PROBLEM SET 4, MRIDUL HARISH, CED18I034

In [ ]:
```
import pandas as pd
from sklearn.preprocessing import Binarizer, OneHotEncoder
```

In [ ]:
```
df = pd.read_csv('Avocado Dataset.csv')
df1 = pd.read_csv('Trail.csv')
```

Question 1 - Select a subset of relevant attributes from the given dataset that are necessary to know about the total volume of avocados with product lookup codes (PLU) 4046, 4225, 4770) which are of organic type. (Use AVOCADO dataset)

In [ ]:
```
v4046 = df.groupby('type')['4046'].sum()
v4225 = df.groupby('type')['4225'].sum()
v4770 = df.groupby('type')['4770'].sum()
```

In [ ]:
```
print("Volume of organic avocado sold with PLU of 4046: {}".format(v4046['orga
print("Volume of organic avocado sold with PLU of 4225: {}".format(v4225['orga
print("Volume of organic avocado sold with PLU of 4770: {}".format(v4770['orga
```

```
Volume of organic avocado sold with PLU of 4046: 66702877.38999989
Volume of organic avocado sold with PLU of 4225: 140603877.57000032
Volume of organic avocado sold with PLU of 4770: 2429040.549999998
```

Question 2 - Discard all duplicate entries in the dataset given and fill all the missing values in the attribute “AveragePrice” as 1.25. Also print the size of the dataset before and after removing duplicates. (Use Trail dataset)

In [ ]:
```
before = df1.shape[0]
df1.drop_duplicates(inplace=True)
after = df1.shape[0]
print("Number of duplicate rows removed: {}".format(before - after))
```

```
Number of duplicate rows removed: 7
```

In [ ]:
```
before = df1.AveragePrice.isna().sum()
df1.AveragePrice.fillna(1.25, inplace=True)
after = df1.AveragePrice.isna().sum()
print("Number of missing values filled: {}".format(before - after))
```

```
Number of missing values filled: 24
```

Question 3 - Binarize the attribute “Year”. Set the threshold above 2016 and print it without truncation. (Use AVOCADO dataset)

In [ ]:
```
years = df.year.values.reshape(1, -1)

print("Binarized data: {}".format(Binarizer(threshold=2016).fit_transform(yea
```

```
Binarized data: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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```

Question 4 - Transform all categorical attributes in the dataset AVOCADO using Integer Encoding.

In [ ]:

```
df["type"] = df.type.astype('category')
df["region"] = df.region.astype('category')
```

In [ ]:

```
df.dtypes
```

Out[ ]:

```
Date                  object
AveragePrice          object
Total Volume         float64
4046                 float64
4225                 float64
4770                 float64
```

```
Total Bags        float64
Small Bags        float64
Large Bags        float64
XLarge Bags       float64
type             category
year                int64
region           category
dtype: object
```

In [ ]:

```
print("The categorical attributes in the dataset are as follows: {}".format(d
```

```
The categorical attributes in the dataset are as follows: ['type', 'region']
```

In [ ]:

```
intEncoding = {}
regions = list(df.region.unique())
intEncoding["region"] = {i: regions.index(i) for i in regions}
types = list(df.type.unique())
intEncoding["type"] = {i: types.index(i) for i in types}

print("The integer encoding for the categorical attributes is as follows: {}"
```

```
The integer encoding for the categorical attributes is as follows: {'region':
{'Albany': 0, 'Atlanta': 1, 'BaltimoreWashington': 2, 'Boise': 3, 'Boston': 4,
'BuffaloRochester': 5, 'California': 6, 'Charlotte': 7, 'Chicago': 8, 'Cincinn
atiDayton': 9, 'Columbus': 10, 'DallasFtWorth': 11, 'Denver': 12, 'Detroit': 1
3, 'GrandRapids': 14, 'GreatLakes': 15, 'HarrisburgScranton': 16, 'HartfordSpr
ingfield': 17, 'Houston': 18, 'Indianapolis': 19, 'Jacksonville': 20, 'LasVega
s': 21, 'LosAngeles': 22, 'Louisville': 23, 'MiamiFtLauderdale': 24, 'Midsouth
': 25, 'Nashville': 26, 'NewOrleansMobile': 27, 'NewYork': 28, 'Northeast': 2
9, 'NorthernNewEngland': 30, 'Orlando': 31, 'Philadelphia': 32, 'PhoenixTucson
': 33, 'Pittsburgh': 34, 'Plains': 35, 'Portland': 36, 'RaleighGreensboro': 3
7, 'RichmondNorfolk': 38, 'Roanoke': 39, 'Sacramento': 40, 'SanDiego': 41, 'Sa
nFrancisco': 42, 'Seattle': 43, 'SouthCarolina': 44, 'SouthCentral': 45, 'Sout
heast': 46, 'Spokane': 47, 'StLouis': 48, 'Syracuse': 49, 'Tampa': 50, 'TotalU
S': 51, 'West': 52, 'WestTexNewMexico': 53}, 'type': {'conventional': 0, 'orga
nic': 1}}
```

In [ ]:

```
df = df.replace(intEncoding)
df
```

Out[ ]:

	Date	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags
0	27-12-2015	1.33	64236.62	1036.74	54454.85	48.16	8696.87	8603.62	93.25
1	20-12-2015	1.35	54876.98	674.28	44638.81	58.33	9505.56	9408.07	97.49
2	13-12-2015	0.93	118220.22	794.70	109149.67	130.50	8145.35	8042.21	103.14
3	06-12-2015	1.08	78992.15	1132.00	71976.41	72.58	5811.16	5677.40	133.76
4	29-11-2015	1.29	51039.60	941.48	43838.39	75.78	6183.95	5986.26	197.69
...	...	...	...	...	...	...	...	...	...
18245	28-01-2018	1.71	13888.04	1191.70	3431.50	0.00	9264.84	8940.04	324.80
18246	21-01-2018	1.87	13766.76	1191.92	2452.79	727.94	9394.11	9351.80	42.31
18247	14-01-2018	1.93	16205.22	1527.63	2981.04	727.01	10969.54	10919.54	50.00

	Date	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags	X
18248	07-01-2018	1.62	17489.58	2894.77	2356.13	224.53	12014.15	11988.14	26.01	

Question 5 - Transform the attribute = “Region” in the given dataset AVOCADO using One-Hot Encoding.

In [ ]:

```
enc = OneHotEncoder(handle_unknown='ignore')

dfEnc = pd.DataFrame(enc.fit_transform(df[['region']]).toarray())
dfMerge = df.join(dfEnc)

dfMerge.columns
```

Out[ ]:

```
Index([         'Date', 'AveragePrice', 'Total Volume',          '4046',
               '4225',          '4770',   'Total Bags',    'Small Bags',
         'Large Bags',   'XLarge Bags',          'type',          'year',
             'region',               0,              1,               2,
                    3,               4,              5,               6,
                    7,               8,              9,              10,
                   11,              12,             13,              14,
                   15,              16,             17,              18,
                   19,              20,             21,              22,
                   23,              24,             25,              26,
                   27,              28,             29,              30,
                   31,              32,             33,              34,
                   35,              36,             37,              38,
                   39,              40,             41,              42,
                   43,              44,             45,              46,
                   47,              48,             49,              50,
                   51,              52,             53],
      dtype='object')
```

Question 6 - Ignore the tuples that hold missing values and print the subset of data from AVOCADO dataset excluding “NaN” values.

In [ ]:

```
dfCleaned = df.dropna()
dfCleaned
```

Out[ ]:

	Date	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags	X
0	27-12-2015	1.33	64236.62	1036.74	54454.85	48.16	8696.87	8603.62	93.25	
1	20-12-2015	1.35	54876.98	674.28	44638.81	58.33	9505.56	9408.07	97.49	
2	13-12-2015	0.93	118220.22	794.70	109149.67	130.50	8145.35	8042.21	103.14	
3	06-12-2015	1.08	78992.15	1132.00	71976.41	72.58	5811.16	5677.40	133.76	
4	29-11-2015	1.29	51039.60	941.48	43838.39	75.78	6183.95	5986.26	197.69	
...	...	...	...	...	...	...	...	...	...	
18245	28-01-2018	1.71	13888.04	1191.70	3431.50	0.00	9264.84	8940.04	324.80	
18246	21-01-2018	1.87	13766.76	1191.92	2452.79	727.94	9394.11	9351.80	42.31	

	Date	AveragePrice	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags
18247	14-01-2018	1.93	16205.22	1527.63	2981.04	727.01	10969.54	10919.54	50.00
18248	07-01-2018	1.62	17489.58	2894.77	2356.13	224.53	12014.15	11988.14	26.01

Question 7 - Drop the attribute that has high nullity as it facilitates efficient prediction. (Use AVOCADO dataset)

In [ ]:

```
df.isnull().sum()
```

Out[ ]:

```
Date              0
AveragePrice     28
Total Volume      0
4046              0
4225              0
4770              0
Total Bags        0
Small Bags        0
Large Bags        0
XLarge Bags       0
type              0
year              0
region            0
dtype: int64
```

In [ ]:

```
df_drop = df.dropna(axis=1, how='any', inplace=False)
df_drop.isnull().sum()
```

Out[ ]:

```
Date            0
Total Volume    0
4046            0
4225            0
4770            0
Total Bags      0
Small Bags      0
Large Bags      0
XLarge Bags     0
type            0
year            0
region          0
dtype: int64
```

Question 8 - Study the entire dataset and report the complete statistical summary about the data (Use AVOCADO dataset) • Dimension of the dataset

• Most frequently occurring value under every attribute.

• Datatype of every attribute

• Count

• Mean

• Standard Deviation

- Minimum Value

- Maximum value

- 25% o

- Median i.e. 50%

- 75%

- Find whether the class distribution of dataset is imbalanced. (Note: Fix the class label as “Type” in the given dataset)

- Correlation matrix

- Skewness of every attribute.

(For the below exercises, you are free to choose an appropriate data set as merited by the problem statements)

In [ ]:

```
df.shape
```

Out[ ]:

```
(18250, 13)
```

In [ ]:

```
dict(zip(df.columns, df.value_counts().idxmax()))
```

Out[ ]:

```
{'Date': '18-03-2018',
 'AveragePrice': '1.56',
 'Total Volume': 15896.38,
 '4046': 2055.35,
 '4225': 1499.55,
 '4770': 0.0,
 'Total Bags': 12341.48,
 'Small Bags': 12114.81,
 'Large Bags': 226.67,
 'XLarge Bags': 0.0,
 'type': 1,
 'year': 2018,
 'region': 53}
```

In [ ]:

```
df.dtypes
```

Out[ ]:

```
Date                 object
AveragePrice         object
Total Volume        float64
4046                float64
4225                float64
4770                float64
Total Bags          float64
Small Bags          float64
Large Bags          float64
XLarge Bags         float64
type                  int64
year                  int64
region                int64
dtype: object
```

In [ ]:

```
df.count()
```

Out[ ]:

```
Date            18250
AveragePrice    18222
Total Volume    18250
4046            18250
4225            18250
4770            18250
Total Bags      18250
Small Bags      18250
Large Bags      18250
XLarge Bags     18250
type            18250
year            18250
region          18250
dtype: int64
```

In [ ]:

```
df.select_dtypes(include=['float64']).mean()
```

Out[ ]:

```
Total Volume    850598.273413
4046            292992.481896
4225            295138.477670
4770             22838.484500
Total Bags      239626.747390
Small Bags      182185.367250
Large Bags       54335.123135
XLarge Bags       3106.256292
dtype: float64
```

In [ ]:

```
df.select_dtypes(include=['float64']).std()
```

Out[ ]:

```
Total Volume    3.453456e+06
4046            1.264956e+06
4225            1.204089e+06
4770            1.074613e+05
Total Bags      9.862168e+05
Small Bags      7.461591e+05
Large Bags      2.439596e+05
XLarge Bags     1.769242e+04
dtype: float64
```

In [ ]:

```
df.select_dtypes(include=['float64']).min()
```

Out[ ]:

```
Total Volume    84.56
4046             0.00
4225             0.00
4770             0.00
Total Bags       0.00
Small Bags       0.00
Large Bags       0.00
XLarge Bags      0.00
dtype: float64
```

In [ ]:

```
df.select_dtypes(include=['float64']).max()
```

Out[ ]:

```
Total Volume    62505646.52
4046            22743616.17
4225            20470572.61
```

```
4770              2546439.11
Total Bags       19373134.37
Small Bags       13384586.80
Large Bags        5719096.61
XLarge Bags        551693.65
dtype: float64
```

In [ ]:

```
df.select_dtypes(include=['float64']).quantile([0.25, 0.5, 0.75])
```

Out[ ]:

	Total Volume	4046	4225	4770	Total Bags	Small Bags	Large Bags	XLarge Bags
0.25	10839.6275	854.2100	3008.0975	0.000	5089.0825	2850.3225	127.580	0.0000
0.50	107365.5050	8643.2000	29058.8750	184.975	39741.1800	26351.6150	2647.270	0.0000
0.75	432952.6650	111008.7125	150166.3350	6242.055	110781.1150	83336.2100	22018.275	132.4325

In [ ]:

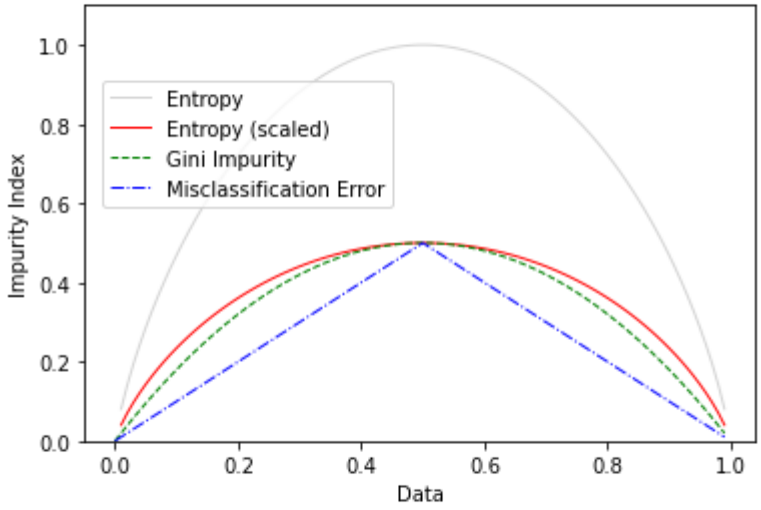
```
counts = df['type'].value_counts()

print("The distribution of the types of avocado sold is as follows: {}".format
```

```
The distribution of the types of avocado sold is as follows: 0    9126
1    9124
Name: type, dtype: int64
```

Question 9 - Test drive the use of Gini Index, Information Gain, Entropy and other measures that are supported in your platform, performing the role of data selection.

In [ ]:

```
import matplotlib.pyplot as plt
import numpy as np

def gini(p):
   return (p)*(1 - (p)) + (1 - p)*(1 - (1-p))

def entropy(p):
   return - p*np.log2(p) - (1 - p)*np.log2((1 - p))

def classification_error(p):
   return 1 - np.max([p, 1 - p])

x = np.arange(0.0, 1.0, 0.01)
ent = [entropy(p) if p != 0 else None for p in x]
scaled_ent = [e*0.5 if e else None for e in ent]
c_err = [classification_error(i) for i in x]

fig = plt.figure()
ax = plt.subplot(111)

for j, lab, ls, c, in zip(
      [ent, scaled_ent, gini(x), c_err],
      ['Entropy', 'Entropy (scaled)', 'Gini Impurity', 'Misclassification Erro
      ['-', '-', '--', '-.'],
      ['lightgray', 'red', 'green', 'blue']):
   line = ax.plot(x, j, label=lab, linestyle=ls, lw=1, color=c)

ax.legend(loc='upper left', bbox_to_anchor=(0.01, 0.85), ncol=1, fancybox=True

plt.ylim([0, 1.1])
plt.xlabel('Data')
plt.ylabel('Impurity Index')
plt.show()
```



Question 10 - Test drive the implementation support in your platform of choice for data preprocessing phases such as cleaning, selection, transformation, integration in addition to the earlier exercises.

In [ ]:

```
from sklearn.impute import SimpleImputer
from sklearn.preprocessing import Normalizer
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import KBinsDiscretizer
```

In [ ]:

```
df3 = pd.read_csv('auto.csv')
df3
```

Out[ ]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	modelyear	origin	car name
0	18.0	8	307.0	130.0	3504.0	12.0	70	1	chevrolet chevelle malibu
1	15.0	8	350.0	165.0	3693.0	11.5	70	1	buick skylark 320
2	18.0	8	318.0	150.0	3436.0	11.0	70	1	plymouth satellite
3	16.0	8	304.0	150.0	3433.0	12.0	70	1	amc rebel sst
4	17.0	8	302.0	140.0	3449.0	10.5	70	1	ford torino
...	...	...	...	...	...	...	...	...	...
393	27.0	4	140.0	86.0	2790.0	15.6	82	1	ford mustang gl
394	44.0	4	97.0	52.0	2130.0	24.6	82	2	vw pickup
395	32.0	4	135.0	84.0	2295.0	11.6	82	1	dodge rampage
396	28.0	4	120.0	79.0	2625.0	18.6	82	1	ford ranger
397	31.0	4	119.0	82.0	2720.0	19.4	82	1	chevy

398 rows × 9 columns

In [ ]:

```
df3.isnull().sum()
```

Out[ ]:

```
mpg             0
cylinders       0
displacement    0
horsepower      6
weight          0
acceleration    0
modelyear       0
origin          0
```

```
car name        0
```

In [ ]:

```
imputer = SimpleImputer(missing_values=np.nan, strategy='mean')
imputer = imputer.fit(df3.iloc[:, 1:7])
df3.iloc[:, 1:7] = imputer.transform(df3.iloc[:, 1:7])
df3.iloc[330]
```

Out[ ]:

```
mpg                              40.9
cylinders                         4.0
displacement                     85.0
horsepower                 104.469388
weight                         1835.0
acceleration                     17.3
modelyear                        80.0
origin                              2
car name         renault lecar deluxe
Name: 330, dtype: object
```

In [ ]:

```
sc = StandardScaler(with_mean=False)
df3_stand = sc.fit_transform(df3.drop(['car name'], axis=1))
df3_stand = pd.DataFrame(df3_stand, columns=df3.columns.tolist()[:-1])
df3_stand
```

Out[ ]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	modelyear	origin
0	2.305872	4.709024	2.947990	3.407497	4.142935	4.356947	18.95489	1.248367
1	1.921560	4.709024	3.360900	4.324900	4.366398	4.175407	18.95489	1.248367
2	2.305872	4.709024	3.053618	3.931728	4.062535	3.993868	18.95489	1.248367
3	2.049664	4.709024	2.919182	3.931728	4.058988	4.356947	18.95489	1.248367
4	2.177768	4.709024	2.899977	3.669612	4.077906	3.812328	18.95489	1.248367
...	...	...	...	...	...	...	...	...
393	3.458807	2.354512	1.344360	2.254190	3.298741	5.664031	22.20430	1.248367
394	5.636575	2.354512	0.931450	1.362999	2.518394	8.931741	22.20430	2.496734
395	4.099327	2.354512	1.296347	2.201767	2.713480	4.211715	22.20430	1.248367
396	3.586911	2.354512	1.152309	2.070710	3.103654	6.753267	22.20430	1.248367
397	3.971223	2.354512	1.142706	2.149344	3.215977	7.043731	22.20430	1.248367

398 rows × 8 columns

In [ ]:

```
nm = Normalizer()
df3_norm = nm.fit_transform(df3_stand)
df3_norm = pd.DataFrame(df3_norm)
df3_norm
```

Out[ ]:

	0	1	2	3	4	5	6	7
0	0.109335	0.223283	0.139782	0.161570	0.196441	0.206589	0.898763	0.059192
1	0.090261	0.221197	0.157872	0.203154	0.205103	0.196132	0.890369	0.058640

	0	1	2	3	4	5	6	7
2	0.109238	0.223085	0.144662	0.186261	0.192458	0.189205	0.897967	0.059140
3	0.096983	0.222814	0.138125	0.186035	0.192056	0.206155	0.896876	0.059068
4	0.103726	0.224289	0.138125	0.174783	0.194229	0.181580	0.902816	0.059459
...	...	...	...	...	...	...	...	...
393	0.145908	0.099324	0.056711	0.095092	0.139155	0.238934	0.936675	0.052662
394	0.225387	0.094149	0.037245	0.054502	0.100702	0.357149	0.887872	0.099836
395	0.175024	0.100528	0.055349	0.094006	0.115854	0.179822	0.948030	0.053300
396	0.149734	0.098288	0.048103	0.086441	0.129561	0.281912	0.926907	0.052112
397	0.164643	0.097616	0.047375	0.089110	0.133331	0.292026	0.920567	0.051756

In [ ]:

```
disc = KBinsDiscretizer(n_bins=6, encode='ordinal',strategy='uniform')
df3_disc = pd.DataFrame(disc.fit_transform(df3_norm), columns=df3.columns.tol
df3_disc
```

Out[ ]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	modelyear	origin
0	1.0	5.0	3.0	2.0	3.0	1.0	2.0	0.0
1	1.0	5.0	4.0	4.0	3.0	1.0	2.0	0.0
2	1.0	5.0	4.0	3.0	3.0	1.0	2.0	0.0
3	1.0	5.0	3.0	3.0	3.0	1.0	2.0	0.0
4	1.0	5.0	3.0	3.0	3.0	1.0	3.0	0.0
...	...	...	...	...	...	...	...	...
393	2.0	0.0	0.0	1.0	1.0	2.0	5.0	0.0
394	5.0	0.0	0.0	0.0	0.0	5.0	2.0	2.0
395	3.0	0.0	0.0	1.0	0.0	0.0	5.0	0.0
396	2.0	0.0	0.0	0.0	1.0	3.0	4.0	0.0
397	3.0	0.0	0.0	1.0	1.0	3.0	4.0	0.0

398 rows × 8 columns