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IMPORT LIBRARIES

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

IMPORT DATASET

```
df=pd.read_csv("WA_Fn-UseC_-HR-Employee-Attrition.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
                                                
                                                
                                                
 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
```

```
<ipython-input-11-7d5195e2bf4d>: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	

```
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
```

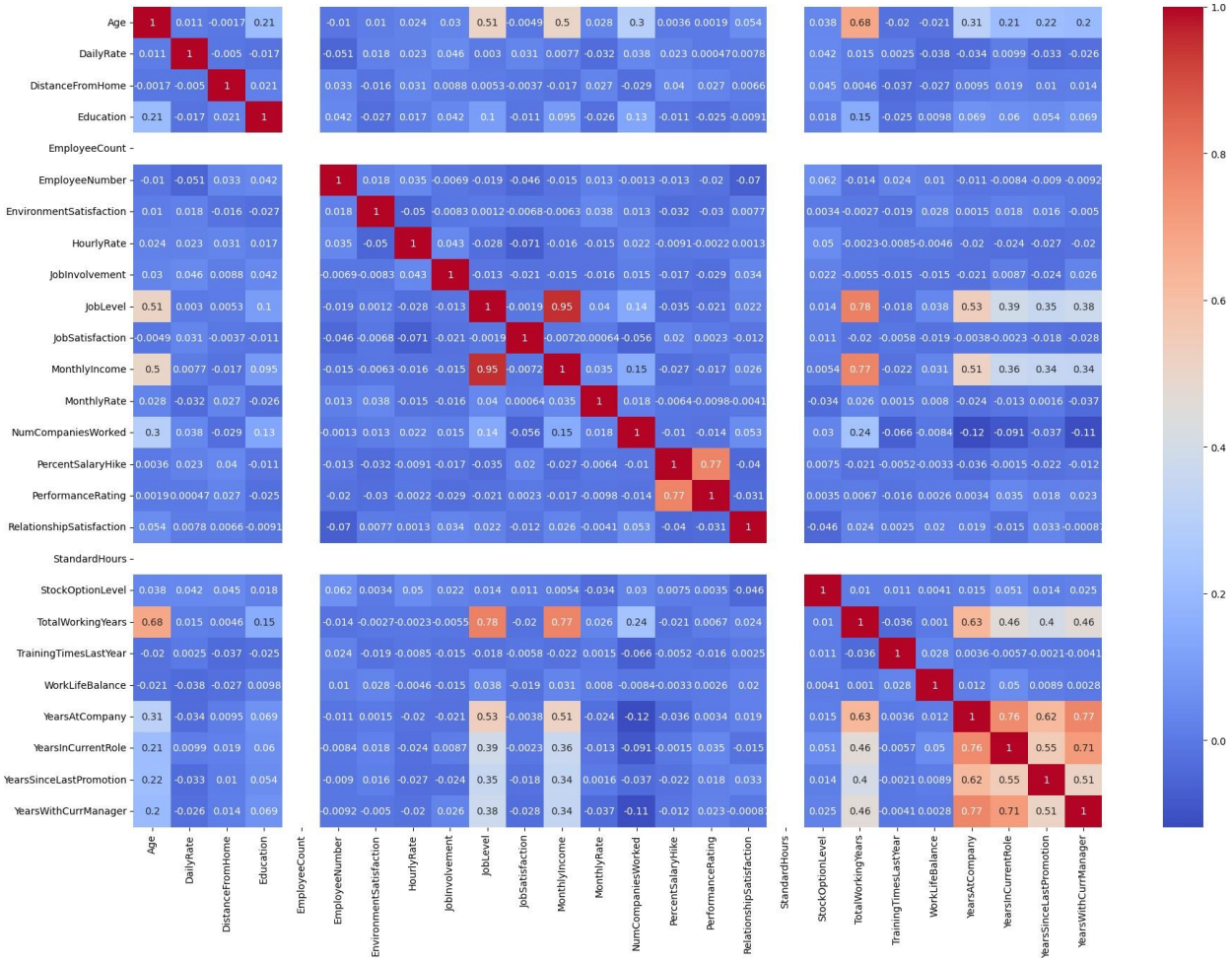
```
MonthlyRate                          0.001467          0.007963
NumCompaniesWorked                  -0.066054         -0.008366
PercentSalaryHike                   -0.005221         -0.003280
PerformanceRating                   -0.015579          0.002572
RelationshipSatisfaction             0.002497          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

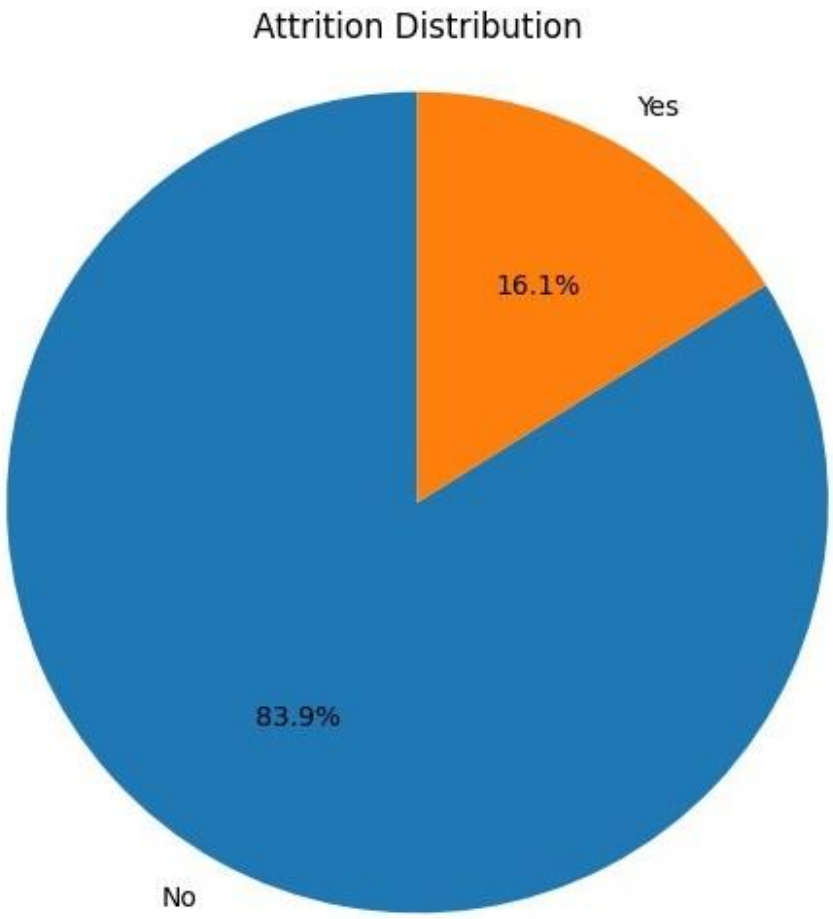
```
df.isnull().any()
```

```
Age                         False
Attrition                   False
```

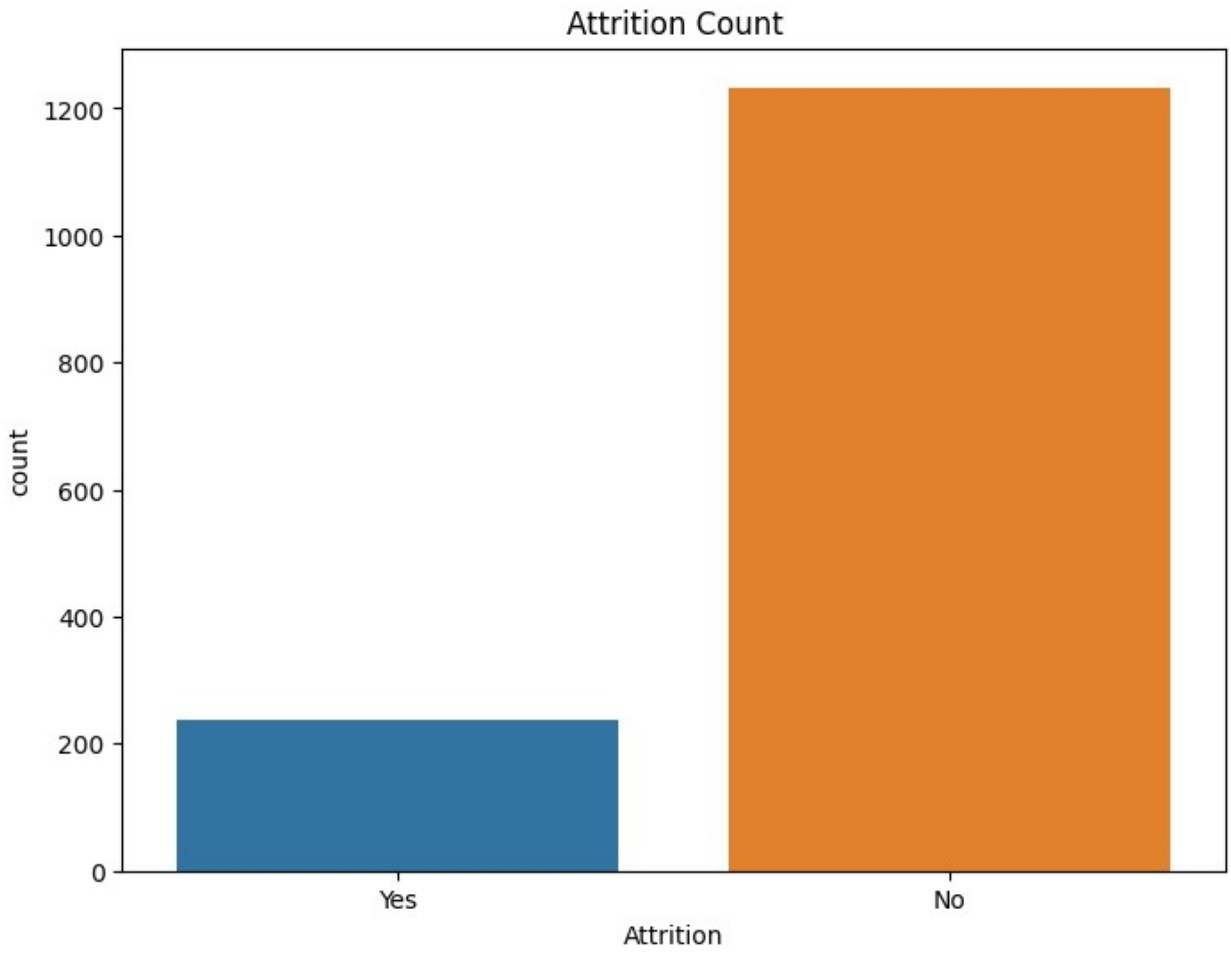
```
BusinessTravel               False
DailyRate                    False
Department                   False
DistanceFromHome             False
Education                    False
EducationField               False
EmployeeCount                False
EmployeeNumber               False
EnvironmentSatisfaction      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
dtype: bool
```

Data Visualization

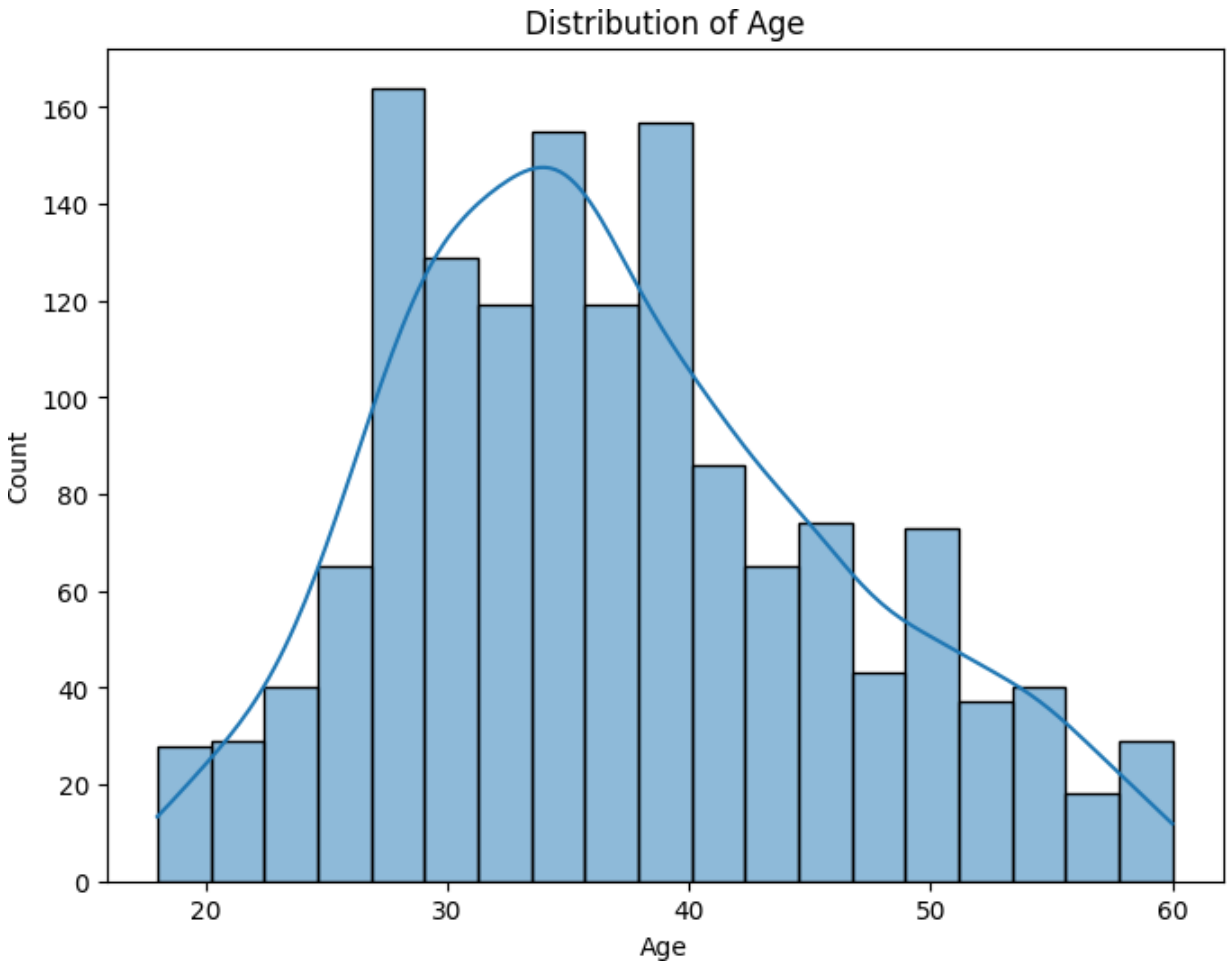
```
attrition_counts = df['Attrition'].value_counts()
plt.figure(figsize=(6, 6))
plt.pie(attrition_counts, labels=attrition_counts.index,
autopct='%1.1f%%', startangle=90)
plt.title('Attrition Distribution')
plt.axis('equal')

plt.show()
```




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

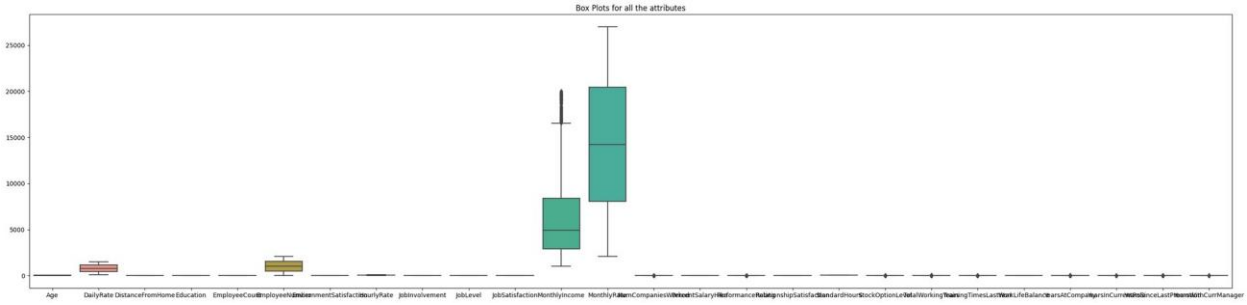



```
plt.figure(figsize=(8, 6))
sns.histplot(data=df, x="Age", kde=True)
plt.title("Distribution of Age")
plt.show()
```



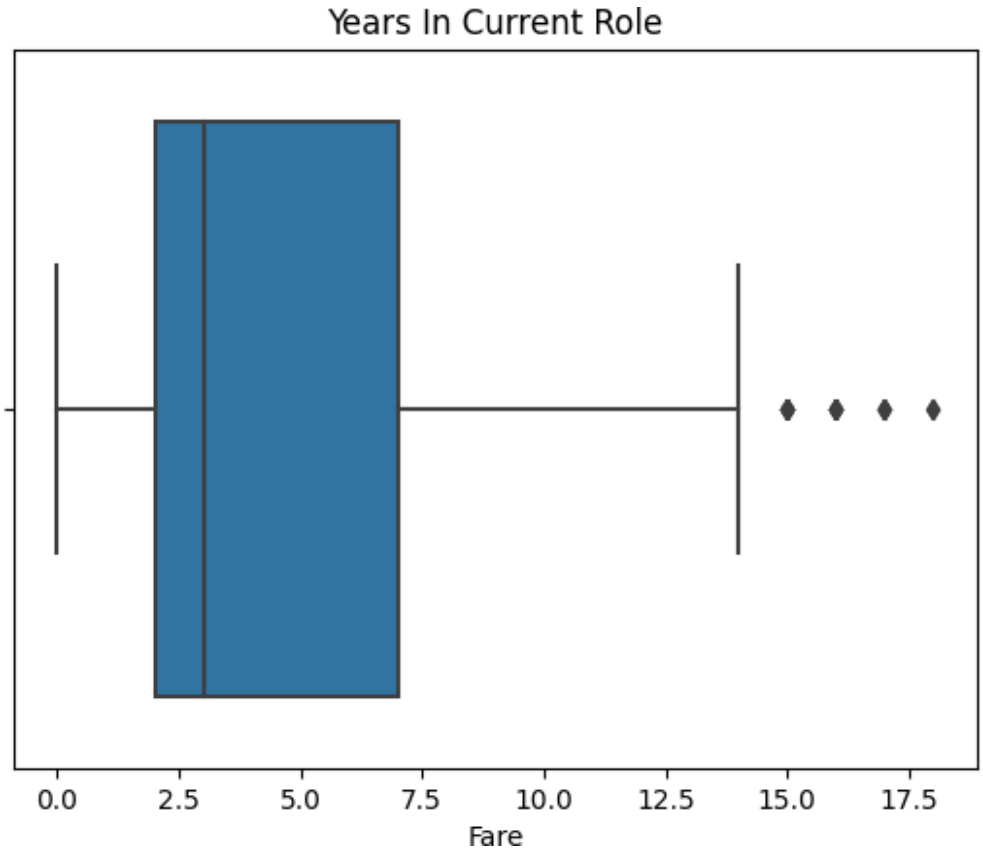
Outlier Detection

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

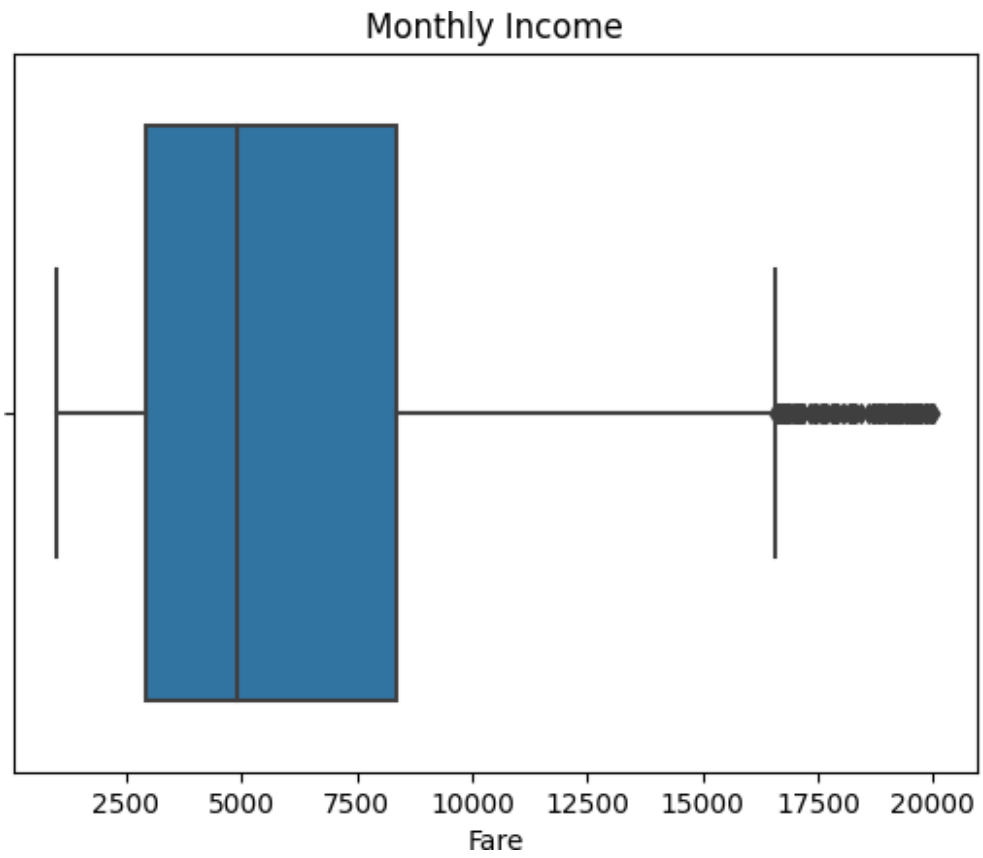



```
sns.boxplot(data=df, x='YearsInCurrentRole')
plt.title('Years In Current Role')
```

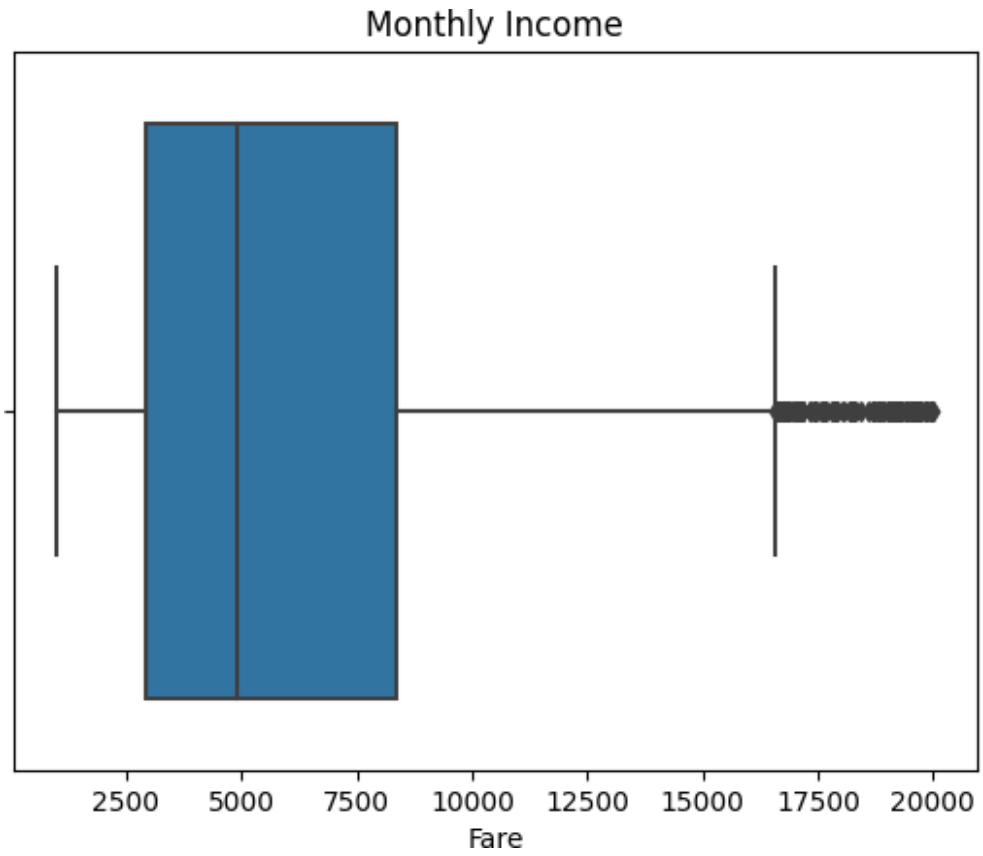
```
plt.xlabel('Fare')
plt.show()
```




```
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

   Environ entSatisfaction ... RelationshipSatisfaction
StandardHo rs \
0                          2  ...                         1
80
1                          3  ...                         4
80
2                          4  ...                         2
80
3                          4  ...                         3
80
4                          1  ...                         4
80

   StockOptionLev l  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

                                                    _
```



```
   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]]
```