In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [ ]:
```
data= pd.read_csv("income.csv")
```

In [ ]:
```
data.shape
```

Out[ ]:
```
(31978, 13)
```

In [ ]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 31978 entries, 0 to 31977
Data columns (total 13 columns):
 #   Column         Non-Null Count  Dtype 
---  ------         --------------  ----- 
 0   age            31978 non-null  int64 
 1   JobType        31978 non-null  object
 2   EdType         31978 non-null  object
 3   maritalstatus  31978 non-null  object
 4   occupation     31978 non-null  object
 5   relationship   31978 non-null  object
 6   race           31978 non-null  object
 7   gender         31978 non-null  object
 8   capitalgain    31978 non-null  int64 
 9   capitalloss    31978 non-null  int64 
 10  hoursperweek   31978 non-null  int64 
 11  nativecountry  31978 non-null  object
 12  SalStat        31978 non-null  object
dtypes: int64(4), object(9)
memory usage: 3.2+ MB
```

In [ ]:
```
#Outlier Detection
#Drop Outliers
#1. Based on Box Plot
# filter the numeric variables from the data
data_num = data.select_dtypes(include = np.number)
data_num
```

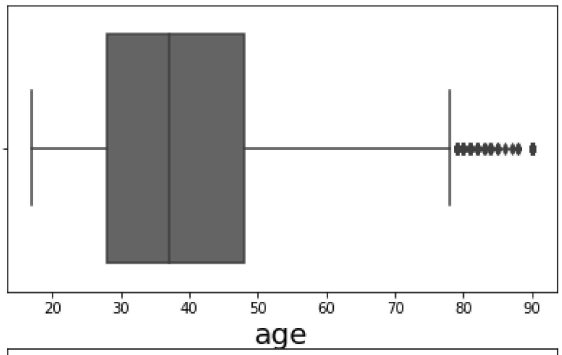
Out[ ]:

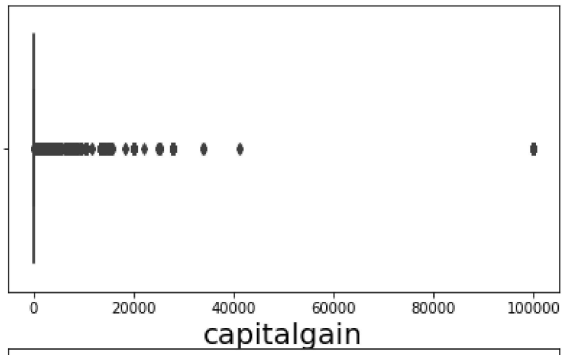
	age	capitalgain	capitalloss	hoursperweek
0	45	0	0	28
1	24	0	0	40
2	44	0	0	40
3	27	0	0	40
4	20	0	0	35
...	...	...	...	...
31973	34	594	0	60
31974	34	0	0	40
31975	23	0	0	40
31976	42	0	0	40
31977	29	0	0	40

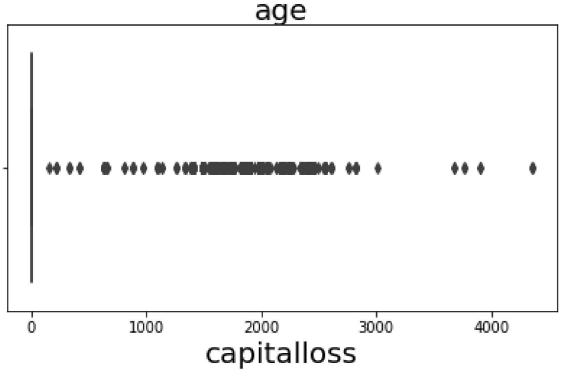
31978 rows × 4 columns

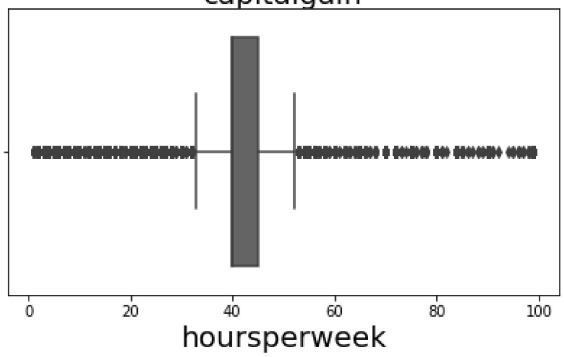
In [ ]:

```
# subplots(): plot subplots
# figsize(): set the figure size
fig, ax = plt.subplots(2, 2, figsize=(15, 8))

# plot the boxplot using boxplot() from seaborn
# z: let the variable z define the boxplot
# x: data for which the boxplot is to be plotted
# orient: "h" specifies horizontal boxplot (for vertical boxplots use "v")
# whis: proportion of the IQR past the low and high quartiles to extend the plot whisk
# ax: specifies the axes object to draw the plot onto
# set_xlabel(): set the x-axis label
# fontsize: set the font size of the x-axis label


for variable, subplot in zip(data_num.columns, ax.flatten()):
    z = sns.boxplot(x = data_num[variable], orient = "h",whis=1.5 , ax=subplot) # plot
    z.set_xlabel(variable, fontsize = 20)
```









In [ ]:
```
#Based on IQR
#The IQR method can be used when the data distribution is non-normal.
#Also the quartiles are less affected by the extreme values.
# obtain the first quartile
Q1 = data_num.quantile(0.25)

# obtain the third quartile
Q3 = data_num.quantile(0.75)

# obtain the IQR
IQR = Q3 - Q1

# print the IQR
print(IQR)
```

```
age             20.0
capitalgain      0.0
capitalloss      0.0
hoursperweek     5.0
dtype: float64
```

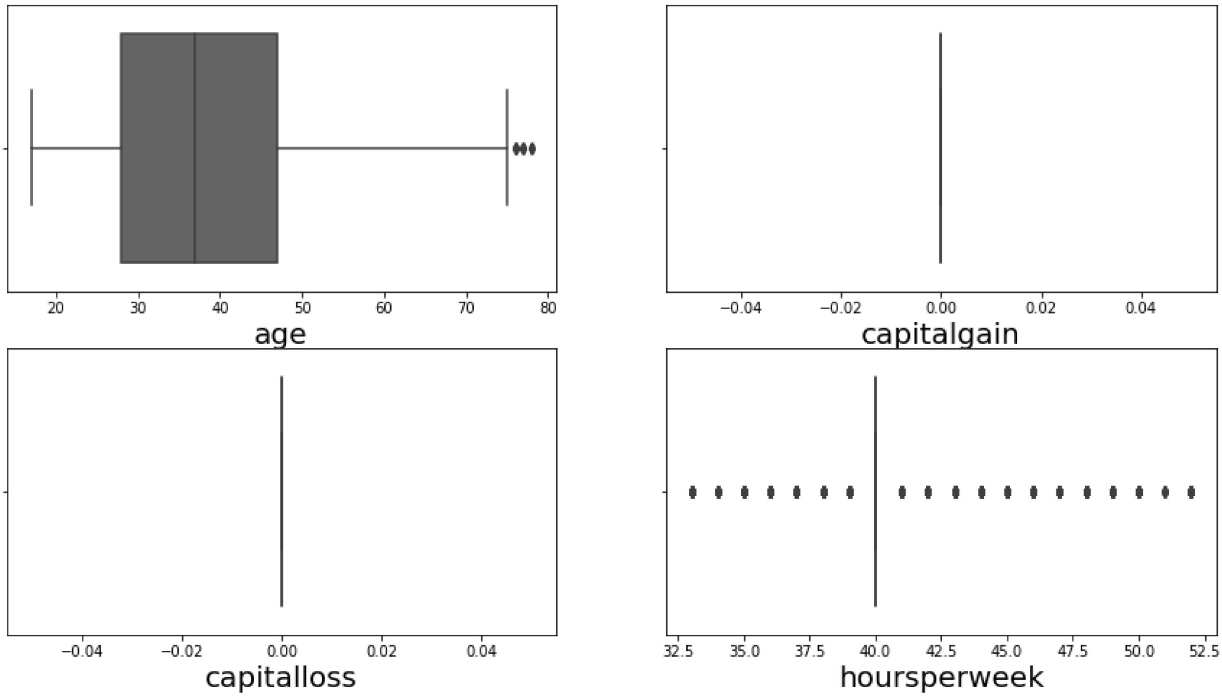
In [ ]:
```
# filter out the outlier values
# ~ : selects all rows which do not satisfy the condition
# any() : returns whether any element is True over the columns
# axis : "1" indicates columns should be altered (0 for 'index')
data_iqr = data[~((data < (Q1 - 1.5 * IQR)) |(data > (Q3 + 1.5 * IQR))).any(axis=1)]
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:5: FutureWarning: Automa
tic reindexing on DataFrame vs Series comparisons is deprecated and will raise ValueE
rror in a future version.  Do `left, right = left.align(right, axis=1, copy=False)` b
efore e.g. `left == right`
  """
```

In [ ]:
```
data_iqr.shape
```

Out[ ]:
```
(20029, 13)
```

In [ ]:
```
#confirm whether the outliers are removed or not.
data_num = data_iqr.select_dtypes(include = np.number)
data_num
fig, ax = plt.subplots(2, 2, figsize=(15, 8))
for variable, subplot in zip(data_num.columns, ax.flatten()):
    z = sns.boxplot(x = data_num[variable], orient = "h",whis=1.5 , ax=subplot) # plot
    z.set_xlabel(variable, fontsize = 20)
```



In [ ]:
```
#Based on Z-score
#This method has a disadvantage that the values of mean and standard deviation are
#highly affected by the presence of outliers.
# import library scipy
import scipy
# from scipy import the module stats
from scipy import stats

# z-scores are defined for each observation in a variable
# compute the z-scores using the method zscore from the scipy library
z_scores_age = scipy.stats.zscore(data_num["age"])

# display the z-scores
z_scores_age
```

Out[ ]:
```
array([-1.16421445,  0.47934863, -0.91767999, ..., -1.24639261,
        0.31499232, -0.75332368])
```

In [ ]:
```
# print the rows where z-score is less than -3
row_index_less = np.where(z_scores_age < -3)

# print the rows where z-score is more than 3
row_index_more = np.where(z_scores_age > 3)

#The rows corresponding to the above index are the outliers for the data.

# count of outliers in the variable representing profit
len(row_index_less[0]) + len(row_index_more[0])
```

Out[ ]:
```
33
```

In [ ]:
```
# filter out the outlier values
# ~ : selects all rows which do not satisfy the condition
data_age_zscore = data_num["age"][~(( z_scores_age < -3) |(z_scores_age > 3))]
```

In [ ]:
```
#Check the shape of the data
data_age_zscore.shape
```

Out[ ]:
```
(19996,)
```

In [ ]:
```
#Based on Scatter Plots
# initialize the figure
# figsize: set the plot size
fig, ax = plt.subplots(figsize=(15,8))

# plot the scatter plot
ax.scatter(data["age"], data["capitalloss"])

# set the x-axis label
# fontsize: set the font size of the label
ax.set_xlabel("age (in %)", fontsize = 15)

# set the y-axis label
# fontsize: set the font size of the label
ax.set_ylabel('capitalloss')
plt.show()
```