import requried libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import scipy
from scipy import stats
from sklearn.preprocessing import OneHotEncoder
```

Read the datasets

In [48]:
```
ds= pd.read_csv('fuel consumption (1).csv')
```

In [3]:
```
ds.head()
```

Out[3]:

	distance	consume	speed	temp_inside	temp_outside	specials	gas_type	AC	rain	sun	refill liters	refill gas
0	28	5	26	21,5	12	NaN	E10	0	0	0	45	E10
1	12	4,2	30	21,5	13	NaN	E10	0	0	0	NaN	NaN
2	11,2	5,5	38	21,5	15	NaN	E10	0	0	0	NaN	NaN
3	12,9	3,9	36	21,5	14	NaN	E10	0	0	0	NaN	NaN
4	18,5	4,5	46	21,5	15	NaN	E10	0	0	0	NaN	NaN

In [4]:
```
ds.tail()
```

Out[4]:

	distance	consume	speed	temp_inside	temp_outside	specials	gas_type	AC	rain	sun	refill liters	refill gas
383	16	3,7	39	24,5	18	NaN	SP98	0	0	0	NaN	NaN
384	16,1	4,3	38	25	31	AC	SP98	1	0	0	NaN	NaN
385	16	3,8	45	25	19	NaN	SP98	0	0	0	NaN	NaN
386	15,4	4,6	42	25	31	AC	SP98	1	0	0	NaN	NaN
387	14,7	5	25	25	30	AC	SP98	1	0	0	NaN	NaN

In [81]:
```
ds.describe()
```

Out[81]:

	speed	temp_outside	AC	rain	sun
count	388.000000	388.000000	388.000000	388.000000	388.000000
mean	41.927835	11.358247	0.077320	0.123711	0.082474
std	13.598524	6.991542	0.267443	0.329677	0.275441
min	14.000000	-5.000000	0.000000	0.000000	0.000000
25%	32.750000	7.000000	0.000000	0.000000	0.000000
50%	40.500000	10.000000	0.000000	0.000000	0.000000
75%	50.000000	16.000000	0.000000	0.000000	0.000000
max	90.000000	31.000000	1.000000	1.000000	1.000000

In [36]:
```
ds.info()
```

```
<class 'pandas.c re.frame.D taFrame'>
RangeIndex: 388 entries, 0 to 387
Data columns (tot al 12 colu ns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   distance        388 non-null    object
 1   consume         388 non-null    object
 2   speed           388 non-null    int64
 3   temp_inside     376 non-null    object
 4   temp_outside    388 non-null    int64
 5   specials        93 non-null     object
 6   gas_type        388 non-null    object
 7   AC              388 non-null    int64
 8   rain            388 non-null    int64
 9   sun             388 non-null    int64
 10  refill liters   13 non-null     object
 11  refill gas      13 non-null     object
dtypes: int64(5), object(7)
memory usage: 36.5+ KB
```

In [8]:
```
ds.columns
```

Out[8]:
```
Index(['distance', 'consume', 'speed', 'temp_inside', 'temp_outside',
       'specials', 'gas_type', 'AC', 'rain', 'sun', 'refill liters',
       'refill gas'],
      dtype='object')
```

Checking null values

In [83]:
```
ds.duplicated().sum()
```

Out[83]:
```
0
```

In [49]:
```
ds.isnull()
```

Out[49]:

	distance	consume	speed	temp_inside	temp_outside	specials	gas_type	AC	rain	sun	refill liters	refill gas
0	False	False	False	False	False	True	False	False	False	False	False	False
1	False	False	False	False	False	True	False	False	False	False	True	True
2	False	False	False	False	False	True	False	False	False	False	True	True
3	False	False	False	False	False	True	False	False	False	False	True	True
4	False	False	False	False	False	True	False	False	False	False	True	True
...	...	...	...	...	...	...	...	...	...	...	...	...
383	False	False	False	False	False	True	False	False	False	False	True	True
384	False	False	False	False	False	False	False	False	False	False	True	True
385	False	False	False	False	False	True	False	False	False	False	True	True
386	False	False	False	False	False	False	False	False	False	False	True	True
387	False	False	False	False	False	False	False	False	False	False	True	True

388 rows × 12 columns

In [50]:
```
ds.isnull().sum()
```

Out[50]:
```
distance          0
consume           0
speed             0
temp_inside      12
temp_outside      0
specials        295
gas_type          0
AC                0
rain              0
sun               0
refill liters   375
refill gas      375
dtype: int64
```

In [86]:
```
ds.isnull().sum().sum()
```

Out[86]:
```
1057
```

Removing null values

In [87]:
```
ds.dropna()
```

Out[87]:

	distance	consume	speed	temp_inside	temp_outside	specials	gas_type	AC	rain	sun	refill liters	refill gas
139	16,1	5,4	24	21,5	7	rain	E10	0	1	0	38	E10
191	43,7	4,7	44	22	9	half rain half sun	SP98	0	1	0	10	SP98
274	25,7	4,9	50	22	10	rain	SP98	0	1	0	41	SP98

In [51]:
```
ds['temp_inside']=ds['temp_inside'].fillna(ds['temp_inside'].mode()[0])
ds['specials']=ds['specials'].fillna(ds['specials'].mode()[0])
ds['refill liters']=ds['refill liters'].fillna(ds['refill liters'].mode()[0])
ds['refill gas']=ds['refill gas'].fillna(ds['refill gas'].mode()[0])
```

Handling null places

In [52]:
```
ds.isnull().sum()
```

Out[52]:
```
distance        0
consume         0
speed           0
temp_inside     0
temp_outside    0
specials        0
gas_type        0
AC              0
rain            0
sun             0
refill liters   0
refill gas      0
dtype: int64
```

In [98]:
```
ds.isnull().sum().sum()
```

Out[98]:
```
0
```

In [53]:
```
ds.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 388 entries, 0 to 387
Data columns (total 12 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   distance        388 non-null    object
 1   consume         388 non-null    object
 2   speed           388 non-null    int64
 3   temp_inside     388 non-null    object
 4   temp_outside    388 non-null    int64
 5   specials        388 non-null    object
 6   gas_type        388 non-null    object
 7   AC              388 non-null    int64
 8   rain            388 non-null    int64
 9   sun             388 non-null    int64
 10  refill liters   388 non-null    object
 11  refill gas      388 non-null object
dtypes: int64(5), object(7)
memory usage: 36.5+ KB
```

In [54]:
```
ds.nunique()
```

Out[54]:
```
distance        174
consume          43
speed            60
temp_inside      13
temp_outside     33
specials         12
gas_type          2
AC                2
rain              2
sun               2
refill liters    10
refill gas        2
dtype: int64
```

In [55]:
```
ds['distance'] = ds['distance'].str.replace(',', '').astype(int)
ds['consume'] = ds['consume'].str.replace(',', '').astype(int)
ds['temp_inside'] = ds['temp_inside'].str.replace(',', '').astype(int)
ds['refill liters'] = ds['refill liters'].str.replace(',', '').astype(int)
```

In [56]:
```
ds['specials'].unique()
```

Out[56]:
```
array(['rain', 'AC rain', 'AC', 'snow', 'AC snow', 'half rain half sun',
       'sun', 'AC sun', 'sun ac', 'ac', 'AC Sun', 'ac rain'], dtype=object)
```

In [57]:
```
ds['gas_type'].unique()
```

Out[57]:
```
array(['E10', 'SP98'], dtype=object)
```

In [58]:
```
ds['refill gas'].unique()
```

Out[58]:
```
array(['E10', 'SP98'], dtype=object)
```

In [59]:
```
ds['specials']=ds['specials'].replace(['rain', 'AC rain', 'AC', 'snow', 'AC snow', 'half rain half sun',
       'sun', 'AC sun', 'sun ac', 'ac', 'AC Sun', 'ac rain'],[0,1,2,3,4,5,6,7,8,9,10,11])
ds['gas_type']=ds['gas_type'].replace(['E10', 'SP98'],[0,1])
ds['gas_type']=ds['gas_type'].replace(['E10', 'SP98'],[0,1])
ds['refill gas']=ds['refill gas'].replace(['E10', 'SP98'],[0,1])
```

In [60]:
```
ds.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 388 entries, 0 to 387
Data columns (total 12 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   distance        388 non-null    int32
 1   consume         388 non-null    int32
 2   speed           388 non-null    int64
 3   temp_inside     388 non-null    int32
 4   temp_outside    388 non-null    int64
 5   specials        388 non-null    int64
 6   gas_type        388 non-null    int64
 7   AC              388 non-null    int64
 8   rain            388 non-null    int64
 9   sun             388 non-null    int64
 10  refill liters   388 non-null    int32
 11  refill gas      388 non-null int64
dtypes: int32(4), int64(8)
memory usage: 30.4 KB
```

visualization

In [61]:
```
ds.describe()
```

Out[61]:

	distance	consume	speed	temp_inside	temp_outside	specials	gas_type	AC	rain	sun	refill liters	refill gas
count	388.000000	388.000000	388.000000	388.000000	388.000000	388.000000	388.000000	388.000000	388.000000	388.000000	388.000000	388.000000
mean	172.891753	43.649485	41.927835	133.175258	11.358247	0.837629	0.587629	0.077320	0.123711	0.082474	369.984536	0.987113
std	211.910501	17.779320	13.598524	98.021910	6.991542	2.222024	0.492897	0.267443	0.329677	0.275441	48.438349	0.112931
min	2.000000	4.000000	14.000000	19.000000	-5.000000	0.000000	0.000000	0.000000	0.000000	0.000000	10.000000	0.000000
25%	86.000000	41.000000	32.750000	22.000000	7.000000	0.000000	0.000000	0.000000	0.000000	0.000000	377.000000	1.000000
50%	124.000000	46.000000	40.500000	215.000000	10.000000	0.000000	1.000000	0.000000	0.000000	0.000000	377.000000	1.000000
75%	184.000000	52.000000	50.000000	215.000000	16.000000	0.000000	1.000000	0.000000	0.000000	0.000000	377.000000	1.000000
max	2161.000000	122.000000	90.000000	255.000000	31.000000	11.000000	1.000000	1.000000	1.000000	1.000000	383.000000	1.000000

In [62]:
```
ds.corr()
```

Out[62]:

	distance	consume	speed	temp_inside	temp_outside	specials	gas_type	AC	rain	sun	refill liters	refill gas
distance	1.000000	-0.002587	0.544747	-0.101877	0.049115	0.129285	-0.080558	-0.021463	-0.003839	0.098344	-0.116857	0.005016
consume	-0.002587	1.000000	-0.103658	0.081657	-0.227296	-0.116168	-0.015062	-0.035586	0.137025	-0.092224	0.008668	0.037640
speed	0.544747	-0.103658	1.000000	-0.045839	0.015411	0.047073	-0.097360	-0.035408	0.009489	0.081618	0.008715	0.073428
temp_inside	-0.101877	0.081657	-0.045839	1.000000	-0.385733	-0.128945	-0.340038	-0.064686	0.027793	-0.060066	0.057217	-0.052784
temp_outside	0.049115	-0.227296	0.015411	-0.385733	1.000000	0.380156	0.148705	0.167562	-0.186315	0.346903	0.053518	0.009135
specials	0.129285	-0.116168	0.047073	-0.128945	0.380156	1.000000	0.068469	0.499483	-0.007782	0.743888	0.010684	0.043127
gas_type	-0.080558	-0.015062	-0.097360	-0.340038	0.148705	0.068469	1.000000	0.105285	0.060328	0.022761	-0.012931	0.136393
AC	-0.021463	-0.035586	-0.035408	-0.064686	0.167562	0.499483	0.105285	1.000000	0.242915	0.088598	0.041980	0.033075
rain	-0.003839	0.137025	0.009489	0.027793	-0.186315	-0.007782	0.060328	0.242915	1.000000	-0.112650	-0.114119	-0.026474
sun	0.098344	-0.092224	0.081618	-0.060066	0.346903	0.743888	0.022761	0.088598	-0.112650	1.000000	0.043479	0.034256
refill liters	-0.116857	0.008668	0.008715	0.057217	0.053518	0.010684	-0.012931	0.041980	-0.114119	0.043479	1.000000	0.457222
refill gas	0.005016	0.037640	0.073428	-0.052784	0.009135	0.043127	0.136393	0.033075	-0.026474	0.034256	0.457222	1.000000

In [63]:
```
sns.heatmap(ds.corr())
```

Out[63]:
```
<AxesSubplot:>
```


In [64]:
```
sns.scatterplot(ds['sun'],ds['rain'])
```

```
C:\Users\Jagadeesan\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variables as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[64]:
```
<AxesSubplot:xlabel='sun', ylabel='rain'>
```