Assignment Week 3-4 Data Wrangling with Python: Activity 5 &6

''' Name : Karthikeyan Chellamuthu

Date : 04-10-2022 '''

1. Data Wrangling with Python: Activity 5 -- Boston Housing Dataset

In [1]:
```
# Load the necessary libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import math
```

In [2]:
```
# Create df of Boston housing dataset.
bs_housing = pd.read_csv('Boston_housing.csv')
```

In [3]:
```
# verify the first 10 records of df.
bs_housing.head(10)
```

Out[3]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	P
0	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	
1	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	
2	0.02729	0.0	7.07	0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	
3	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	
4	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	5.33	
5	0.02985	0.0	2.18	0	0.458	6.430	58.7	6.0622	3	222	18.7	394.12	5.21	
6	0.08829	12.5	7.87	0	0.524	6.012	66.6	5.5605	5	311	15.2	395.60	12.43	
7	0.14455	12.5	7.87	0	0.524	6.172	96.1	5.9505	5	311	15.2	396.90	19.15	
8	0.21124	12.5	7.87	0	0.524	5.631	100.0	6.0821	5	311	15.2	386.63	29.93	
9	0.17004	12.5	7.87	0	0.524	6.004	85.9	6.5921	5	311	15.2	386.71	17.10	

In [4]:
```
# Find the number of records

print('Total number of records in the Boston Housing dataframe: ', len(bs_housing.in
```

```
Total number of records in the Boston Housing dataframe:  506
```

In [6]:
```
# Create a mini dataframe with columns that do not include CHAS, NOX, B, and LSTAT

bs_housing_sml = bs_housing.drop(['CHAS', 'NOX', 'B', 'LSTAT'], axis=1)
bs_housing_sml.head()
```

Out[6]:

	CRIM	ZN	INDUS	RM	AGE	DIS	RAD	TAX	PTRATIO	PRICE
0	0.00632	18.0	2.31	6.575	65.2	4.0900	1	296	15.3	24.0
1	0.02731	0.0	7.07	6.421	78.9	4.9671	2	242	17.8	21.6
2	0.02729	0.0	7.07	7.185	61.1	4.9671	2	242	17.8	34.7
3	0.03237	0.0	2.18	6.998	45.8	6.0622	3	222	18.7	33.4
4	0.06905	0.0	2.18	7.147	54.2	6.0622	3	222	18.7	36.2

In [7]:

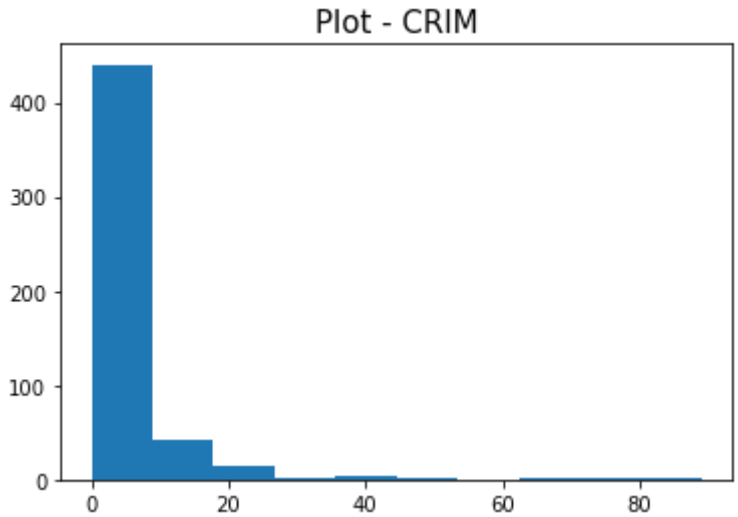
```
# verify the last 7 records of the new dataframe you just created.

bs_housing_sml.tail(7)
```

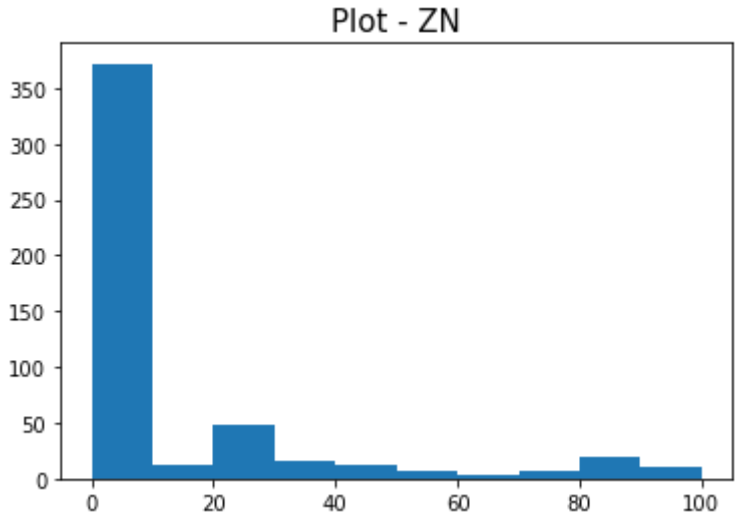
Out[7]:

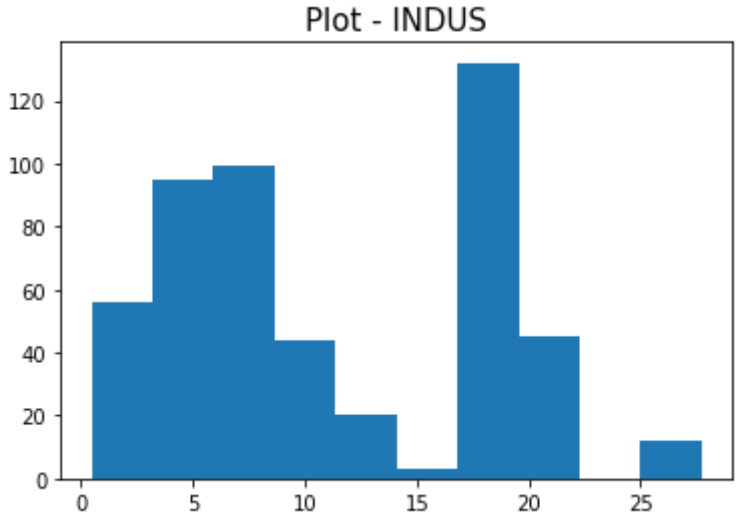
	CRIM	ZN	INDUS	RM	AGE	DIS	RAD	TAX	PTRATIO	PRICE
499	0.17783	0.0	9.69	5.569	73.5	2.3999	6	391	19.2	17.5
500	0.22438	0.0	9.69	6.027	79.7	2.4982	6	391	19.2	16.8
501	0.06263	0.0	11.93	6.593	69.1	2.4786	1	273	21.0	22.4
502	0.04527	0.0	11.93	6.120	76.7	2.2875	1	273	21.0	20.6
503	0.06076	0.0	11.93	6.976	91.0	2.1675	1	273	21.0	23.9
504	0.10959	0.0	11.93	6.794	89.3	2.3889	1	273	21.0	22.0
505	0.04741	0.0	11.93	6.030	80.8	2.5050	1	273	21.0	11.9

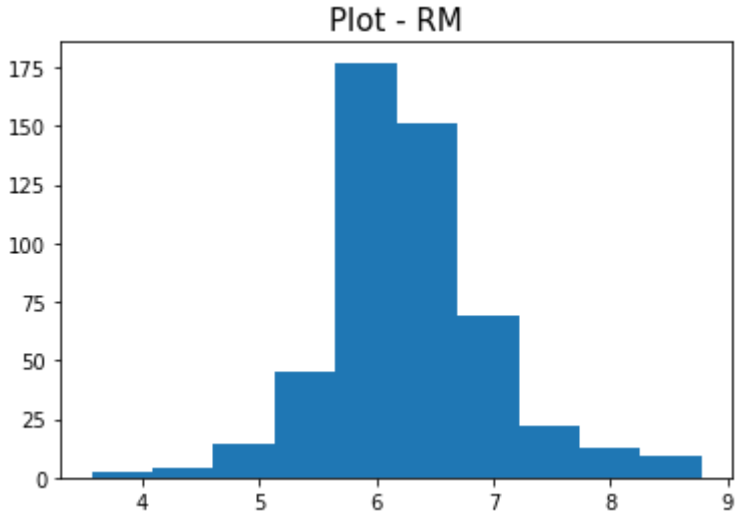
In [8]:

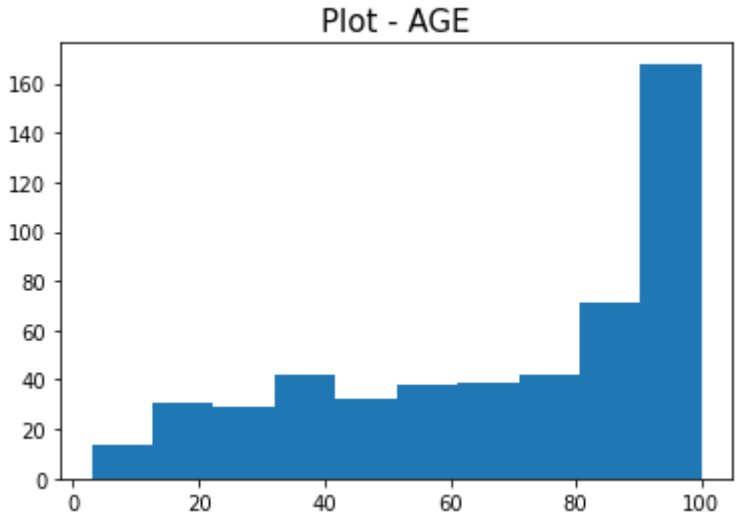
```
# Draw the histograms of all the variables(columns) in the new dataframe. Plot them

for x in bs_housing_sml.columns:
    plt.title("Plot - "+x,fontsize=15)     # Name the title of the plot
    plt.hist(bs_housing_sml[x])            # Build hostogram of column
    plt.show()                             # Show the plot
```

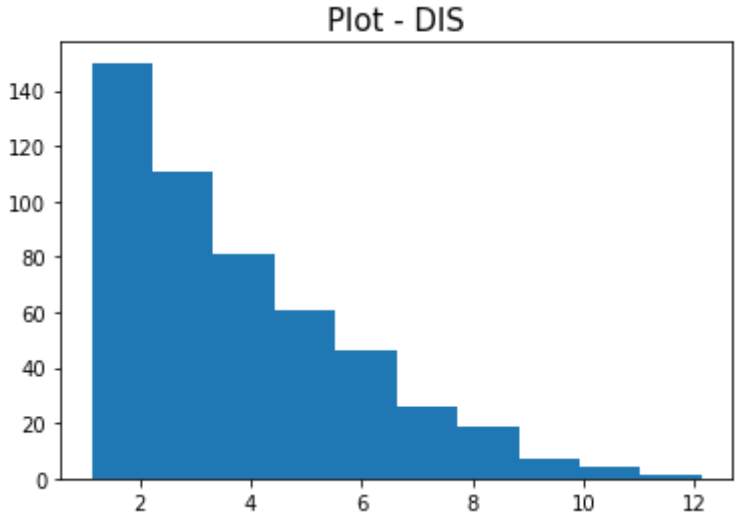


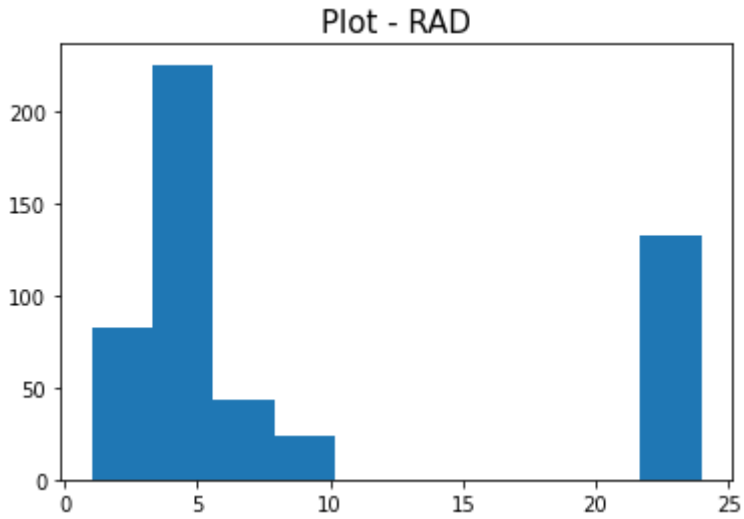

Plot - ZN
350
300
250
200
150
100
50
0
0
20
40
60
80
100

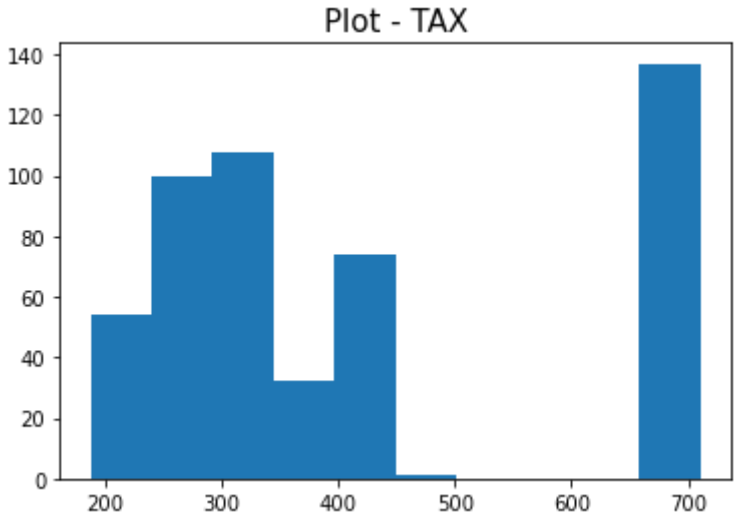

Plot - INDUS
120
100
80
60
40
20
0
0
5
10
15
20
25

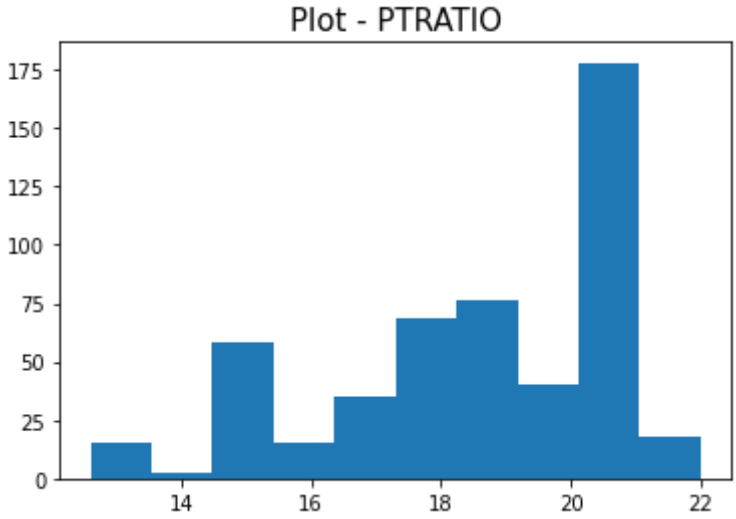

Plot - RM
175
150
125
100
75
50
25
0
4
5
6
7
8
9

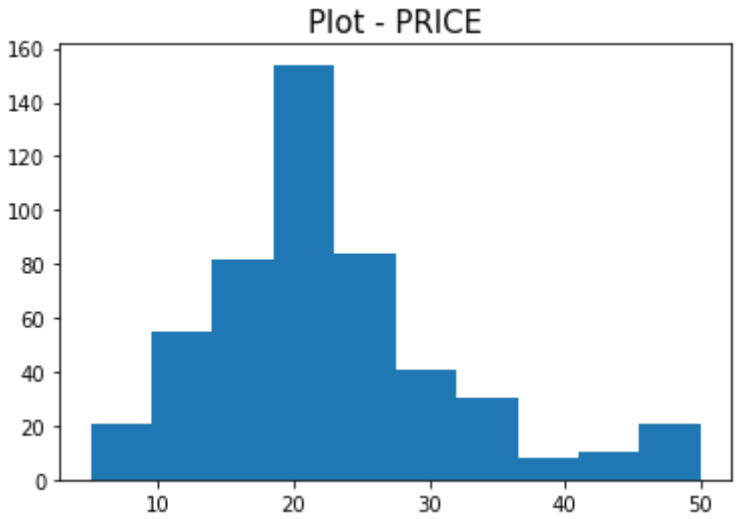

Plot - AGE
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100


Plot - DIS
140
120
100
80
60
40
20
0
2
4
6
8
10
12


Plot - RAD
200
150
100
50
0
0
5
10
15
20
25

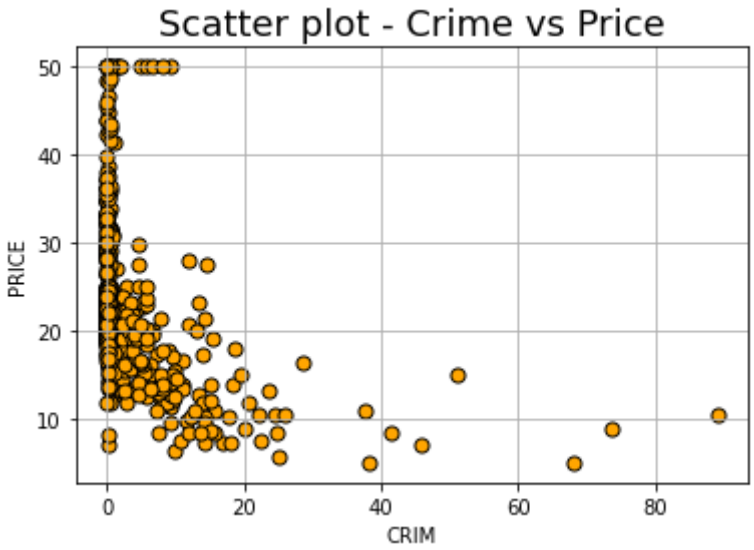




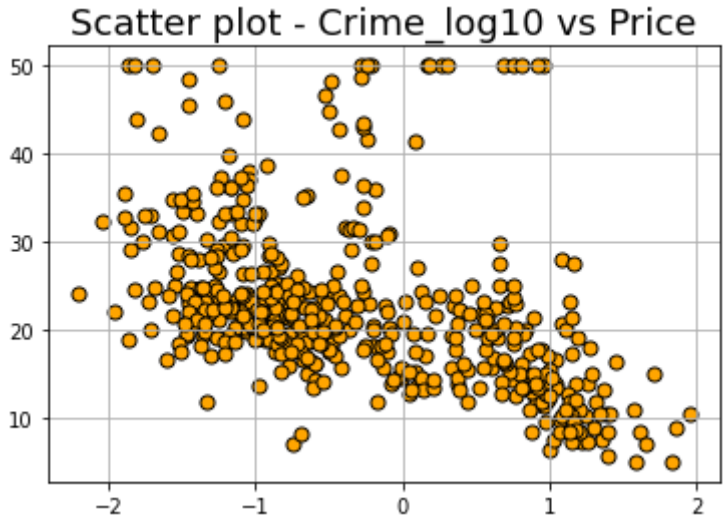


In [9]:

```
# Plot scatter plot of crime versus price.

bs_housing_sml.plot.scatter('CRIM', 'PRICE', s=50, c='orange', edgecolor='k')
plt.grid(True)
plt.title('Scatter plot - Crime vs Price', fontsize=18)
plt.show()
```



In [10]:
```
# Plot using log10(crime) vs price.

CRIM_lg = np.log10(bs_housing_sml['CRIM'])

plt.scatter(CRIM_lg, bs_housing_sml['PRICE'], s=50, c='orange', edgecolor='k')
plt.grid(True)
plt.title('Scatter plot - Crime_log10 vs Price', fontsize=18)
plt.show()
```



In [11]:
```
# Calculate some useful statistics.

print('mean of room per dwelling: ', bs_housing_sml['RM'].mean())
```

```
mean of room per dwelling:  6.284634387351787
```

In [12]:
```
print('median of age: ', bs_housing_sml['AGE'].median())
```

```
median of age:  77.5
```

In [13]:
```
print('mean of distance to five Boston employment center: ', bs_housing_sml['DIS'].m
```

```
mean of distance to five Boston employment center:  3.795042687747034
```

In [14]:
```
# Percentage of houses with low price(<20,000)
```

```
Count_low = bs_housing_sml[bs_housing_sml['PRICE'] < 20].count()['PRICE']      # cou
Count_all = bs_housing_sml['PRICE'].count()                                    # cou

print('percentage of houses with low price(<20k): ', Count_low*100/Count_all)
```

```
percentage of houses with low price(<20k):  41.50197628458498
```

2. Data Wrangling with Python: Activity 6 -- Adult Income Dataset

In [15]:

```
# All necessary libraries are loaded under Activity 5.

# Read Adult Income Dataset from URL/CSV file

adult_inc = pd.read_csv('adult_income_data.csv')
adult_inc.head()
```

Out[15]:

	39	State-gov	77516	Bachelors	13	Never-married	Adm-clerical	Not-in-family	Male	2174	0	40	United-States
0	50	Self-emp-not-inc	83311	Bachelors	13	Married-civ-spouse	Exec-managerial	Husband	Male	0	0	13	United-States
1	38	Private	215646	HS-grad	9	Divorced	Handlers-cleaners	Not-in-family	Male	0	0	40	United-States
2	53	Private	234721	11th	7	Married-civ-spouse	Handlers-cleaners	Husband	Male	0	0	40	United-States
3	28	Private	338409	Bachelors	13	Married-civ-spouse	Prof-specialty	Wife	Female	0	0	40	Cuba
4	37	Private	284582	Masters	14	Married-civ-spouse	Exec-managerial	Wife	Female	0	0	40	United-States

In [16]:

```
# Read txt file line by line and create list of coulumn names

names = []
with open('adult_income_names.txt', 'r') as t:       # Open txt file for read
    for line in t:
        t.readline()                                 # read line by line
        var=line.split(":")[0]                       # end reading when encountering
        names.append(var)                            # add column name into name lis

names
```

Out[16]:

```
['age',
 'workclass',
 'fnlwgt',
 'education',
 'education-num',
 'marital-status',
 'occupation',
 'relationship',
 'sex',
 'capital-gain',
```

```
 'capital-loss',
 'hours-per-week',
 'native-country']
```

In [17]:
```
# Add a name of Income into list of column names.

names.append('Income')
names
```

Out[17]:
```
['age',
 'workclass',
 'fnlwgt',
 'education',
 'education-num',
 'marital-status',
 'occupation',
 'relationship',
 'sex',
 'capital-gain',
 'capital-loss',
 'hours-per-week',
 'native-country',
 'Income']
```

In [18]:
```
# read the csv file again, with column with list of names as column

adult_inc1 = pd.read_csv('adult_income_data.csv', names=names)
adult_inc1.head()
```

Out[18]:

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	sex	capit ga
0	39	State-gov	77516	Bachelors	13	Never-married	Adm-clerical	Not-in-family	Male	21
1	50	Self-emp-not-inc	83311	Bachelors	13	Married-civ-spouse	Exec-managerial	Husband	Male	
2	38	Private	215646	HS-grad	9	Divorced	Handlers-cleaners	Not-in-family	Male	
3	53	Private	234721	11th	7	Married-civ-spouse	Handlers-cleaners	Husband	Male	
4	28	Private	338409	Bachelors	13	Married-civ-spouse	Prof-specialty	Wife	Female	

In [19]:
```
# Find missing value

adult_inc1.isnull().sum()
```

Out[19]:
```
age             0
workclass       0
fnlwgt          0
education       0
education-num   0
```

```
marital-status    0
occupation        0
relationship      0
sex               0
capital-gain      0
capital-loss      0
hours-per-week    0
native-country    0
Income            0
dtype: int64
```

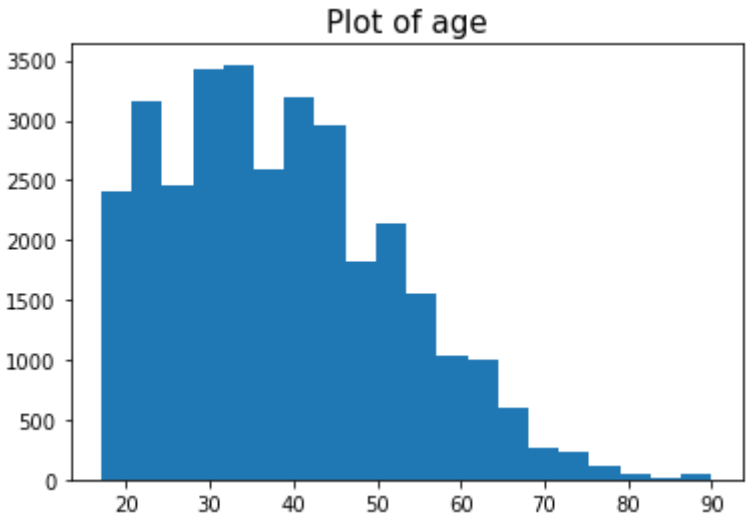
'''I do not see any missing values'''

In [20]:
```
# Create dataframe with only age, education, and occupation by using subsetting

adult_inc2 = adult_inc1[['age', 'education', 'occupation']]
adult_inc2.head()
```

Out[20]:

	age	education	occupation
0	39	Bachelors	Adm-clerical
1	50	Bachelors	Exec-managerial
2	38	HS-grad	Handlers-cleaners
3	53	11th	Handlers-cleaners
4	28	Bachelors	Prof-specialty

In [21]:
```
# Plot histogram of age wih a bin size of 20.

plt.title("Plot of age",fontsize=15)   # Name the title of the plot
plt.hist(adult_inc2['age'], bins=20)   # Build hostogram of column
plt.show()                             # Show the plot
```



In [22]:
```
# Create a function to strip whitespace characters.

def strip_wt_spc(var):
    var.strip()                        # strip function to remove whitespace
    return
```

In [23]:
```
# Apply above function to all columns with string values.
```

```
def strip_col(var):                                  # Function to create new col and
    adult_inc2['newcol'] = var.apply(strip_wt_spc)
    adult_inc2.var = adult_inc2['newcol']            # Replace old col with new col

    return

# Strip whitespace from 'education' column
strip_col(adult_inc2['education'])

# Strip whitespace from 'occupation' column
strip_col(adult_inc2['occupation'])

adult_inc2 = adult_inc2.drop(['newcol'], axis=1)
adult_inc2.head()
```

```
C:\Users\LENOVO\AppData\Local\Temp/ipykernel_9660/3264325673.py:4: SettingWithCopyWa
rning:
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-docs/stable/u
ser_guide/indexing.html#returning-a-view-versus-a-copy
  adult_inc2['newcol'] = var.apply(strip_wt_spc)
```

Out[23]:

	age	education	occupation
0	39	Bachelors	Adm-clerical
1	50	Bachelors	Exec-managerial
2	38	HS-grad	Handlers-cleaners
3	53	11th	Handlers-cleaners
4	28	Bachelors	Prof-specialty

In [24]:

```
# Find number of people who are gaed between 30 and 50

Count = adult_inc2[(30 < adult_inc2['age']) & (adult_inc2['age'] < 50)].count()['age

print('There are ', Count, ' people aged between 30 and 50.')
```

```
There are  14927  people aged between 30 and 50.
```

In [25]:

```
# Group the records based on age and education to find how the mean age is distribut

adult_inc3 = adult_inc2.groupby(['education'])['age'].mean()

# Display mean of age by education
adult_inc3
```

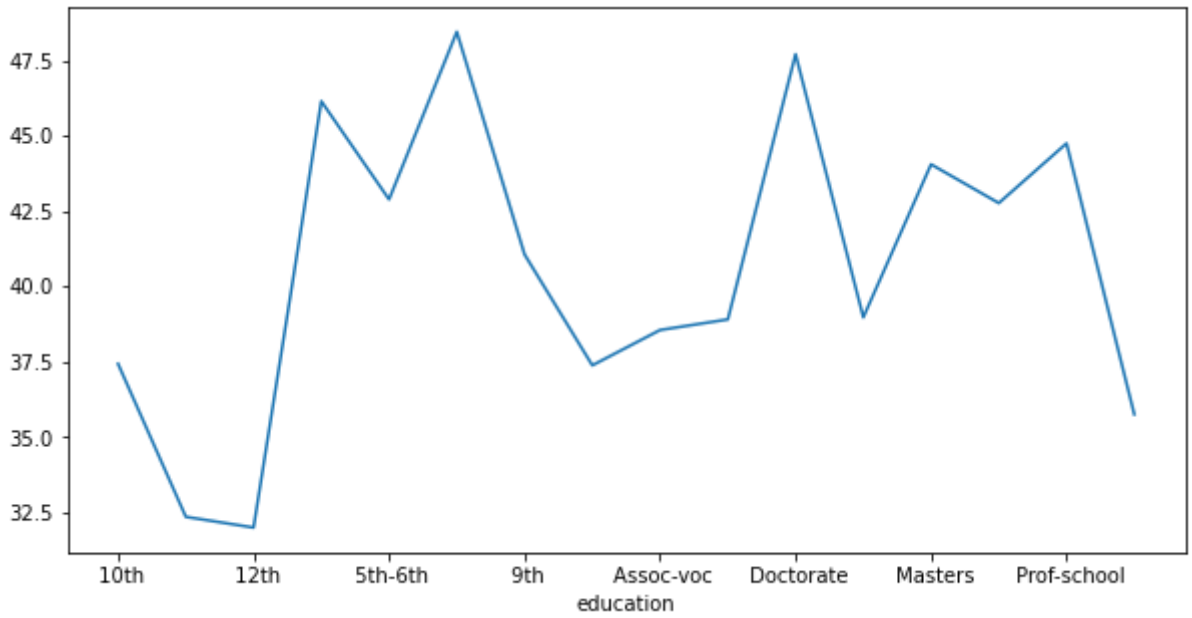
Out[25]:

```
education
 10th            37.429796
 11th            32.355745
 12th            32.000000
 1st-4th         46.142857
 5th-6th         42.885886
 7th-8th         48.445820
 9th             41.060311
 Assoc-acdm      37.381443
 Assoc-voc       38.553546
 Bachelors       38.904949
```

```
Doctorate       47.702179
HS-grad         38.974479
Masters         44.049913
Preschool       42.764706
Prof-school     44.746528
Some-college    35.756275
Name: age, dtype: float64
```

In [26]:
```
# Plot series of mean

adult_inc3.plot(kind='line', figsize=(10,5))
```

Out[26]:
```
<AxesSubplot:xlabel='education'>
```



In [27]:
```
# Group by occupation and show the summary statistics of age.
adult_inc2.groupby(['occupation'])['age'].describe()
```

Out[27]:

occupation	count	mean	std	min	25%	50%	75%	max
?	1843.0	40.882800	20.336350	17.0	21.0	35.0	61.0	90.0
Adm-clerical	3770.0	36.964456	13.362998	17.0	26.0	35.0	46.0	90.0
Armed-Forces	9.0	30.222222	8.089774	23.0	24.0	29.0	34.0	46.0
Craft-repair	4099.0	39.031471	11.606436	17.0	30.0	38.0	47.0	90.0
Exec-managerial	4066.0	42.169208	11.974548	17.0	33.0	41.0	50.0	90.0
Farming-fishing	994.0	41.211268	15.070283	17.0	29.0	39.0	52.0	90.0
Handlers-cleaners	1370.0	32.165693	12.372635	17.0	23.0	29.0	39.0	90.0
Machine-op-inspct	2002.0	37.715285	12.068266	17.0	28.0	36.0	46.0	90.0
Other-service	3295.0	34.949621	14.521508	17.0	22.0	32.0	45.0	90.0
Priv-house-serv	149.0	41.724832	18.633688	17.0	24.0	40.0	57.0	81.0
Prof-specialty	4140.0	40.517633	12.016676	17.0	31.0	40.0	48.0	90.0
Protective-serv	649.0	38.953775	12.822062	17.0	29.0	36.0	47.0	90.0

occupation	count	mean	std	min	25%	50%	75%	max
Sales	3650.0	37.353973	14.186352	17.0	25.0	35.0	47.0	90.0
Tech-support	928.0	37.022629	11.316594	17.0	28.0	36.0	44.0	73.0
Transport-moving	1597.0	40.197871	12.450792	17.0	30.0	39.0	49.0	90.0

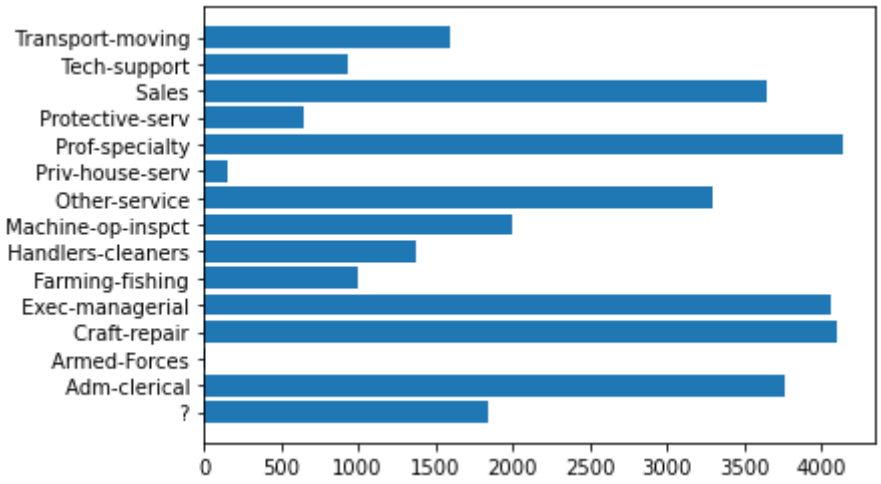
"Exec-managerial" occupation has oldest workers with average of 42 years.

"?" has lagest share of the workforce above 75th percentile.

Armed-Forces occupation has least count of '9' and its very low as compared to other occupations. Hence, this group can be considered as outlier

In [28]:
```
# Plot values on bar chart

summary = adult_inc2.groupby(['occupation'])['age'].describe()  # Write summary into
plt.barh(summary.index, summary['count'])                       # PLot horizontal ba
```

Out[28]:
```
<BarContainer object of 15 artists>
```



In [29]:
```
# Merge the data using common key
# Create 2 test datasets with one common variable.

adult_inc4 = adult_inc1[['age', 'education', 'occupation']].sample(5, random_state=1
adult_inc4.head()
```

Out[29]:

	age	education	occupation
22357	51	HS-grad	Machine-op-inspct
26009	19	11th	Sales
20734	40	HS-grad	Exec-managerial
17695	17	10th	Handlers-cleaners
27908	61	7th-8th	Craft-repair

In [30]:
```
adult_inc5 = adult_inc1[['age', 'marital-status', 'native-country']].sample(5, rando
adult_inc5.head()
```

Out[30]:

	age	marital-status	native-country
22357	51	Married-civ-spouse	United-States
26009	19	Never-married	United-States
20734	40	Married-civ-spouse	United-States
17695	17	Never-married	United-States
27908	61	Married-civ-spouse	Poland

In [31]:
```
# Merge above 2 dataframes using age column

adult_mrg = pd.merge(adult_inc4, adult_inc5, on='age', how='inner')
adult_mrg
```

Out[31]:

	age	education	occupation	marital-status	native-country
0	51	HS-grad	Machine-op-inspct	Married-civ-spouse	United-States
1	19	11th	Sales	Never-married	United-States
2	40	HS-grad	Exec-managerial	Married-civ-spouse	United-States
3	17	10th	Handlers-cleaners	Never-married	United-States
4	61	7th-8th	Craft-repair	Married-civ-spouse	Poland

3. Create a series and practice basic arithmetic steps

In [32]:
```
# series 1

data1 = [7.3, -2.5, 3.4, 1.5]
label1 = ['a', 'c', 'd', 'e']

series1 = pd.Series(data=data1, index=label1)      # Create series
print(series1)
```

```
a    7.3
c   -2.5
d    3.4
e    1.5
dtype: float64
```

In [33]:
```
# Series 2

data2 = [-2.1, 3.6, -1.5, 4, 3.1]
label2 = ['a', 'c', 'e', 'f', 'g']

series2 = pd.Series(data=data2, index=label2)      # Create series
print(series2)
```

```
a   -2.1
c    3.6
e   -1.5
f    4.0
g    3.1
dtype: float64
```

In [34]:
```
# Add both series
```

```
series_sum = series1 + series2
print(series_sum)
```

```
a    5.2
c    1.1
d    NaN
e    0.0
f    NaN
g    NaN
dtype: float64
```

In [35]:

```
# Substract series1 from series2

series_sub = series2 - series1
print(series_sub)
```

```
a   -9.4
c    6.1
d    NaN
e   -3.0
f    NaN
g    NaN
dtype: float64
```

In [ ]: