jupyter EDA_HR_analysis Last Checkpoint: 23 hours ago

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Markdown JupyterLab Python 3 (ipykernel)

Objective:

The objective of the "HR Analytics - Employee Promotion Prediction" project is to assist HR teams in identifying employees who are likely to be promoted based on various attributes. This helps organizations streamline the promotion process, recognize deserving employees, and ensure fairness and efficiency in talent management.

Understanding Business Problems for " Employee Promotion Prediction "

The "HR Analytics - Employee Promotion Prediction" problem helps companies identify which employees are likely to be promoted based on data like performance, training, and experience. This ensures fair promotions, keeps employees happy, and improves productivity.

Problem Statement:

The goal is to predict employee promotions using historical data like performance ratings, training hours, and experience, with "Promoted" as the target column. Using EDA, a module is created to ensure fair and data-driven promotion decisions.

[3]:
```
# lib for extraction ,manipulation,analysis
import numpy as np
import pandas as pd
# for visualtion
import matplotlib.pyplot as plt
import seaborn as sns
# for stats
import scipy.stats
from scipy.stats import shapiro, chi2, normaltest, kstest, zscore
# train test split
from sklearn.model_selection import train_test_split
```

[4]:
```
# importing dataset
data=pd.read_csv(r"C:\Users\deshm\OneDrive\Desktop\Python\EDA_Hr_Analytics_Employee_Promotion.csv")
data
```

[4]:

	Employee_ID	Department	Education	Gender	Age	Experience_Years	Previous_Ratings	Training_Hours	Awards	Average_Work_Hours	Promoted
0	E0001	Finance	Bachelor	Female	55	3	2.26	21	4	37	No
1	E0002	Operations	Bachelor	Female	30	8	1.90	97	1	44	No
2	E0003	HR	Bachelor	Male	45	23	1.28	78	2	51	No
3	E0004	Operations	Bachelor	Female	29	11	4.31	93	0	41	No
4	E0005	Operations	Bachelor	Male	28	8	2.02	48	1	49	No
...	...	...	...	...	...	...	...	...	...	...	...
995	E0996	Marketing	Bachelor	Female	31	23	4.46	79	2	47	Yes
996	E0997	Operations	Master	Male	53	15	2.78	97	3	50	No
997	E0998	Sales	Bachelor	Female	36	33	1.55	15	1	43	No
998	E0999	Sales	PhD	Male	58	21	4.45	36	0	36	No
999	E1000	Operations	Bachelor	Female	41	23	4.26	91	1	57	Yes

1000 rows × 11 columns

[5]:
```
#EDA for each data analysis
def eda(data):
    print("Shape:",data.shape)
    print("- "*50)
    print("Size:",data.size)
    print("- "*50)
    print("INFO:",data.info)
    print("- "*50)
    print("Describe:",data.describe())
    print("- "*50)
    print("Dtype:",data.dtypes)
    print("- "*50)
    print("Checking Null Values:",data.isnull().sum())

eda(data)
```

```
Shape: (1000, 11)
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Size: 11000
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
INFO: <bound method DataFrame.info of     Employee_ID  Department Education  Gender  Age  Experience_Years  \
0         E0001     Finance  Bachelor  Female   55                 3
1         E0002  Operations  Bachelor  Female   30                 8
2         E0003          HR  Bachelor    Male   45                23
3         E0004  Operations  Bachelor  Female   29                11
4         E0005  Operations  Bachelor    Male   28                 8
..          ...         ...       ...     ...  ...               ...
995       E0996   Marketing  Bachelor  Female   31                23
996       E0997  Operations    Master    Male   53                15
997       E0998       Sales  Bachelor  Female   36                33
```

```
998       E0999       Sales       PhD    Male   58                21
999       E1000  Operations  Bachelor  Female   41                23

     Previous_Ratings  Training_Hours  Awards  Average_Work_Hours Promoted
0                2.26              21       4                  37       No
1                1.90              97       1                  44       No
2                1.28              78       2                  51       No
3                4.31              93       0                  41       No
4                2.02              48       1                  49       No
..                ...             ...     ...                 ...      ...
995              4.46              79       2                  47      Yes
996              2.78              97       3                  50       No
997              1.55              15       1                  43       No
998              4.45              36       0                  36       No
999              4.26              91       1                  57      Yes

[1000 rows x 11 columns]>
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Describe:                Age  Experience_Years  Previous_Ratings  Training_Hours  \
count  1000.000000       1000.00000       1000.000000     1000.000000
mean     40.515000         17.68600          2.951060       54.253000
std      10.898006          9.50946          1.147999       26.065771
min      22.000000          1.00000          1.000000       10.000000
25%      31.000000         10.00000          1.967500       32.000000
50%      41.000000         18.00000          2.930000       54.000000
75%      50.000000         26.00000          3.960000       77.250000
max      59.000000         34.00000          4.990000       99.000000

           Awards  Average_Work_Hours
count  1000.000000         1000.000000
mean      1.933000           47.213000
std       1.422158            7.344493
min       0.000000           35.000000
25%       1.000000           41.000000
50%       2.000000           47.000000
75%       3.000000           53.000000
max       4.000000           59.000000
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Dtype: Employee_ID           object
Department             object
Education              object
Gender                 object
Age                     int64
Experience_Years        int64
Previous_Ratings      float64
Training_Hours          int64
Awards                  int64
Average_Work_Hours      int64
Promoted               object
dtype: object
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Checking Null Values: Employee_ID          0
Department             0
Education              0
Gender                 0
Age                    0
Experience_Years       0
Previous_Ratings       0
Training_Hours         0
Awards                 0
Average_Work_Hours     0
Promoted               0
dtype: int64
```

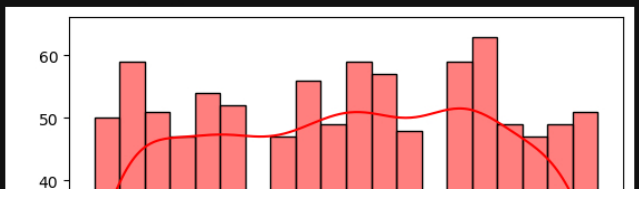
[6]:
```python
# Analysis for Numerical Columns
def Num_col(data, col):
    mean=data[col].mean()
    median=data[col].median()
    mode=data[col].mode()[0]
    var =data[col].var()
    std=data[col].std()
    skew=data[col].skew()
    Min=data[col].min()
    Max=data[col].max()
    Range=Max-Min
    print("Numerical Columns Analysis:")
    print(f"mean:{mean}\nmedian:{median}\nmode:{mode}\nvar:{var}\nstd:{std}\nskew:{skew}\nMIN:{Min}\nMAAX:{Max}\nRange:{Range}")
```

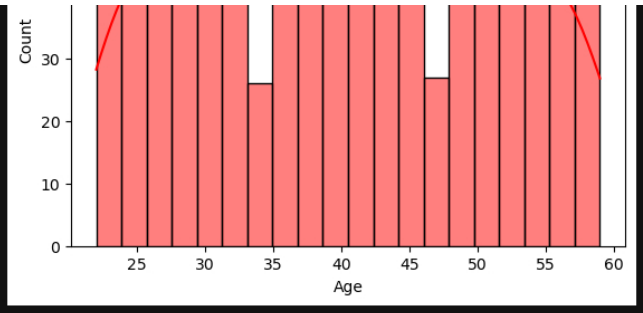
[7]:
```python
Num_col(data,"Age")
```

```
Numerical Columns Analysis:
mean:40.515
median:41.0
mode:50
var:118.76654154154176
std:10.89800631040108
skew:-0.022107532391192068
MIN:22
MAAX:59
Range:37
```

[87]:
```python
sns.histplot(data=data,x="Age",bins=20,kde=True,color="red")
```

[87]:
```
<Axes: xlabel='Age', ylabel='Count'>
```



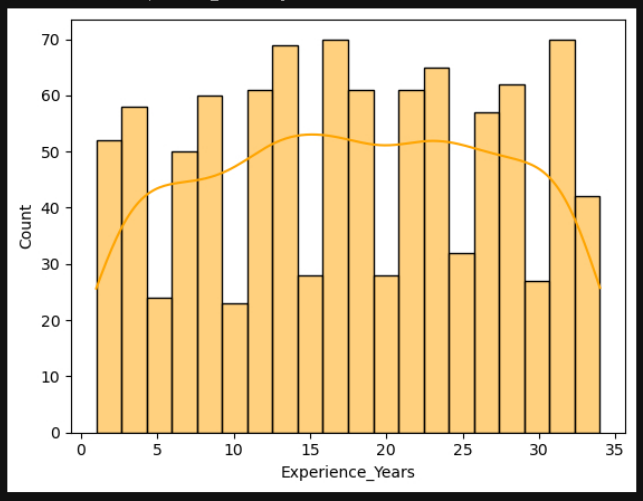


[9]:
```
Num_col(data,"Experience_Years")
```

```
Numerical Columns Analysis:
mean:17.686
median:18.0
mode:23
var:90.42983383383378
std:9.509460228311267
skew:-0.04056089551054327
MIN:1
MAAX:34
Range:33
```

[94]:
```
sns.histplot(data=data,x="Experience_Years",bins=20,kde=True,color="orange")
```

[94]: <Axes: xlabel='Experience_Years', ylabel='Count'>

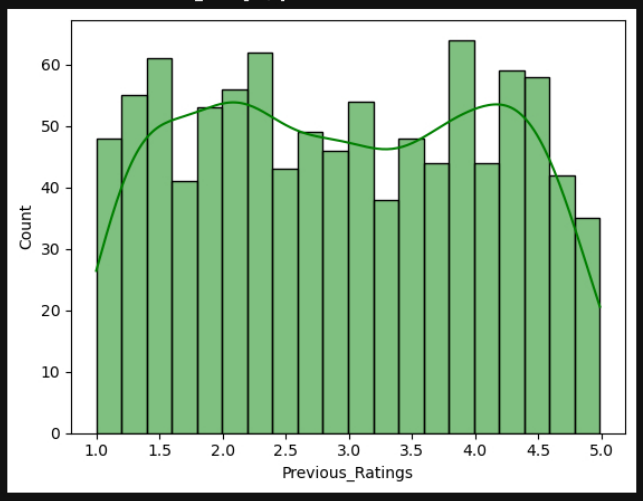


[10]:
```
Num_col(data,"Previous_Ratings")
```

```
Numerical Columns Analysis:
mean:2.95106
median:2.93
mode:4.45
var:1.3179025789789776
std:1.147999381088238
skew:0.021283061052464452
MIN:1.0
MAAX:4.99
Range:3.99
```

[96]:
```
sns.histplot(data=data,x="Previous_Ratings",bins=20,kde=True,color="green")
```

[96]: <Axes: xlabel='Previous_Ratings', ylabel='Count'>



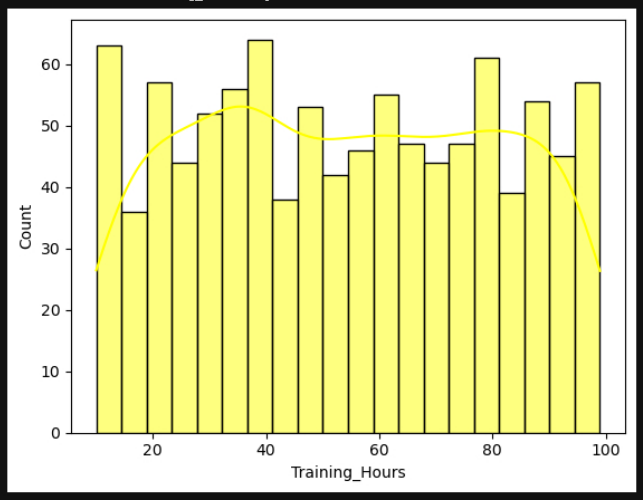
[11]:
```
Num_col(data,"Training_Hours")
```

```
Numerical Columns Analysis:
mean:54.253
```

```
median:54.0
mode:67
var:679.4244154154142
std:26.065770953789457
skew:0.021975281445215742
MIN:10
MAAX:99
Range:89
```

[98]:
```
sns.histplot(data=data,x="Training_Hours",bins=20,kde=True,color="yellow")
```

[98]:
```
<Axes: xlabel='Training_Hours', ylabel='Count'>
```

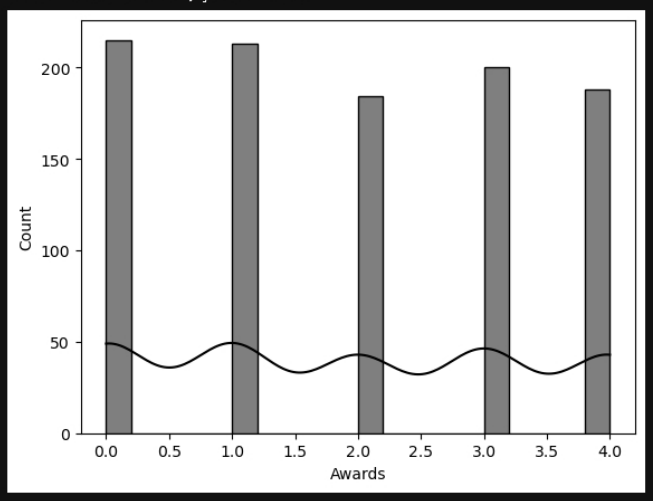


[12]:
```
Num_col(data,"Awards")
```

```
Numerical Columns Analysis:
mean:1.933
median:2.0
mode:0
var:2.0225335335334984
std:1.422158055046449
skew:0.06186876582583571
MIN:0
MAAX:4
Range:4
```

[100]:
```
sns.histplot(data=data,x="Awards",bins=20,kde=True,color="black")
```

[100]:
```
<Axes: xlabel='Awards', ylabel='Count'>
```

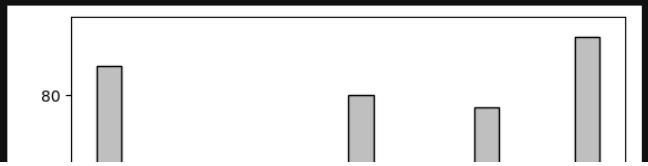


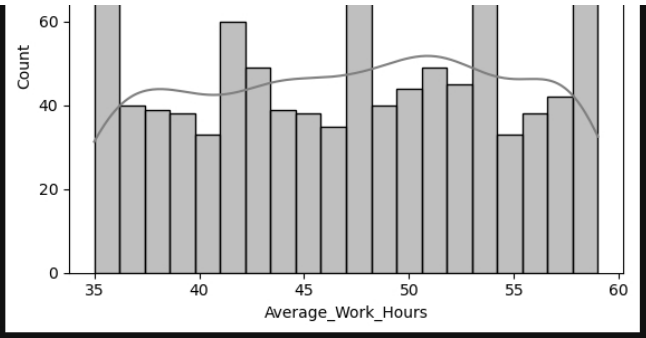
[13]:
```
Num_col(data,"Average_Work_Hours")
```

```
Numerical Columns Analysis:
mean:47.213
median:47.0
mode:35
var:53.941572572572625
std:7.344492669515889
skew:-0.0672501713964894 8
MIN:35
MAAX:59
Range:24
```

[102]:
```
sns.histplot(data=data,x="Average_Work_Hours",bins=20,kde=True,color="gray")
```

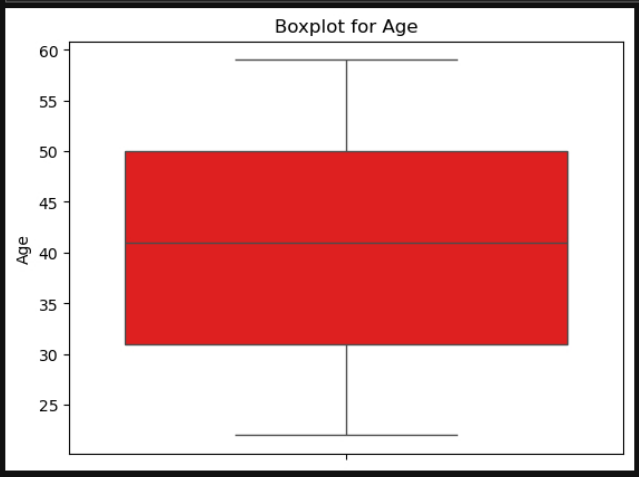
[102]:
```
<Axes: xlabel='Average_Work_Hours', ylabel='Count'>
```





[14]:
```python
# checking and handling of outliers

def Checking_and_Handling_Of_Outliers(data, col):
    sns.boxplot(data[col], color = "Red")
    plt.title(f"Boxplot for {col}")
    plt.show()

    q1 = data[col].quantile(0.25)
    q3 = data[col].quantile(0.75)

    iqr = q3 - q1

    LowerTail = q1 - 1.5*iqr
    UpperTail = q3 + 1.5*iqr

    print(f"25% Quantile q1 = {q1}\n75% Quantile q3 = {q3}\nIQR = {iqr}\n")
    print("-"*80)
    print(f"Lower Tail = {LowerTail}\nUpper Tail = {UpperTail}")
    print("-"*80)

    # Checking for Outliers
    Outliers = data[(data[col] < LowerTail) | (data[col] > UpperTail)]
    print("\nOutliers :\n",Outliers)
    print("-"*80)

    #HAndling of Outliers :
    data.loc[data[col] < LowerTail, col] = LowerTail # all outliers less than lowertail, assigned by lowertail value
    data.loc[data[col] > UpperTail, col] = UpperTail # all outliers greater than uppertail, assigned by uppertail value

    print("After handling of Outliers data:\n")
    print(data.head())
```

[15]:
```python
Checking_and_Handling_Of_Outliers(data, "Age")
```

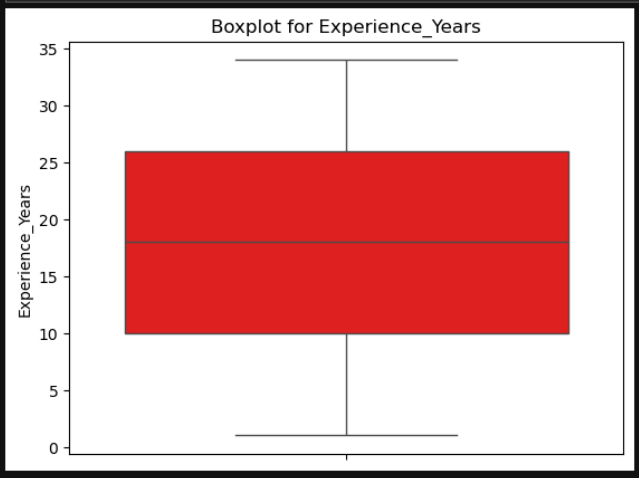



```
25% Quantile q1 = 31.0
75% Quantile q3 = 50.0
IQR = 19.0

--------------------------------------------------------------------------------
Lower Tail = 2.5
Upper Tail = 78.5
--------------------------------------------------------------------------------

Outliers :
 Empty DataFrame
Columns: [Employee_ID, Department, Education, Gender, Age, Experience_Years, Previous_Ratings, Training_Hours, Awards, Average_Work_Hours, Promoted]
Index: []
--------------------------------------------------------------------------------
After handling of Outliers data:

  Employee_ID  Department Education  Gender   Age  Experience_Years  \
0       E0001     Finance  Bachelor  Female  55.0                 3
1       E0002  Operations  Bachelor  Female  30.0                 8
2       E0003          HR  Bachelor    Male  45.0                23
3       E0004  Operations  Bachelor  Female  29.0                11
4       E0005  Operations  Bachelor    Male  28.0                 8

   Previous_Ratings  Training_Hours  Awards  Average_Work_Hours Promoted
0              2.26              21       4                  37       No
1              1.90              97       1                  44       No
2              1.28              78       2                  51       No
```

```
3             4.31             93       0                 41       No
4             2.02             48       1                 49       No
```

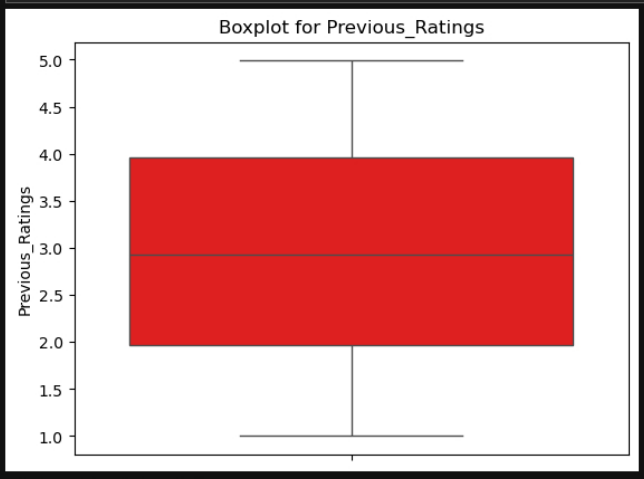
```
C:\Users\deshm\AppData\Local\Temp\ipykernel_33896\2491079757.py:27: FutureWarning: Setting an item of incompatible dtype is deprecated and will raise an error
in a future version of pandas. Value '2.5' has dtype incompatible with int64, please explicitly cast to a compatible dtype first.
  data.loc[data[col] < LowerTail, col] = LowerTail # all outliers less than lowertail, assigned by lowertail value
```

[16]:
```
Checking_and_Handling_Of_Outliers(data, "Experience_Years")
```




```
25% Quantile q1 = 10.0
75% Quantile q3 = 26.0
IQR = 16.0

--------------------------------------------------------------------------------
Lower Tail = -14.0
Upper Tail = 50.0
--------------------------------------------------------------------------------

Outliers :
 Empty DataFrame
Columns: [Employee_ID, Department, Education, Gender, Age, Experience_Years, Previous_Ratings, Training_Hours, Awards, Average_Work_Hours, Promoted]
Index: []
--------------------------------------------------------------------------------
After handling of Outliers data:

  Employee_ID  Department Education  Gender   Age  Experience_Years  \
0       E0001     Finance  Bachelor  Female  55.0                 3
1       E0002  Operations  Bachelor  Female  30.0                 8
2       E0003          HR  Bachelor    Male  45.0                23
3       E0004  Operations  Bachelor  Female  29.0                11
4       E0005  Operations  Bachelor    Male  28.0                 8

   Previous_Ratings  Training_Hours  Awards  Average_Work_Hours Promoted
0              2.26              21       4                  37       No
1              1.90              97       1                  44       No
2              1.28              78       2                  51       No
3              4.31              93       0                  41       No
4              2.02              48       1                  49       No
```

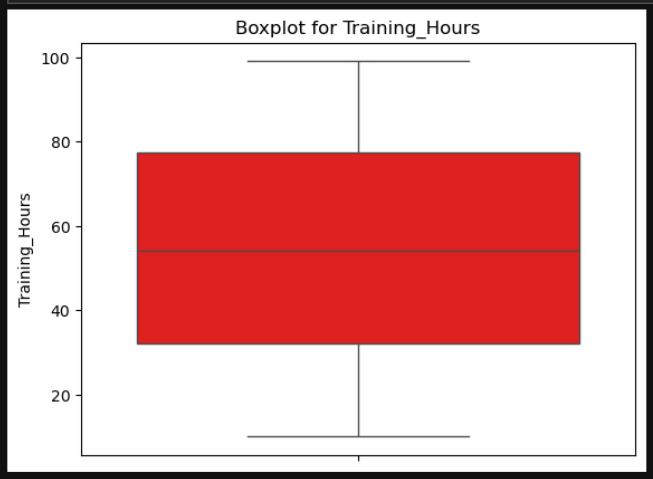
[17]:
```
Checking_and_Handling_Of_Outliers(data, "Previous_Ratings")
```




```
25% Quantile q1 = 1.9675
75% Quantile q3 = 3.96
IQR = 1.9925

--------------------------------------------------------------------------------
Lower Tail = -1.02125
Upper Tail = 6.94875
--------------------------------------------------------------------------------

Outliers :
 Empty DataFrame
Columns: [Employee_ID, Department, Education, Gender, Age, Experience_Years, Previous_Ratings, Training_Hours, Awards, Average_Work_Hours, Promoted]
Index: []
--------------------------------------------------------------------------------
After handling of Outliers data:

  Employee_ID  Department Education  Gender   Age  Experience_Years  \
```

```
0       E0001     Finance  Bachelor  Female  55.0               3
1       E0002  Operations  Bachelor  Female  30.0               8
2       E0003          HR  Bachelor    Male  45.0              23
3       E0004  Operations  Bachelor  Female  29.0              11
4       E0005  Operations  Bachelor    Male  28.0               8

   Previous_Ratings  Training_Hours  Awards  Average_Work_Hours Promoted
0              2.26              21       4                  37       No
1              1.90              97       1                  44       No
2              1.28              78       2                  51       No
3              4.31              93       0                  41       No
4              2.02              48       1                  49       No
```

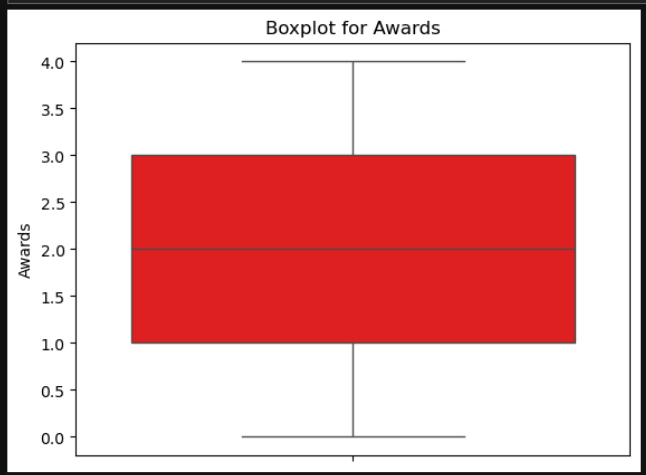
[18]:
```
Checking_and_Handling_Of_Outliers(data, "Training_Hours")
```




```
25% Quantile q1 = 32.0
75% Quantile q3 = 77.25
IQR = 45.25

--------------------------------------------------------------------------------
Lower Tail = -35.875
Upper Tail = 145.125
--------------------------------------------------------------------------------

Outliers :
 Empty DataFrame
Columns: [Employee_ID, Department, Education, Gender, Age, Experience_Years, Previous_Ratings, Training_Hours, Awards, Average_Work_Hours, Promoted]
Index: []
--------------------------------------------------------------------------------
After handling of Outliers data:

  Employee_ID  Department Education  Gender   Age  Experience_Years  \
0       E0001     Finance  Bachelor  Female  55.0               3
1       E0002  Operations  Bachelor  Female  30.0               8
2       E0003          HR  Bachelor    Male  45.0              23
3       E0004  Operations  Bachelor  Female  29.0              11
4       E0005  Operations  Bachelor    Male  28.0               8

   Previous_Ratings  Training_Hours  Awards  Average_Work_Hours Promoted
0              2.26            21.0       4                  37       No
1              1.90            97.0       1                  44       No
2              1.28            78.0       2                  51       No
3              4.31            93.0       0                  41       No
4              2.02            48.0       1                  49       No
```

```
C:\Users\deshm\AppData\Local\Temp\ipykernel_33896\2491079757.py:27: FutureWarning: Setting an item of incompatible dtype is deprecated and will raise an error in a future version of pandas. Value '-35.875' has dtype incompatible with int64, please explicitly cast to a compatible dtype first.
  data.loc[data[col] < LowerTail, col] = LowerTail # all outliers less than lowertail, assigned by lowertail value
```

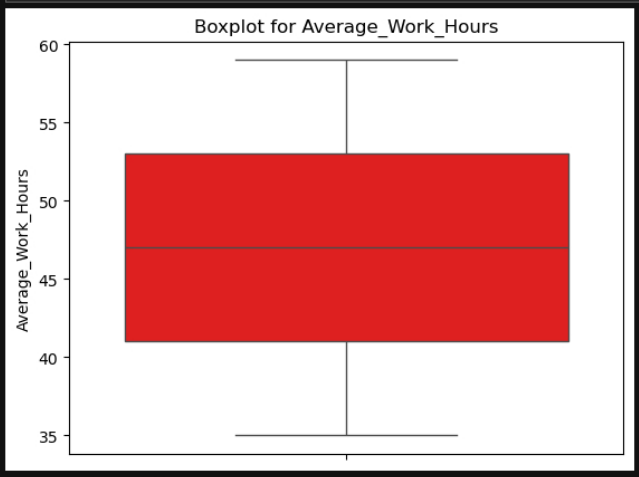
[19]:
```
Checking_and_Handling_Of_Outliers(data, "Awards")
```




```
25% Quantile q1 = 1.0
75% Quantile q3 = 3.0
IQR = 2.0

--------------------------------------------------------------------------------
Lower Tail = -2.0
Upper Tail = 6.0
```

```
--------------------------------------------------------------------------------

Outliers :
 Empty DataFrame
Columns: [Employee_ID, Department, Education, Gender, Age, Experience_Years, Previous_Ratings, Training_Hours, Awards, Average_Work_Hours, Promoted]
Index: []
--------------------------------------------------------------------------------
After handling of Outliers data:

  Employee_ID  Department Education  Gender   Age  Experience_Years  \
0       E0001     Finance  Bachelor  Female  55.0                 3
1       E0002  Operations  Bachelor  Female  30.0                 8
2       E0003          HR  Bachelor    Male  45.0                23
3       E0004  Operations  Bachelor  Female  29.0                11
4       E0005  Operations  Bachelor    Male  28.0                 8

   Previous_Ratings  Training_Hours  Awards  Average_Work_Hours Promoted
0              2.26            21.0       4                  37       No
1              1.90            97.0       1                  44       No
2              1.28            78.0       2                  51       No
3              4.31            93.0       0                  41       No
4              2.02            48.0       1                  49       No
```

[20]:
```
Checking_and_Handling_Of_Outliers(data, "Average_Work_Hours")
```




```
25% Quantile q1 = 41.0
75% Quantile q3 = 53.0
IQR = 12.0

--------------------------------------------------------------------------------
Lower Tail = 23.0
Upper Tail = 71.0
--------------------------------------------------------------------------------

Outliers :
 Empty DataFrame
Columns: [Employee_ID, Department, Education, Gender, Age, Experience_Years, Previous_Ratings, Training_Hours, Awards, Average_Work_Hours, Promoted]
Index: []
--------------------------------------------------------------------------------
After handling of Outliers data:

  Employee_ID  Department Education  Gender   Age  Experience_Years  \
0       E0001     Finance  Bachelor  Female  55.0                 3
1       E0002  Operations  Bachelor  Female  30.0                 8
2       E0003          HR  Bachelor    Male  45.0                23
3       E0004  Operations  Bachelor  Female  29.0                11
4       E0005  Operations  Bachelor    Male  28.0                 8

   Previous_Ratings  Training_Hours  Awards  Average_Work_Hours Promoted
0              2.26            21.0       4                  37       No
1              1.90            97.0       1                  44       No
2              1.28            78.0       2                  51       No
3              4.31            93.0       0                  41       No
4              2.02            48.0       1                  49       No
```

[21]:
```
data.isna().sum()
```

[21]:
```
Employee_ID          0
Department           0
Education            0
Gender               0
Age                  0
Experience_Years     0
Previous_Ratings     0
Training_Hours       0
Awards               0
Average_Work_Hours   0
Promoted             0
dtype: int64
```

[22]:
```
data.dtypes
```

[22]:
```
Employee_ID           object
Department            object
Education             object
Gender                object
Age                  float64
Experience_Years       int64
Previous_Ratings     float64
Training_Hours       float64
Awards                 int64
```

```
Average_Work_Hours      int64
Promoted               object
dtype: object
```

[23]:
```
# Analysis of categorical Columns
def Cat_col(data, col):
    unique_values = data[col].unique()  # Fixed typo: renamed to unique_values
    value_counts = data[col].value_counts()
    mode = data[col].mode()[0]  # Fixed mode access by adding parentheses

    # Enhanced string formatting for clarity
    print(f"Unique Values in '{col}':\n{unique_values}\n")
    print(f"Value Counts in '{col}':\n{value_counts}\n")
    print(f"Mode of '{col}': {mode}\n")


    data[col].value_counts().plot.pie(autopct="%1.1f%%")
    plt.title(f"data-{col} (pie chart)")
    plt.show
```

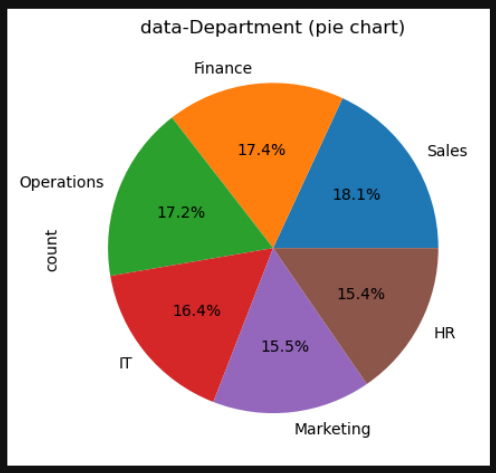
[24]:
```
data.dtypes
```

[24]:
```
Employee_ID            object
Department             object
Education              object
Gender                 object
Age                   float64
Experience_Years        int64
Previous_Ratings      float64
Training_Hours        float64
Awards                  int64
Average_Work_Hours      int64
Promoted               object
dtype: object
```

[25]:
```
data.drop(columns=["Employee_ID"],inplace=True)
```

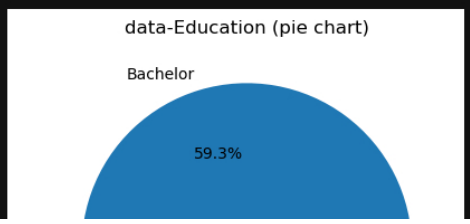
[26]:
```
Cat_col(data, "Department")
```

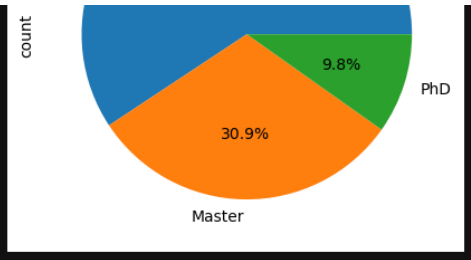
```
Unique Values in 'Department':
['Finance' 'Operations' 'HR' 'IT' 'Marketing' 'Sales']

Value Counts in 'Department':
Department
Sales         181
Finance       174
Operations    172
IT            164
Marketing     155
HR            154
Name: count, dtype: int64

Mode of 'Department': Sales
```



[27]:
```
Cat_col(data, "Education")
```

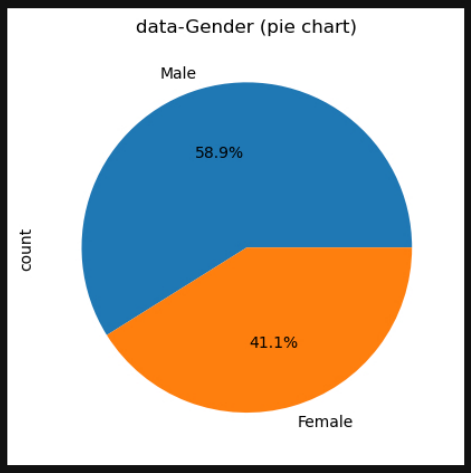
```
Unique Values in 'Education':
['Bachelor' 'Master' 'PhD']

Value Counts in 'Education':
Education
Bachelor    593
Master      309
PhD          98
Name: count, dtype: int64

Mode of 'Education': Bachelor
```





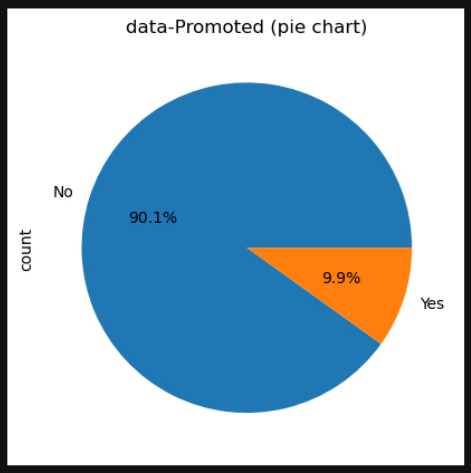
[28]:
```
Cat_col(data, "Gender")
```

```
Unique Values in 'Gender':
['Female' 'Male']

Value Counts in 'Gender':
Gender
Male      589
Female    411
Name: count, dtype: int64

Mode of 'Gender': Male
```



[29]:
```
Cat_col(data, "Promoted")
```

```
Unique Values in 'Promoted':
['No' 'Yes']

Value Counts in 'Promoted':
Promoted
No     901
Yes     99
Name: count, dtype: int64

Mode of 'Promoted': No
```

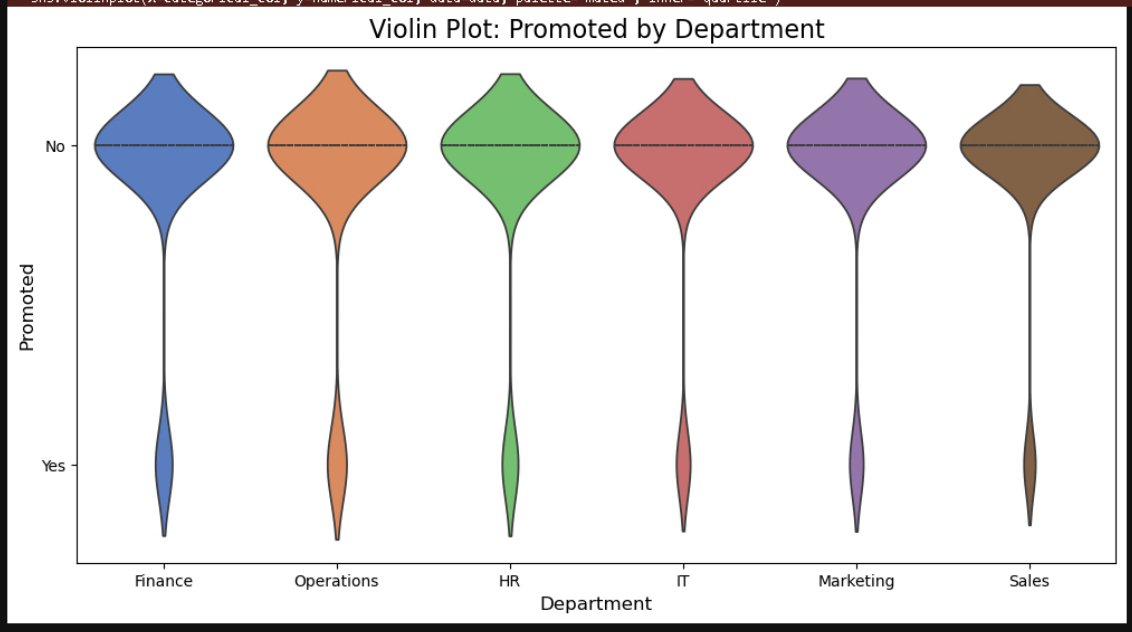


[30]:
```
# Bivariate analysis Column Analysis
def bivariate_violin_plot(data, categorical_col, numerical_col):
    plt.figure(figsize=(12, 6))
    sns.violinplot(x=categorical_col, y=numerical_col, data=data, palette="muted", inner="quartile")
    plt.title(f'Violin Plot: {numerical_col} by {categorical_col}', fontsize=16)
    plt.xlabel(categorical_col, fontsize=12)
    plt.ylabel(numerical_col, fontsize=12)
    plt.show()
```

[31]:
```
bivariate_violin_plot(data, "Department", "Promoted")
```

```
C:\Users\deshm\AppData\Local\Temp\ipykernel_33896\868759973.py:4: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same e
```

```
ffect.

  sns.violinplot(x=categorical_col, y=numerical_col, data=data, palette="muted", inner="quartile")
```



[32]:
```
data.dtypes
```

[32]:
```
Department            object
Education             object
Gender                object
Age                  float64
Experience_Years       int64
Previous_Ratings     float64
Training_Hours       float64
Awards                 int64
Average_Work_Hours     int64
Promoted              object
dtype: object
```

[33]:
```
#Encoding of categorical columns
#Bathroom
data["Education"].unique()
```

[33]:
```
array(['Bachelor', 'Master', 'PhD'], dtype=object)
```

[34]:
```
data["Education_encoded"]=data["Education"].replace({'Bachelor':0, 'Master':1, 'PhD':3})
```

```
C:\Users\deshm\AppData\Local\Temp\ipykernel_33896\4236576312.py:1: FutureWarning: Downcasting behavior in `replace` is deprecated and will be removed in a fut
ure version. To retain the old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to the future behavior, set `pd.set_option('future.no_s
ilent_downcasting', True)`
  data["Education_encoded"]=data["Education"].replace({'Bachelor':0, 'Master':1, 'PhD':3})
```

[35]:
```
#Gender
data["Gender"].unique()
```

[35]:
```
array(['Female', 'Male'], dtype=object)
```

[36]:
```
data["Gender_encoding"]=data["Gender"].replace({'Female':0, 'Male':1})
```

```
C:\Users\deshm\AppData\Local\Temp\ipykernel_33896\242963522.py:1: FutureWarning: Downcasting behavior in `replace` is deprecated and will be removed in a futu
re version. To retain the old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to the future behavior, set `pd.set_option('future.no_si
lent_downcasting', True)`
  data["Gender_encoding"]=data["Gender"].replace({'Female':0, 'Male':1})
```

[37]:
```
#Department
data["Department"].unique()
```

[37]:
```
array(['Finance', 'Operations', 'HR', 'IT', 'Marketing', 'Sales'],
      dtype=object)
```

[38]:
```
data["Departmen_encoded"]=data["Department"].replace({'Finance':0, 'Operations':1, 'HR':2, 'IT':3, 'Marketing':4, 'Sales':5})
```

```
C:\Users\deshm\AppData\Local\Temp\ipykernel_33896\873350904.py:1: FutureWarning: Downcasting behavior in `replace` is deprecated and will be removed in a futu
re version. To retain the old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to the future behavior, set `pd.set_option('future.no_si
lent_downcasting', True)`
  data["Departmen_encoded"]=data["Department"].replace({'Finance':0, 'Operations':1, 'HR':2, 'IT':3, 'Marketing':4, 'Sales':5})
```

[39]:
```
data.drop(columns=["Education"],inplace=True)
data.drop(columns=["Gender"],inplace=True)
data.drop(columns=["Department"],inplace=True)
```

[40]:
```
data
```

[40]:

	Age	Experience_Years	Previous_Ratings	Training_Hours	Awards	Average_Work_Hours	Promoted	Education_encoded	Gender_encoding	Departmen_encoded
0	55.0	3	2.26	21.0	4	37	No	0	0	0
1	30.0	8	1.90	97.0	1	44	No	0	0	1
2	45.0	23	1.28	78.0	2	51	No	0	1	2
3	29.0	11	4.31	93.0	0	41	No	0	0	1
4	28.0	8	2.02	48.0	1	49	No	0	1	1

...	...	...	...	...	...	...	...	...	...	...
995	31.0	23	4.46	79.0	2	47	Yes	0	0	4
996	53.0	15	2.78	97.0	3	50	No	1	1	1
997	36.0	33	1.55	15.0	1	43	No	0	0	5
998	58.0	21	4.45	36.0	0	36	No	3	1	5
999	41.0	23	4.26	91.0	1	57	Yes	0	0	1

1000 rows × 10 columns

[41]:
```
# Dependent Column (target)
data=data.loc[:,data.columns.difference(["Promoted"]).tolist() + ["Promoted"]]
```

[42]:
```
data
```

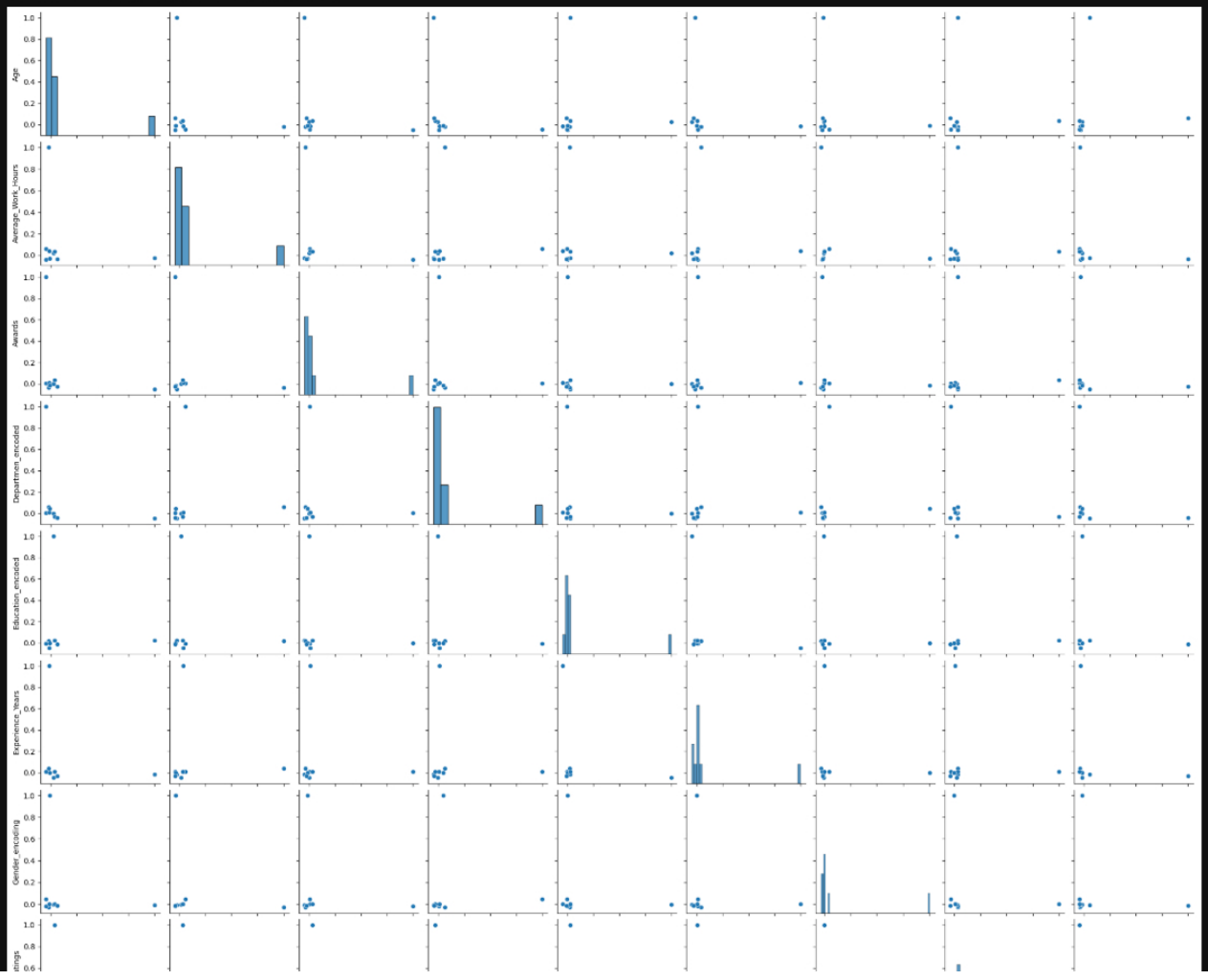
[42]:

	Age	Average_Work_Hours	Awards	Departmen_encoded	Education_encoded	Experience_Years	Gender_encoding	Previous_Ratings	Training_Hours	Promoted
0	55.0	37	4	0	0	3	0	2.26	21.0	No
1	30.0	44	1	1	0	8	0	1.90	97.0	No
2	45.0	51	2	2	0	23	1	1.28	78.0	No
3	29.0	41	0	1	0	11	0	4.31	93.0	No
4	28.0	49	1	1	0	8	1	2.02	48.0	No
...	...	...	...	...	...	...	...	...	...	...
995	31.0	47	2	4	0	23	0	4.46	79.0	Yes
996	53.0	50	3	1	1	15	1	2.78	97.0	No
997	36.0	43	1	5	0	33	0	1.55	15.0	No
998	58.0	36	0	5	3	21	1	4.45	36.0	No
999	41.0	57	1	1	0	23	0	4.26	91.0	Yes

1000 rows × 10 columns

[43]:
```
corr=data.iloc[:,0:9].corr()
sns.pairplot(corr)
```

[43]:
```
<seaborn.axisgrid.PairGrid at 0x2162e7dfe00>
```



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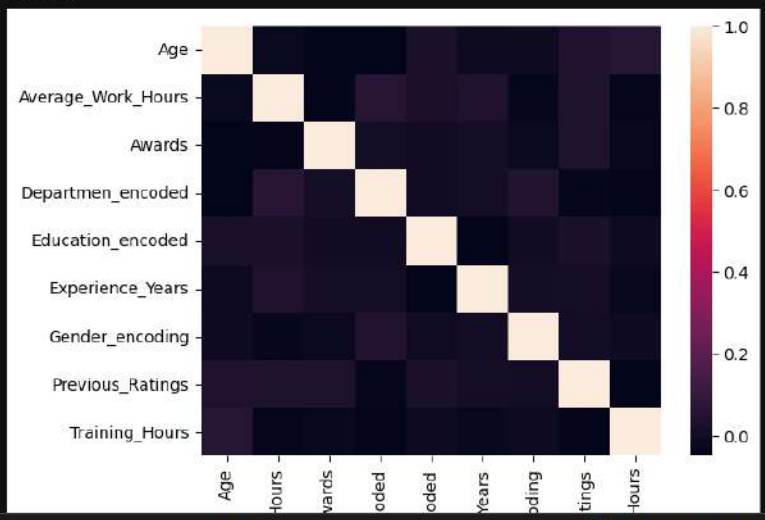
Markdown JupyterLab Python 3 (ipykernel)

[44]:
```
sns.heatmap(corr)
```

[44]: <Axes: >



86°F Partly sunny

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ENG IN 16:46 15-01-2025

[45]:
```
# Train-test split

X = data.drop(columns=['Promoted'])  # Replace 'target_column' with your target variable
Y = data['Promoted']

xtrain, xtest, ytrain, ytest = train_test_split(X, Y, test_size=0.2, random_state=42)

print(f'Shape of X_train: {xtrain.shape}')
print(f'Shape of X_test: {xtest.shape}')
print(f'Shape of y_train: {ytrain.shape}')
print(f'Shape of y_test: {ytest.shape}')
```

```
Shape of X_train: (800, 9)
Shape of X_test: (200, 9)
Shape of y_train: (800,)
Shape of y_test: (200,)
```