       0.061675    0.150553
50%      0.435515                       0.107220    0.216130
75%      0.549092                       0.180255    0.309883
max      0.669730                       0.551910    0.795880

       Dystopia Residual
count         158.000000
mean            2.098977
std             0.553550
min             0.328580
25%             1.759410
50%             2.095415
75%             2.462415
max             3.602140
```

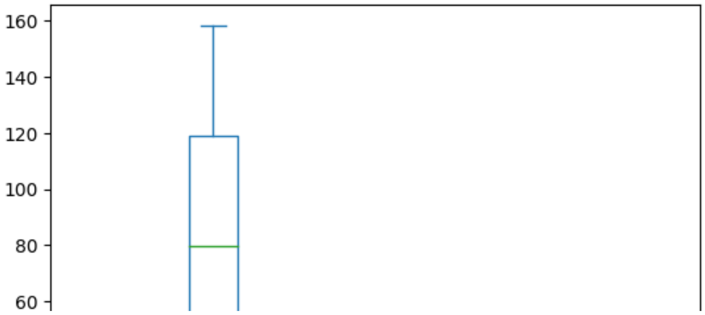
```
data.plot.line()
```

```
<Axes: >
```



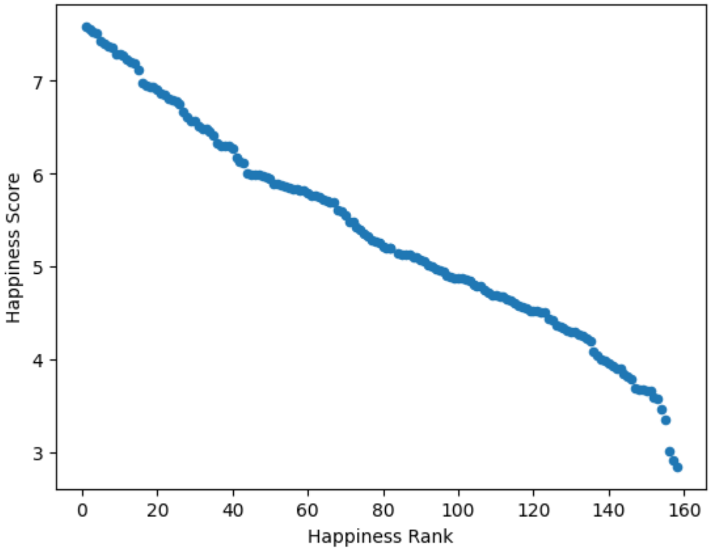
```
data.plot.box()
```

```
<Axes: >
```



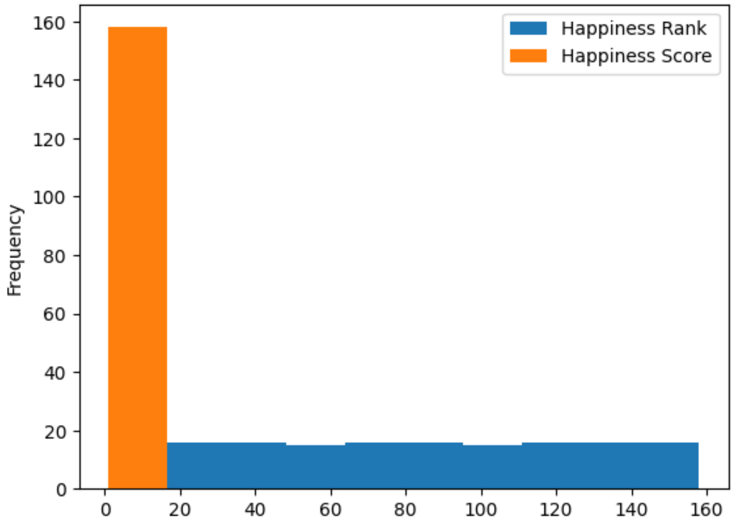
```
data.plot.scatter(x="Happiness Rank",y="Happiness Score")
```

```
<Axes: xlabel='Happiness Rank', ylabel='Happiness Score'>
```



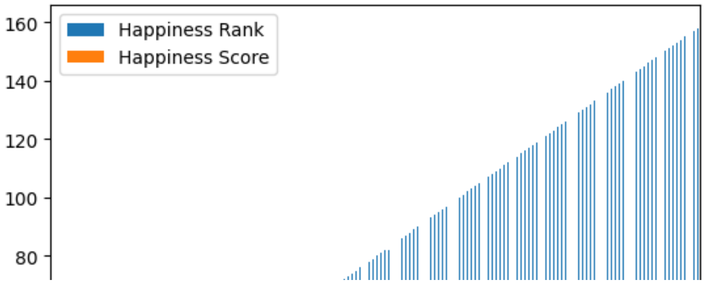
```
data.plot.hist()
```

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



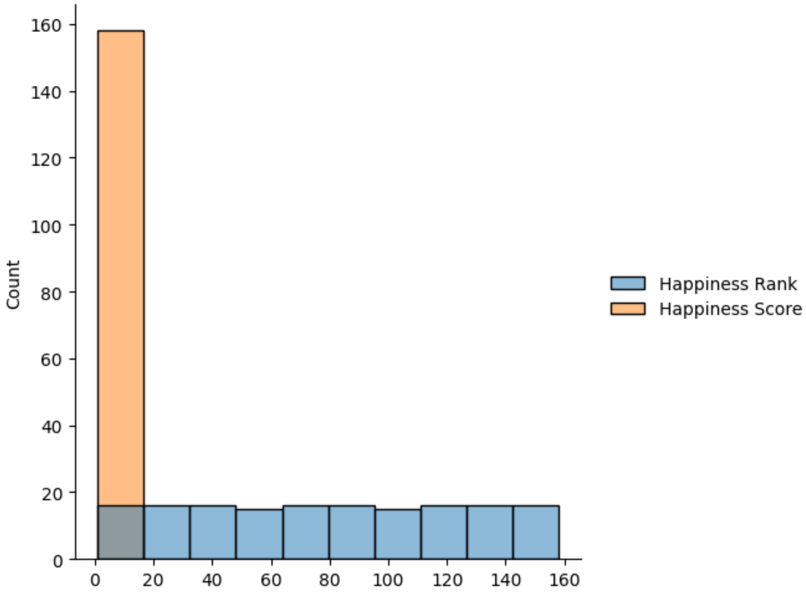
```
data.plot.bar()
```

```
<Axes: >
```



```
sns.displot(data)
```

```
<seaborn.axisgrid.FacetGrid at 0x7c47f2294c10>
```



```
print(df.cov())
print("Pearson Corelation :\n",pearsonr(df["Happiness Rank"],df["Happiness Score"]))
print("Spearman Corelation :\n",spearmanr(df["Freedom"],df["Family"]))
```

```
                               Happiness Rank  Happiness Score  \
Happiness Rank                    2093.461743       -51.975613   
Happiness Score                    -51.975613         1.311048   
Standard Error                       0.124358        -0.003480   
Economy (GDP per Capita)           -14.483883         0.360476   
Family                              -9.142720         0.230969   
Health (Life Expectancy)            -8.316021         0.204881   
Freedom                             -3.839647         0.098042   
Trust (Government Corruption)       -2.044785         0.054316   
Generosity                          -0.928243         0.026156   
Dystopia Residual                  -13.220847         0.336225   

                               Standard Error  Economy (GDP per Capita)  \
Happiness Rank                       0.124358                -14.483883   
Happiness Score                     -0.003480                  0.360476   
Standard Error                       0.000294                 -0.001504   
Economy (GDP per Capita)            -0.001504                  0.162506   
Family                              -0.000564                  0.070852   
Health (Life Expectancy)            -0.001315                  0.081323   
Freedom                             -0.000335                  0.022495   
Trust (Government Corruption)       -0.000367                  0.014898   
Generosity                          -0.000192                 -0.000534   
Dystopia Residual                    0.000797                  0.008939   

                                 Family  Health (Life Expectancy)   Freedom  \
Happiness Rank                -9.142720                 -8.316021 -3.839647   
Happiness Score                0.230969                  0.204881  0.098042   
Standard Error                -0.000564                 -0.001315 -0.000335   
Economy (GDP per Capita)       0.070852                  0.081323  0.022495   
Family                         0.074185                  0.035741  0.018122   
Health (Life Expectancy)       0.035741                  0.061047  0.013422   
Freedom                        0.018122                  0.013422  0.022708   
Trust (Government Corruption)  0.006722                  0.007365  0.008927   
Generosity                     0.003020                  0.003391  0.007138   
Dystopia Residual              0.022332                  0.002596  0.005237   

                               Trust (Government Corruption)  Generosity  \
Happiness Rank                                     -2.044785   -0.928243
Happiness Score                                     0.054316    0.026156
Standard Error                                     -0.000367   -0.000192
Economy (GDP per Capita)                            0.014898   -0.000534
Family                                              0.006722    0.003020
Health (Life Expectancy)                            0.007365    0.003391
Freedom                                             0.008927    0.007138
Trust (Government Corruption)                       0.014408    0.004199
Generosity                                          0.004199    0.016049
Dystopia Residual                                  -0.002200   -0.007104

                               Dystopia Residual
Happiness Rank                        -13.220847
Happiness Score                         0.336225
Standard Error                          0.000797
Economy (GDP per Capita)                0.008939
Family                                  0.022332
Health (Life Expectancy)                0.002596
Freedom                                 0.005237
Trust (Government Corruption)          -0.002200
```

```
df2=pd.read_csv("/content/1_fiat500_VehicleSelection_Dataset - 1_fiat500_VehicleSelection_Dataset.csv")
df2
```

	ID	model	engine_power	age_in_days	km	previous_owners	lat
0	1.0	lounge	51.0	882.0	25000.0	1.0	44.907242
1	2.0	pop	51.0	1186.0	32500.0	1.0	45.666359
2	3.0	sport	74.0	4658.0	142228.0	1.0	45.503300
3	4.0	lounge	51.0	2739.0	160000.0	1.0	40.633171
4	5.0	pop	73.0	3074.0	106880.0	1.0	41.903221
...	...	...	...	...	...	...	...
1544	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1545	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1546	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1547	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1548	NaN	NaN	NaN	NaN	NaN	NaN	NaN

```
df2.isna().sum()
```

```
ID                   11
model                11
engine_power         11
age_in_days          11
km                   11
previous_owners      11
lat                  11
lon                   0
price                 0
Unnamed: 9         1549
Unnamed: 10        1548
dtype: int64
```

```
df2=df2.drop(df2.index[1537:1549],axis=0)
df2=df2.drop(["Unnamed: 9","Unnamed: 10"],axis=1)
df2
```

	ID	model	engine_power	age_in_days	km	previous_owners	la
0	1.0	lounge	51.0	882.0	25000.0	1.0	44.90724
1	2.0	pop	51.0	1186.0	32500.0	1.0	45.66635
2	3.0	sport	74.0	4658.0	142228.0	1.0	45.50330
3	4.0	lounge	51.0	2739.0	160000.0	1.0	40.63317

```
print("First 10 Rows:\n",df2.head(10))
print("Last 7 Rows:\n",df2.tail(7))
```

```
First 10 Rows:
       ID   model  engine_power  age_in_days        km  previous_owners  \
0   1.0  lounge          51.0        882.0   25000.0              1.0   
1   2.0     pop          51.0       1186.0   32500.0              1.0   
2   3.0   sport          74.0       4658.0  142228.0              1.0   
3   4.0  lounge          51.0       2739.0  160000.0              1.0   
4   5.0     pop          73.0       3074.0  106880.0              1.0   
5   6.0     pop          74.0       3623.0   70225.0              1.0   
6   7.0  lounge          51.0        731.0   11600.0              1.0   
7   8.0  lounge          51.0       1521.0   49076.0              1.0   
8   9.0   sport          73.0       4049.0   76000.0              1.0   
9  10.0   sport          51.0       3653.0   89000.0              1.0   

         lat          lon  price  
0  44.907242  8.611559868   8900  
1  45.666359  12.24188995   8800  
2  45.503300     11.41784   4200  
3  40.633171  17.63460922   6000  
4  41.903221  12.49565029   5700  
5  45.000702   7.68227005   7900  
6  44.907242  8.611559868  10750  
7  41.903221  12.49565029   9190  
8  45.548000  11.54946995   5600  
9  45.438301  10.99170017   6000  
Last 7 Rows:
           ID   model  engine_power  age_in_days        km  previous_owners  \
1530  1531.0  lounge          51.0        670.0   29000.0              1.0   
1531  1532.0   sport          73.0       4505.0  127000.0              1.0   
1532  1533.0     pop          51.0       1917.0   52008.0              1.0   
1533  1534.0   sport          51.0       3712.0  115280.0              1.0   
1534  1535.0  lounge          74.0       3835.0  112000.0              1.0   
1535  1536.0     pop          51.0       2223.0   60457.0              1.0   
1536  1537.0  lounge          51.0       2557.0   80750.0              1.0   

            lat          lon  price  
1530  45.764648   8.99450016  10800  
1531  45.528511  9.593230247   4750  
1532  45.548000  11.54946995   9900  
1533  45.069679  7.704919815   5200  
1534  45.845692  8.666870117   4600  
1535  45.481541  9.413479805   7500  
1536  45.000702   7.68227005   5990  
```

```
data3=df2[["age_in_days","km"]]
print(data3.sum())
print(data3.median())
print("Mode:\n",df2.mode().iloc[0])
```

```
age_in_days     2537442.0
km             82068790.0
dtype: float64
age_in_days     1035.0
km             39024.0
dtype: float64
Mode:
 ID                         1.0
model                   lounge
engine_power              51.0
age_in_days              366.0
km                     17000.0
previous_owners            1.0
lat                  41.903221
lon                12.49565029
price                    10500
Name: 0, dtype: object
```

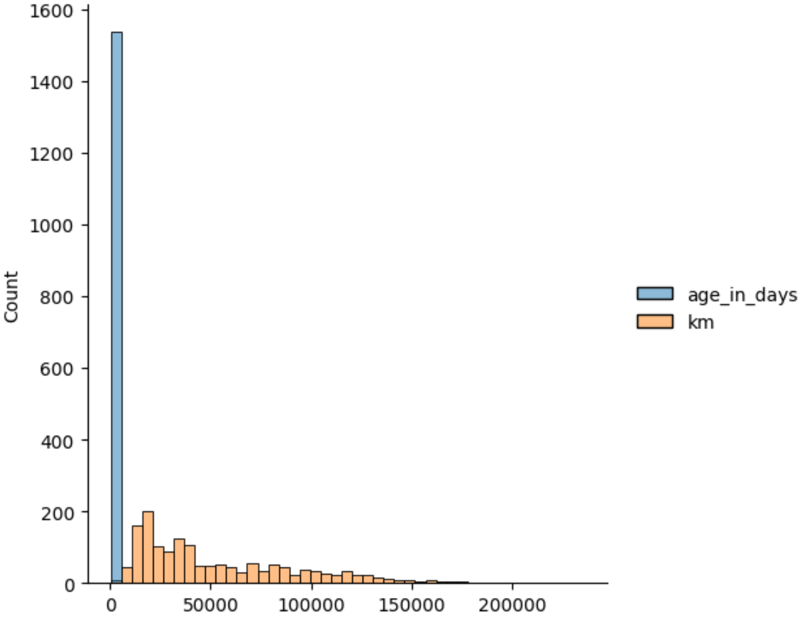
```
print("Shape:",df2.shape)
print("Dimension:",df2.ndim)
print("Size:",df2.size)
print("Description:\n",df2.describe())
```

```
Shape: (1537, 9)
Dimension: 2
Size: 13833
```

```
Description:
                ID  engine_power  age_in_days             km  previous_owners  \
count  1537.000000   1537.000000  1537.000000    1537.000000      1537.000000
mean    769.000000     51.905010  1650.905660   53395.439167         1.123617
std     443.837996      3.989254  1289.938635   40059.858383         0.416546
min       1.000000     51.000000   366.000000    1232.000000         1.000000
25%     385.000000     51.000000   670.000000   20000.000000         1.000000
50%     769.000000     51.000000  1035.000000   39024.000000         1.000000
75%    1153.000000     51.000000  2616.000000   79800.000000         1.000000
max    1537.000000     77.000000  4658.000000  235000.000000         4.000000

              lat
count  1537.000000
mean     43.543455
std       2.132631
min      36.855839
25%      41.802990
50%      44.399971
75%      45.467960
max      46.795612
```

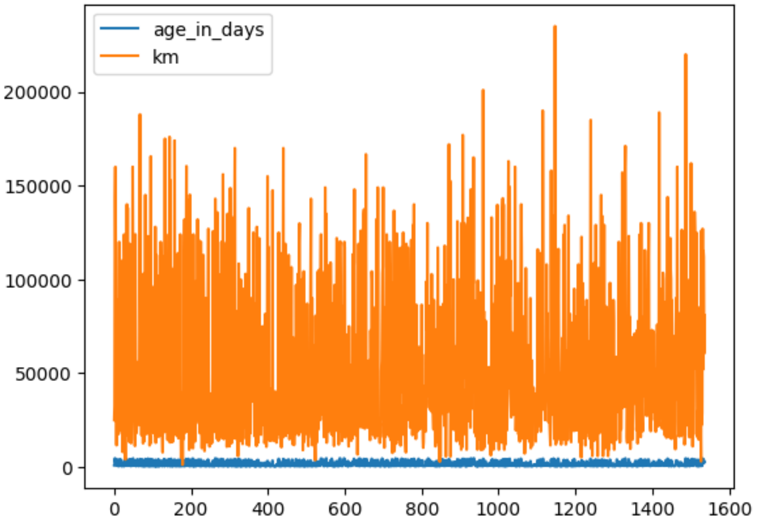
```
sns.displot(data3)
```

```
<seaborn.axisgrid.FacetGrid at 0x7c47e71d2020>
```



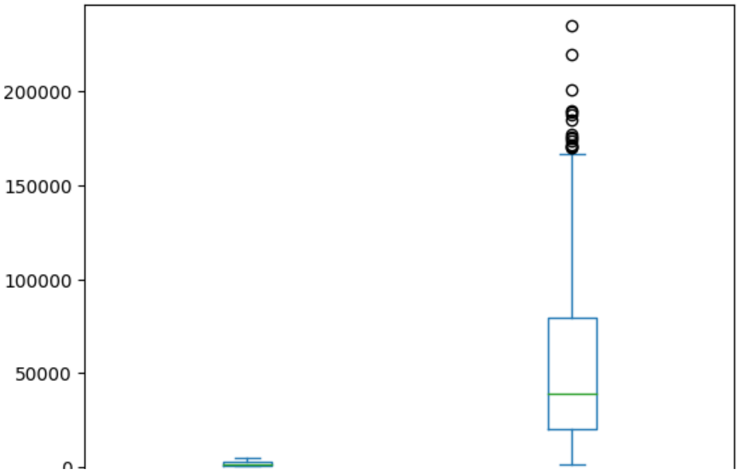
```
data3.plot.line()
```

```
<Axes: >
```



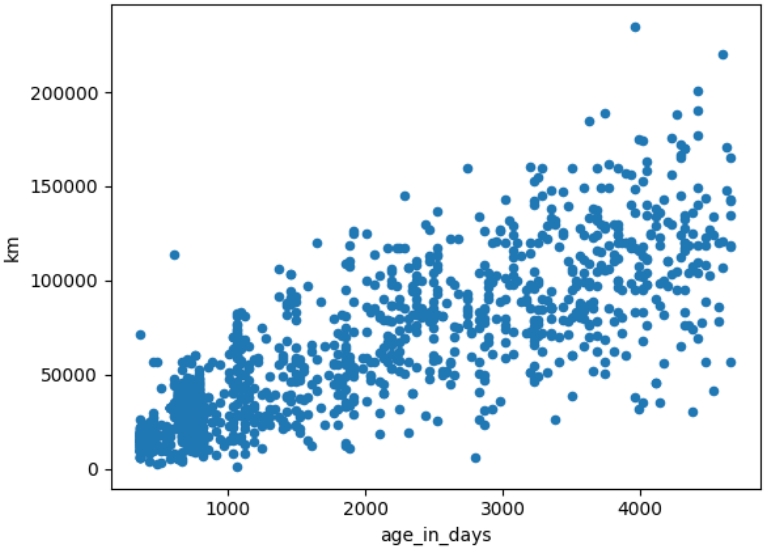
```
data3.plot.box()
```

```
<Axes: >
```



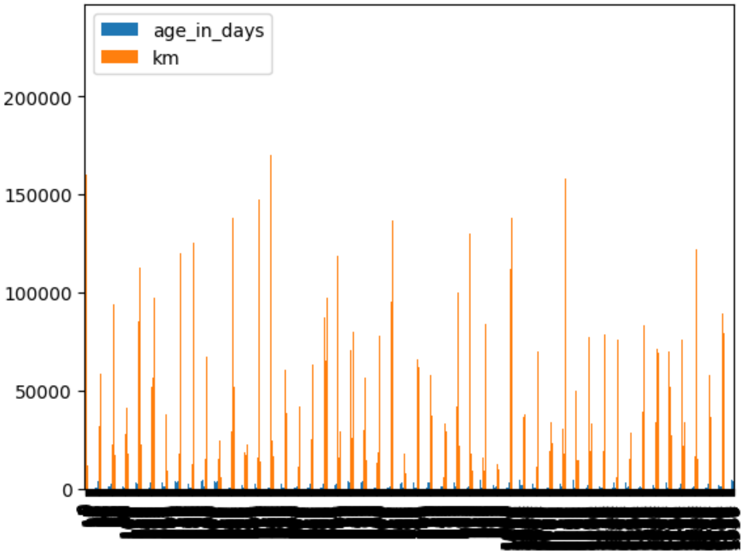
```
data3.plot.scatter("age_in_days","km")
```

```
<Axes: xlabel='age_in_days', ylabel='km'>
```



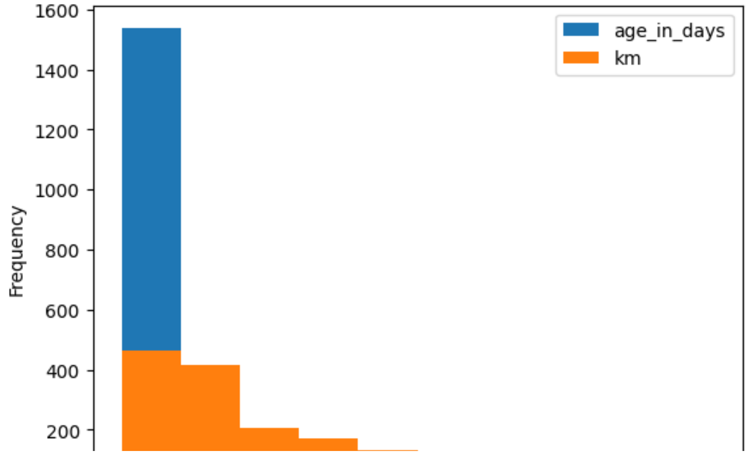
```
data3.plot.bar()
```

```
<Axes: >
```



```
data3.plot.hist()
```

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



```
print(df2.cov())
print("Pearson Corelation :\n",pearsonr(df2["engine_power"],df2["km"]))
print("Spearman Corelation :\n",spearmanr(df2["engine_power"],df2["km"]))
```

```
                            ID  engine_power   age_in_days            km  \
ID               196992.166667    -59.912109 -3.487395e+04 -1.167776e+05
engine_power        -59.912109     15.914148  1.642617e+03  4.562600e+04
age_in_days      -34873.952474   1642.617335  1.663942e+06  4.309110e+07
km              -116777.595703  45626.001379  4.309110e+07  1.604792e+09
previous_owners       1.505859     -0.008432  4.072586e+01  1.627724e+03
lat                 -53.578661      0.046811  1.736320e+02  3.038624e+03

                 previous_owners          lat
ID                      1.505859   -53.578661
engine_power           -0.008432     0.046811
age_in_days            40.725862   173.631987
km                   1627.723671  3038.623575
previous_owners         0.173511     0.001250
lat                     0.001250     4.548116
Pearson Corelation :
 PearsonRResult(statistic=0.2855034117553602, pvalue=3.227790125120896e-30)
Spearman Corelation :
 SignificanceResult(statistic=0.23693784711375426, pvalue=4.691193244222526e-21)
<ipython-input-192-f44d629ea5d1>:1: FutureWarning: The default value of numeric_only in DataFrame.cov is deprecated. In a future version, it will default
  print(df2.cov())
```

```
df3=pd.read_csv("/content/3_Fitness-1 - 3_Fitness-1.csv")
df3
```

	Row Labels	Sum of Jan	Sum of Feb	Sum of Mar	Sum of Total Sales
0	A	5.62%	7.73%	6.16%	75
1	B	4.21%	17.27%	19.21%	160
2	C	9.83%	11.60%	5.17%	101
3	D	2.81%	21.91%	7.88%	127
4	E	25.28%	10.57%	11.82%	179
5	F	8.15%	16.24%	18.47%	167
6	G	18.54%	8.76%	17.49%	171
7	H	25.56%	5.93%	13.79%	170
8	Grand Total	100.00%	100.00%	100.00%	1150

```
print("First 10 Rows:\n",df3.head(10))
print("Last 7 Rows:\n",df3.tail(7))
```

```
First 10 Rows:
     Row Labels Sum of Jan Sum of Feb Sum of Mar  Sum of Total Sales
0             A      5.62%      7.73%      6.16%                  75
1             B      4.21%     17.27%     19.21%                 160
2             C      9.83%     11.60%      5.17%                 101
3             D      2.81%     21.91%      7.88%                 127
4             E     25.28%     10.57%     11.82%                 179
5             F      8.15%     16.24%     18.47%                 167
6             G     18.54%      8.76%     17.49%                 171
7             H     25.56%      5.93%     13.79%                 170
8   Grand Total    100.00%    100.00%    100.00%                1150
Last 7 Rows:
     Row Labels Sum of Jan Sum of Feb Sum of Mar  Sum of Total Sales
2            C      9.83%     11.60%      5.17%                 101
3            D      2.81%     21.91%      7.88%                 127
4            E     25.28%     10.57%     11.82%                 179
5            F      8.15%     16.24%     18.47%                 167
6            G     18.54%      8.76%     17.49%                 171
7            H     25.56%      5.93%     13.79%                 170
8  Grand Total    100.00%    100.00%    100.00%                1150
```

```
da=df3[["Sum of Mar","Sum of Total Sales"]]
da
```

	Sum of Mar	Sum of Total Sales
0	6.16%	75
1	19.21%	160
2	5.17%	101
3	7.88%	127
4	11.82%	179
5	18.47%	167
6	17.49%	171
7	13.79%	170
8	100.00%	1150

```
print(da.sum())
print(da.median())
print("Mode:\n",df3.mode().iloc[0])
```

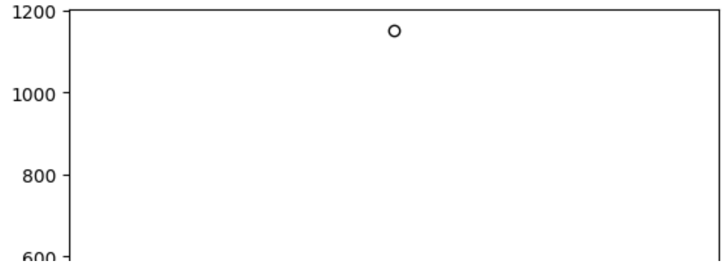
```
Sum of Mar            6.16%19.21%5.17%7.88%11.82%18.47%17.49%13.79%1...
Sum of Total Sales                                                 2300
dtype: object
Sum of Total Sales    167.0
dtype: float64
Mode:
 Row Labels                 A
Sum of Jan            100.00%
Sum of Feb             10.57%
Sum of Mar            100.00%
Sum of Total Sales         75
Name: 0, dtype: object
<ipython-input-182-bed56b5da75d>:2: FutureWarning: The default value of numeric_only in DataFrame.median is deprecated. In a future version, it will defau
  print(da.median())
```

```
print("Shape:",df3.shape)
print("Dimension:",df3.ndim)
print("Size:",df3.size)
print("Description:\n",df3.describe())
```

```
Shape: (9, 5)
Dimension: 2
Size: 45
Description:
        Sum of Total Sales
count            9.000000
mean           255.555556
std            337.332963
min             75.000000
25%            127.000000
50%            167.000000
75%            171.000000
max           1150.000000
```

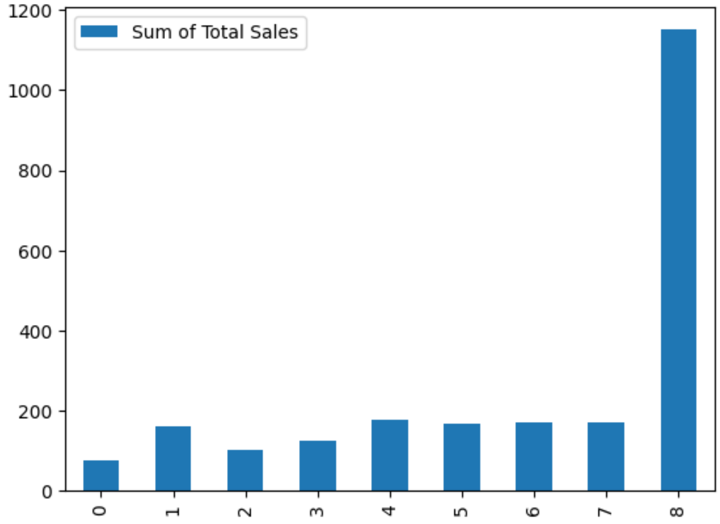
```
da.plot.box()
```

```
<Axes: >
```



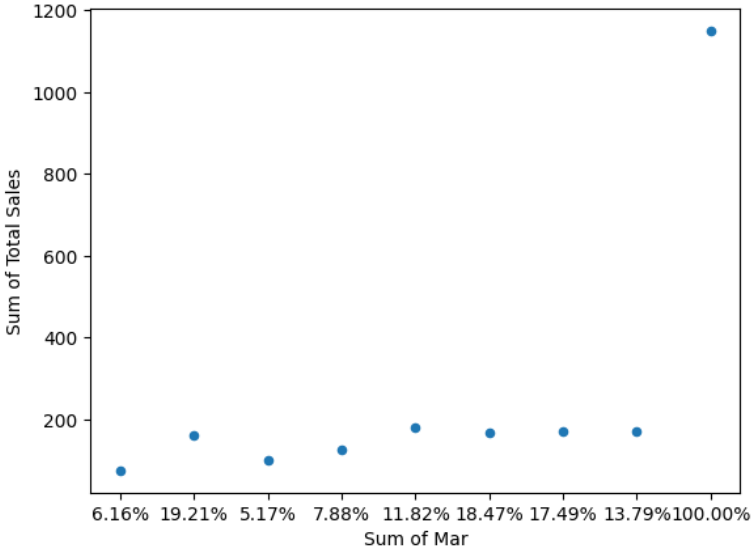
```
da.plot.bar()
```

```
<Axes: >
```



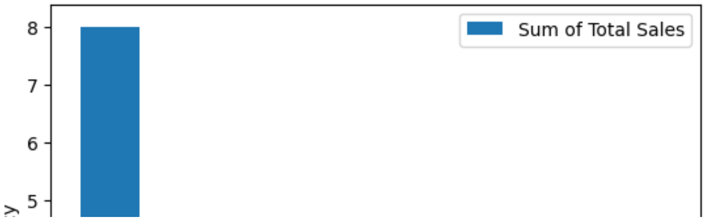
```
da.plot.scatter("Sum of Mar","Sum of Total Sales")
```

```
<Axes: xlabel='Sum of Mar', ylabel='Sum of Total Sales'>
```



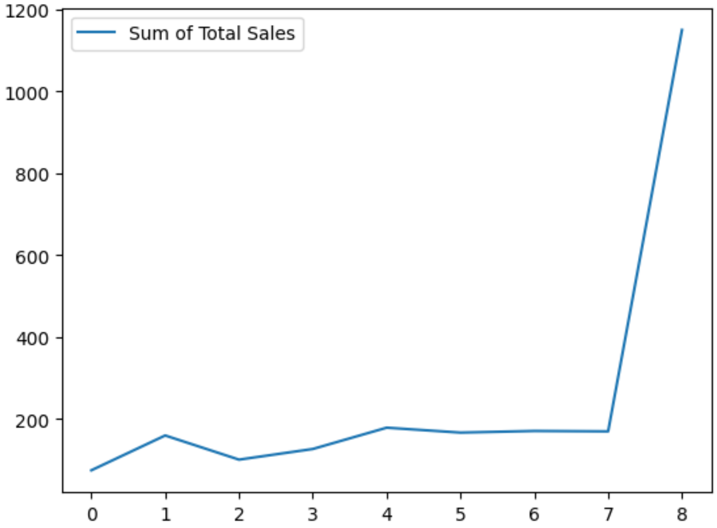
```
da.plot.hist()
```

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



```
da.plot.line()
```

```
<Axes: >
```



```
df3["Sum of Mar"]=df3["Sum of Mar"].str.rstrip("%")
df3["Sum of Mar"]=df3["Sum of Mar"].astype(float)


print(df3.cov())
print("Pearson Corelation :\n",pearsonr(df3["Sum of Mar"],df3["Sum of Total Sales"]))
print("Spearman Corelation :\n",spearmanr(df3["Sum of Mar"],df3["Sum of Total Sales"]))
```

```
                     Sum of Mar  Sum of Total Sales
Sum of Mar           878.588811         9935.666806
Sum of Total Sales  9935.666806       113793.527778
Pearson Corelation :
 PearsonRResult(statistic=0.9936773809789188, pvalue=6.576638324757487e-08)
Spearman Corelation :
 SignificanceResult(statistic=0.6666666666666667, pvalue=0.04986723056888511)
<ipython-input-191-b19954d893e0>:1: FutureWarning: The default value of numeric_only in DataFrame.cov is deprecated. In a future version, it will default
  print(df3.cov())
```