AttritionAssignmentSolution

Step1 - Launching

```
import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

dataset1=pd.read_csv('l.csv')

dataset1.head()

Out[41]:

Age Attrition ... YearsSinceLastPromotion
YearsWithCurrManager

0 51 No ... 0 0

1 31 Yes ... 1 4

2 32 No ... 0 3

3 38 No ... 7 5

4 32 No ... 0 4

[5 rows x 24 columns]

dataset1.columns

Out[7]:

Index(['Age', 'Attrition', 'BusinessTravel',
'Department', 'DistanceFromHome',

       'Education', 'EducationField',
'EmployeeCount', 'EmployeeID', 'Gender',

       'JobLevel', 'JobRole', 'MaritalStatus',
'MonthlyIncome',
```

```
       'NumCompaniesWorked', 'Over18',
'PercentSalaryHike', 'StandardHours',
       'StockOptionLevel', 'TotalWorkingYears',
'TrainingTimesLastYear',
       'YearsAtCompany', 'YearsSinceLastPromotion',
'YearsWithCurrManager'],
      dtype='object')
```

Step 2 - Data Treatment:

```
dataset1.isnull()
Out[47]:
Age Attrition ... YearsSinceLastPromotion
YearsWithCurrManager
0 False False ... False False
1 False False ... False False
2 False False ... False False
3 False False ... False False
4 False False ... False False
... ... ... ... ...
4405 False False ... False False
4406 False False ... False False
4407 False False ... False False
4408 False False ... False False
4409 False False ... False False
[4410 rows x 24 columns]
dataset1.duplicated()
Out[50]:
```

0 False

1 False

2 False

3 False

4 False

4405 True

4406 True

4407 True

4408 True

4409 False

Length: 4410, dtype: bool

dataset1.drop_duplicates()

Out[53]:

Age Attrition ... YearsSinceLastPromotion YearsWithCurrManager

0 51 No ... 0 0

1 31 Yes ... 1 4

2 32 No ... 0 3

3 38 No ... 7 5

4 32 No ... 0 4

... ...

3818 28 Yes ... 0 0

3910 41 No ... 1 2

4226 36 No ... 0 0

4395 40 No ... 4 7

4409 40 No ... 3 9

[4410 rows x 24 columns]

Step 3 – Univariate Analysis:

```
dataset3=dataset1[['Age','DistanceFromHome','Educat
ion','MonthlyIncome', 'NumCompaniesWorked',
'PercentSalaryHike','TotalWorkingYears',
'TrainingTimesLastYear',
'YearsAtCompany','YearsSinceLastPromotion',
'YearsWithCurrManager']].describe()
```

Dataset3

Index	Age	DistanceFromHome	Education	MonthlyIncome	NumCompaniesWorked	PercentSalaryHike	TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsSinceLastPromotion	YearsWithCurrManager
count	4410	4410	4410	4410	4391	4410	4401	4410	4410	4410	4410
mean	36.…	9.19252	2.91293	65029.3	2.69483	15.2095	11.2799	2.79932	7.00816	2.18776	4.12313
std	9.1…	8.10503	1.02393	47068.9	2.49889	3.65911	7.78222	1.28898	6.12514	3.2217	3.56733
min	18	1	1	10090	0	11	0	0	0	0	0
25%	30	2	2	29110	1	12	6	2	3	0	2
50%	36	7	3	49190	2	14	10	3	5	1	3
75%	43	14	4	83800	4	18	15	3	9	3	7
max	60	29	5	199990	9	25	40	6	40	15	17

```
dataset3=dataset1[['Age','DistanceFromHome','Educat
ion','MonthlyIncome', 'NumCompaniesWorked',
'PercentSalaryHike','TotalWorkingYears',
'TrainingTimesLastYear',
'YearsAtCompany','YearsSinceLastPromotion',
'YearsWithCurrManager']].median()
```

Dataset3

Out[67]:

Age 36.0

DistanceFromHome 7.0

Education 3.0

MonthlyIncome 49190.0

NumCompaniesWorked 2.0

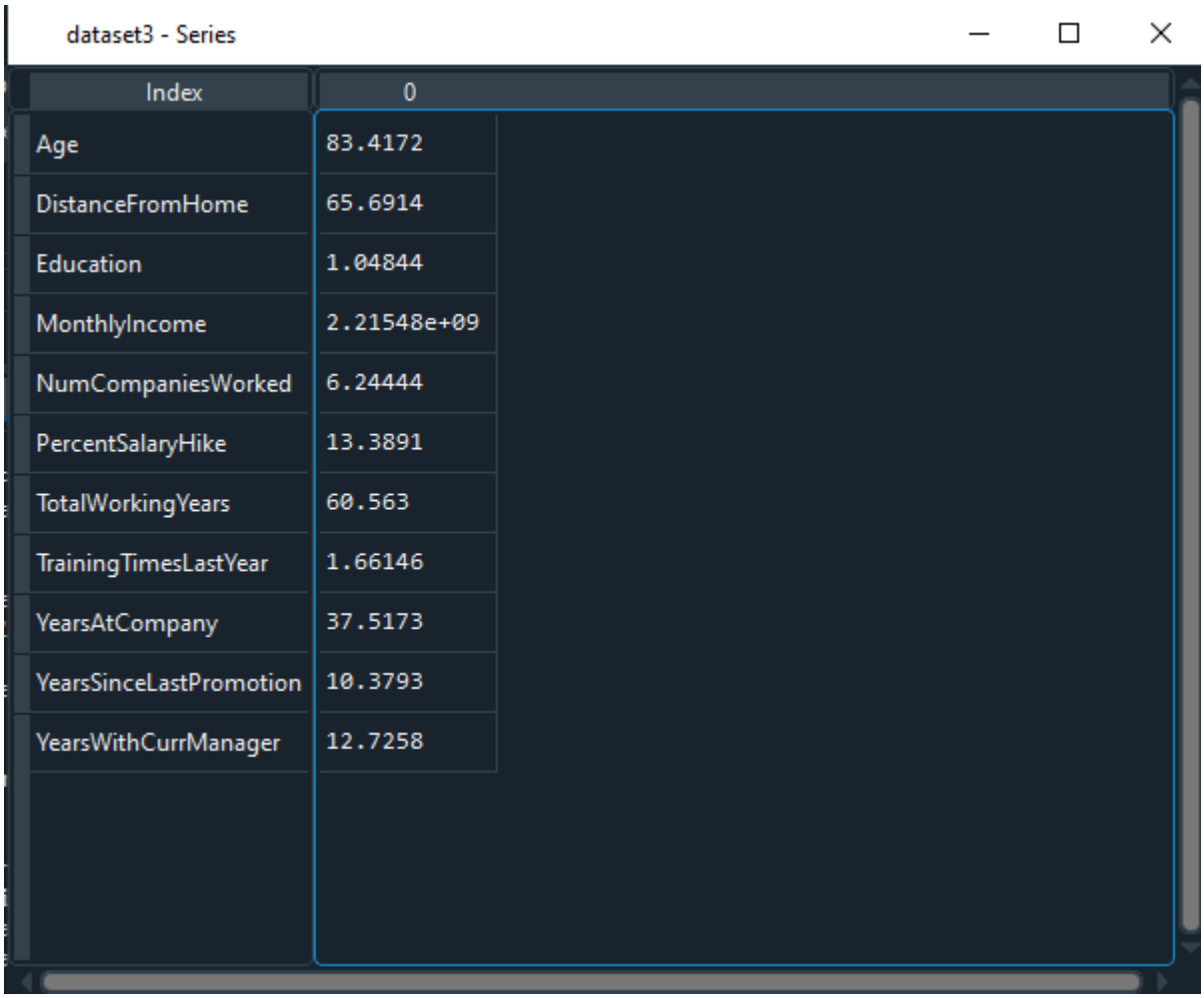
```
PercentSalaryHike 14.0

TotalWorkingYears 10.0

TrainingTimesLastYear 3.0

YearsAtCompany 5.0

YearsSinceLastPromotion 1.0

YearsWithCurrManager 3.0

dtype: float64

dataset3=dataset1[['Age','DistanceFromHome','Educat
ion','MonthlyIncome', 'NumCompaniesWorked',
'PercentSalaryHike','TotalWorkingYears',
'TrainingTimesLastYear',
'YearsAtCompany','YearsSinceLastPromotion',
'YearsWithCurrManager']].mode()

dataset3

Out[69]:

Age 35

DistanceFromHome 2

Education 3

MonthlyIncome 23420

NumCompaniesWorked 1

PercentSalaryHike 11

TotalWorkingYears 10

TrainingTimesLastYear 2

YearsAtCompany 5.0

YearsSinceLastPromotion 0

YearsWithCurrManager 2
```

```
dtype: float64
```

```
dataset3=dataset1[['Age','DistanceFromHome','Educat
ion','MonthlyIncome', 'NumCompaniesWorked',
'PercentSalaryHike','TotalWorkingYears',
'TrainingTimesLastYear',
'YearsAtCompany','YearsSinceLastPromotion',
'YearsWithCurrManager']].var()
```

```
dataset3
```

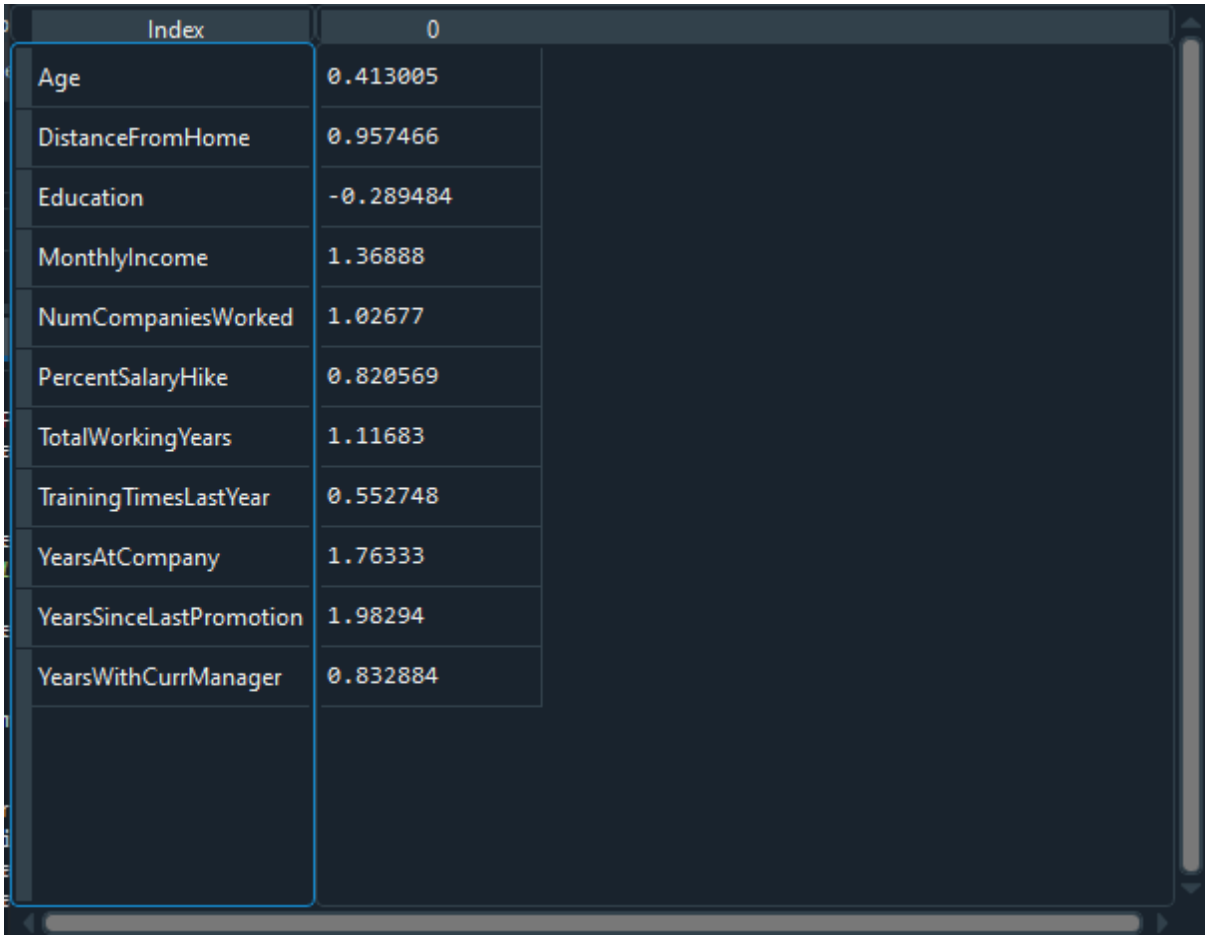
```
1
```




```
dataset3=dataset1[['Age','DistanceFromHome','Educat
ion','MonthlyIncome', 'NumCompaniesWorked',
'PercentSalaryHike','TotalWorkingYears',
'TrainingTimesLastYear',
```

```
'YearsAtCompany','YearsSinceLastPromotion',
'YearsWithCurrManager']].skew()
```

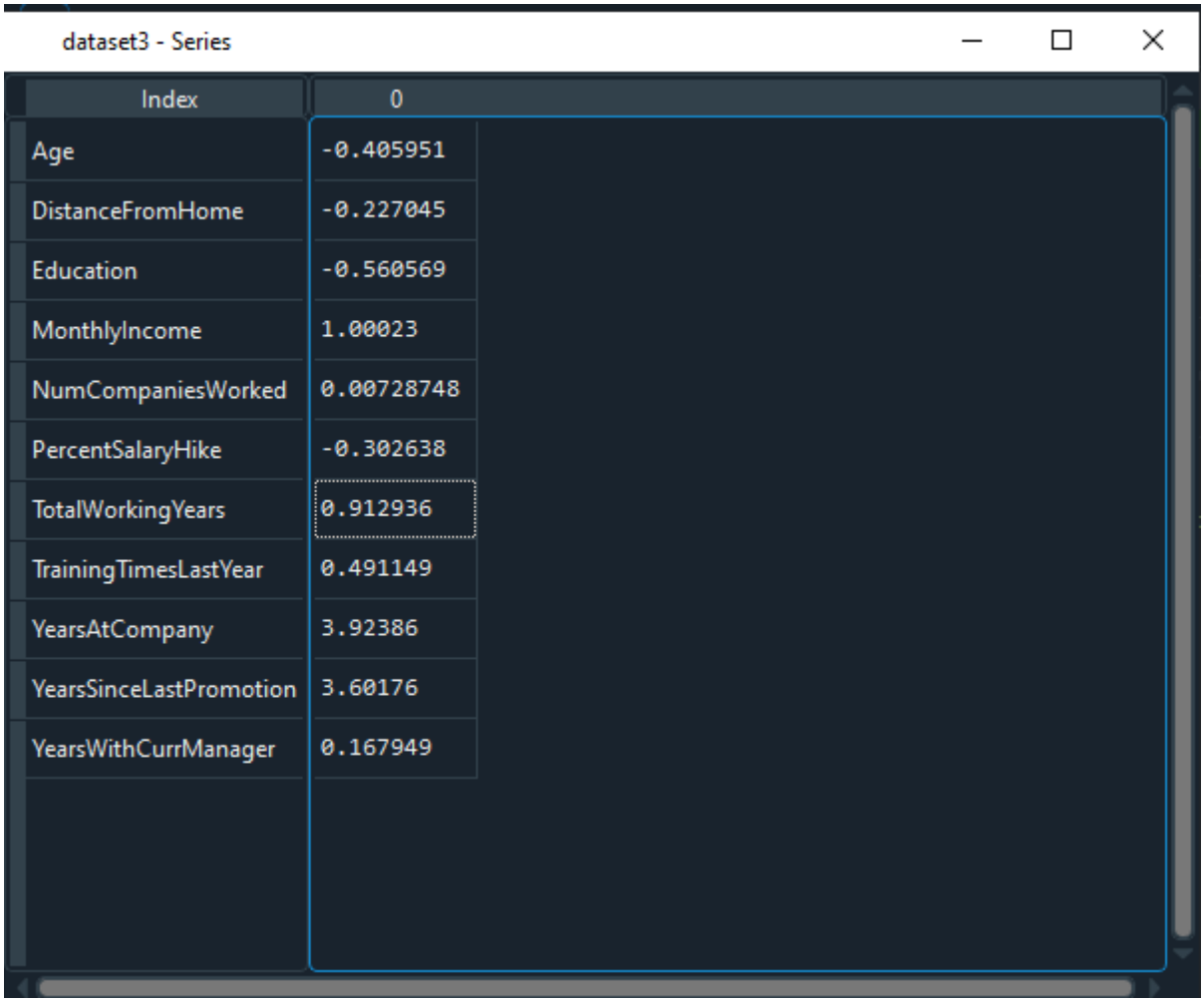
Dataset3



Index	0
Age	0.413005
DistanceFromHome	0.957466
Education	-0.289484
MonthlyIncome	1.36888
NumCompaniesWorked	1.02677
PercentSalaryHike	0.820569
TotalWorkingYears	1.11683
TrainingTimesLastYear	0.552748
YearsAtCompany	1.76333
YearsSinceLastPromotion	1.98294
YearsWithCurrManager	0.832884

```
dataset3=dataset1[['Age','DistanceFromHome','Educat
ion','MonthlyIncome', 'NumCompaniesWorked',
'PercentSalaryHike','TotalWorkingYears',
'TrainingTimesLastYear',
'YearsAtCompany','YearsSinceLastPromotion',
'YearsWithCurrManager']].kurt()
```

Dataset3



	Mean	Median	Mode	Variance	Std Deviation	IQR	Skewness	Kurtosis
Mean Age (Yrs)	36	36	35	83.14	9.1	13	0.418	-0.4
Mean Distance from Home (Kms)	9	7	2	65.69	8.1	2	0.957	-0.22
Mean Monthly Income (Rs)	65000	49190	23420	2215480000	47068	54000	1.36	1
Mean Work Experience (Yrs)	11.29	10	10	60	7.72	9	1.11	0.91
Mean Years at Company (Yrs)	7	5	5	37.51	6.12	6	1.76	3.92
Mean Years since last promotion (Yrs)	2	1	0	10.37	3.22	3	1.98	3.6
Mean Years with Current Manager (Yrs)	4	3	2	12.72	3.56	5	0.83	0.16

Inference from the analysis:

 All the above variables show positive skewness; while Age & Mean_distance_from_home are leptokurtic and all other variables are platykurtic.

 The Mean_Monthly_Income’s IQR is at 54K suggesting company wide attrition across all income bands

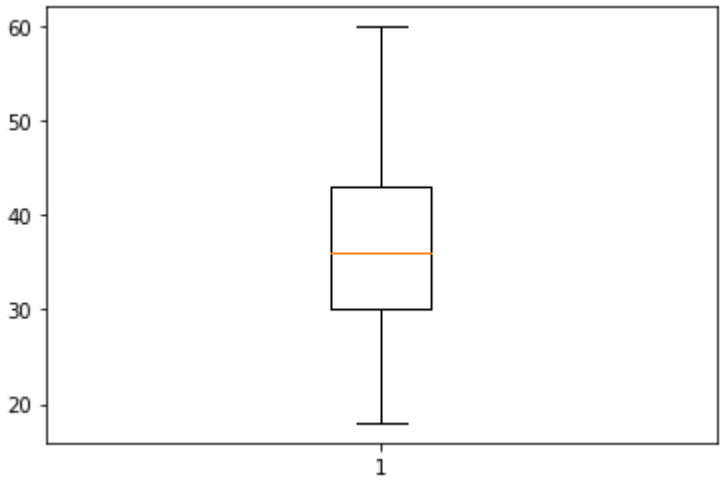
 Mean age forms a near normal distribution with 13 years of IQR

Outliers:

There’s no regression found while plotting Age, MonthlyIncome, TotalWorkingYears, YearsAtCompany, etc., on a scatter plot

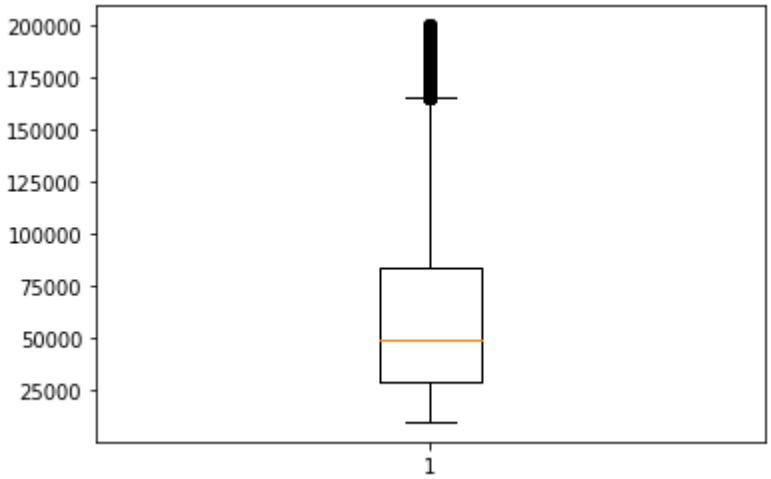
```
box_plot=dataset1.Age

plt.boxplot(box_plot)
```

Out[23]:



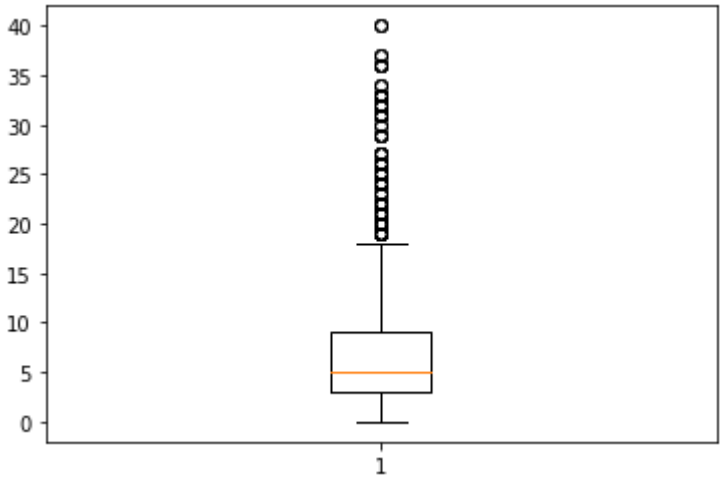
Age is normally distributed without any outliers

```
box_plot=dataset1.MonthlyIncome

plt.boxplot(box_plot)
```



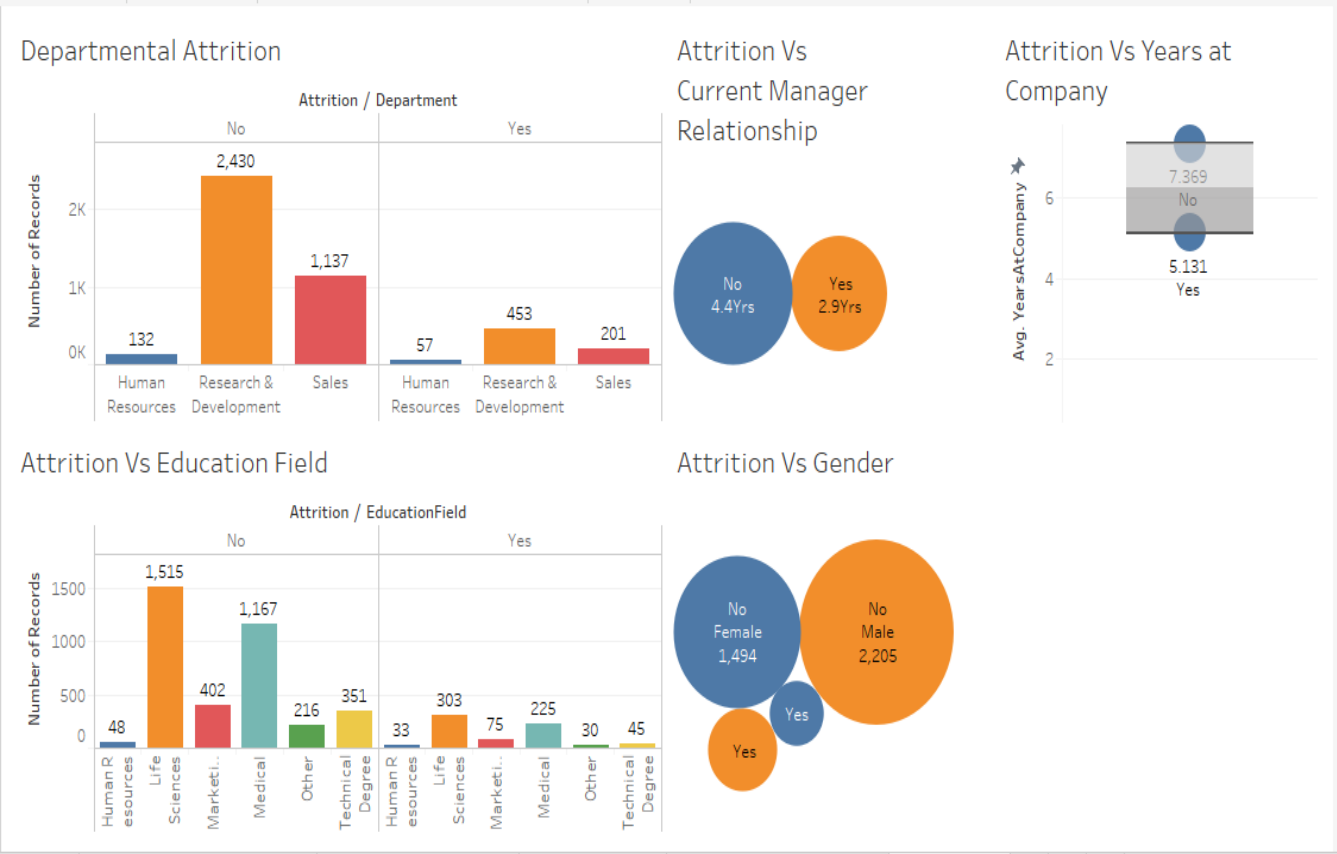
Monthly Income is Right skewed with several outliers

```
box_plot=dataset1.YearsAtCompany

plt.boxplot(box_plot)
```



Years at company is also Right Skewed with several outliers observed.

Step 4 – Visualisation.



Step 5 – Statistical Tests (Mann-Whitney)

1. Attrition Vs Distance from Home

```
import pandas as pd

dataset=pd.read_excel('C:/Group_Folder/TheDataScience/Dinesh/Group 1- HR Analytics - Employee Attrition rate analysis/Working_sheet.xlsx', sheet_name=1)

dataset.head()

Out[3]:

DistanceFromHome_Yes ... YearsWithCurrManager_No
```

0 0 ... 0

1 10 ... 0

2 0 ... 3

3 0 ... 5

4 0 ... 4

[5 rows x 10 columns]

dataset.columns

Out[4]:

Index(['Index(['DistanceFromHome_Yes', 'DistanceFromHome_No', 'MonthlyIncome_Yes',

'MonthlyIncome_No', 'TotalWorkingYears_Yes', 'TotalWorkingYears_No',

'YearsAtCompany_Yes', 'YearsAtCompany_No', 'YearsWithCurrManager_Yes',

'YearsWithCurrManager_No'],

dtype='object')

from scipy.stats import mannwhitneyu

a1=dataset.DistanceFromHome_Yes

a2=dataset.DistanceFromHome_No

stat, p=mannwhitneyu(a1,a2)

print(stat, p)

3132625.5 0.0

As the P value of 0.0 is < 0.05, the H0 is rejected and Ha is accepted.

H0: There is no significant differences in the Distance From Home between attrition (Y) and attirition (N)

Ha: There is significant differences in the Distance From Home between attrition (Y) and attirition (N)

2. Attrition Vs Income

a1=dataset.MonthlyIncome_Yes

a2=dataset.MonthlyIncome_No

stat, p=mannwhitneyu(a1,a2)

print(stat, p)

3085416.0 0.0

As the P value is again 0.0, which is < than 0.05, the H0 is rejected and ha is accepted.

H0: There is no significant differences in the income between attrition (Y) and attirition (N)

Ha: There is significant differences in the income between attrition (Y) and attirition (N)

3. Attrition Vs Total Working Years

a1=dataset.TotalWorkingYears_Yes

a2=dataset.TotalWorkingYears_No

stat, p=mannwhitneyu(a1,a2)

print(stat, p)

2760982.0 0.0

As the P value is again 0.0, which is < than 0.05, the H0 is rejected and ha is accepted.

H0: There is no significant differences in the Total Working Years between attrition (Y) and attirition (N)

Ha: There is significant differences in the Total Working Years between attrition (Y) and attirition (N)

4. Attrition Vs Years at company

a1=dataset.YearsAtCompany_Yes

a2=dataset.YearsAtCompany_No

stat, p=mannwhitneyu(a1,a2)

print(stat, p)

2882047.5 0.0

As the P value is again 0.0, which is < than 0.05, the H0 is rejected and ha is accepted.

H0: There is no significant differences in the Years At Company between attrition (Y) and attirition (N)

Ha: There is significant differences in the Years At Company between attrition (Y) and attirition (N)

5. Attrition Vs YearsWithCurrentManager

a1=dataset.YearsWithCurrManager_Yes

a2=dataset.YearsWithCurrManager_No

stat, p=mannwhitneyu(a1,a2)

print(stat, p)

3674749.5 0.0

As the P value is again 0.0, which is < than 0.05, the H0 is rejected and ha is accepted.

H0: There is no significant differences in the Years With Current Manager between attrition (Y) and attirition (N)

Ha: There is significant differences in the Years With Current Manager between attrition (Y) and attirition (N)

Step 6 – Statistical Tests (Separate T Test)

1. Attrition Vs Distance From Home

```
from scipy.stats import ttest_ind

dataset.columns

Out[49]:

Index(['DistanceFromHome_Yes',
'DistanceFromHome_No', 'MonthlyIncome_Yes',

'MonthlyIncome_No', 'TotalWorkingYears_Yes',
'TotalWorkingYears_No',

'YearsAtCompany_Yes', 'YearsAtCompany_No',
'YearsWithCurrManager_Yes',

'YearsWithCurrManager_No'],

dtype='object')

z1=dataset.DistanceFromHome_Yes

z2=dataset.DistanceFromHome_No

stat, p=ttest_ind(z2,z1)

print(stat, p)

44.45445917636664 0.0
```

As the P value is again 0.0, which is < than 0.05, the H0 is rejected and ha is accepted.

H0: There is no significant differences in the Distance From Home between attrition (Y) and attirition (N)

Ha: There is significant differences in the Distance From Home between attrition (Y) and attirition (N)

2. Attrition Vs Income

```
z1=dataset.MonthlyIncome_Yes

z2=dataset.MonthlyIncome_No

stat, p=ttest_ind(z2, z1)

print(stat, p)
```

52.09279408504947 0.0

As the P value is again 0.0, which is < than 0.05, the H0 is rejected and ha is accepted.

H0: There is no significant differences in the Monthly Income between attrition (Y) and attirition (N)

Ha: There is significant differences in the Monthly Income between attrition (Y) and attirition (N)

3. Attrition Vs Yeats At Company

```
z1=dataset.YearsAtCompany_Yes

z2=dataset.YearsAtCompany_No

stat, p=ttest_ind(z2, z1)

print(stat, p)
```

51.45296941515692 0.0

As the P value is again 0.0, which is < than 0.05, the H0 is rejected and ha is accepted.

H0: There is no significant differences in the Years At Company between attrition (Y) and attirition (N)

Ha: There is significant differences in the Years At Company between attrition (Y) and attirition (N)

4. Attrition Vs Years With Current Manager

```
z1=dataset.YearsWithCurrManager_Yes

z2=dataset.YearsWithCurrManager_No

stat, p=ttest_ind(z2, z1)

print(stat, p)
```

53.02424349024521 0.0

As the P value is again 0.0, which is < than 0.05, the H0 is rejected and ha is accepted.

H0: There is no significant differences in the Years With Current Manager between attrition (Y) and attirition (N)

Ha: There is significant differences in the Years With Current Manager between attrition (Y) and attirition (N)

Step 7 – Unsupervised Learning - Correlation Analysis

In order to find the interdependency of the variables DistanceFromHome, MonthlyIncome, TotalWorkingYears, YearsAtCompany, YearsWithCurrManager from that of Attrition, we executed the Correlation Analysis as follows.

```
dataset=pd.read_csv(“1.csv”)

from scipy.stats import pearsonr

dataset['TotalWorkingYears']=dataset['TotalWorkingY
ears'].fillna(11.28)

dataset.columns

Out[258]:

Index(['Age', 'Attrition', 'BusinessTravel',
'Department', 'DistanceFromHome',

'Education', 'EducationField', 'Gender', 'JobRole',
'MaritalStatus',

'MonthlyIncome', 'NumCompaniesWorked',
'PercentSalaryHike',

'TotalWorkingYears', 'TrainingTimesLastYear',
'YearsAtCompany',

'YearsSinceLastPromotion', 'YearsWithCurrManager'],

dtype='object')

stats, p=pearsonr(dataset.Attrition,
dataset.DistanceFromHome)

print(stats, p)

-0.009730141010179438 0.5182860428049617

stats, p=pearsonr(dataset.Attrition,
dataset.MonthlyIncome)

print(stats, p)

-0.031176281698114025 0.0384274849060192

stats, p=pearsonr(dataset.Attrition,
dataset.TotalWorkingYears)

print(stats, p)
```

-0.170111363559646 5.4731597518148054e-30

```
stats, p=pearsonr(dataset.Attrition,
dataset.YearsAtCompany)

print(stats, p)
```

-0.13439221398997386 3.163883122493571e-19

```
stats, p=pearsonr(dataset.Attrition,
dataset.YearsWithCurrManager)

print(stats, p)
```

-0.15619931590162422 1.7339322652951965e-25

The inference of the above analysis are as follows:

Attrition & DistanceFromHome:

As r = -0.009, there’s low negative correlation between Attrition and DistanceFromHome

As the P value of 0.518 is > 0.05, we are accepting H0 and hence there’s no significant correlation between Attrition & DistanceFromHome

Attrition & MonthlyIncome:

As r = -0.031, there’s low negative correlation between Attrition and MonthlyIncome

As the P value of 0.038 is < 0.05, we are accepting Ha and hence there’s significant correlation between Attrition & MonthlyIncome

Attrition & TotalWorkingYears:

As r = -0.17, there’s low negative correlation between Attrition and TotalWorkingYears

As the P value is < 0.05, we are accepting Ha and hence there’s significant correlation between Attrition & TotalWorkingYears

Attrition & YearsAtCompany:

As r = -0.1343, there’s low negative correlation between Attrition and YearsAtCompany

As the P value is < 0.05, we are accepting Ha and hence there’s significant correlation between Attrition & YearsAtCompany

Attrition & YearsWithCurrManager:

As r = -0.1561, there’s low negative correlation between Attrition and YearsWithCurrManager

As the P value is < 0.05, we are accepting Ha and hence there’s significant correlation between Attrition & YearsWithCurrManager