assignment4

September 28, 2023

1 Anurag Sonar 21BEC0496

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

[ ]:
```
df=pd.read_csv("Employee.csv")
```

[ ]:
```
df
```

[ ]:
```
      Age Attrition     BusinessTravel  DailyRate              Department  \
0      41       Yes      Travel_Rarely       1102                   Sales
1      49        No  Travel_Frequently        279  Research & Development
2      37       Yes      Travel_Rarely       1373  Research & Development
3      33        No  Travel_Frequently       1392  Research & Development
4      27        No      Travel_Rarely        591  Research & Development
…    …       …                 …         …                       …
1465   36        No  Travel_Frequently        884  Research & Development
1466   39        No      Travel_Rarely        613  Research & Development
1467   27        No      Travel_Rarely        155  Research & Development
1468   49        No  Travel_Frequently       1023                   Sales
1469   34        No      Travel_Rarely        628  Research & Development

      DistanceFromHome  Education EducationField  EmployeeCount  \
0                    1          2  Life Sciences              1
1                    8          1  Life Sciences              1
2                    2          2          Other              1
3                    3          4  Life Sciences              1
4                    2          1        Medical              1
…                  …        …             …            …
1465                23          2        Medical              1
1466                 6          1        Medical              1
1467                 4          3  Life Sciences              1
1468                 2          3        Medical              1
1469                 8          3        Medical              1
```

```
      EmployeeNumber  …  RelationshipSatisfaction StandardHours  \
0                  1  …                         1            80
1                  2  …                         4            80
2                  4  …                         2            80
3                  5  …                         3            80
4                  7  …                         4            80
…                …  …                       …           …
1465            2061  …                         3            80
1466            2062  …                         1            80
1467            2064  …                         2            80
1468            2065  …                         4            80
1469            2068  …                         1            80

      StockOptionLevel  TotalWorkingYears  TrainingTimesLastYear  \
0                    0                  8                      0
1                    1                 10                      3
2                    0                  7                      3
3                    0                  8                      3
4                    1                  6                      3
…                  …                  …                    …
1465                 1                 17                      3
1466                 1                  9                      5
1467                 1                  6                      0
1468                 0                 17                      3
1469                 0                  6                      3

     WorkLifeBalance  YearsAtCompany YearsInCurrentRole  \
0                  1               6                  4
1                  3              10                  7
2                  3               0                  0
3                  3               8                  7
4                  3               2                  2
…                …             …                …
1465               3               5                  2
1466               3               7                  7
1467               3               6                  2
1468               2               9                  6
1469               4               4                  3

      YearsSinceLastPromotion  YearsWithCurrManager
0                           0                     5
1                           1                     7
2                           0                     0
3                           3                     0
4                           2                     2
…                         …                   …
```

```
1465                        0                    3
1466                        1                    7
1467                        0                    3
1468                        0                    8
1469                        1                    2

[1470 rows x 35 columns]
```

[ ]:
```
df.head()
```

[ ]:
```
   Age Attrition     BusinessTravel  DailyRate              Department  \
0   41       Yes      Travel_Rarely       1102                   Sales
1   49        No  Travel_Frequently        279  Research & Development
2   37       Yes      Travel_Rarely       1373  Research & Development
3   33        No  Travel_Frequently       1392  Research & Development
4   27        No      Travel_Rarely        591  Research & Development

   DistanceFromHome  Education EducationField  EmployeeCount  EmployeeNumber  \
0                 1          2  Life Sciences              1               1
1                 8          1  Life Sciences              1               2
2                 2          2          Other              1               4
3                 3          4  Life Sciences              1               5
4                 2          1        Medical              1               7

   …  RelationshipSatisfaction StandardHours  StockOptionLevel  \
0  …                         1            80                 0
1  …                         4            80                 1
2  …                         2            80                 0
3  …                         3            80                 0
4  …                         4            80                 1

   TotalWorkingYears  TrainingTimesLastYear WorkLifeBalance  YearsAtCompany  \
0                  8                      0               1               6
1                 10                      3               3              10
2                  7                      3               3               0
3                  8                      3               3               8
4                  6                      3               3               2

  YearsInCurrentRole  YearsSinceLastPromotion  YearsWithCurrManager
0                  4                        0                     5
1                  7                        1                     7
2                  0                        0                     0
3                  7                        3                     0
4                  2                        2                     2

[5 rows x 35 columns]
```

[ ]:
```
df.tail()
```

[ ]:
```
      Age Attrition     BusinessTravel  DailyRate              Department  \
1465   36        No  Travel_Frequently        884  Research & Development
1466   39        No      Travel_Rarely        613  Research & Development
1467   27        No      Travel_Rarely        155  Research & Development
1468   49        No  Travel_Frequently       1023                   Sales
1469   34        No      Travel_Rarely        628  Research & Development

      DistanceFromHome  Education EducationField  EmployeeCount  \
1465                23          2        Medical              1
1466                 6          1        Medical              1
1467                 4          3  Life Sciences              1
1468                 2          3        Medical              1
1469                 8          3        Medical              1

      EmployeeNumber  …  RelationshipSatisfaction StandardHours  \
1465            2061  …                         3            80
1466            2062  …                         1            80
1467            2064  …                         2            80
1468            2065  …                         4            80
1469            2068  …                         1            80

      StockOptionLevel  TotalWorkingYears  TrainingTimesLastYear  \
1465                 1                 17                      3
1466                 1                  9                      5
1467                 1                  6                      0
1468                 0                 17                      3
1469                 0                  6                      3

     WorkLifeBalance  YearsAtCompany YearsInCurrentRole  \
1465               3               5                  2
1466               3               7                  7
1467               3               6                  2
1468               2               9                  6
1469               4               4                  3

      YearsSinceLastPromotion  YearsWithCurrManager
1465                        0                     3
1466                        1                     7
1467                        0                     3
1468                        0                     8
1469                        1                     2

[5 rows x 35 columns]
```

[ ]:
```
df.shape
```

[ ]: (1470, 35)

[ ]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1470 entries, 0 to 1469
Data columns (total 35 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   Age                       1470 non-null   int64
 1   Attrition                 1470 non-null   object
 2   BusinessTravel            1470 non-null   object
 3   DailyRate                 1470 non-null   int64
 4   Department                1470 non-null   object
 5   DistanceFromHome          1470 non-null   int64
 6   Education                 1470 non-null   int64
 7   EducationField            1470 non-null   object
 8   EmployeeCount             1470 non-null   int64
 9   EmployeeNumber            1470 non-null   int64
 10  EnvironmentSatisfaction   1470 non-null   int64
 11  Gender                    1470 non-null   object
 12  HourlyRate                1470 non-null   int64
 13  JobInvolvement            1470 non-null   int64
 14  JobLevel                  1470 non-null   int64
 15  JobRole                   1470 non-null   object
 16  JobSatisfaction           1470 non-null   int64
 17  MaritalStatus             1470 non-null   object
 18  MonthlyIncome             1470 non-null   int64
 19  MonthlyRate               1470 non-null   int64
 20  NumCompaniesWorked        1470 non-null   int64
 21  Over18                    1470 non-null   object
 22  OverTime                  1470 non-null   object
 23  PercentSalaryHike         1470 non-null   int64
 24  PerformanceRating         1470 non-null   int64
 25  RelationshipSatisfaction  1470 non-null   int64
 26  StandardHours             1470 non-null   int64
 27  StockOptionLevel          1470 non-null   int64
 28  TotalWorkingYears         1470 non-null   int64
 29  TrainingTimesLastYear     1470 non-null   int64
 30  WorkLifeBalance           1470 non-null   int64
 31  YearsAtCompany            1470 non-null   int64
 32  YearsInCurrentRole        1470 non-null   int64
 33  YearsSinceLastPromotion   1470 non-null   int64
 34  YearsWithCurrManager      1470 non-null   int64
dtypes: int64(26), object(9)
memory usage: 402.1+ KB
```

[ ]:
```
df.describe()
```

[ ]:
```
                Age    DailyRate  DistanceFromHome    Education  EmployeeCount  \
count  1470.000000  1470.000000       1470.000000  1470.000000         1470.0
mean     36.923810   802.485714          9.192517     2.912925            1.0
std       9.135373   403.509100          8.106864     1.024165            0.0
min      18.000000   102.000000          1.000000     1.000000            1.0
25%      30.000000   465.000000          2.000000     2.000000            1.0
50%      36.000000   802.000000          7.000000     3.000000            1.0
75%      43.000000  1157.000000         14.000000     4.000000            1.0
max      60.000000  1499.000000         29.000000     5.000000            1.0

       EmployeeNumber  EnvironmentSatisfaction   HourlyRate  JobInvolvement  \
count     1470.000000              1470.000000  1470.000000     1470.000000
mean      1024.865306                 2.721769    65.891156        2.729932
std        602.024335                 1.093082    20.329428        0.711561
min          1.000000                 1.000000    30.000000        1.000000
25%        491.250000                 2.000000    48.000000        2.000000
50%       1020.500000                 3.000000    66.000000        3.000000
75%       1555.750000                 4.000000    83.750000        3.000000
max       2068.000000                 4.000000   100.000000        4.000000

          JobLevel  …  RelationshipSatisfaction  StandardHours  \
count  1470.000000  …               1470.000000         1470.0
mean      2.063946  …                  2.712245           80.0
std       1.106940  …                  1.081209            0.0
min       1.000000  …                  1.000000           80.0
25%       1.000000  …                  2.000000           80.0
50%       2.000000  …                  3.000000           80.0
75%       3.000000  …                  4.000000           80.0
max       5.000000  …                  4.000000           80.0

       StockOptionLevel  TotalWorkingYears  TrainingTimesLastYear  \
count       1470.000000        1470.000000            1470.000000
mean           0.793878          11.279592               2.799320
std            0.852077           7.780782               1.289271
min            0.000000           0.000000               0.000000
25%            0.000000           6.000000               2.000000
50%            1.000000          10.000000               3.000000
75%            1.000000          15.000000               3.000000
max            3.000000          40.000000               6.000000

       WorkLifeBalance  YearsAtCompany  YearsInCurrentRole  \
count      1470.000000     1470.000000         1470.000000
mean          2.761224        7.008163            4.229252
std           0.706476        6.126525            3.623137
min           1.000000        0.000000            0.000000
```

25%	2.000000	3.000000	2.000000
50%	3.000000	5.000000	3.000000
75%	3.000000	9.000000	7.000000
max	4.000000	40.000000	18.000000

	YearsSinceLastPromotion	YearsWithCurrManager
count	1470.000000	1470.000000
mean	2.187755	4.123129
std	3.222430	3.568136
min	0.000000	0.000000
25%	0.000000	2.000000
50%	1.000000	3.000000
75%	3.000000	7.000000
max	15.000000	17.000000

[8 rows x 26 columns]

[ ]:
```
corr=df.corr()
corr
```

```
C:\Users\chait\AppData\Local\Temp\ipykernel_12348\3182140910.py:1:
FutureWarning: The default value of numeric_only in DataFrame.corr is
deprecated. In a future version, it will default to False. Select only valid
columns or specify the value of numeric_only to silence this warning.
  corr=df.corr()
```

[ ]:

	Age	DailyRate	DistanceFromHome	Education	\
Age	1.000000	0.010661	-0.001686	0.208034	
DailyRate	0.010661	1.000000	-0.004985	-0.016806	
DistanceFromHome	-0.001686	-0.004985	1.000000	0.021042	
Education	0.208034	-0.016806	0.021042	1.000000	
EmployeeCount	NaN	NaN	NaN	NaN	
EmployeeNumber	-0.010145	-0.050990	0.032916	0.042070	
EnvironmentSatisfaction	0.010146	0.018355	-0.016075	-0.027128	
HourlyRate	0.024287	0.023381	0.031131	0.016775	
JobInvolvement	0.029820	0.046135	0.008783	0.042438	
JobLevel	0.509604	0.002966	0.005303	0.101589	
JobSatisfaction	-0.004892	0.030571	-0.003669	-0.011296	
MonthlyIncome	0.497855	0.007707	-0.017014	0.094961	
MonthlyRate	0.028051	-0.032182	0.027473	-0.026084	
NumCompaniesWorked	0.299635	0.038153	-0.029251	0.126317	
PercentSalaryHike	0.003634	0.022704	0.040235	-0.011111	
PerformanceRating	0.001904	0.000473	0.027110	-0.024539	
RelationshipSatisfaction	0.053535	0.007846	0.006557	-0.009118	
StandardHours	NaN	NaN	NaN	NaN	
StockOptionLevel	0.037510	0.042143	0.044872	0.018422	
TotalWorkingYears	0.680381	0.014515	0.004628	0.148280	

TrainingTimesLastYear	-0.019621	0.002453	-0.036942	-0.025100
WorkLifeBalance	-0.021490	-0.037848	-0.026556	0.009819
YearsAtCompany	0.311309	-0.034055	0.009508	0.069114
YearsInCurrentRole	0.212901	0.009932	0.018845	0.060236
YearsSinceLastPromotion	0.216513	-0.033229	0.010029	0.054254
YearsWithCurrManager	0.202089	-0.026363	0.014406	0.069065

	EmployeeCount	EmployeeNumber
Age	NaN	-0.010145
DailyRate	NaN	-0.050990
DistanceFromHome	NaN	0.032916
Education	NaN	0.042070
EmployeeCount	NaN	NaN
EmployeeNumber	NaN	1.000000
EnvironmentSatisfaction	NaN	0.017621
HourlyRate	NaN	0.035179
JobInvolvement	NaN	-0.006888
JobLevel	NaN	-0.018519
JobSatisfaction	NaN	-0.046247
MonthlyIncome	NaN	-0.014829
MonthlyRate	NaN	0.012648
NumCompaniesWorked	NaN	-0.001251
PercentSalaryHike	NaN	-0.012944
PerformanceRating	NaN	-0.020359
RelationshipSatisfaction	NaN	-0.069861
StandardHours	NaN	NaN
StockOptionLevel	NaN	0.062227
TotalWorkingYears	NaN	-0.014365
TrainingTimesLastYear	NaN	0.023603
WorkLifeBalance	NaN	0.010309
YearsAtCompany	NaN	-0.011240
YearsInCurrentRole	NaN	-0.008416
YearsSinceLastPromotion	NaN	-0.009019
YearsWithCurrManager	NaN	-0.009197

	EnvironmentSatisfaction	HourlyRate	JobInvolvement
Age	0.010146	0.024287	0.029820
DailyRate	0.018355	0.023381	0.046135
DistanceFromHome	-0.016075	0.031131	0.008783
Education	-0.027128	0.016775	0.042438
EmployeeCount	NaN	NaN	NaN
EmployeeNumber	0.017621	0.035179	-0.006888
EnvironmentSatisfaction	1.000000	-0.049857	-0.008278
HourlyRate	-0.049857	1.000000	0.042861
JobInvolvement	-0.008278	0.042861	1.000000
JobLevel	0.001212	-0.027853	-0.012630
JobSatisfaction	-0.006784	-0.071335	-0.021476

MonthlyIncome	-0.006259	-0.015794	-0.015271
MonthlyRate	0.037600	-0.015297	-0.016322
NumCompaniesWorked	0.012594	0.022157	0.015012
PercentSalaryHike	-0.031701	-0.009062	-0.017205
PerformanceRating	-0.029548	-0.002172	-0.029071
RelationshipSatisfaction	0.007665	0.001330	0.034297
StandardHours	NaN	NaN	NaN
StockOptionLevel	0.003432	0.050263	0.021523
TotalWorkingYears	-0.002693	-0.002334	-0.005533
TrainingTimesLastYear	-0.019359	-0.008548	-0.015338
WorkLifeBalance	0.027627	-0.004607	-0.014617
YearsAtCompany	0.001458	-0.019582	-0.021355
YearsInCurrentRole	0.018007	-0.024106	0.008717
YearsSinceLastPromotion	0.016194	-0.026716	-0.024184
YearsWithCurrManager	-0.004999	-0.020123	0.025976

	JobLevel	…	RelationshipSatisfaction	\
Age	0.509604	…	0.053535	
DailyRate	0.002966	…	0.007846	
DistanceFromHome	0.005303	…	0.006557	
Education	0.101589	…	-0.009118	
EmployeeCount	NaN	…	NaN	
EmployeeNumber	-0.018519	…	-0.069861	
EnvironmentSatisfaction	0.001212	…	0.007665	
HourlyRate	-0.027853	…	0.001330	
JobInvolvement	-0.012630	…	0.034297	
JobLevel	1.000000	…	0.021642	
JobSatisfaction	-0.001944	…	-0.012454	
MonthlyIncome	0.950300	…	0.025873	
MonthlyRate	0.039563	…	-0.004085	
NumCompaniesWorked	0.142501	…	0.052733	
PercentSalaryHike	-0.034730	…	-0.040490	
PerformanceRating	-0.021222	…	-0.031351	
RelationshipSatisfaction	0.021642	…	1.000000	
StandardHours	NaN	…	NaN	
StockOptionLevel	0.013984	…	-0.045952	
TotalWorkingYears	0.782208	…	0.024054	
TrainingTimesLastYear	-0.018191	…	0.002497	
WorkLifeBalance	0.037818	…	0.019604	
YearsAtCompany	0.534739	…	0.019367	
YearsInCurrentRole	0.389447	…	-0.015123	
YearsSinceLastPromotion	0.353885	…	0.033493	
YearsWithCurrManager	0.375281	…	-0.000867	

	StandardHours	StockOptionLevel	TotalWorkingYears	\
Age	NaN	0.037510	0.680381	
DailyRate	NaN	0.042143	0.014515	

DistanceFromHome	NaN	0.044872	0.004628
Education	NaN	0.018422	0.148280
EmployeeCount	NaN	NaN	NaN
EmployeeNumber	NaN	0.062227	-0.014365
EnvironmentSatisfaction	NaN	0.003432	-0.002693
HourlyRate	NaN	0.050263	-0.002334
JobInvolvement	NaN	0.021523	-0.005533
JobLevel	NaN	0.013984	0.782208
JobSatisfaction	NaN	0.010690	-0.020185
MonthlyIncome	NaN	0.005408	0.772893
MonthlyRate	NaN	-0.034323	0.026442
NumCompaniesWorked	NaN	0.030075	0.237639
PercentSalaryHike	NaN	0.007528	-0.020608
PerformanceRating	NaN	0.003506	0.006744
RelationshipSatisfaction	NaN	-0.045952	0.024054
StandardHours	NaN	NaN	NaN
StockOptionLevel	NaN	1.000000	0.010136
TotalWorkingYears	NaN	0.010136	1.000000
TrainingTimesLastYear	NaN	0.011274	-0.035662
WorkLifeBalance	NaN	0.004129	0.001008
YearsAtCompany	NaN	0.015058	0.628133
YearsInCurrentRole	NaN	0.050818	0.460365
YearsSinceLastPromotion	NaN	0.014352	0.404858
YearsWithCurrManager	NaN	0.024698	0.459188

	TrainingTimesLastYear	WorkLifeBalance	\
Age	-0.019621	-0.021490	
DailyRate	0.002453	-0.037848	
DistanceFromHome	-0.036942	-0.026556	
Education	-0.025100	0.009819	
EmployeeCount	NaN	NaN	
EmployeeNumber	0.023603	0.010309	
EnvironmentSatisfaction	-0.019359	0.027627	
HourlyRate	-0.008548	-0.004607	
JobInvolvement	-0.015338	-0.014617	
JobLevel	-0.018191	0.037818	
JobSatisfaction	-0.005779	-0.019459	
MonthlyIncome	-0.021736	0.030683	
MonthlyRate	0.001467	0.007963	
NumCompaniesWorked	-0.066054	-0.008366	
PercentSalaryHike	-0.005221	-0.003280	
PerformanceRating	-0.015579	0.002572	
RelationshipSatisfaction	0.002497	0.019604	
StandardHours	NaN	NaN	
StockOptionLevel	0.011274	0.004129	
TotalWorkingYears	-0.035662	0.001008	
TrainingTimesLastYear	1.000000	0.028072	

WorkLifeBalance	0.028072	1.000000
YearsAtCompany	0.003569	0.012089
YearsInCurrentRole	-0.005738	0.049856
YearsSinceLastPromotion	-0.002067	0.008941
YearsWithCurrManager	-0.004096	0.002759

	YearsAtCompany	YearsInCurrentRole	\
Age	0.311309	0.212901	
DailyRate	-0.034055	0.009932	
DistanceFromHome	0.009508	0.018845	
Education	0.069114	0.060236	
EmployeeCount	NaN	NaN	
EmployeeNumber	-0.011240	-0.008416	
EnvironmentSatisfaction	0.001458	0.018007	
HourlyRate	-0.019582	-0.024106	
JobInvolvement	-0.021355	0.008717	
JobLevel	0.534739	0.389447	
JobSatisfaction	-0.003803	-0.002305	
MonthlyIncome	0.514285	0.363818	
MonthlyRate	-0.023655	-0.012815	
NumCompaniesWorked	-0.118421	-0.090754	
PercentSalaryHike	-0.035991	-0.001520	
PerformanceRating	0.003435	0.034986	
RelationshipSatisfaction	0.019367	-0.015123	
StandardHours	NaN	NaN	
StockOptionLevel	0.015058	0.050818	
TotalWorkingYears	0.628133	0.460365	
TrainingTimesLastYear	0.003569	-0.005738	
WorkLifeBalance	0.012089	0.049856	
YearsAtCompany	1.000000	0.758754	
YearsInCurrentRole	0.758754	1.000000	
YearsSinceLastPromotion	0.618409	0.548056	
YearsWithCurrManager	0.769212	0.714365	

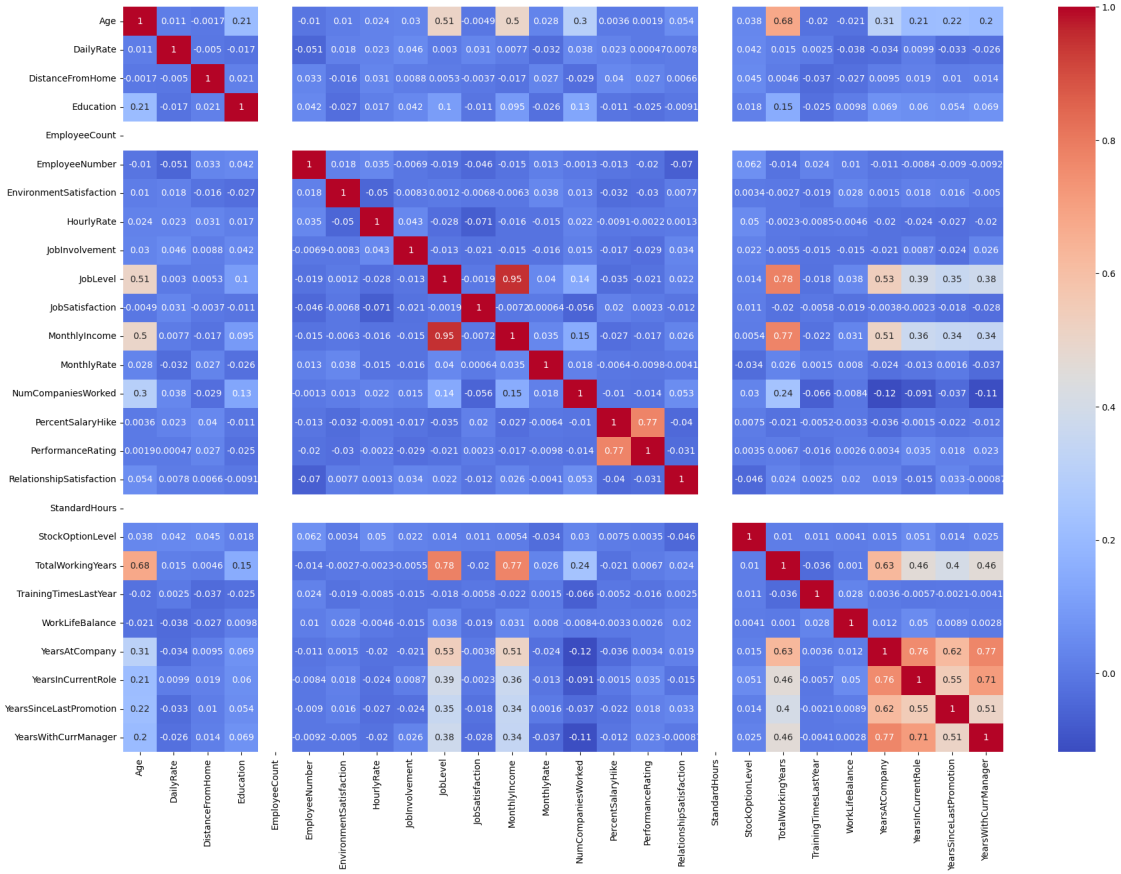
	YearsSinceLastPromotion	YearsWithCurrManager
Age	0.216513	0.202089
DailyRate	-0.033229	-0.026363
DistanceFromHome	0.010029	0.014406
Education	0.054254	0.069065
EmployeeCount	NaN	NaN
EmployeeNumber	-0.009019	-0.009197
EnvironmentSatisfaction	0.016194	-0.004999
HourlyRate	-0.026716	-0.020123
JobInvolvement	-0.024184	0.025976
JobLevel	0.353885	0.375281
JobSatisfaction	-0.018214	-0.027656
MonthlyIncome	0.344978	0.344079

MonthlyRate	0.001567	-0.036746
NumCompaniesWorked	-0.036814	-0.110319
PercentSalaryHike	-0.022154	-0.011985
PerformanceRating	0.017896	0.022827
RelationshipSatisfaction	0.033493	-0.000867
StandardHours	NaN	NaN
StockOptionLevel	0.014352	0.024698
TotalWorkingYears	0.404858	0.459188
TrainingTimesLastYear	-0.002067	-0.004096
WorkLifeBalance	0.008941	0.002759
YearsAtCompany	0.618409	0.769212
YearsInCurrentRole	0.548056	0.714365
YearsSinceLastPromotion	1.000000	0.510224
YearsWithCurrManager	0.510224	1.000000

[26 rows x 26 columns]

[ ]:
```
plt.subplots(figsize=(22,15))
sns.heatmap(corr,annot=True,cmap="coolwarm")
```

[ ]: <Axes: >



[ ]:
```
df.Attrition.value_counts()
```

[ ]:
```
No     1233
Yes     237
Name: Attrition, dtype: int64
```

Checking for NULL Values

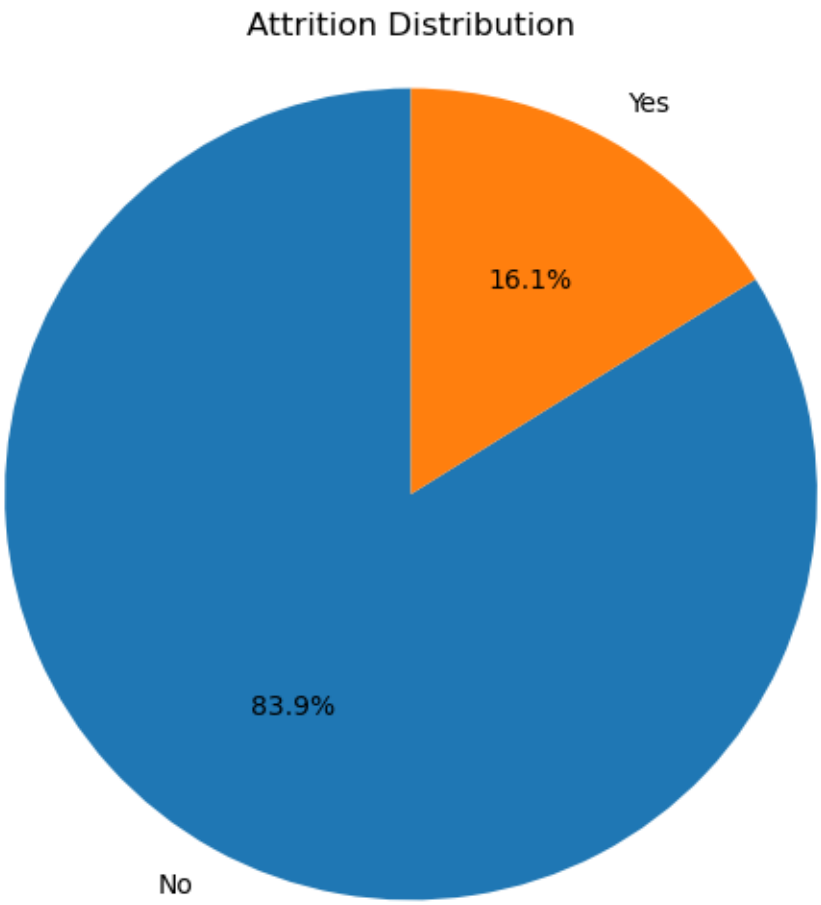
[ ]:
```
df.isnull().any()
```

[ ]:
```
Age                         False
Attrition                   False
BusinessTravel              False
DailyRate                   False
Department                  False
DistanceFromHome            False
Education                   False
EducationField              False
EmployeeCount               False
EmployeeNumber              False
EnvironmentSatisfaction     False
Gender                      False
HourlyRate                  False
JobInvolvement              False
JobLevel                    False
JobRole                     False
JobSatisfaction             False
MaritalStatus               False
MonthlyIncome               False
MonthlyRate                 False
NumCompaniesWorked          False
Over18                      False
OverTime                    False
PercentSalaryHike           False
PerformanceRating           False
RelationshipSatisfaction    False
StandardHours               False
StockOptionLevel            False
TotalWorkingYears           False
TrainingTimesLastYear       False
WorkLifeBalance             False
YearsAtCompany              False
YearsInCurrentRole          False
YearsSinceLastPromotion     False
YearsWithCurrManager        False
```

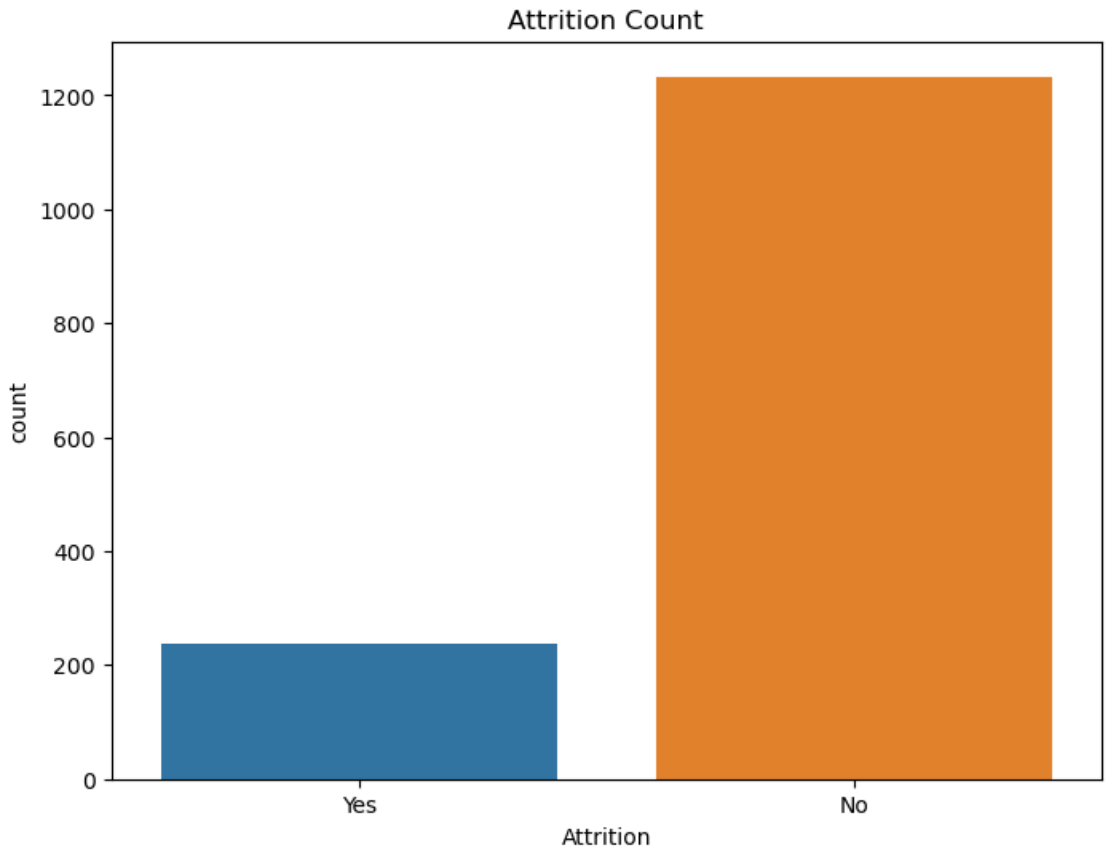
```
dtype: bool
```

Data Visualization

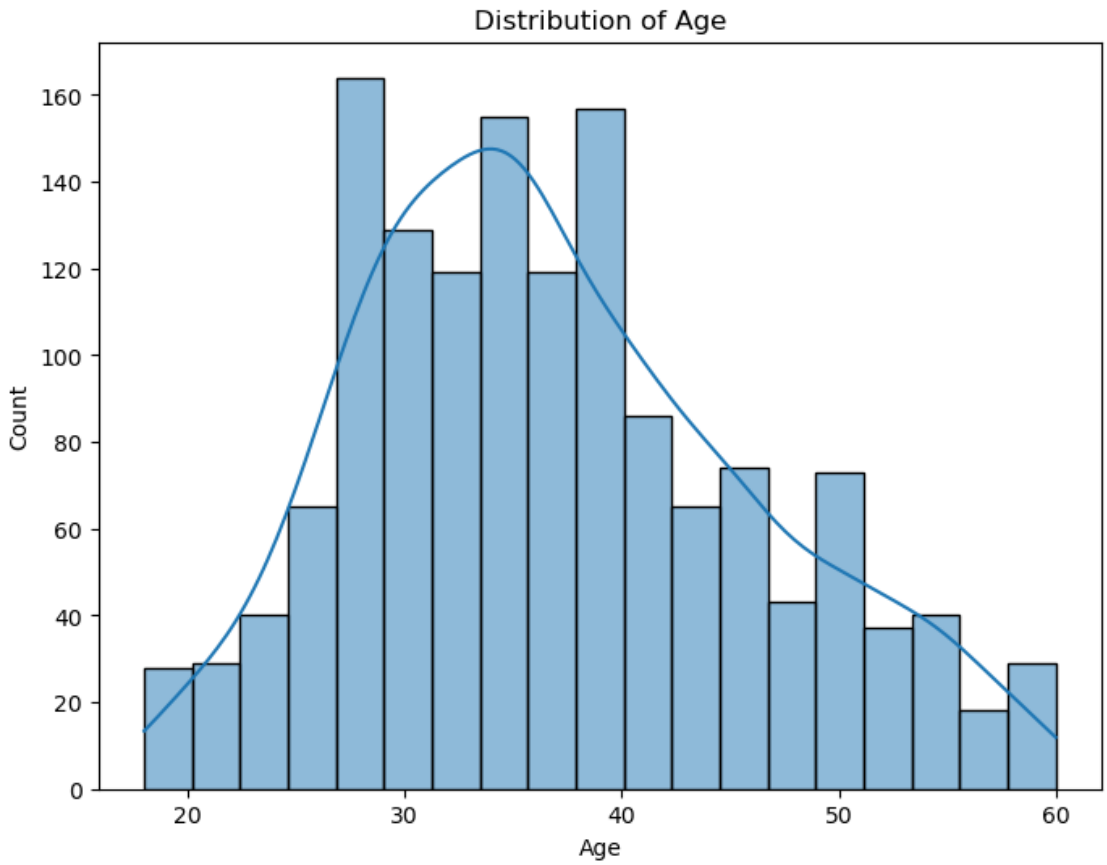
[ ]:
```
attrition_counts = df['Attrition'].value_counts()
plt.figure(figsize=(6, 6))
plt.pie(attrition_counts, labels=attrition_counts.index, autopct='%1.1f%%',␣
 ↪startangle=90)
plt.title('Attrition Distribution')
plt.axis('equal')

plt.show()
```



[ ]:
```
plt.figure(figsize=(8, 6))
sns.countplot(x="Attrition", data=df)
plt.title("Attrition Count")
plt.show()
```

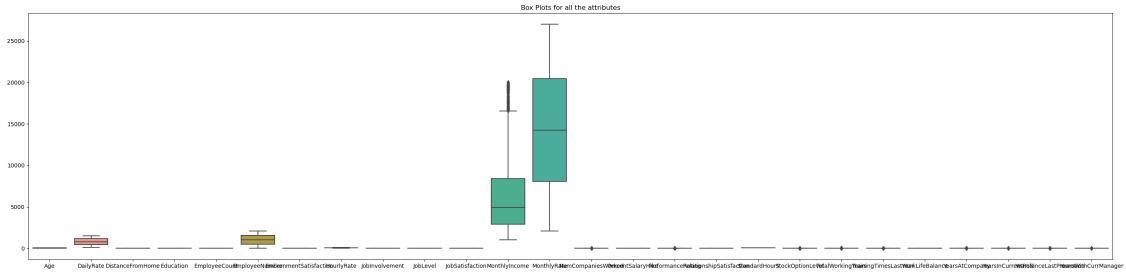


[ ]:
```
plt.figure(figsize=(8, 6))
sns.histplot(data=df, x="Age", kde=True)
plt.title("Distribution of Age")
plt.show()
```



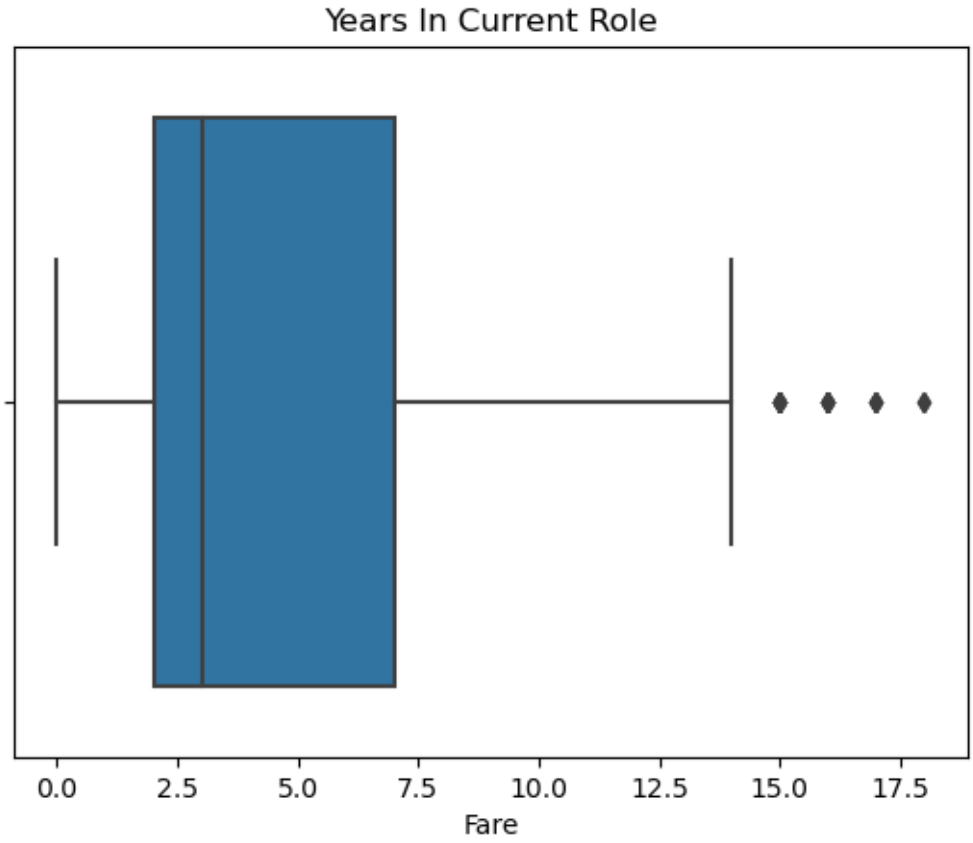
Outlier Detection

[ ]:
```
plt.figure(figsize=(35, 8))
sns.boxplot(data=df)
plt.title('Box Plots for all the attributes')
plt.show()
```

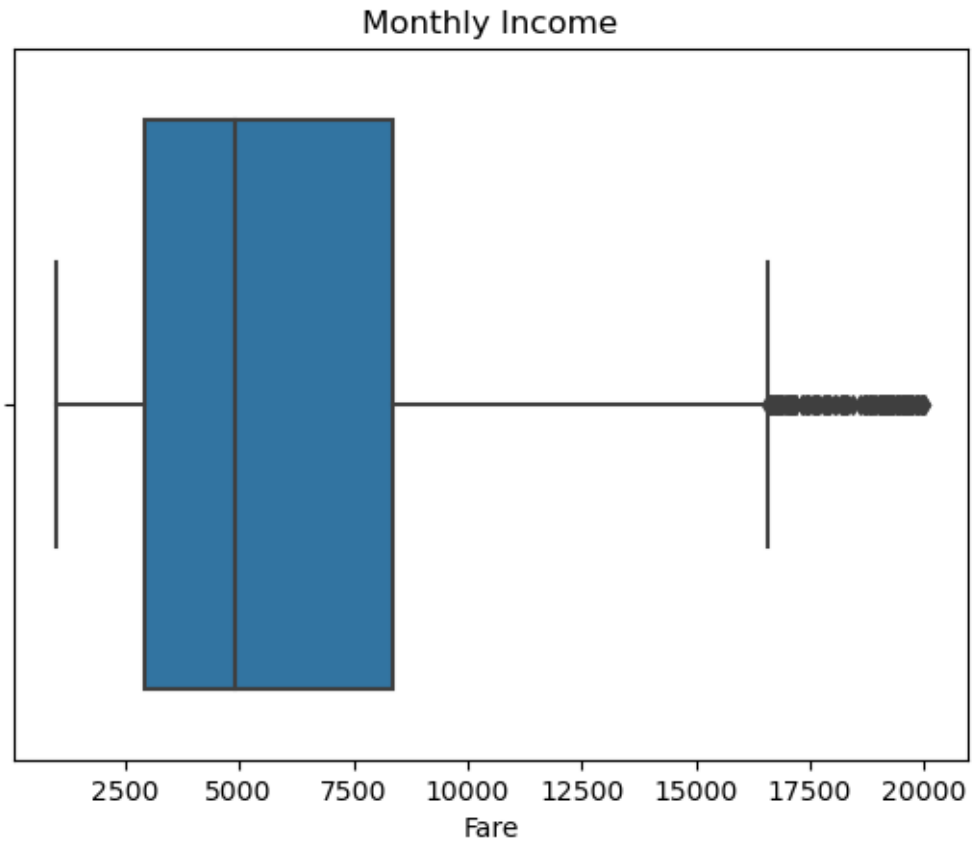


[ ]:
```
sns.boxplot(data=df, x='YearsInCurrentRole')
plt.title('Years In Current Role')
```

```
plt.xlabel('Fare')
plt.show()
```

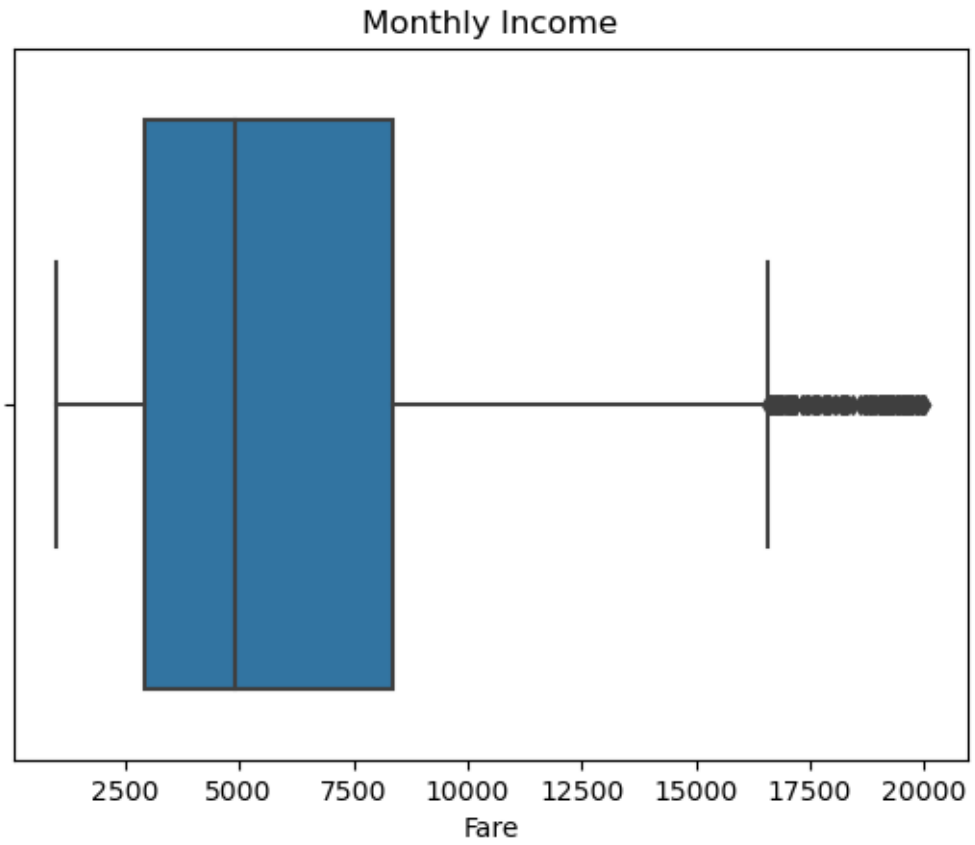


[ ]:
```
sns.boxplot(data=df, x='MonthlyIncome')
plt.title('Monthly Income')
plt.xlabel('Fare')
plt.show()
```



[ ]:
```
from scipy import stats

z_scores = stats.zscore(df['MonthlyIncome'])
z_score_threshold = 3
df_cleaned = df[(np.abs(z_scores) <= z_score_threshold)]
```

[ ]:
```
sns.boxplot(data=df_cleaned, x='MonthlyIncome')
plt.title('Monthly Income')
plt.xlabel('Fare')
plt.show()
```



So the outliers are in large quantity, and they are inside the threshold, so let us not remove the outliers

SPLITTING INDEPENDENT AND DEPENDENT VARIABLES

[ ]:
```
x= df.drop(columns=["Attrition"])
y = df["Attrition"]
```

[ ]:
```
x.head()
```

[ ]:

	Age	BusinessTravel	DailyRate	Department	\
0	41	Travel_Rarely	1102	Sales	
1	49	Travel_Frequently	279	Research & Development	
2	37	Travel_Rarely	1373	Research & Development	
3	33	Travel_Frequently	1392	Research & Development	
4	27	Travel_Rarely	591	Research & Development	

	DistanceFromHome	Education	EducationField	EmployeeCount	EmployeeNumber	\
0	1	2	Life Sciences	1	1	
1	8	1	Life Sciences	1	2	
2	2	2	Other	1	4	

```
3                  3          4  Life Sciences              1               5
4                  2          1        Medical              1               7

   EnvironmentSatisfaction  … RelationshipSatisfaction  StandardHours  \
0                        2  …                         1             80
1                        3  …                         4             80
2                        4  …                         2             80
3                        4  …                         3             80
4                        1  …                         4             80

   StockOptionLevel  TotalWorkingYears TrainingTimesLastYear  WorkLifeBalance  \
0                 0                  8                     0                1
1                 1                 10                     3                3
2                 0                  7                     3                3
3                 0                  8                     3                3
4                 1                  6                     3                3

  YearsAtCompany  YearsInCurrentRole  YearsSinceLastPromotion  \
0              6                   4                        0
1             10                   7                        1
2              0                   0                        0
3              8                   7                        3
4              2                   2                        2

   YearsWithCurrManager
0                     5
1                     7
2                     0
3                     0
4                     2

[5 rows x 34 columns]
```

[ ]:
```
y.head()
```

[ ]:
```
0    Yes
1     No
2    Yes
3     No
4     No
Name: Attrition, dtype: object
```

ENCODING

[ ]:
```
categorical_features = x.select_dtypes(include=['object']).columns.tolist()
x_encoded = pd.get_dummies(x, columns=categorical_features, drop_first=True)
```

[ ]:
```
x_encoded.head()
```

[ ]:
```
   Age  DailyRate  DistanceFromHome  Education  EmployeeCount  EmployeeNumber  \
0   41       1102                 1          2              1               1
1   49        279                 8          1              1               2
2   37       1373                 2          2              1               4
3   33       1392                 3          4              1               5
4   27        591                 2          1              1               7

   EnvironmentSatisfaction  HourlyRate  JobInvolvement  JobLevel  …  \
0                        2          94               3         2  …
1                        3          61               2         2  …
2                        4          92               2         1  …
3                        4          56               3         1  …
4                        1          40               3         1  …

   JobRole_Laboratory Technician  JobRole_Manager  \
0                              0                0
1                              0                0
2                              1                0
3                              0                0
4                              1                0

   JobRole_Manufacturing Director  JobRole_Research Director  \
0                               0                          0
1                               0                          0
2                               0                          0
3                               0                          0
4                               0                          0

   JobRole_Research Scientist  JobRole_Sales Executive  \
0                           0                        1
1                           1                        0
2                           0                        0
3                           1                        0
4                           0                        0

   JobRole_Sales Representative  MaritalStatus_Married  MaritalStatus_Single  \
0                             0                      0                     1
1                             0                      1                     0
2                             0                      0                     1
3                             0                      1                     0
4                             0                      1                     0

   OverTime_Yes
0             1
1             0
```

```
2              1
3              1
4              0

[5 rows x 47 columns]
```

FEATURE SCALING

[ ]:
```
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
x_scaled = pd.DataFrame(scaler.fit_transform(x_encoded), columns=x_encoded.
 ↪columns)
```

[ ]:
```
x_scaled.head()
```

[ ]:
```
        Age  DailyRate  DistanceFromHome  Education  EmployeeCount  \
0  0.446350   0.742527         -1.010909  -0.891688            0.0
1  1.322365  -1.297775         -0.147150  -1.868426            0.0
2  0.008343   1.414363         -0.887515  -0.891688            0.0
3 -0.429664   1.461466         -0.764121   1.061787            0.0
4 -1.086676  -0.524295         -0.887515  -1.868426            0.0

   EmployeeNumber  EnvironmentSatisfaction  HourlyRate  JobInvolvement  \
0       -1.701283                -0.660531    1.383138        0.379672
1       -1.699621                 0.254625   -0.240677       -1.026167
2       -1.696298                 1.169781    1.284725       -1.026167
3       -1.694636                 1.169781   -0.486709        0.379672
4       -1.691313                -1.575686   -1.274014        0.379672

   JobLevel  …  JobRole_Laboratory Technician  JobRole_Manager  \
0 -0.057788  …                      -0.462464        -0.273059
1 -0.057788  …                      -0.462464        -0.273059
2 -0.961486  …                       2.162331        -0.273059
3 -0.961486  …                      -0.462464        -0.273059
4 -0.961486  …                       2.162331        -0.273059

   JobRole_Manufacturing Director  JobRole_Research Director  \
0                       -0.330808                  -0.239904
1                       -0.330808                  -0.239904
2                       -0.330808                  -0.239904
3                       -0.330808                  -0.239904
4                       -0.330808                  -0.239904

   JobRole_Research Scientist  JobRole_Sales Executive  \
0                   -0.497873                 1.873287
1                    2.008543                -0.533821
```

```
2                   -0.497873                -0.533821
3                    2.008543                -0.533821
4                   -0.497873                -0.533821

   JobRole_Sales Representative  MaritalStatus_Married  MaritalStatus_Single  \
0                     -0.244625              -0.918921              1.458650
1                     -0.244625               1.088232             -0.685565
2                     -0.244625              -0.918921              1.458650
3                     -0.244625               1.088232             -0.685565
4                     -0.244625               1.088232             -0.685565

   OverTime_Yes
0      1.591746
1     -0.628241
2      1.591746
3      1.591746
4     -0.628241

[5 rows x 47 columns]
```

[ ]:
```
x=x_scaled
```

Train and test split

[ ]:
```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2,␣
 ↪random_state=42)
```

MODEL BUILDING

[ ]:
```
# Import the necessary libraries
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score, classification_report,␣
 ↪confusion_matrix
from joblib import dump
```

[ ]:
```
logreg_model = LogisticRegression(random_state=42)
dt_model = DecisionTreeClassifier(random_state=42)
```

[ ]:
```
logreg_model.fit(x_train, y_train)
dt_model.fit(x_train, y_train)
```

[ ]:
```
DecisionTreeClassifier(random_state=42)
```

[ ]:
```
logreg_predictions = logreg_model.predict(x_test)

dt_predictions = dt_model.predict(x_test)
```

```
logreg_accuracy = accuracy_score(y_test, logreg_predictions)
print("Logistic Regression Accuracy:", logreg_accuracy)

dt_accuracy = accuracy_score(y_test, dt_predictions)
print("Decision Tree Accuracy:", dt_accuracy)

logreg_report = classification_report(y_test, logreg_predictions)
print("Classification Report for Logistic Regression:\n", logreg_report)

dt_report = classification_report(y_test, dt_predictions)
print("Classification Report for Decision Tree Classifier:\n", dt_report)

logreg_conf_matrix = confusion_matrix(y_test, logreg_predictions)
print("Confusion Matrix for Logistic Regression:\n", logreg_conf_matrix)

dt_conf_matrix = confusion_matrix(y_test, dt_predictions)
print("Confusion Matrix for Decision Tree Classifier:\n", dt_conf_matrix)
```

```
Logistic Regression Accuracy: 0.8809523809523809
Decision Tree Accuracy: 0.7721088435374149
Classification Report for Logistic Regression:
              precision    recall  f1-score   support

          No       0.92      0.95      0.93       255
         Yes       0.56      0.46      0.51        39

    accuracy                           0.88       294
   macro avg       0.74      0.70      0.72       294
weighted avg       0.87      0.88      0.88       294

Classification Report for Decision Tree Classifier:
              precision    recall  f1-score   support

          No       0.87      0.86      0.87       255
         Yes       0.17      0.18      0.17        39

    accuracy                           0.77       294
   macro avg       0.52      0.52      0.52       294
weighted avg       0.78      0.77      0.78       294

Confusion Matrix for Logistic Regression:
 [[241  14]
 [ 21  18]]
Confusion Matrix for Decision Tree Classifier:
 [[220  35]
 [ 32   7]]
```