Big Data analysis of HR and Employees.

In [102…
```
# Import libraries

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
```

In [103…
```
# load dataset
df = pd.read_csv('HR_Dataset.csv', encoding='unicode_escape')
```

Basic informations about the dataset

In [104…
```
df
```

Out[104…

	Unnamed: 0	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	
0	0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	
1	1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	
2	2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	
3	3	EMP0000004	Nicholas Valdez	IT	Software Engineer	2023-10-12	
4	4	EMP0000005	Joel Hendricks	Operations	Logistics Coordinator	2024-12-09	
…	…	…	…	…	…	…	
1999995	1999995	EMP1999996	Cody Russell	Operations	Logistics Coordinator	2010-08-31	C
1999996	1999996	EMP1999997	Tracey Smith	IT	Software Engineer	2021-05-07	
1999997	1999997	EMP1999998	Tracy Lee	Sales	Business Development Manager	2024-05-29	
1999998	1999998	EMP1999999	Michael Roberson	IT	Software Engineer	2023-02-14	Jo
1999999	1999999	EMP2000000	Angela Lambert	HR	Talent Acquisition Specialist	2020-11-11	M

2000000 rows × 12 columns

In [105…
```
df.shape
```

Out[105…
```
(2000000, 12)
```

In [106…
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2000000 entries, 0 to 1999999
Data columns (total 12 columns):
 #   Column              Dtype
---  ------              -----
 0   Unnamed: 0          int64
 1   Employee_ID         object
 2   Full_Name           object
 3   Department          object
 4   Job_Title           object
 5   Hire_Date           object
 6   Location            object
 7   Performance_Rating  int64
 8   Experience_Years    int64
 9   Status              object
 10  Work_Mode           object
 11  Salary_INR          int64
dtypes: int64(4), object(8)
memory usage: 183.1+ MB
```

In [107…

```
# Check for null values
pd.isnull(df).sum()
```

Out[107…

```
Unnamed: 0            0
Employee_ID           0
Full_Name             0
Department            0
Job_Title             0
Hire_Date             0
Location              0
Performance_Rating    0
Experience_Years      0
Status                0
Work_Mode             0
Salary_INR            0
dtype: int64
```

In [108…

```
# Removing unwanted column from the dataframe

df.drop('Unnamed: 0', axis=1, inplace=True)
```

In [109…

```
df
```

Out[109…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Locatio
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	Isaaclanc Denmar
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	Anthonyside Costa Ric
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	Por Christinapor Saudi Arabi
3	EMP0000004	Nicholas Valdez	IT	Software Engineer	2023-10-12	Por Shelbycheste Antigua an Barbud
4	EMP0000005	Joel Hendricks	Operations	Logistics Coordinator	2024-12-09	Lake Kimberly Palestinia Territor
…	…	…	…	…	…	.
1999995	EMP1999996	Cody Russell	Operations	Logistics Coordinator	2010-08-31	Casefurt, Serbi
1999996	EMP1999997	Tracey Smith	IT	Software Engineer	2021-05-07	Dannypor Kuwa
1999997	EMP1999998	Tracy Lee	Sales	Business Development Manager	2024-05-29	Craighaver Nigeri
1999998	EMP1999999	Michael Roberson	IT	Software Engineer	2023-02-14	Jonathanmouth Djibou
1999999	EMP2000000	Angela Lambert	HR	Talent Acquisition Specialist	2020-11-11	Morgancheste Canad

2000000 rows × 11 columns

In [110…

```
# Change the data-tpye of "Hire_Date" object to date

df['Hire_Date'] = pd.to_datetime(df['Hire_Date'])
df['Hire_Date'].dtypes
```

Out[110…

```
dtype('<M8[ns]')
```

In [111…

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2000000 entries, 0 to 1999999
Data columns (total 11 columns):
 #   Column              Dtype         
---  ------              -----         
 0   Employee_ID         object        
 1   Full_Name           object        
 2   Department          object        
 3   Job_Title           object        
 4   Hire_Date           datetime64[ns]
 5   Location            object        
 6   Performance_Rating  int64         
 7   Experience_Years    int64         
 8   Status              object        
 9   Work_Mode           object        
 10  Salary_INR          int64         
dtypes: datetime64[ns](1), int64(3), object(7)
memory usage: 167.8+ MB
```

In [112…
```
# About "Performance_Rating" column
df['Performance_Rating'].unique()
```

Out[112…
```
array([5, 2, 1, 4, 3])
```

In [113…
```
df['Performance_Rating'].value_counts()
```

Out[113…
```
Performance_Rating
4    400529
2    400174
3    399814
1    399756
5    399727
Name: count, dtype: int64
```

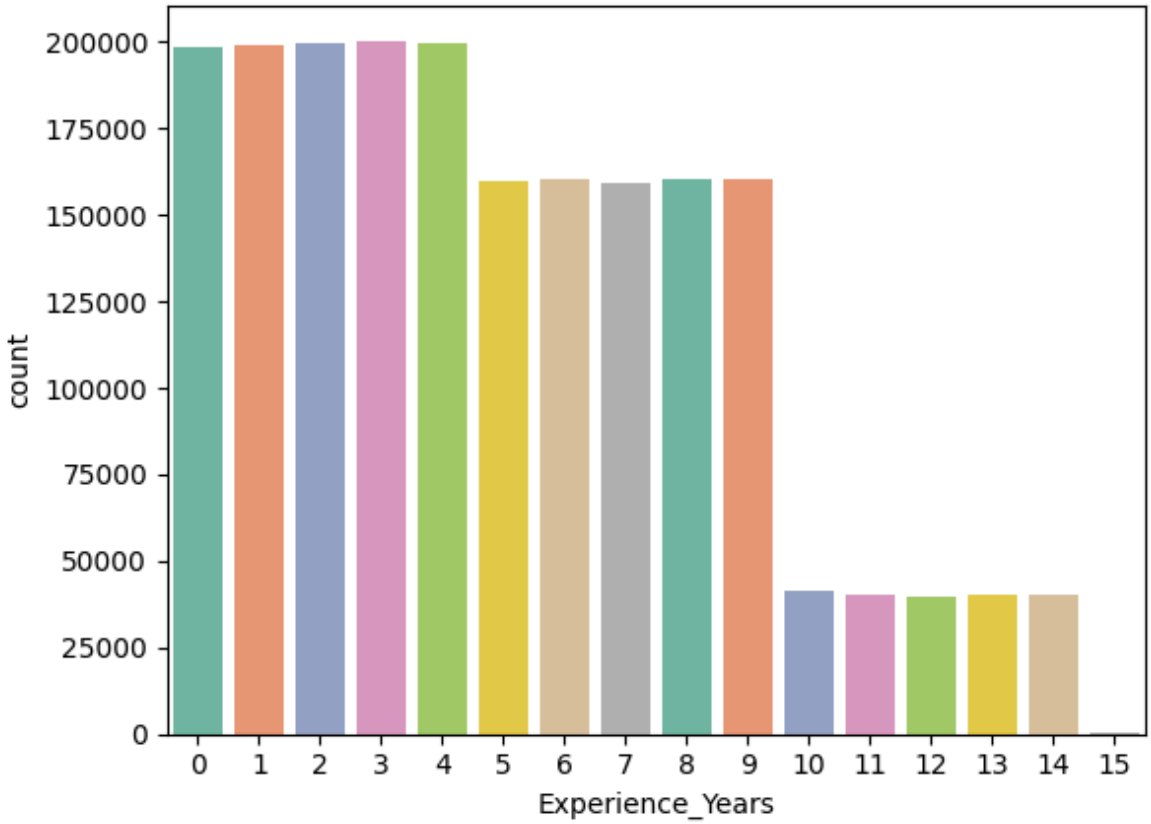
In [114…
```
# About "Experience_Years" Column
df['Experience_Years'].unique()
```

Out[114…
```
array([14,  7,  2,  1,  0,  4,  9,  5,  6,  8,  3, 10, 11, 12, 13, 15])
```

In [115…
```
df['Experience_Years'].value_counts()
```

Out[115…
```
Experience_Years
3     200522
2     199924
4     199866
1     199162
0     198775
6     160410
9     160223
8     160212
5     160112
7     159005
10     41209
13     40149
11     40146
14     40005
12     39709
15       571
Name: count, dtype: int64
```

In [116…
```
sns.countplot( x = 'Experience_Years', data = df, hue='Experience_Years', palett

plt.show()
```



In [117…
```
# Want to show the "Object" columns only
df.select_dtypes( include = 'object')
```

Out[117…

	Employee_ID	Full_Name	Department	Job_Title	Location	Status
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	Isaacland, Denmark	Resigned
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	Anthonyside, Costa Rica	Active
2	EMP0000003	Alyssa Martinez	HR	HR Manager	Port Christinaport, Saudi Arabia	Active
3	EMP0000004	Nicholas Valdez	IT	Software Engineer	Port Shelbychester, Antigua and Barbuda	Active
4	EMP0000005	Joel Hendricks	Operations	Logistics Coordinator	Lake Kimberly, Palestinian Territory	Active
…	…	…	…	…	…	…
1999995	EMP1999996	Cody Russell	Operations	Logistics Coordinator	Casefurt, Serbia	Active
1999996	EMP1999997	Tracey Smith	IT	Software Engineer	Dannyport, Kuwait	Active
1999997	EMP1999998	Tracy Lee	Sales	Business Development Manager	Craighaven, Nigeria	Active
1999998	EMP1999999	Michael Roberson	IT	Software Engineer	Jonathanmouth, Djibouti	Retired
1999999	EMP2000000	Angela Lambert	HR	Talent Acquisition Specialist	Morganchester, Canada	Active

2000000 rows × 7 columns

In [118…

```
# Want to show the "Numeric" columns only
df.select_dtypes( include = 'number')
```

Out[118…

	Performance_Rating	Experience_Years	Salary_INR
0	5	14	1585363
1	2	7	847686
2	1	2	1430084
3	1	1	990689
4	5	0	535082
...	...	...	...
1999995	3	14	657648
1999996	3	4	1030109
1999997	5	1	1313085
1999998	4	2	1479727
1999999	1	4	993718

2000000 rows × 3 columns

Exploratory Data Analysis (EDA)

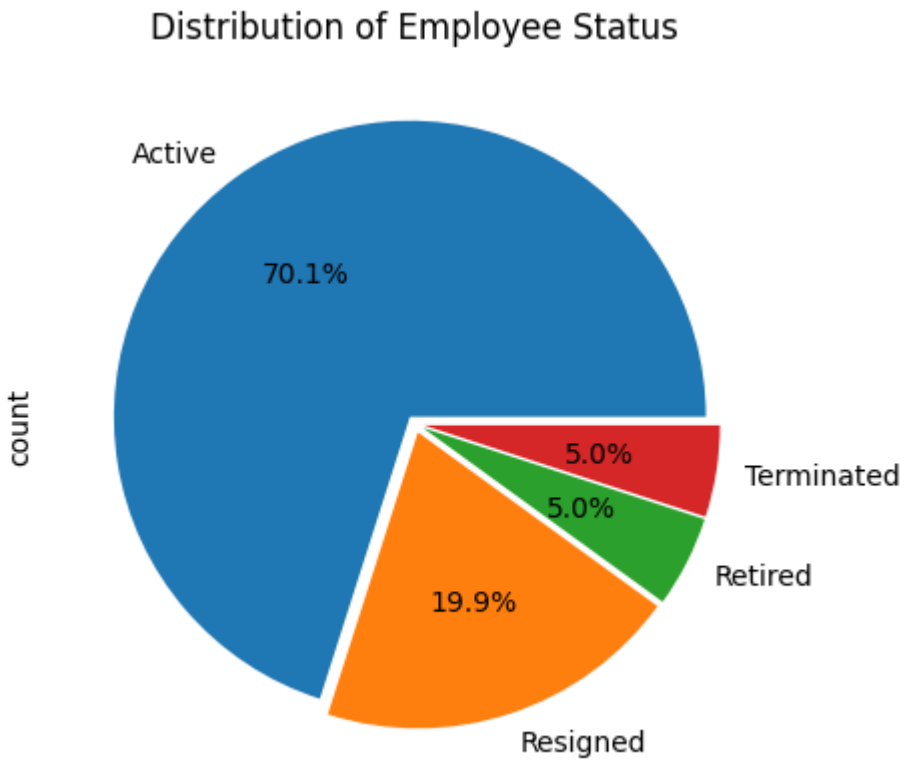
Q.1) What is the distribution of Employee Status (Active, Resigned, Retired, Terminated) ?

In [119…
```
status = df['Status'].value_counts()
```

In [120…
```
status
```

Out[120…
```
Status
Active        1401558
Resigned       398660
Retired         99912
Terminated      99870
Name: count, dtype: int64
```

In [121…
```
status.plot( kind = 'pie' , autopct= '%1.1f%%', explode=(0.03,0.03,0.03,0.03))

plt.title('Distribution of Employee Status')
plt.show()
```

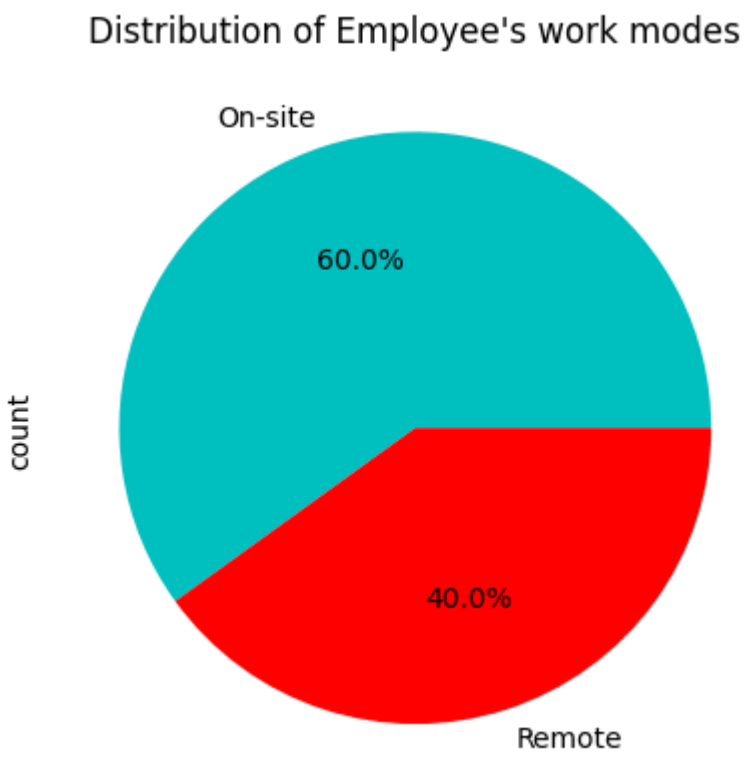


Q.2) What is the distribution of work modes (On-site, Remote) ?

In [122…
```
work_mode = df['Work_Mode'].value_counts()
work_mode
```

Out[122…
```
Work_Mode
On-site    1199109
Remote      800891
Name: count, dtype: int64
```

In [123…
```
work_mode.plot( kind = 'pie' , colors = 'cr', autopct= '%1.1f%%')

plt.title("Distribution of Employee's work modes")
plt.show()
```

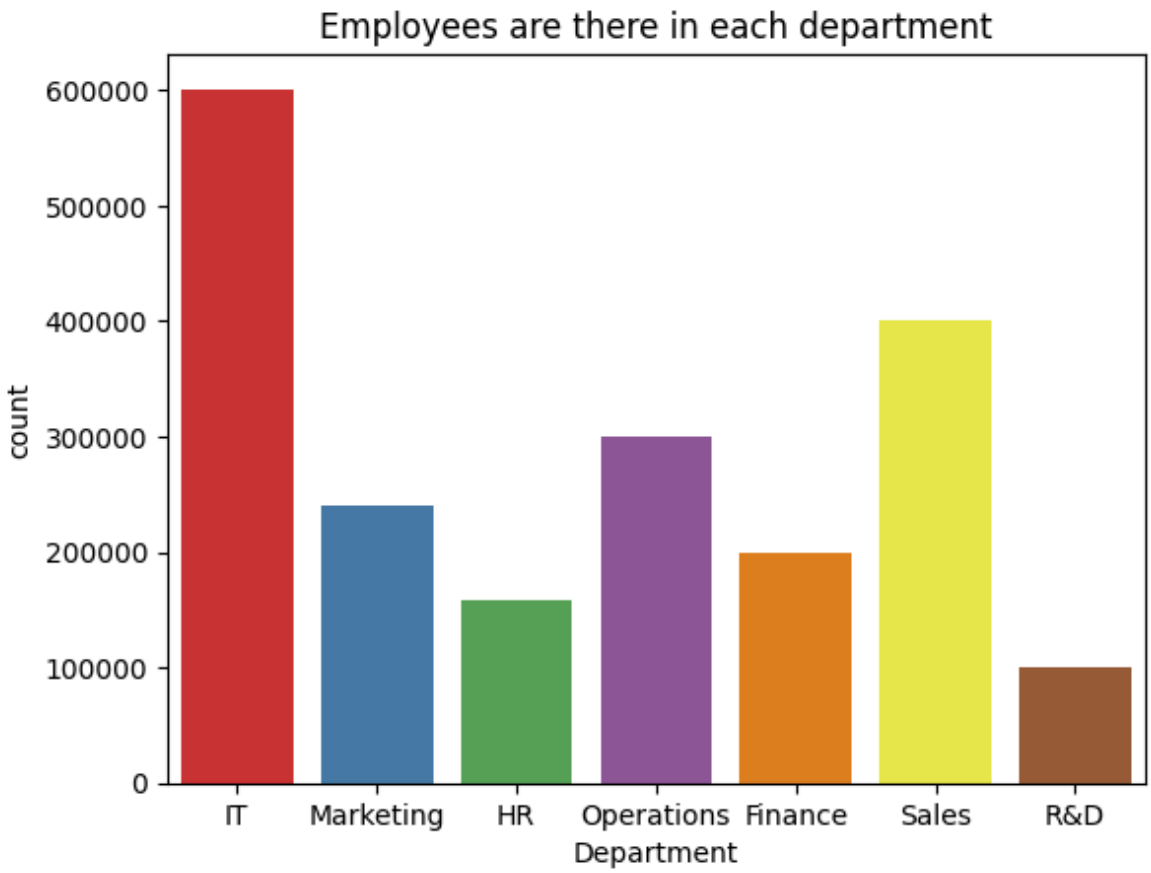


Q.3) How many employees are there in each department?

In [124…
```
df['Department'].value_counts()
```

Out[124…
```
Department
IT            601042
Sales         400031
Operations    300095
Marketing     240081
Finance       199873
HR            159119
R&D            99759
Name: count, dtype: int64
```

In [125…
```
sns.countplot( x = 'Department', data = df, hue='Department', palette='Set1', le

plt.title('Employees are there in each department')
plt.show()
```



Q.4) How many employees are there in each Job_Tilte?

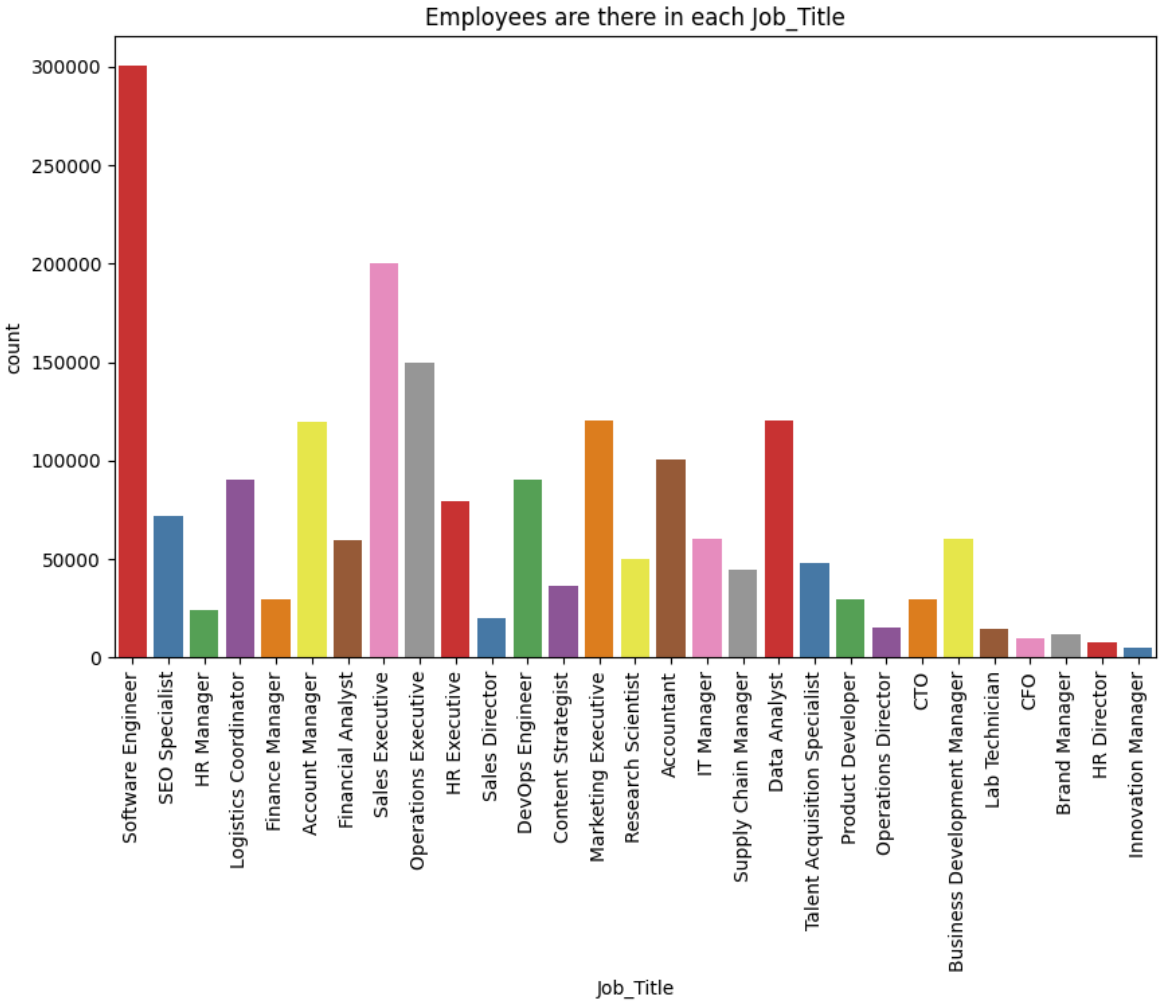
In [126…
```
df['Job_Title'].value_counts()
```

Out[126…

```
Job_Title
Software Engineer                300358
Sales Executive                  199982
Operations Executive             150058
Data Analyst                     120375
Marketing Executive              120154
Account Manager                  119929
Accountant                       100307
DevOps Engineer                   90197
Logistics Coordinator             90188
HR Executive                      79348
SEO Specialist                    71692
Business Development Manager      60233
IT Manager                        60224
Financial Analyst                 59815
Research Scientist                50017
Talent Acquisition Specialist     47994
Supply Chain Manager              44935
Content Strategist                36154
CTO                               29888
Product Developer                 29872
Finance Manager                   29799
HR Manager                        23841
Sales Director                    19887
Operations Director               14914
Lab Technician                    14829
Brand Manager                     12081
CFO                                9952
HR Director                        7936
Innovation Manager                 5041
Name: count, dtype: int64
```

In [127…

```
plt.figure(figsize=(10,6))
sns.countplot( x = 'Job_Title', data = df, hue='Job_Title', palette='Set1', lege

plt.xticks( rotation = 'vertical')
plt.title('Employees are there in each Job_Title')
plt.show()
```



Q.5) What is the average salary by Department?

In [128…
```
df.head(3)
```

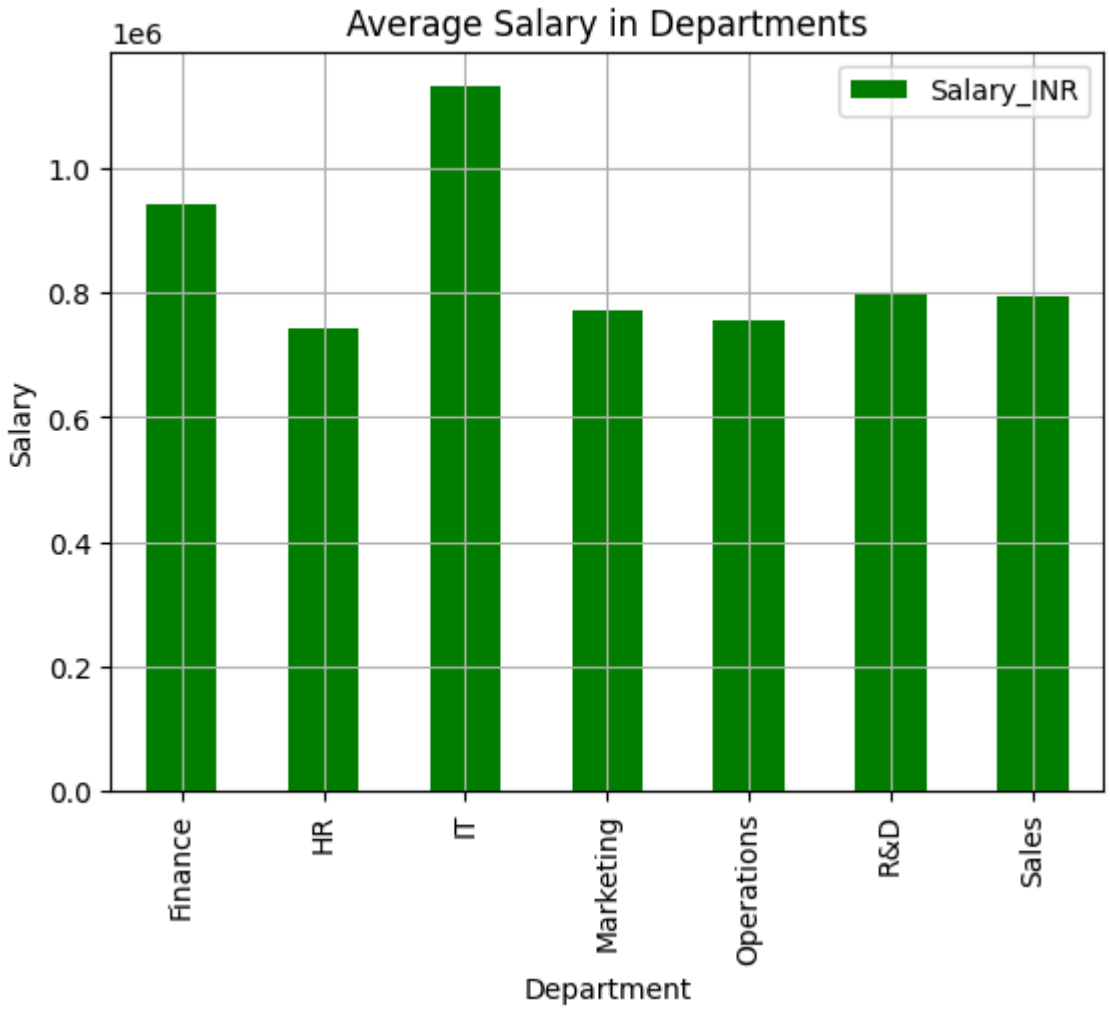
Out[128…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Location	Performan
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	Port Christinaport, Saudi Arabia	

In [129…
```
dept = df.groupby('Department')['Salary_INR'].mean()

dept
```

Out[129…
```
Department
Finance       9.404117e+05
HR            7.438536e+05
IT            1.129858e+06
Marketing     7.699362e+05
Operations    7.546263e+05
R&D           8.003772e+05
Sales         7.929579e+05
Name: Salary_INR, dtype: float64
```

In [130…
```
dept.plot( x = dept.index, y = dept.values, kind = 'bar', color = 'g', legend =

plt.grid()
plt.title("Average Salary in Departments")
plt.ylabel("Salary")

plt.show()
```



Q.6) Which job title has the highest average salary?

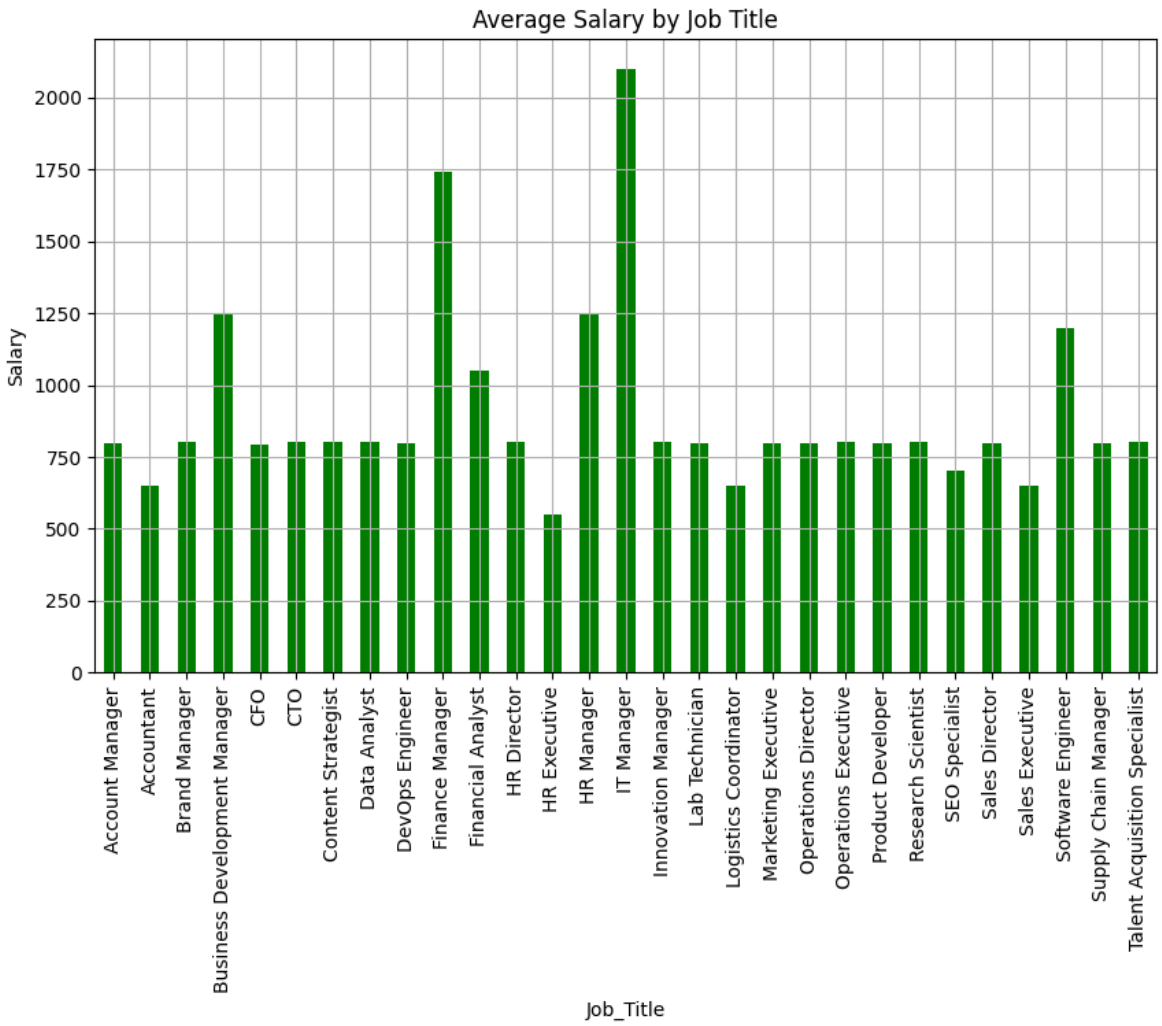
In [131…
```
salary = df.groupby('Job_Title')['Salary_INR'].mean()/1000 # we devide it by 100
salary
```

Out[131…

```
Job_Title
Account Manager                    799.373734
Accountant                         650.076482
Brand Manager                      803.127787
Business Development Manager      1252.016231
CFO                                795.015873
CTO                                801.402754
Content Strategist                 800.760030
Data Analyst                       800.996380
DevOps Engineer                    799.949184
Finance Manager                   1743.241525
Financial Analyst                 1051.522903
HR Director                        800.694437
HR Executive                       550.548859
HR Manager                        1252.401915
IT Manager                        2098.155777
Innovation Manager                 801.870103
Lab Technician                     800.181468
Logistics Coordinator              649.631726
Marketing Executive                798.780404
Operations Director                798.298093
Operations Executive               800.350915
Product Developer                  798.652261
Research Scientist                 801.314879
SEO Specialist                     700.456337
Sales Director                     799.069374
Sales Executive                    650.237755
Software Engineer                 1199.260843
Supply Chain Manager               798.168555
Talent Acquisition Specialist      801.422237
Name: Salary_INR, dtype: float64
```

In [132…

```
plt.figure(figsize=(10,6))

salary.plot( x = salary.index, y = salary.values, kind = 'bar', color = 'g')

plt.grid(True)
plt.title("Average Salary by Job Title")
plt.ylabel("Salary")

plt.show()
```



Q.7) What is the average salary in different Departments based on Job Title ?

In [133…
```
df.head(3)
```

Out[133…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Location	Performan
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	Port Christinaport, Saudi Arabia	

In [134…
```
dept_job = df.groupby(['Department', 'Job_Title'])['Salary_INR'].mean()/1000

dept_job
```

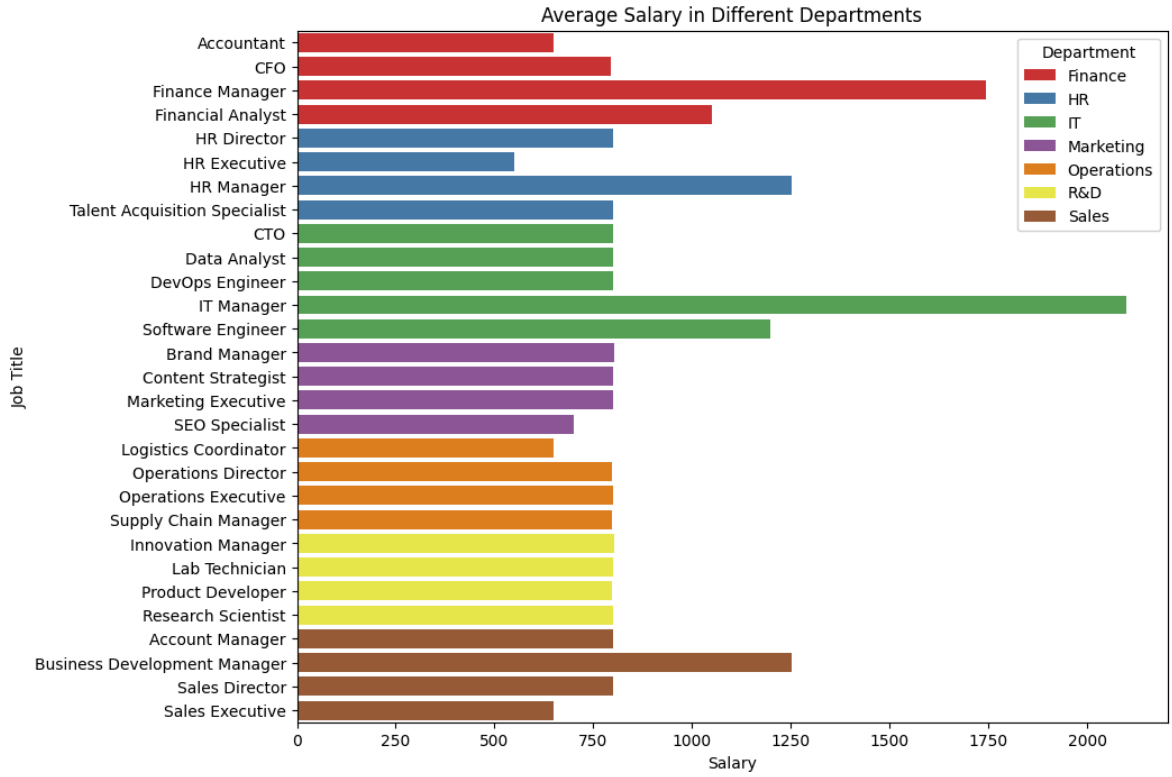
Out[134…

Department	Job_Title	
Finance	Accountant	650.076482
	CFO	795.015873
	Finance Manager	1743.241525
	Financial Analyst	1051.522903
HR	HR Director	800.694437
	HR Executive	550.548859
	HR Manager	1252.401915
	Talent Acquisition Specialist	801.422237
IT	CTO	801.402754
	Data Analyst	800.996380
	DevOps Engineer	799.949184
	IT Manager	2098.155777
	Software Engineer	1199.260843
Marketing	Brand Manager	803.127787
	Content Strategist	800.760030
	Marketing Executive	798.780404
	SEO Specialist	700.456337
Operations	Logistics Coordinator	649.631726
	Operations Director	798.298093
	Operations Executive	800.350915
	Supply Chain Manager	798.168555
R&D	Innovation Manager	801.870103
	Lab Technician	800.181468
	Product Developer	798.652261
	Research Scientist	801.314879
Sales	Account Manager	799.373734
	Business Development Manager	1252.016231
	Sales Director	799.069374
	Sales Executive	650.237755

Name: Salary_INR, dtype: float64

In [135…

```
dept_job_df = dept_job.reset_index()
plt.figure(figsize=(10,8))
sns.barplot( y='Job_Title', x='Salary_INR', data=dept_job_df, hue='Department',
plt.title('Average Salary in Different Departments')
plt.xlabel("Salary")
plt.ylabel("Job Title")
plt.show()
```



Q.8) How many employees Resigned & Terminated in each department ?

In [136…
```
df.head(3)
```

Out[136…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Location	Performan
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	Port Christinaport, Saudi Arabia	

In [137…
```
df.Status.unique()
```

Out[137…
```
array(['Resigned', 'Active', 'Terminated', 'Retired'], dtype=object)
```

In [138…
```
df_resigned = df[df["Status"]=='Resigned']
df_resigned
```

Out[138…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Locatio
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	Isaaclanc Denmar
8	EMP0000009	Cathy Thompson	Finance	Financial Analyst	2018-05-29	Soutl Catherine Beliz
11	EMP0000012	Kevin Lowe	Sales	Account Manager	2024-07-02	East Kent Qata
16	EMP0000017	Robert Martin	Operations	Logistics Coordinator	2025-05-13	Laurahaver Afghanistar
19	EMP0000020	Donald Hoffman	Marketing	Content Strategist	2022-04-01	South James New Zealanc
...	...	...	...	...	...	.
1999976	EMP1999977	Angela Curtis	Operations	Operations Executive	2021-08-07	Eas Jeremiahburgh Rwand
1999983	EMP1999984	Joshua Ponce	Sales	Account Manager	2020-05-08	North Tracey Venezuel
1999985	EMP1999986	Aaron Montgomery	Marketing	Marketing Executive	2017-06-03	Maddenmouth Beliz
1999986	EMP1999987	Mason Parker	Operations	Operations Executive	2018-02-27	Joseside Cameroo
1999989	EMP1999990	Adrian Lopez	Sales	Sales Executive	2017-07-25	Nortl Elizabethfort Morocc

398660 rows × 11 columns

In [139…

```
r_emp = df_resigned.groupby('Department')['Status'].count() # we can use any of
r_emp
```

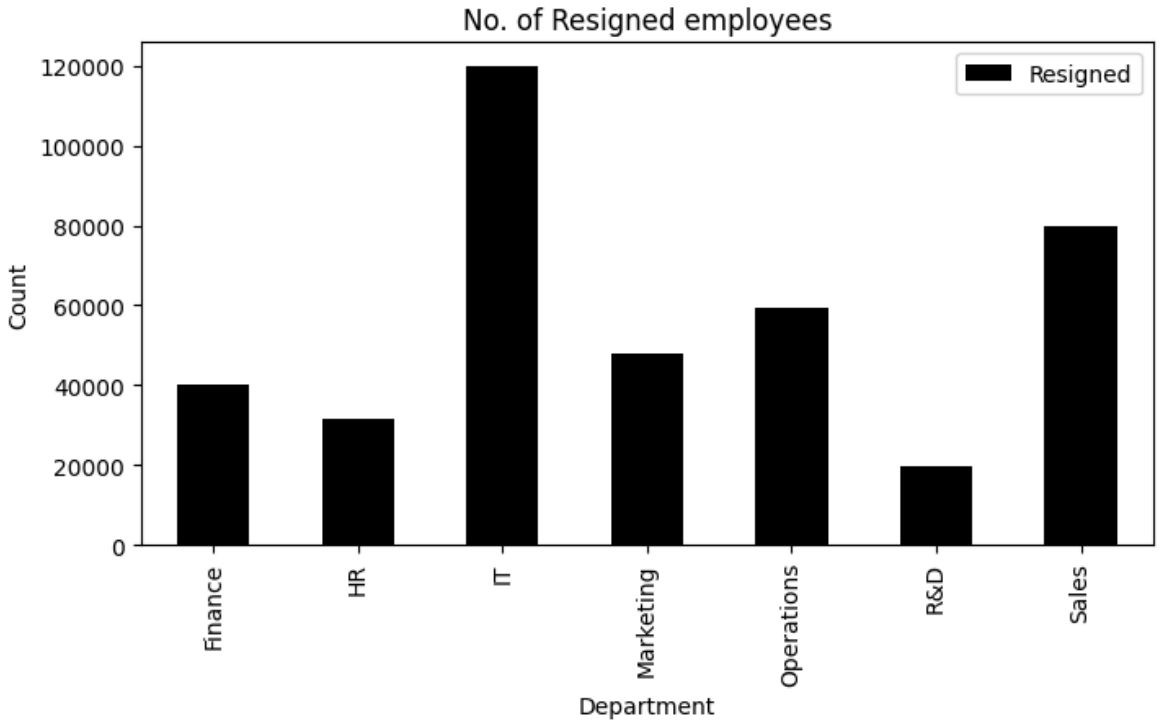
Out[139…

```
Department
Finance        40238
HR             31736
IT            119852
Marketing      47793
Operations     59397
R&D            19919
Sales          79725
Name: Status, dtype: int64
```

In [140…

```
plt.figure(figsize=(8,4))

r_emp.plot( x = r_emp.index, y = r_emp.values , kind = 'bar', color = 'black', l

plt.title("No. of Resigned employees")
plt.ylabel("Count")
```

```
plt.show()
```



In [141…

```
# Now for 'Terminated'
df_terminated = df[df["Status"]=='Terminated']
df_terminated
```

Out[141…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Location
20	EMP0000021	Mr. Billy Rodgers DDS	Marketing	Marketing Executive	2017-10-12	West Bryanton, Saint Martin
33	EMP0000034	Steve Carlson	IT	Software Engineer	2020-04-25	Grahamfurt, Jamaica
56	EMP0000057	Claire Martinez	IT	DevOps Engineer	2020-01-17	Garciaton, Libyan Arab Jamahiriya
100	EMP0000101	Johnny Shepard	Finance	Accountant	2023-02-02	North Briannatown, Cuba
121	EMP0000122	Vanessa Brown	IT	Data Analyst	2017-08-14	South Teresa, Liechtenstein
…	…	…	…	…	…	…
1999912	EMP1999913	Stefanie Valentine	Marketing	Content Strategist	2016-05-04	New Aaronton, Andorra
1999936	EMP1999937	Lisa Gordon	Finance	Financial Analyst	2025-02-25	Baxtermouth, Qatar
1999947	EMP1999948	John Johnson	Sales	Sales Executive	2019-11-13	Maryborough, Nepal
1999981	EMP1999982	Mindy Campbell	Sales	Account Manager	2018-07-16	Sharonchester, Belgium
1999993	EMP1999994	Ashley Fuller	IT	DevOps Engineer	2018-06-09	Dylanhaven, Bermuda

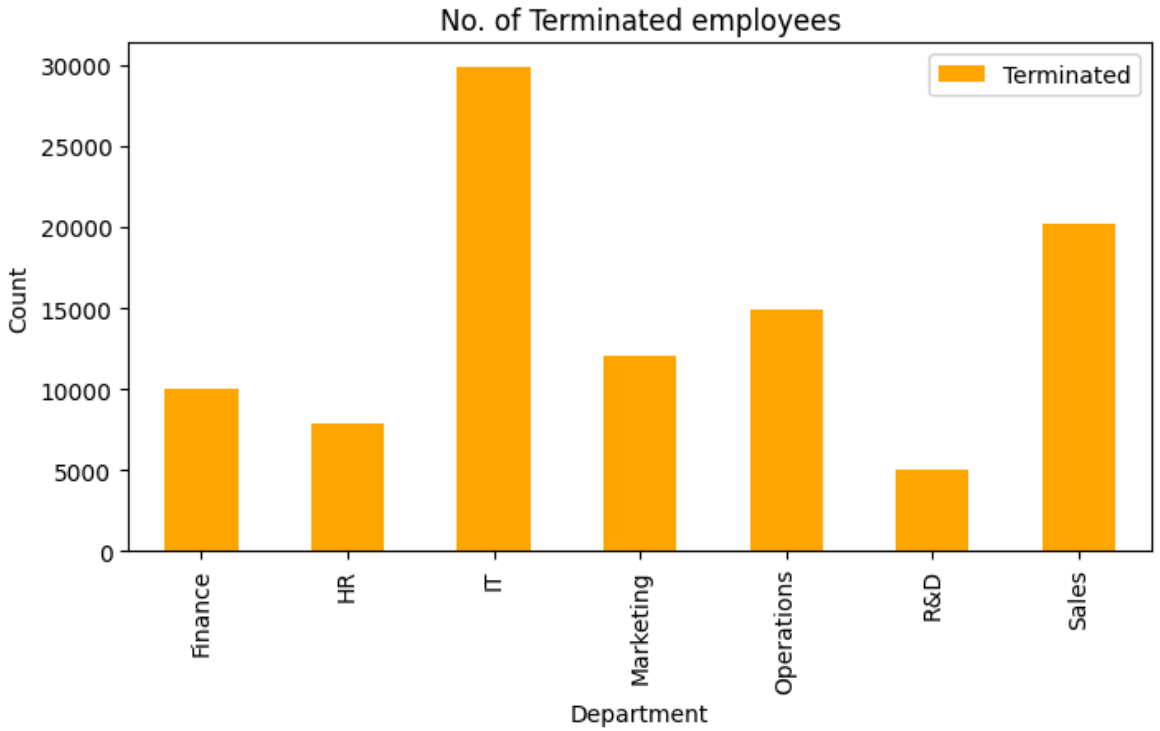
99870 rows × 11 columns

In [142…
```
r_term = df_terminated.groupby('Department')['Status'].count() # we can use any
r_term
```

Out[142…
```
Department
Finance        9988
HR             7861
IT            29881
Marketing     12044
Operations    14884
R&D            4998
Sales         20214
Name: Status, dtype: int64
```

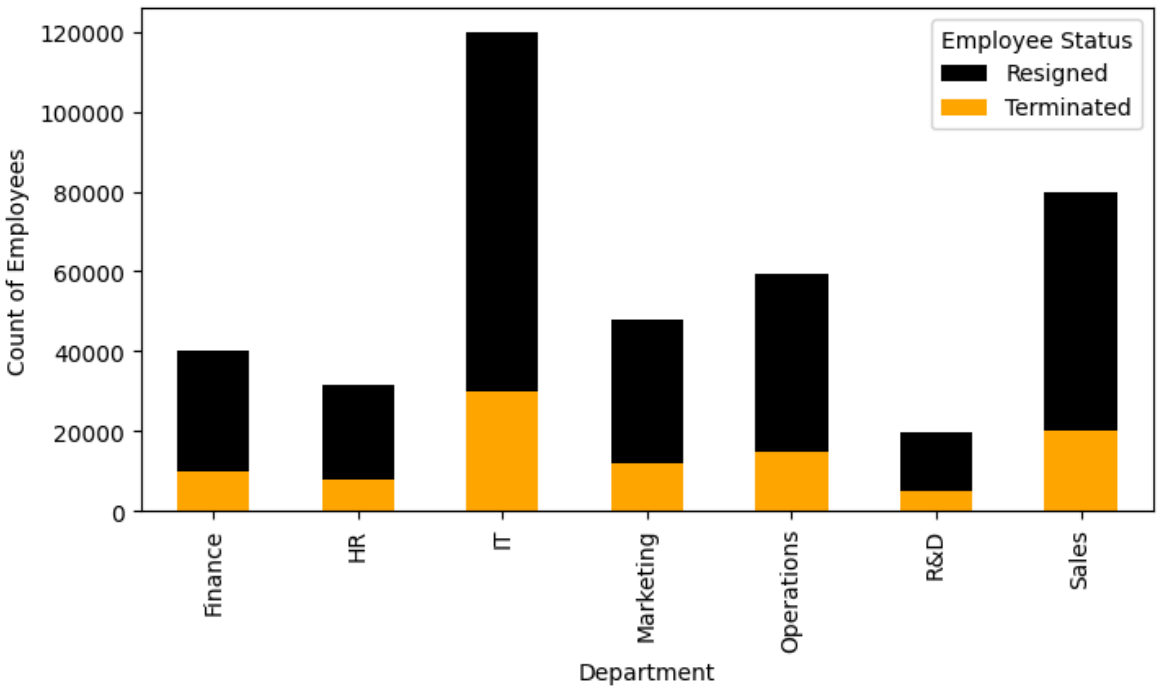
In [143…
```
plt.figure(figsize=(8,4))

r_term.plot( x = r_term.index, y = r_term.values , kind = 'bar', color = 'orange

plt.title("No. of Terminated employees")
plt.ylabel("Count")
```

```
plt.show()
```



In [144…

```
# Combine "Resigned" and "Terminated" graphs
plt.figure(figsize=(8,4))

r_emp.plot( x = r_emp.index, y = r_emp.values , kind = 'bar', color = 'black', l
r_term.plot( x = r_term.index, y = r_term.values , kind = 'bar', color = 'orange

plt.legend(title= "Employee Status")
plt.ylabel("Count of Employees")
plt.show()
```



Q.9) How does salary vary with years of experience?

In [145…
```
df['Experience_Years'].unique()
```

Out[145…
```
array([14,  7,  2,  1,  0,  4,  9,  5,  6,  8,  3, 10, 11, 12, 13, 15])
```

In [146…
```
df.groupby('Experience_Years')['Salary_INR'].mean()
```

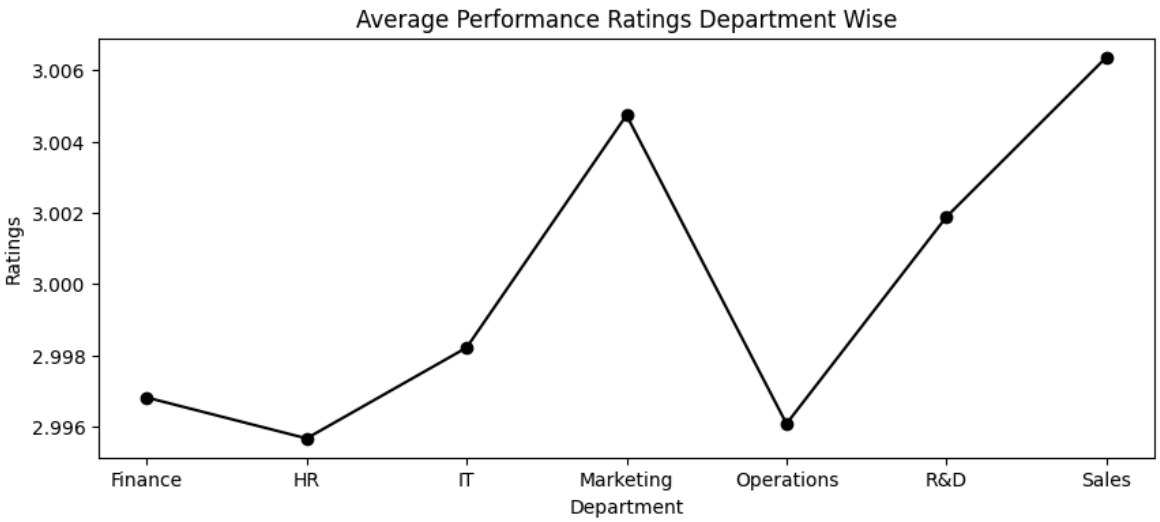
Out[146…
```
Experience_Years
0     896737.454775
1     895903.759824
2     896755.652313
3     896861.245240
4     897944.573965
5     896484.084828
6     896012.632467
7     895722.673960
8     897148.361090
9     898482.940577
10    895662.027882
11    901452.750112
12    896432.933416
13    898790.197041
14    895610.790251
15    895647.401051
Name: Salary_INR, dtype: float64
```

Q.10) What is the average performance rating by department?

In [147…
```
PR = df.groupby('Department')['Performance_Rating'].mean()
PR
```

Out[147…
```
Department
Finance       2.996818
HR            2.995670
IT            2.998216
Marketing     3.004736
Operations    2.996081
R&D           3.001885
Sales         3.006362
Name: Performance_Rating, dtype: float64
```

In [148…
```
plt.figure(figsize=(10,4))

PR.plot(x = PR.index, y = PR.values, color = 'black', marker='o', markersize=6)

plt.title("Average Performance Ratings Department Wise")
plt.ylabel("Ratings")

plt.show()
```



Q.11) Which Country have the highest concentration of employees?

In [149…
```
df.head()
```

Out[149…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Location	Perforn
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	Port Christinaport, Saudi Arabia	
3	EMP0000004	Nicholas Valdez	IT	Software Engineer	2023-10-12	Port Shelbychester, Antigua and Barbuda	
4	EMP0000005	Joel Hendricks	Operations	Logistics Coordinator	2024-12-09	Lake Kimberly, Palestinian Territory	

In [150…
```
# Now we have to split country name from the "Location" and make a new column na
df['Country'] = df['Location'].apply( lambda x : str(x.split(',')[1]))
# put '1' because we want the values after ',' if we put '0' then it will show t
```

In [151…
```
df.head()
```

Out[151…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Location	Perforn
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	Port Christinaport, Saudi Arabia	
3	EMP0000004	Nicholas Valdez	IT	Software Engineer	2023-10-12	Port Shelbychester, Antigua and Barbuda	
4	EMP0000005	Joel Hendricks	Operations	Logistics Coordinator	2024-12-09	Lake Kimberly, Palestinian Territory	

In [152…

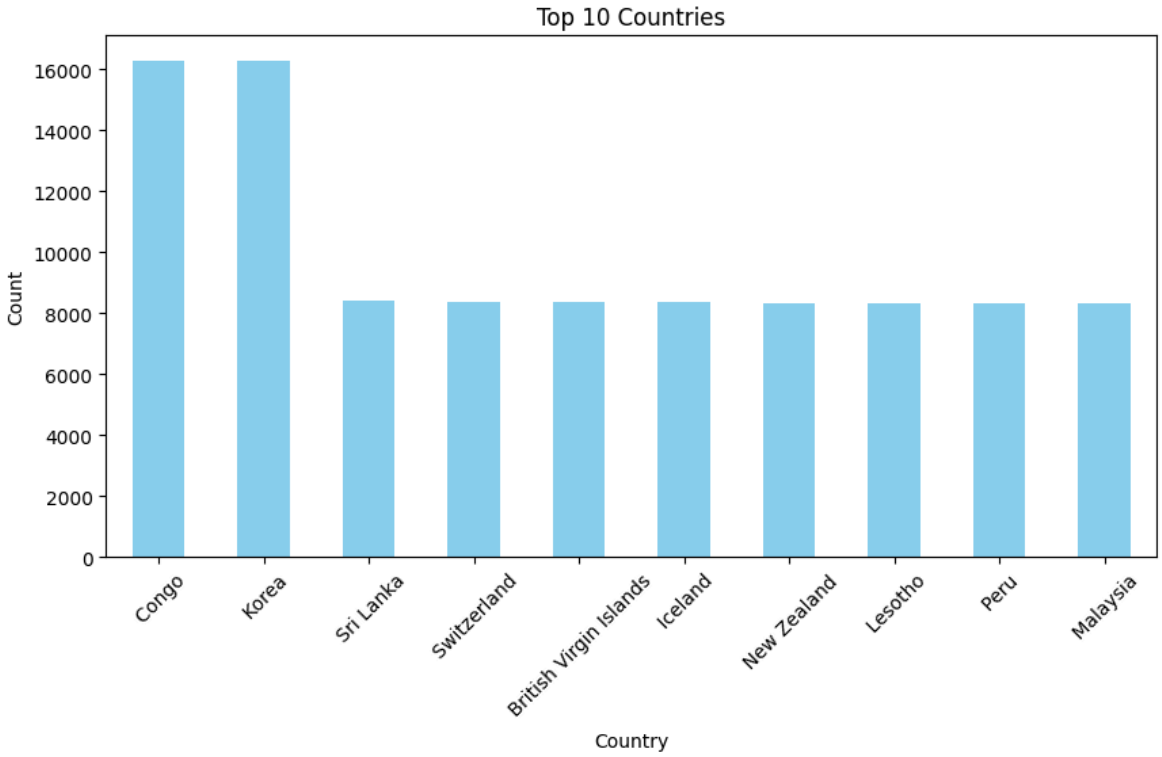
```
df.Country.value_counts()
```

Out[152…

```
Country
Congo                     16286
Korea                     16285
Sri Lanka                  8409
Switzerland                8391
British Virgin Islands     8373
                          ...
Indonesia                  7983
Kazakhstan                 7973
Montenegro                 7972
Bhutan                     7971
Palestinian Territory      7895
Name: count, Length: 243, dtype: int64
```

In [153…

```
# Top 10 country
top_countries = df['Country'].value_counts().head(10)

plt.figure(figsize=(10,5))
top_countries.plot(kind='bar', color='skyblue')

plt.title("Top 10 Countries")
plt.ylabel("Count")
plt.xticks(rotation=45)
plt.show()
```



Q.12) Is there a correlation between performance rating and salary?

In [154…
```
df['Performance_Rating'].corr(df['Salary_INR'])
```

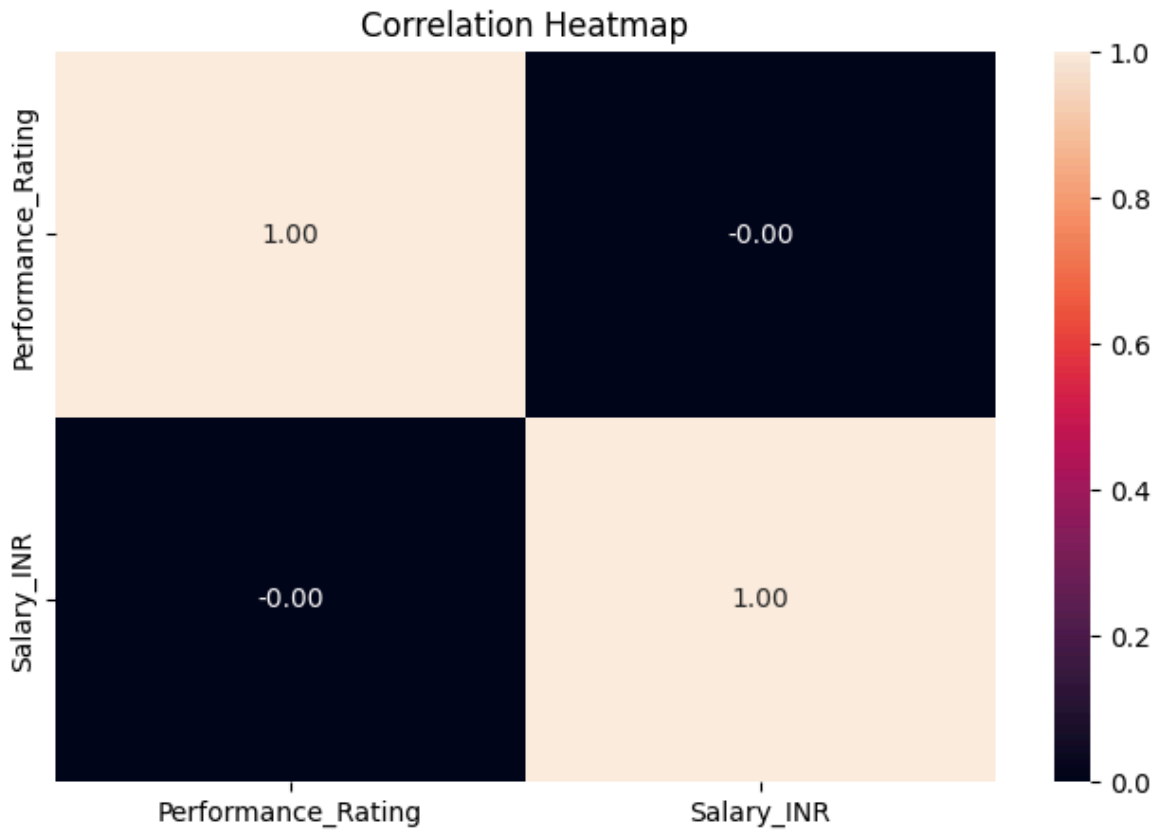
Out[154…
```
np.float64(-0.00020919799940916518)
```

In [155…
```
# Alternated Command to show Correlation
corr_matrix = df[['Performance_Rating', 'Salary_INR']].corr()
corr_matrix
```

Out[155…

	Performance_Rating	Salary_INR
Performance_Rating	1.000000	-0.000209
Salary_INR	-0.000209	1.000000

In [156…
```
# Showing Coorelation with Heatmap
plt.figure(figsize=(8,5))
sns.heatmap(corr_matrix, annot=True, fmt=".2f")

plt.title("Correlation Heatmap")
plt.show()
```



Q.13) How has the number of hires changed over time (per year)?

In [157…
```
df.head(3)
```

Out[157…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Location	Performan
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	Port Christinaport, Saudi Arabia	

In [158…
```
# Now we have to split the year from the "Hire_Date" and create a new column at
df.insert(5, 'Year', df['Hire_Date'].dt.year)
```

In [159…
```
df.head()
```

Out[159…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Year	Location	I
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	2011	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	2018	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	2023	Port Christinaport, Saudi Arabia	
3	EMP0000004	Nicholas Valdez	IT	Software Engineer	2023-10-12	2023	Port Shelbychester, Antigua and Barbuda	
4	EMP0000005	Joel Hendricks	Operations	Logistics Coordinator	2024-12-09	2024	Lake Kimberly, Palestinian Territory	

In [160…
```
df.Year.nunique()
```

Out[160…
```
16
```

In [161…
```
df.Year.unique()
```

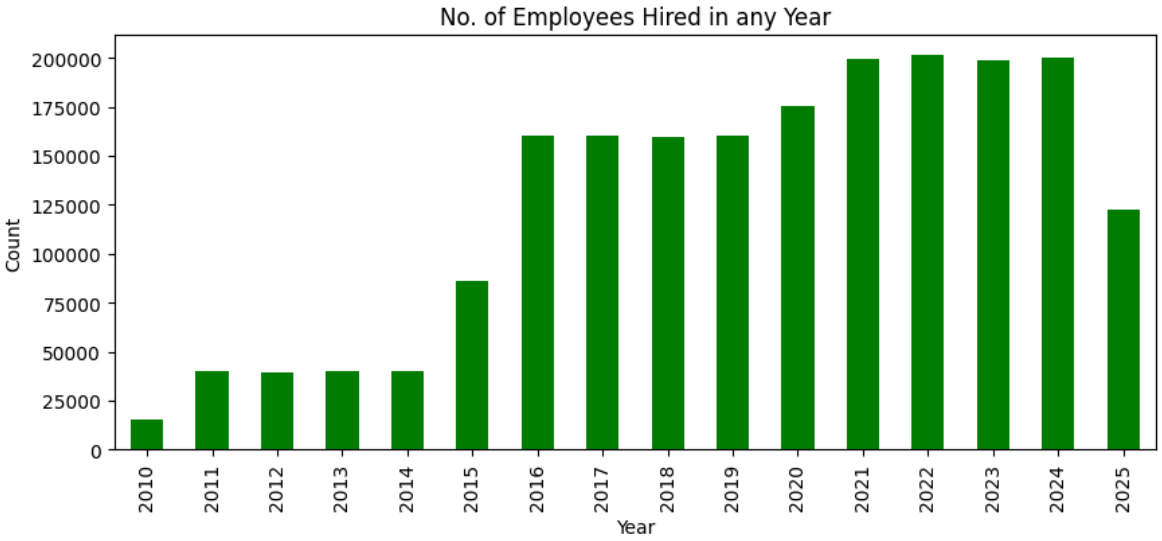
Out[161…
```
array([2011, 2018, 2023, 2024, 2021, 2016, 2020, 2015, 2025, 2022, 2017,
       2019, 2014, 2013, 2012, 2010], dtype=int32)
```

In [162…
```
hire = df.groupby('Year')['Employee_ID'].count()
hire
```

Out[162…
```
Year
2010     15520
2011     40089
2012     39765
2013     39988
2014     40202
2015     85984
2016    160249
2017    160363
2018    159658
2019    160202
2020    175460
2021    199366
2022    201373
2023    198982
2024    200001
2025    122798
Name: Employee_ID, dtype: int64
```

In [163…
```
plt.figure(figsize=(10,4))

hire.plot(x = hire.index, y = hire.values, kind = 'bar', color = 'green')

plt.title("No. of Employees Hired in any Year")
```

```
plt.ylabel("Count")
plt.show()
```



Q.14) Compare salaries of Remote vs On-site employees — is there a significant difference?

In [164…
```
df.head(3)
```

Out[164…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Year	Location	Perf
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	2011	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	2018	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	2023	Port Christinaport, Saudi Arabia	

In [165…
```
df.groupby('Work_Mode')['Salary_INR'].mean()
```

Out[165…
```
Work_Mode
On-site    896835.945792
Remote     896965.326373
Name: Salary_INR, dtype: float64
```

Q.15) Find the top 3 employees with the highest salary in each department.

In [166…
```
df.head(3)
```

Out[166...

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Year	Location	Perf
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	2011	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	2018	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	2023	Port Christinaport, Saudi Arabia	

In [167...

```
top3_each_dept = (df.sort_values(['Department', 'Salary_INR'], ascending=[True,

top3_each_dept[['Department', 'Full_Name', 'Job_Title', 'Salary_INR']].head(21)
# there are 7 departments so we want to see head(21)
```

Out[167...

	Department	Full_Name	Job_Title	Salary_INR
888712	Finance	Christopher Sloan	Finance Manager	2499958
695808	Finance	Todd Rodgers	Finance Manager	2499929
459273	Finance	Angela Payne	Finance Manager	2499925
223845	HR	Ethan Jones	HR Manager	1799839
1068270	HR	Austin Hall	HR Manager	1799791
1541972	HR	Daniel Wilson	HR Manager	1799769
1697605	IT	Kathryn Owens	IT Manager	2999976
1284141	IT	Robert Bowman	IT Manager	2999973
1912378	IT	Christina Delgado	IT Manager	2999944
1268998	Marketing	Shannon Fox	Marketing Executive	1199997
1015129	Marketing	Laura Allen	Content Strategist	1199995
1214216	Marketing	Rebecca Davies	Content Strategist	1199989
61771	Operations	Rachel Rodriguez	Operations Executive	1199991
1145588	Operations	Daniel Ramirez	Operations Executive	1199985
1219675	Operations	Deborah Brown	Operations Executive	1199977
1601509	R&D	Amanda Osborne	Research Scientist	1199995
1870413	R&D	William Moore	Product Developer	1199950
1992769	R&D	Whitney Guzman	Lab Technician	1199943
1729875	Sales	Hector Love	Business Development Manager	1799983
3493	Sales	Tracy Hill	Business Development Manager	1799975
161163	Sales	Mark Mccann	Business Development Manager	1799975

In [168…
```
# or we can also do this in another way
# top_3 = df.groupby('Department').apply(lambda x:x.nlargest(3, "Salary_INR"))
```

Q.16) Identify departments with the highest attrition rate (Resigned %).

In [169…
```
df.head(3)
```

Out[169…

	Employee_ID	Full_Name	Department	Job_Title	Hire_Date	Year	Location	Perf
0	EMP0000001	Joshua Nguyen	IT	Software Engineer	2011-08-10	2011	Isaacland, Denmark	
1	EMP0000002	Julie Williams	Marketing	SEO Specialist	2018-03-02	2018	Anthonyside, Costa Rica	
2	EMP0000003	Alyssa Martinez	HR	HR Manager	2023-03-20	2023	Port Christinaport, Saudi Arabia	

In [170…
```
dept_counts = df.groupby('Department')['Status'].agg(total_emp = 'count', resign
dept_counts
```

Out[170…

Department	total_emp	resigned
Finance	199873	40238
HR	159119	31736
IT	601042	119852
Marketing	240081	47793
Operations	300095	59397
R&D	99759	19919
Sales	400031	79725

In [171…
```
# Calculate resigned rate and create a new column named 'resigned_rate_%'

dept_counts['resigned_rate_%'] = (dept_counts['resigned'] / dept_counts['total_e
dept_counts
```

Out[171…

Department	total_emp	resigned	resigned_rate_%
Finance	199873	40238	20.131784
HR	159119	31736	19.944821
IT	601042	119852	19.940703
Marketing	240081	47793	19.907031
Operations	300095	59397	19.792732
R&D	99759	19919	19.967121
Sales	400031	79725	19.929705

In [173…

```
# Sort by attrition rate (highest first)
dept_counts.sort_values("resigned_rate_%", ascending = False)
```

Out[173…

Department	total_emp	resigned	resigned_rate_%
Finance	199873	40238	20.131784
R&D	99759	19919	19.967121
HR	159119	31736	19.944821
IT	601042	119852	19.940703
Sales	400031	79725	19.929705
Marketing	240081	47793	19.907031
Operations	300095	59397	19.792732

Overall Summary

Dataset: 2M employees, 11 columns (Employee_ID, Name, Department, Job_Title, Hire_Date, Location, Performance_Rating, Experience_Years, Status, Work_Mode, Salary_INR).

Employee Status: ~70% Active, ~20% Resigned, ~5% Retired, ~5% Terminated → high voluntary attrition.

Work Mode: ~60% On-site, ~40% Remote → significant remote workforce presence.

Department Size: IT (largest), then Sales & Operations → IT is the company's backbone.

Job Titles: Software Engineer, Sales Executive, Operations Executive are the most common roles.

Average Salary: IT highest (≈ ₹1.13M), others around ₹0.75–0.80M → IT attracts premium pay.

Top Salaries: Department Managers earn 2–3× more than average employees.

Attrition Counts: Highest absolute resignations in IT, but attrition rate ~20% across all departments (almost equal).

Salary vs Experience: Almost flat → no major salary growth with more experience.

Performance Rating: Average ≈ 3 for all departments → little differentiation in evaluation.

Performance vs Salary: Correlation ≈ 0 → pay not linked to performance.

Hiring Trend: Sharp growth from 2016 to 2024 → expansion period.

Remote vs On-site Salary: Nearly identical → fair pay for remote work.