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Project- "Employee Salary Prediction(ML)

⬇️

Import Libraries:

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn import linear_model
```

Import & Read File:

In [2]:
```
data=pd.read_csv('Dataset09-Employee-salary-prediction.csv')
```

In [3]:
```
data.index
```

Out[3]:
```
RangeIndex(start=0, stop=375, step=1)
```

In [4]:
```
data.columns
```

Out[4]:
```
Index(['Age', 'Gender', 'Education Level', 'Job Title', 'Years of Experience',
       'Salary'],
      dtype='object')
```

In [5]:
```
print(data.shape)
```

```
(375, 6)
```

In [6]:
```
data.head(4)
```

Out[6]:

	Age	Gender	Education Level	Job Title	Years of Experience	Salary
0	32.0	Male	Bachelor's	Software Engineer	5.0	90000.0
1	28.0	Female	Master's	Data Analyst	3.0	65000.0
2	45.0	Male	PhD	Senior Manager	15.0	150000.0
3	36.0	Female	Bachelor's	Sales Associate	7.0	60000.0

In [7]:
```
data.tail(3)
```

Out[7]:

	Age	Gender	Education Level	Job Title	Years of Experience	Salary
372	29.0	Female	Bachelor's	Junior Project Manager	2.0	40000.0
373	34.0	Male	Bachelor's	Senior Operations Coordinator	7.0	90000.0
374	44.0	Female	PhD	Senior Business Analyst	15.0	150000.0

Data Modifying & Cleaning:

In [8]:
```
data.columns=['Age','Gender','Degree','Job Title','Experience Years','Salary']
```

In [9]:
```
data.dtypes
```

Out[9]:
```
Age                 float64
Gender               object
Degree               object
Job Title            object
Experience Years    float64
Salary              float64
dtype: object
```

In [10]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 375 entries, 0 to 374
Data columns (total 6 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   Age               373 non-null    float64
 1   Gender            373 non-null    object 
 2   Degree            373 non-null    object 
 3   Job Title         373 non-null    object 
 4   Experience Years  373 non-null    float64
 5   Salary            373 non-null    float64
dtypes: float64(3), object(3)
memory usage: 17.7+ KB
```

In [11]:
```
data.duplicated().value_counts()  # How many duplicates ?
```

Out[11]:
```
False    325
True      50
Name: count, dtype: int64
```

In [12]:
```
data.drop_duplicates(keep='first',inplace=True)
```

In [13]:
```
data.duplicated().value_counts()
```

Out[13]:
```
False    325
Name: count, dtype: int64
```

In [14]:
```
data.isnull().sum()    # Check Null Values
```

Out[14]:
```
Age                1
Gender             1
Degree             1
Job Title          1
Experience Years   1
Salary             1
dtype: int64
```

In [15]:
```
data.dropna(how='all',inplace=True)    # Remove Null Values
```

In [16]:
```
data.isnull().sum()
```

Out[16]:
```
Age                0
Gender             0
Degree             0
Job Title          0
Experience Years   0
Salary             0
dtype: int64
```

In [17]:
```
data.shape
```

Out[17]:
```
(324, 6)
```

In [18]:
```
data.describe()   #Descriptive statistics
```

Out[18]:

	Age	Experience Years	Salary
count	324.000000	324.000000	324.000000
mean	37.382716	10.058642	99985.648148
std	7.185844	6.650470	48652.271440
min	23.000000	0.000000	350.000000
25%	31.000000	4.000000	55000.000000
50%	36.500000	9.000000	95000.000000
75%	44.000000	16.000000	140000.000000
max	53.000000	25.000000	250000.000000

In [19]:
```
data.describe(include=object)
```

Out[19]:

	Gender	Degree	Job Title
count	324	324	324
unique	2	3	174
top	Male	Bachelor's	Director of Operations
freq	170	191	9

Find Relations & Visualizations:

In [20]:
```
data.head(3)
```

Out[20]:

	Age	Gender	Degree	Job Title	Experience Years	Salary
0	32.0	Male	Bachelor's	Software Engineer	5.0	90000.0
1	28.0	Female	Master's	Data Analyst	3.0	65000.0
2	45.0	Male	PhD	Senior Manager	15.0	150000.0

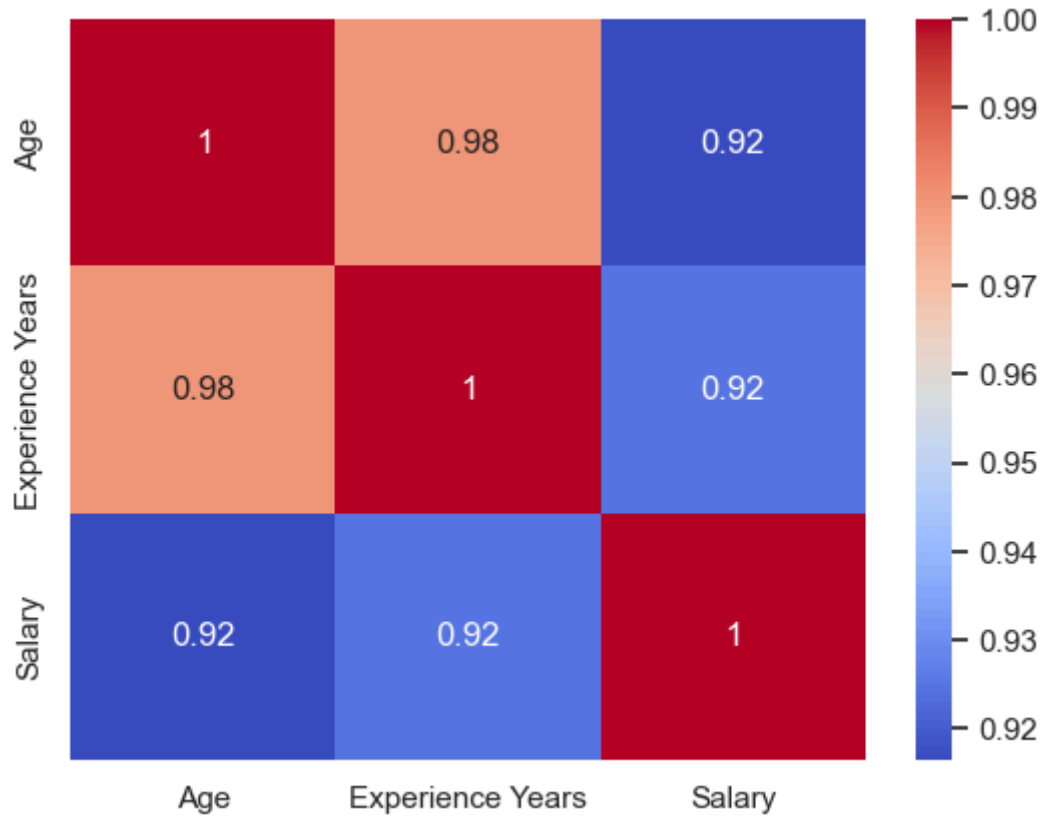
In [21]:
```
data.corr(numeric_only=True)
```

Out[21]:

	Age	Experience Years	Salary
Age	1.000000	0.979192	0.916543
Experience Years	0.979192	1.000000	0.924455
Salary	0.916543	0.924455	1.000000

In [22]:
```
sns.set(style="darkgrid")
```

In [23]:
```
sns.heatmap(data.corr(numeric_only=True),cmap='coolwarm',annot=True);
```



In [24]:
```
data.head(3)
```

Out[24]:

	Age	Gender	Degree	Job Title	Experience Years	Salary
0	32.0	Male	Bachelor's	Software Engineer	5.0	90000.0
1	28.0	Female	Master's	Data Analyst	3.0	65000.0
2	45.0	Male	PhD	Senior Manager	15.0	150000.0

In [25]:
```
gr=data.groupby(['Degree'])['Degree'].count().reset_index(name='count').sort_values(by='count',ascending=False)
```

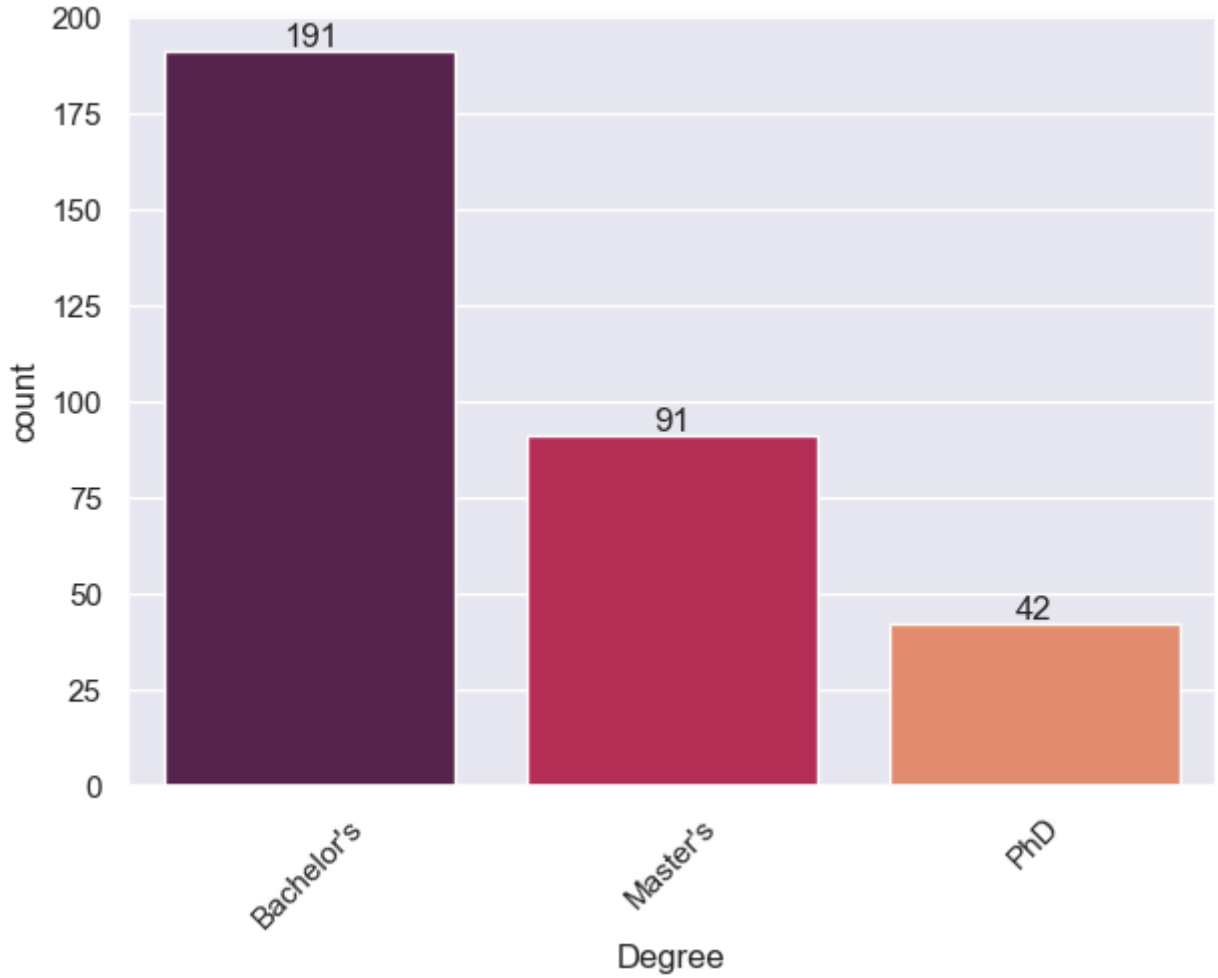
In [26]:
```
gr
```

Out[26]:

	Degree	count
0	Bachelor's	191
1	Master's	91
2	PhD	42

In [27]:

```
plt.figure(figsize=(7, 5))
ax=sns.countplot(x='Degree',data=data,palette='rocket')
for bars in ax.containers:
    ax.bar_label(bars)
plt.xticks(rotation=45);
```



In [28]:
```
gr=data.groupby(['Job Title'])['Job Title'].count().reset_index(name='count').sort_values(by='count',ascending=False)
```

In [29]:
```
gr.head()
```

Out[29]:

	Job Title	count
30	Director of Operations	9
29	Director of Marketing	8
134	Senior Marketing Manager	8
144	Senior Project Manager	7
110	Senior Business Analyst	6

In [30]:
```
gr.count()
```

Out[30]:
```
Job Title    174
count        174
dtype: int64
```

In [31]:
```
pd.unique(data['Job Title'])
```

Out[31]:
```
array(['Software Engineer', 'Data Analyst', 'Senior Manager',
       'Sales Associate', 'Director', 'Marketing Analyst',
       'Product Manager', 'Sales Manager', 'Marketing Coordinator',
       'Senior Scientist', 'Software Developer', 'HR Manager',
       'Financial Analyst', 'Project Manager', 'Customer Service Rep',
       'Operations Manager', 'Marketing Manager', 'Senior Engineer',
       'Data Entry Clerk', 'Sales Director', 'Business Analyst',
       'VP of Operations', 'IT Support', 'Recruiter', 'Financial Manager',
       'Social Media Specialist', 'Software Manager', 'Junior Developer',
       'Senior Consultant', 'Product Designer', 'CEO', 'Accountant',
       'Data Scientist', 'Marketing Specialist', 'Technical Writer',
       'HR Generalist', 'Project Engineer', 'Customer Success Rep',
       'Sales Executive', 'UX Designer', 'Operations Director',
       'Network Engineer', 'Administrative Assistant',
       'Strategy Consultant', 'Copywriter', 'Account Manager',
       'Director of Marketing', 'Help Desk Analyst',
       'Customer Service Manager', 'Business Intelligence Analyst',
       'Event Coordinator', 'VP of Finance', 'Graphic Designer',
       'UX Researcher', 'Social Media Manager', 'Director of Operations',
       'Senior Data Scientist', 'Junior Accountant',
       'Digital Marketing Manager', 'IT Manager',
       'Customer Service Representative', 'Business Development Manager',
       'Senior Financial Analyst', 'Web Developer', 'Research Director',
       'Technical Support Specialist', 'Creative Director',
       'Senior Software Engineer', 'Human Resources Director',
       'Content Marketing Manager', 'Technical Recruiter',
       'Sales Representative', 'Chief Technology Officer',
       'Junior Designer', 'Financial Advisor', 'Junior Account Manager',
       'Senior Project Manager', 'Principal Scientist',
       'Supply Chain Manager', 'Senior Marketing Manager',
       'Training Specialist', 'Research Scientist',
       'Junior Software Developer', 'Public Relations Manager',
       'Operations Analyst', 'Product Marketing Manager',
       'Senior HR Manager', 'Junior Web Developer',
       'Senior Project Coordinator', 'Chief Data Officer',
       'Digital Content Producer', 'IT Support Specialist',
       'Senior Marketing Analyst', 'Customer Success Manager',
       'Senior Graphic Designer', 'Software Project Manager',
       'Supply Chain Analyst', 'Senior Business Analyst',
       'Junior Marketing Analyst', 'Office Manager', 'Principal Engineer',
       'Junior HR Generalist', 'Senior Product Manager',
       'Junior Operations Analyst', 'Senior HR Generalist',
       'Sales Operations Manager', 'Senior Software Developer',
       'Junior Web Designer', 'Senior Training Specialist',
```

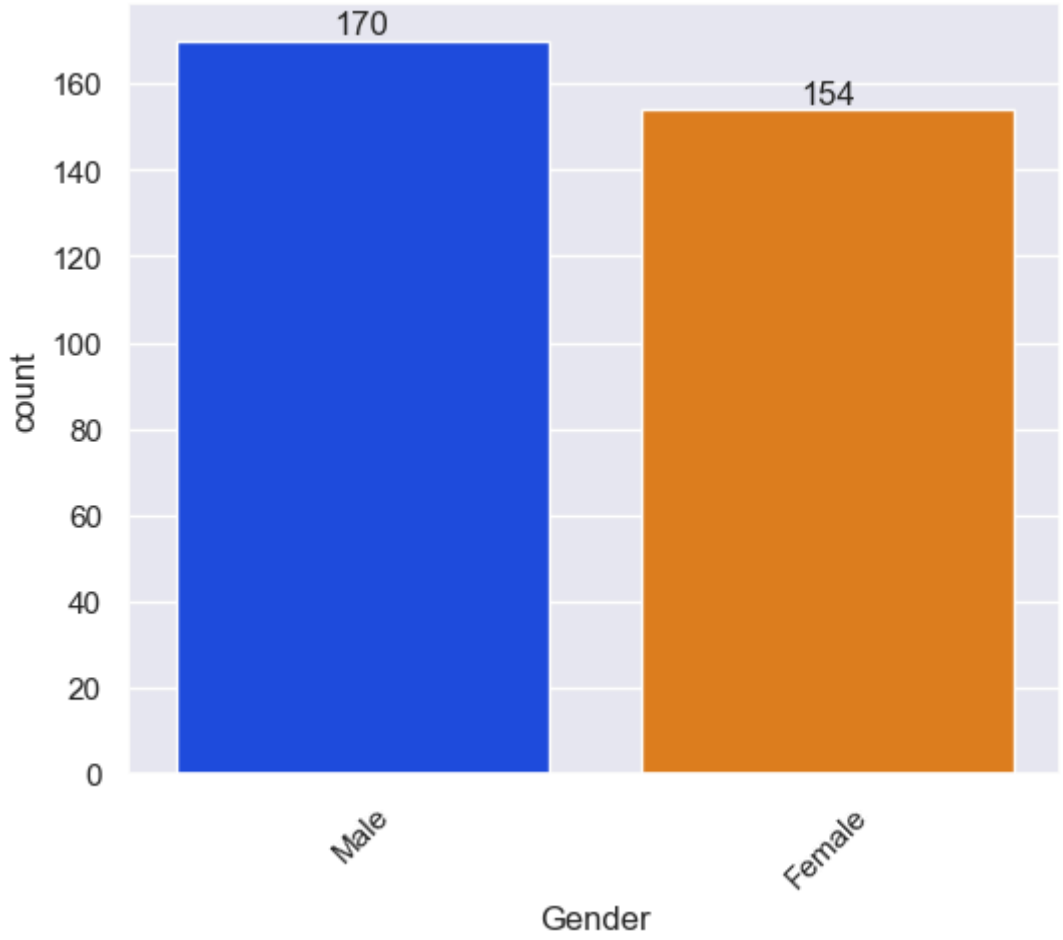
```
 'Senior Research Scientist', 'Junior Sales Representative',
 'Junior Marketing Manager', 'Junior Data Analyst',
 'Senior Product Marketing Manager', 'Junior Business Analyst',
 'Senior Sales Manager', 'Junior Marketing Specialist',
 'Junior Project Manager', 'Senior Accountant', 'Director of Sales',
 'Junior Recruiter', 'Senior Business Development Manager',
 'Senior Product Designer', 'Junior Customer Support Specialist',
 'Senior IT Support Specialist', 'Junior Financial Analyst',
 'Senior Operations Manager', 'Director of Human Resources',
 'Junior Software Engineer', 'Senior Sales Representative',
 'Director of Product Management', 'Junior Copywriter',
 'Senior Marketing Coordinator', 'Senior Human Resources Manager',
 'Junior Business Development Associate', 'Senior Account Manager',
 'Senior Researcher', 'Junior HR Coordinator',
 'Director of Finance', 'Junior Marketing Coordinator',
 'Junior Data Scientist', 'Senior Operations Analyst',
 'Senior Human Resources Coordinator', 'Senior UX Designer',
 'Junior Product Manager', 'Senior Marketing Specialist',
 'Senior IT Project Manager', 'Senior Quality Assurance Analyst',
 'Director of Sales and Marketing', 'Senior Account Executive',
 'Director of Business Development', 'Junior Social Media Manager',
 'Senior Human Resources Specialist', 'Senior Data Analyst',
 'Director of Human Capital', 'Junior Advertising Coordinator',
 'Junior UX Designer', 'Senior Marketing Director',
 'Senior IT Consultant', 'Senior Financial Advisor',
 'Junior Business Operations Analyst',
 'Junior Social Media Specialist',
 'Senior Product Development Manager', 'Junior Operations Manager',
 'Senior Software Architect', 'Junior Research Scientist',
 'Senior Financial Manager', 'Senior HR Specialist',
 'Senior Data Engineer', 'Junior Operations Coordinator',
 'Director of HR', 'Senior Operations Coordinator',
 'Junior Financial Advisor', 'Director of Engineering'],
dtype=object)
```

In [32]:
```
data['Gender'].value_counts()
```

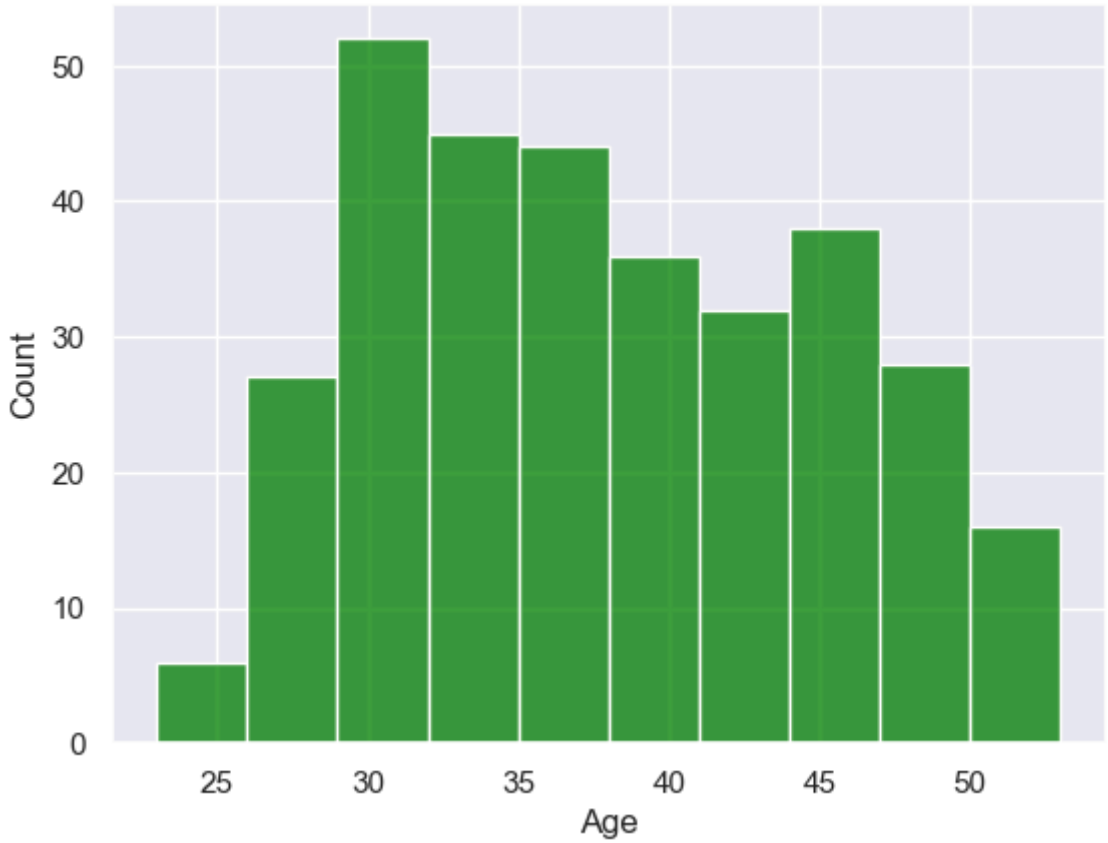
Out[32]:
```
Gender
Male      170
Female    154
Name: count, dtype: int64
```

In [33]:
```
plt.figure(figsize=(6, 5))
ax=sns.countplot(x='Gender',data=data,palette='bright')
```

```
for bars in ax.containers:
    ax.bar_label(bars)
plt.xticks(rotation=45);
```

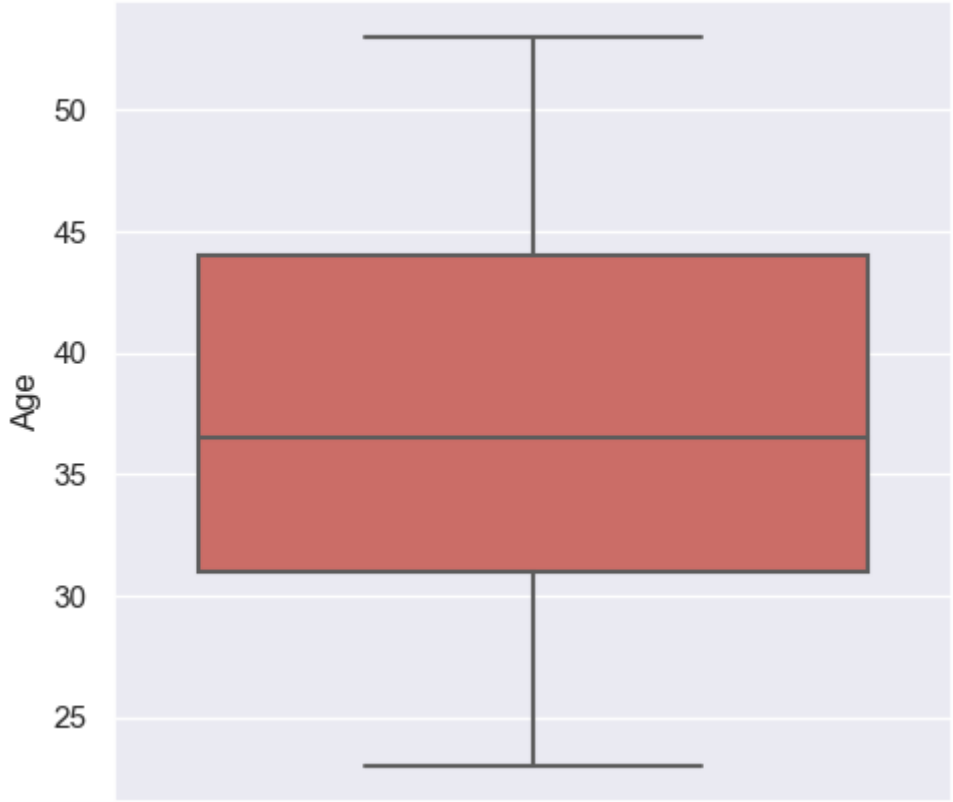


In [34]:
```
sns.histplot(data['Age'],color='green');
```

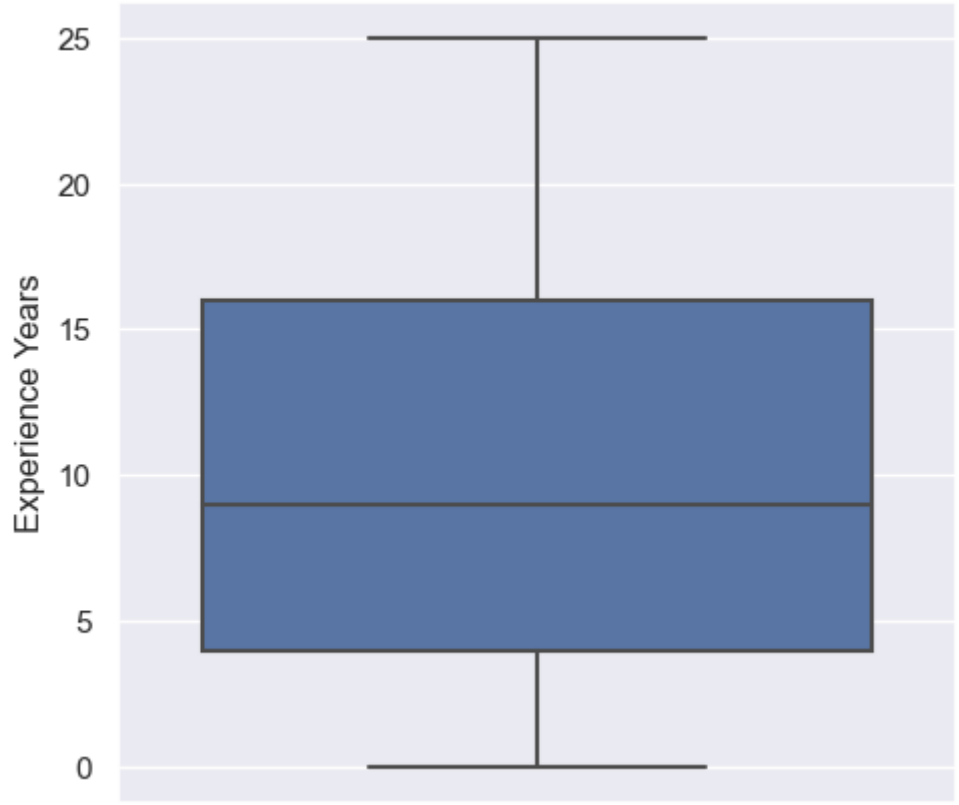


In [35]:
```
#inferno
```

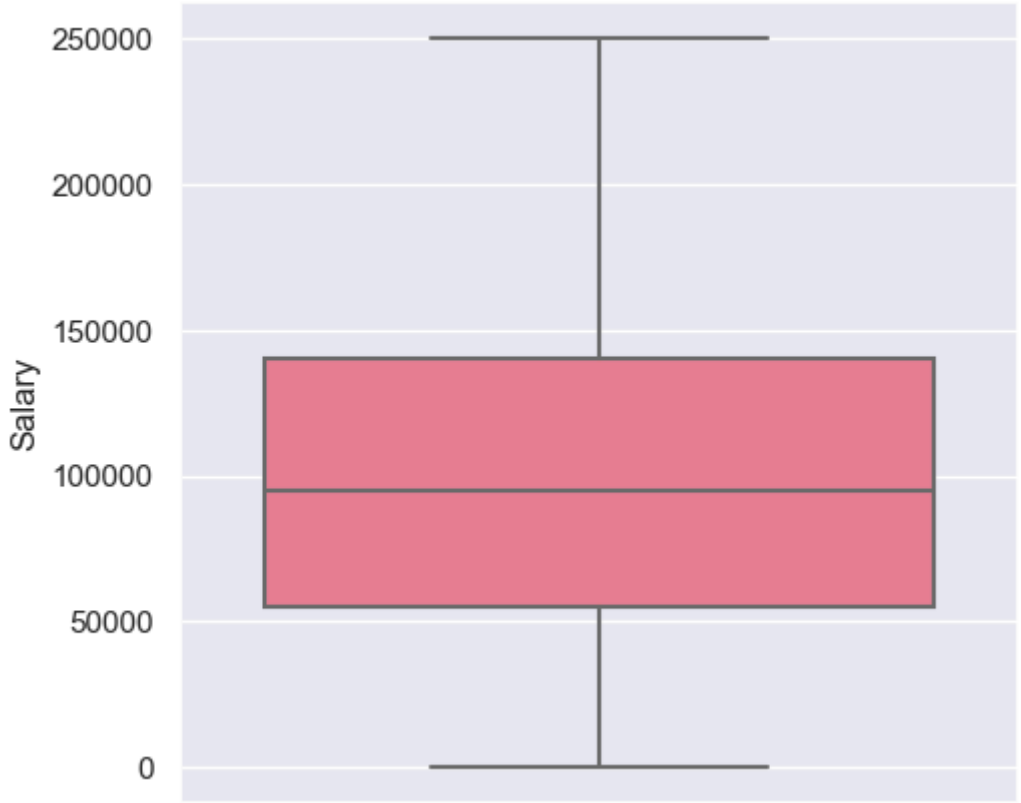
In [36]:
```
plt.figure(figsize=(5.4, 5.2))
sns.boxplot(y=data['Age'],palette='hls');
```



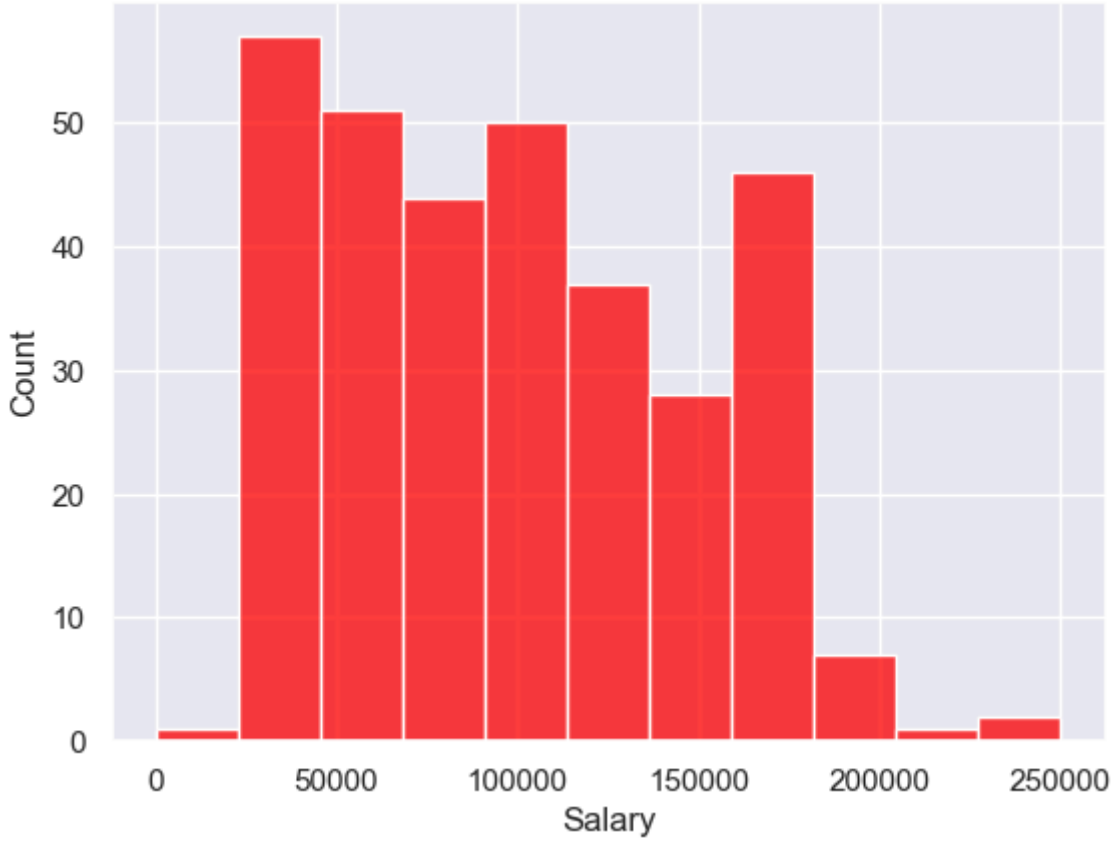
In [37]:
```
plt.figure(figsize=(5.4, 5.2))
sns.boxplot(y=data['Experience Years'],palette='deep');
```



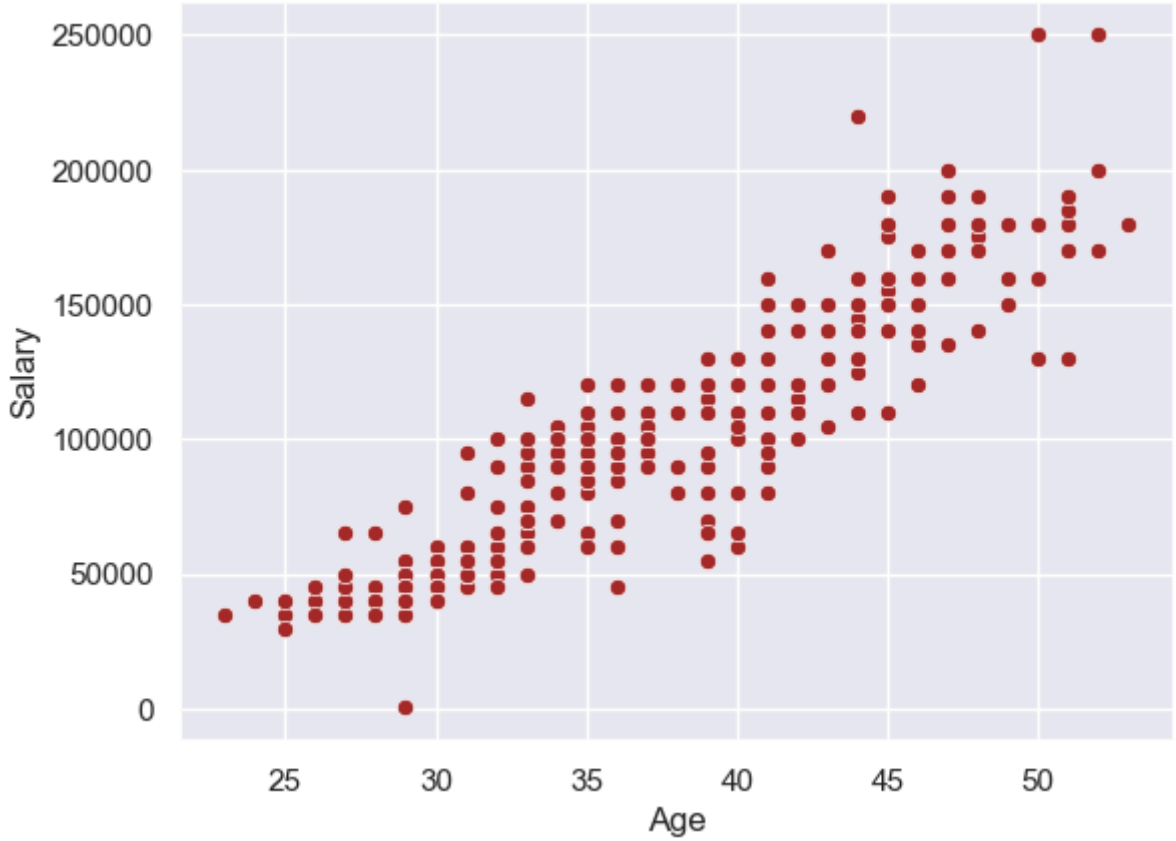
In [38]:
```
plt.figure(figsize=(5.4, 5.2))
sns.boxplot(y='Salary',data=data,palette='husl');
```



In [39]:
```
sns.histplot(x='Salary',data=data,color='red');
```



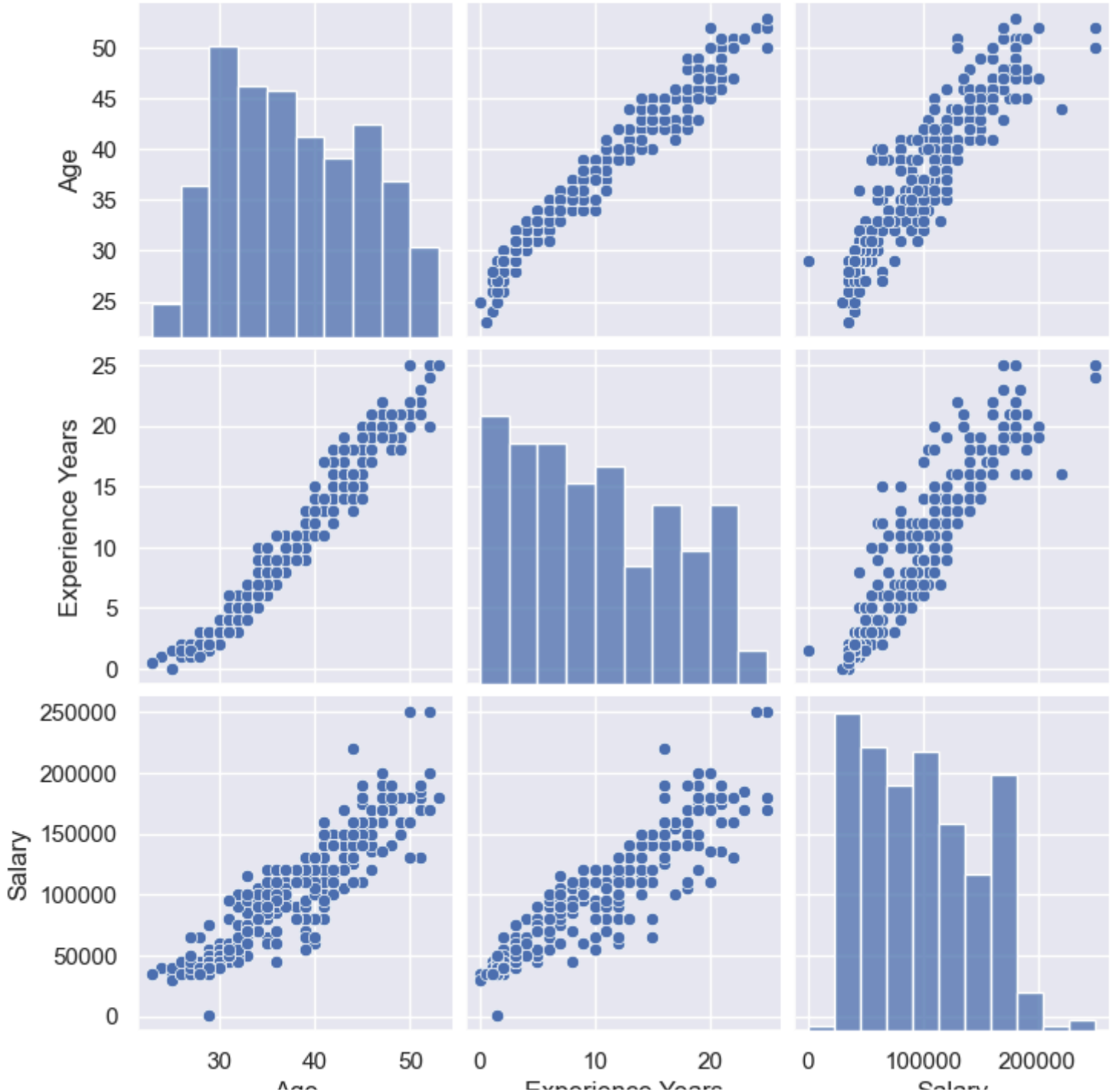
In [40]:
```
sns.scatterplot(x=data['Age'],y=data['Salary'],color='brown');
```



In [41]:
```
sns.pairplot(data=data)
```

```
C:\Users\19mri\anaconda4\Lib\site-packages\seaborn\axisgrid.py:118: UserWarning: The figure layout has changed to tight
  self._figure.tight_layout(*args, **kwargs)
```

Out[41]:
```
<seaborn.axisgrid.PairGrid at 0x1f79af30890>
```


Age
Experience Years
Salary
50
45
40
35
30
25
25
20
15
10
5
0
250000
200000
150000
100000
50000
0
30
40
50
0
10
20
0
100000
200000

Age Experience Years Salary

In [42]:
```
data.head(4)
```

Out[42]:

	Age	Gender	Degree	Job Title	Experience Years	Salary
0	32.0	Male	Bachelor's	Software Engineer	5.0	90000.0
1	28.0	Female	Master's	Data Analyst	3.0	65000.0
2	45.0	Male	PhD	Senior Manager	15.0	150000.0
3	36.0	Female	Bachelor's	Sales Associate	7.0	60000.0

Label Encoding:

In [43]:
```
from sklearn.preprocessing import LabelEncoder
```

In [44]:
```
label_Encoder=LabelEncoder()
```

In [45]:
```
label_Encoder
```

Out[45]:
```
LabelEncoder()
```

In [46]:
```
data['Gender_Encode']=label_Encoder.fit_transform(data['Gender'])
```

In [47]:
```
data['Degree_Encode']=label_Encoder.fit_transform(data['Degree'])
```

In [48]:
```
data['Job_Title_Encode']=label_Encoder.fit_transform(data['Job Title'])
```

In [49]:
```
data.head(4)
```

Out[49]:

	Age	Gender	Degree	Job Title	Experience Years	Salary	Gender_Encode	Degree_Encode	Job_Title_Encode
0	32.0	Male	Bachelor's	Software Engineer	5.0	90000.0	1	0	159
1	28.0	Female	Master's	Data Analyst	3.0	65000.0	0	1	17
2	45.0	Male	PhD	Senior Manager	15.0	150000.0	1	2	130
3	36.0	Female	Bachelor's	Sales Associate	7.0	60000.0	0	0	101

Feature Scalling:

In [50]:
```
from sklearn.preprocessing import StandardScaler
```

In [51]:
```
std_scaler=StandardScaler()
```

In [52]:
```
std_scaler
```

Out[52]:
```
StandardScaler
StandardScaler()
```

In [53]:
```
data['Age_Scaled']=std_scaler.fit_transform(data[['Age']])
```

In [54]:
```
data['Experience Years_Scaled']=std_scaler.fit_transform(data[['Experience Years']])
```

In [55]:
```
data.head(3)
```

Out[55]:

	Age	Gender	Degree	Job Title	Experience Years	Salary	Gender_Encode	Degree_Encode	Job_Title_Encode	Age_Scaled	Experience Years_Scaled
0	32.0	Male	Bachelor's	Software Engineer	5.0	90000.0	1	0	159	-0.750231	-0.761821
1	28.0	Female	Master's	Data Analyst	3.0	65000.0	0	1	17	-1.307742	-1.063017
2	45.0	Male	PhD	Senior Manager	15.0	150000.0	1	2	130	1.061680	0.744158

Independent & Dependent Features:

In [56]:
```
X=data.iloc[:,[6,7,8,9,10]]
y=data['Salary']
```

In [57]:
```
X.head()
```

Out[57]:

	Gender_Encode	Degree_Encode	Job_Title_Encode	Age_Scaled	Experience Years_Scaled
0	1	0	159	-0.750231	-0.761821
1	0	1	17	-1.307742	-1.063017
2	1	2	130	1.061680	0.744158
3	0	0	101	-0.192720	-0.460625
4	1	1	22	2.037324	1.497148

Split Data Into Train & Test:

In [58]:
```
from sklearn.model_selection import train_test_split
```

In [59]:
```
x_train,x_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=42)
```

In [60]:
```
x_train.shape,y_train.shape  # 80% data
```

Out[60]:
```
((259, 5), (259,))
```

In [61]:
```
x_test.shape,y_test.shape # 20% data
```

Out[61]:
```
((65, 5), (65,))
```

Model Development:

In [62]:
```
from sklearn.linear_model import LinearRegression
```

In [63]:
```
model=linear_model.LinearRegression()
```

In [64]:
```
model.fit(x_train,y_train)  #Model Tranning
```

Out[64]:
```
▾ LinearRegression

LinearRegression()
```

In [65]:
```
y_predict=model.predict(x_test)   # Model Prediction
```

In [66]:
```
y_predict
```

Out[66]:
```
array([117415.91344602, 125562.80742759,  48965.15386167, 128739.34887988,
       106828.49930535,  99654.76748821,  49101.27883652,  57130.71108104,
       166333.69009266,  43112.61060113,  40544.18249367, 122553.217185  ,
       107631.15450849, 155580.48335296,  83652.23602446, 170890.28450906,
        98984.50106226, 109338.33008328,  42267.86835535,  48089.87647812,
        75674.93528581,  64499.29874156,  63619.2494321 ,  31543.41552147,
       188376.92844437,  90340.76921722, 155285.91529198, 160863.57809872,
       185183.73163709,  34741.26224478, 124850.6230462 , 165106.94121634,
        87085.00622186, 155425.69514031, 149190.25441885,  45729.74800187,
        88475.39474629,  92025.62668073,  97997.32557607,  40411.112659  ,
        89995.79796521,  53873.21977084, 108677.48549927,  54590.96778663,
        36497.92729223,  48611.85493217, 129193.72126941,  43102.58902589,
       162383.16672117,  81874.95829259, 157771.0301154 ,  43984.89040816,
        59950.21740617,  94023.81456492,  84929.38809181,  60296.00325465,
        91816.87952546,  56177.12587279,  75243.32853162, 104701.69952733,
       117279.78847117,  83396.82187583, 177743.7610287 ,  72275.14427419,
        86307.61361918])
```

Comparision:

In [67]:
```
df = pd.DataFrame({'Original Salary': y_test, 'Predicted Salary': y_predict})
```

In [68]:
```
df
```

Out[68]:

	Original Salary	Predicted Salary
132	100000.0	117415.913446
108	100000.0	125562.807428
137	50000.0	48965.153862
9	110000.0	128739.348880
181	105000.0	106828.499305
...	...	...
104	80000.0	117279.788471
233	85000.0	83396.821876
60	170000.0	177743.761029
94	75000.0	72275.144274
278	95000.0	86307.613619

65 rows × 2 columns

Check Errors:

In [69]:
```
df['errors']=df['Original Salary']-df['Predicted Salary']
```

In [70]:
```
df
```

Out[70]:

	Original Salary	Predicted Salary	errors
132	100000.0	117415.913446	-17415.913446
108	100000.0	125562.807428	-25562.807428
137	50000.0	48965.153862	1034.846138
9	110000.0	128739.348880	-18739.348880
181	105000.0	106828.499305	-1828.499305
...	...	...	...
104	80000.0	117279.788471	-37279.788471
233	85000.0	83396.821876	1603.178124
60	170000.0	177743.761029	-7743.761029
94	75000.0	72275.144274	2724.855726
278	95000.0	86307.613619	8692.386381

65 rows × 3 columns

Sum of squared errors (SSE): & The mean squared error (MSE)

In [71]:
```
Q=df['errors']*df['errors']
```

In [72]:
```
SSE=Q.sum()
```

In [73]:
```
SSE
```

Out[73]:
```
13374018821.622133
```

In [74]:
```
df.shape
```

Out[74]:
```
(65, 3)
```

In [75]:
```
MSE=SSE/65
```

In [76]:
```
MSE
```

Out[76]:
```
205754135.71726358
```

Coef & Intercept:

In [77]:
```
model.coef_
```

Out[77]:
```
array([7.38907834e+03, 1.54227359e+04, 1.95769562e+01, 2.01818940e+04,
       1.92043082e+04])
```

In [78]:
```
model.intercept_
```

Out[78]:
```
86001.49320552872
```

Check Model ACCURACY:

In [79]:
```
from sklearn.metrics import r2_score
```

In [80]:
```
r2=r2_score(df['Original Salary'],df['Predicted Salary'])
```

In [81]:
```
r2
```

Out[81]:
```
0.8911231066517076
```

89.2 % ACCURACY OF THIS MODEL..... (SUPER MODEL)

In [ ]:
```

```

In [ ]:
```

```

Solving Real Problem:

➡ **Name= MOHIT**

➡ **Age= 49**

➡ **Gender= F(0)**

➡ **Degree =PHD (2)**

➡ **Job= Director(22)**

➡ **Exp.Year= 15**

➡ **Salary ❓**

In [82]:
```
data.head(2)
```

Out[82]:

	Age	Gender	Degree	Job Title	Experience Years	Salary	Gender_Encode	Degree_Encode	Job_Title_Encode	Age_Scaled	Experience Years_Scaled
0	32.0	Male	Bachelor's	Software Engineer	5.0	90000.0	1	0	159	-0.750231	-0.761821
1	28.0	Female	Master's	Data Analyst	3.0	65000.0	0	1	17	-1.307742	-1.063017

In [83]:
```
AGE=std_scaler.transform([[49]])
AGE
```

```
C:\Users\19mri\anaconda4\Lib\site-packages\sklearn\base.py:464: UserWarning: X does not have valid feature names, but StandardSc
aler was fitted with feature names
  warnings.warn(
```

Out[83]:
```
array([[5.86448677]])
```

In [84]:
```
Experience_Years=std_scaler.transform([[15]])
Experience_Years
```

```
C:\Users\19mri\anaconda4\Lib\site-packages\sklearn\base.py:464: UserWarning: X does not have valid feature names, but StandardSc
aler was fitted with feature names
  warnings.warn(
```

Out[84]:
```
array([[0.74415815]])
```

FINALLY PREDICT SALARY__

In [85]:
```
print(model.predict([[0,2,22,5.86448677,0.74415815]]),'is the Salary of This Employee>>>>>>>>>>>>>>>')
```

```
[249925.15061727] is the Salary of This Employee>>>>>>>>>>>>>>>
C:\Users\19mri\anaconda4\Lib\site-packages\sklearn\base.py:464: UserWarning: X does not have valid feature names, but LinearRegr
ession was fitted with feature names
  warnings.warn(
```