Data Analysis Project

PAKISTAN JOB MARKET ANALYSIS REPORT

18/01/2025

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1 Pakistan Job Market Analysis Dec 19 - Mar-21

1.1 Importing Essential Libraries

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

1.1.1 loading Data set

[2]:
```
file_path='Pakistan Available Job Dec 19 - Mar-21.csv'
df=pd.read_csv(file_path )
```

[3]:
```
df.head()
```

[3]:
```
                                          Job Name        label  \
0  Full Time New Job Positions .Net, .Netcore, Fl…  Premium Job
1    Full Time Senior Web Developer Jobs in Pakistan  Premium Job
2        Full Time Russian Speakers Jobs in Pakistan  Premium Job
3  Full Time Customer Support Specialist - Intern…  Premium Job
4  Full Time English Speaker - International Busi…  Premium Job

                             Company Name        Job Type  \
0               Nayel Solutions, Pakistan  Full Time Jobs
1  Eurosoft Tech Private Limited, Pakistan  Full Time Jobs
2                     ICM JAPAN, Pakistan  Full Time Jobs
3                          ibex, Pakistan  Full Time Jobs
4                     ICM JAPAN, Pakistan   Full Time Job

       Experience Required             Department  \
0        2 Years Job Exp.                IT Jobs
1        2 Years Job Exp.                IT Jobs
2                < 1 Year  Customer Service Jobs
3  Job for Fresh Graduates  Customer Service Jobs
4                < 1 Year   Customer Service Job
```

```
                                                   JD       City Date Posted
0  New Job Positions .net, .netcore, flutter, Tea…  Islamabad   12-Mar-21
1  We are looking for an experienced Web Develope…    Karachi   12-Mar-21
2  International clients dealing exposure (B2B).S…    Karachi   12-Mar-21
3  Responsible for acting as a liaison between ou…  Islamabad    9-Mar-21
4  International clients dealing exposure (B2B) a…    Karachi    5-Mar-21
```

1.1.2 Summary Statistics

[4]:
```
df.shape
```

[4]:
```
(6680, 9)
```

[5]:
```
df.describe()
```

[5]:
```
                                        Job Name        label  \
count                                       6680         1115
unique                                      3838            3
top     Full Time Graphic Designer Job in Pakistan  Gallery Job
freq                                          60          775

          Company Name       Job Type Experience Required Department  \
count             6017           6680                 6680       6680
unique            2879              2                   17        111
top     ibex, Pakistan  Full Time Job    2 Years Job Exp.     IT Job
freq                93           3821                 1635        820

                                                    JD    City Date Posted
count                                             6680    6680        6680
unique                                            5043      86         443
top     To generate quality leads that result in sales…  Lahore   23-Feb-21
freq                                                37    2046         134
```

[6]:
```
df.columns
```

[6]:
```
Index(['Job Name', 'label', 'Company Name', 'Job Type', 'Experience Required',
       'Department', 'JD', 'City', 'Date Posted'],
      dtype='object')
```

[7]:
```
type(df)
```

[7]:
```
pandas.core.frame.DataFrame
```

[8]:
```
df.isnull().sum()
```

[8]:
```
Job Name                0
label                5565
```

```
Company Name            663
Job Type                  0
Experience Required       0
Department                0
JD                        0
City                      0
Date Posted               0
dtype: int64
```

1.2 Data Cleaning

[9]:
```
df.dropna(subset=['Company Name'] , inplace=True)
```

[10]:
```
df
```

[10]:
```
                                              Job Name        label  \
0     Full Time New Job Positions .Net, .Netcore, Fl…  Premium Job
1       Full Time Senior Web Developer Jobs in Pakistan  Premium Job
2           Full Time Russian Speakers Jobs in Pakistan  Premium Job
3     Full Time Customer Support Specialist - Intern…  Premium Job
4     Full Time English Speaker - International Busi…  Premium Job
…                                                   …           …
6674  Full Time Senior Python Developer  Jobs in Pak…          NaN
6675  Full Time Senior Software Engineer  Job in Pak…          NaN
6677  Full Time Business Development Executive Job i…          NaN
6678  Full Time 3D Modeler / CG Artist Game Jobs in …          NaN
6679  Full Time Bidding Expert / Social Media Market…          NaN

                                Company Name        Job Type  \
0                    Nayel Solutions, Pakistan  Full Time Jobs
1     Eurosoft Tech Private Limited, Pakistan  Full Time Jobs
2                          ICM JAPAN, Pakistan  Full Time Jobs
3                               ibex, Pakistan  Full Time Jobs
4                          ICM JAPAN, Pakistan   Full Time Job
…                                          …            …
6674   Bridging Trade International, Pakistan  Full Time Jobs
6675                        KnovaSol, Pakistan   Full Time Job
6677                    Loop Brackets, Pakistan   Full Time Job
6678             Super Duper Studio , Pakistan  Full Time Jobs
6679             Super Duper Studio , Pakistan  Full Time Jobs

          Experience Required              Department  \
0             2 Years Job Exp.                 IT Jobs
1             2 Years Job Exp.                 IT Jobs
2                    < 1 Year   Customer Service Jobs
3     Job for Fresh Graduates   Customer Service Jobs
4                    < 1 Year    Customer Service Job
```

```
…                        …                        …
6674         4 Years Job Exp.                  IT Jobs
6675         3 Years Job Exp.    Computer Software Job
6677         2 Years Job Exp.    Computer Software Job
6678         2 Years Job Exp.   Computer Software Jobs
6679  Job for Fresh Graduates   Computer Software Jobs

                                                     JD       City Date Posted
0     New Job Positions .net, .netcore, flutter, Tea…  Islamabad   12-Mar-21
1     We are looking for an experienced Web Develope…    Karachi   12-Mar-21
2     International clients dealing exposure (B2B).S…    Karachi   12-Mar-21
3     Responsible for acting as a liaison between ou…  Islamabad    9-Mar-21
4     International clients dealing exposure (B2B) a…    Karachi    5-Mar-21
…                                                   …        …         …
6674  What they will do:&middot; Development of appl…  Islamabad   30-Dec-20
6675  We required services of Senior Software Engine…  Islamabad   30-Dec-20
6677  The ideal candidate will have experience in al…     Lahore   29-Dec-20
6678  Must be able to create 3D Game Environments an…     Lahore   29-Dec-20
6679  Candidate Shall Be Expert in Getting Work from…     Lahore   29-Dec-20

[6017 rows x 9 columns]
```

[16]:
```
df['label']=df['label'].fillna('unkown')
```

[17]:
```
df.isnull().sum()
```

[17]:
```
Job Name              0
label                 0
Company Name          0
Job Type              0
Experience Required   0
Department            0
JD                    0
City                  0
Date Posted           0
dtype: int64
```

[18]:
```
df=df.drop_duplicates()
```

[19]:
```
df
```

[19]:
```
                                        Job Name        label  \
0     Full Time New Job Positions .Net, .Netcore, Fl…  Premium Job
1       Full Time Senior Web Developer Jobs in Pakistan  Premium Job
2           Full Time Russian Speakers Jobs in Pakistan  Premium Job
3     Full Time Customer Support Specialist - Intern…  Premium Job
4     Full Time English Speaker - International Busi…  Premium Job
```

```
…                                                    …          …
6665  Full Time Sr. Full Stack Engineer  Job in Paki…      unknown
6666         Full Time Node Developer Jobs in Pakistan      unknown
6667  Full Time Principal Software Engineer - Node J…      unknown
6668      Full Time Android Developer  Job in Pakistan      unknown
6675  Full Time Senior Software Engineer  Job in Pak…      unknown

                                        Company Name        Job Type  \
0                           Nayel Solutions, Pakistan  Full Time Jobs
1               Eurosoft Tech Private Limited, Pakistan  Full Time Jobs
2                                ICM JAPAN, Pakistan  Full Time Jobs
3                                     ibex, Pakistan  Full Time Jobs
4                                ICM JAPAN, Pakistan   Full Time Job
…                                                    …            …
6665  Professional Employers Private Limited, Pakistan   Full Time Job
6666  Professional Employers Private Limited, Pakistan  Full Time Jobs
6667  Professional Employers Private Limited, Pakistan   Full Time Job
6668                               KnovaSol, Pakistan   Full Time Job
6675                               KnovaSol, Pakistan   Full Time Job

          Experience Required              Department  \
0            2 Years Job Exp.                 IT Jobs
1            2 Years Job Exp.                 IT Jobs
2                   < 1 Year   Customer Service Jobs
3     Job for Fresh Graduates   Customer Service Jobs
4                   < 1 Year    Customer Service Job
…                       …                       …
6665         2 Years Job Exp.   Computer Software Job
6666         2 Years Job Exp.  Computer Software Jobs
6667         4 Years Job Exp.   Computer Software Job
6668         2 Years Job Exp.   Computer Software Job
6675         3 Years Job Exp.   Computer Software Job

                                                    JD       City Date Posted
0     New Job Positions .net, .netcore, flutter, Tea…  Islamabad   12-Mar-21
1     We are looking for an experienced Web Develope…    Karachi   12-Mar-21
2     International clients dealing exposure (B2B).S…    Karachi   12-Mar-21
3     Responsible for acting as a liaison between ou…  Islamabad    9-Mar-21
4     International clients dealing exposure (B2B) a…    Karachi    5-Mar-21
…                                                    …        …         …
6665  Job description:Adapting interface for modern …     Lahore   30-Dec-20
6666  We are looking for a highly capable Node.js se…     Lahore   30-Dec-20
6667  We are looking for a highly capable Node.js se…     Lahore   30-Dec-20
6668  We required services of Android developer.Mini…  Islamabad   30-Dec-20
6675  We required services of Senior Software Engine…  Islamabad   30-Dec-20

[5291 rows x 9 columns]
```

[20]:
```
df['label'].unique()
```

[20]:
```
array(['Premium Job', 'Hot Job', 'Gallery Job', 'unknown'], dtype=object)
```

[21]:
```
df['City'].unique()
```

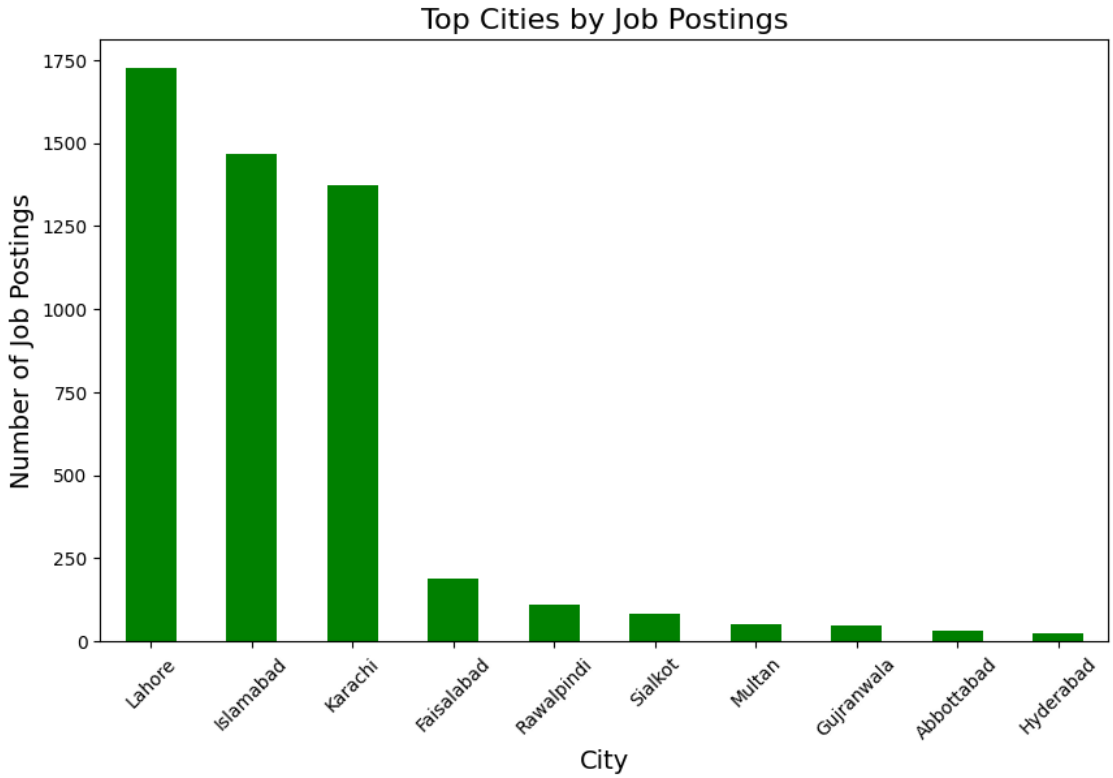
[21]:
```
array(['Islamabad', 'Karachi', 'Faisalabad', 'Lahore', 'Sialkot',
       'Malakand', 'Rawalpindi', 'Bhakkar', 'Gujrat', 'Hasan Abdal',
       'Abbottabad', 'Attock', 'Swat', 'Hyderabad', 'Peshawar',
       'Gujranwala', 'Multan', 'Mardan', 'Khanewal', 'Jhang',
       'Ahmadpur East', 'Kharian', 'Mailsi', 'Bahawalpur', 'Khushab',
       'Sargodha', 'Haripur', 'Wah', 'Muridke', 'Daska', 'Dipalpur',
       'Ghakhar Mandi', 'Bahawalnagar', 'Pattoki', 'Mirpur', 'Hazara',
       'Bhurban', 'Rahim Yar Khan', 'Ali Khan Abad', 'Chakwal', 'Chiniot',
       'Besham', 'Sahiwal', 'Layyah', 'Muzaffargarh', 'Mirpur Khas',
       'Gojra', 'Kasur', 'Dera Murad Jamali', 'Badin', 'Jhelum', 'Kamoke',
       'Malakwal', 'Gujar Khan', 'Shikarpur', 'Sukkur', 'Kamra', 'Quetta',
       'Dadu', 'Chitral', 'Bajaur', 'Gilgit', 'Nankana Sahib', 'Burewala',
       'Kohat', 'Arifwala', 'Sadiqabad', 'Mianwali', 'Kamalia',
       'Dera Ismail Khan', 'Sheikhupura', 'Dina'], dtype=object)
```

1.2.1 Top Cities with Heighest Job Posting

[22]:
```
top_cities = df['City'].value_counts().head(10)
print(top_cities)
```

```
City
Lahore        1726
Islamabad     1469
Karachi       1372
Faisalabad     189
Rawalpindi     111
Sialkot         82
Multan          50
Gujranwala      47
Abbottabad      30
Hyderabad       25
Name: count, dtype: int64
```

[23]:
```
top_cities.plot(kind='bar', figsize=(10, 6), color='green')
plt.title('Top Cities by Job Postings', fontsize=16)
plt.xlabel('City', fontsize=14)
plt.ylabel('Number of Job Postings', fontsize=14)
plt.xticks(rotation=45)
plt.show()
```



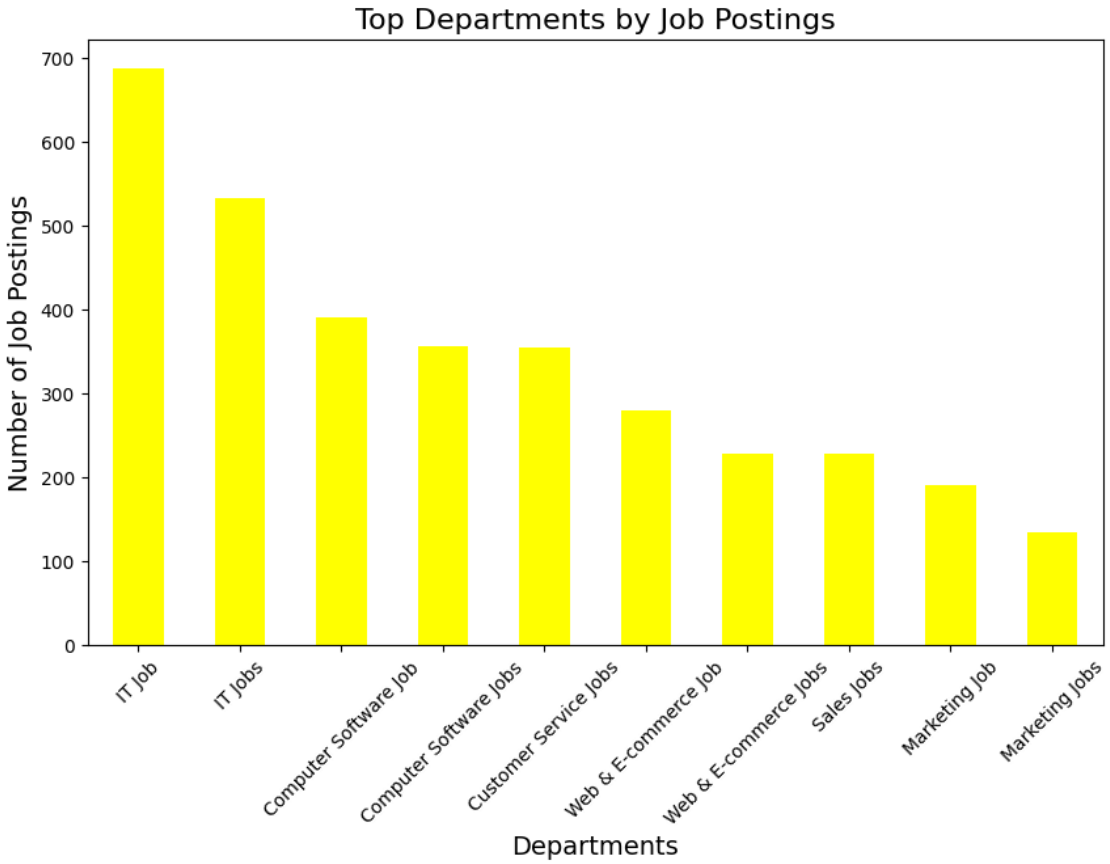
1.2.2 Top Departments

[24]:
```
top_department=df['Department'].value_counts().head(10)
print(top_department)
```

```
Department
IT Job                    687
IT Jobs                   532
Computer Software Job     390
Computer Software Jobs    356
Customer Service Jobs     354
Web & E-commerce Job      280
Web & E-commerce Jobs     228
Sales Jobs                227
Marketing Job             191
Marketing Jobs            134
Name: count, dtype: int64
```

[25]:
```
top_department.plot(kind='bar', figsize=(10, 6), color='yellow')
plt.title('Top Departments by Job Postings', fontsize=16)
plt.xlabel('Departments', fontsize=14)
plt.ylabel('Number of Job Postings', fontsize=14)
```

```
plt.xticks(rotation=45)
plt.show()
```



1.2.3 Experience Requirements

[26]:
```
def parse_experience(exp):
    if "Years" in exp:
        return float(exp.split()[0])  # Extract the number before 'Years'
    elif "< 1 Year" in exp:
        return 0.5  # Assign 0.5 for less than 1 year
    elif "Fresh Graduates" in exp:
        return 0  # Assign 0 for fresh graduates
    else:
        return None  # Handle unexpected cases

# Apply the function to clean the data
df['Experience_cleaned'] = df['Experience Required'].apply(parse_experience)

# Calculate the average experience required
```

```
average_experience = df['Experience_cleaned'].mean()

print(f"The average experience required is {average_experience:.2f} years.")
```

```
The average experience required is 1.97 years.
```

```
C:\Users\progr\AppData\Local\Temp\ipykernel_10712\3482562680.py:12:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Experience_cleaned'] = df['Experience Required'].apply(parse_experience)
```

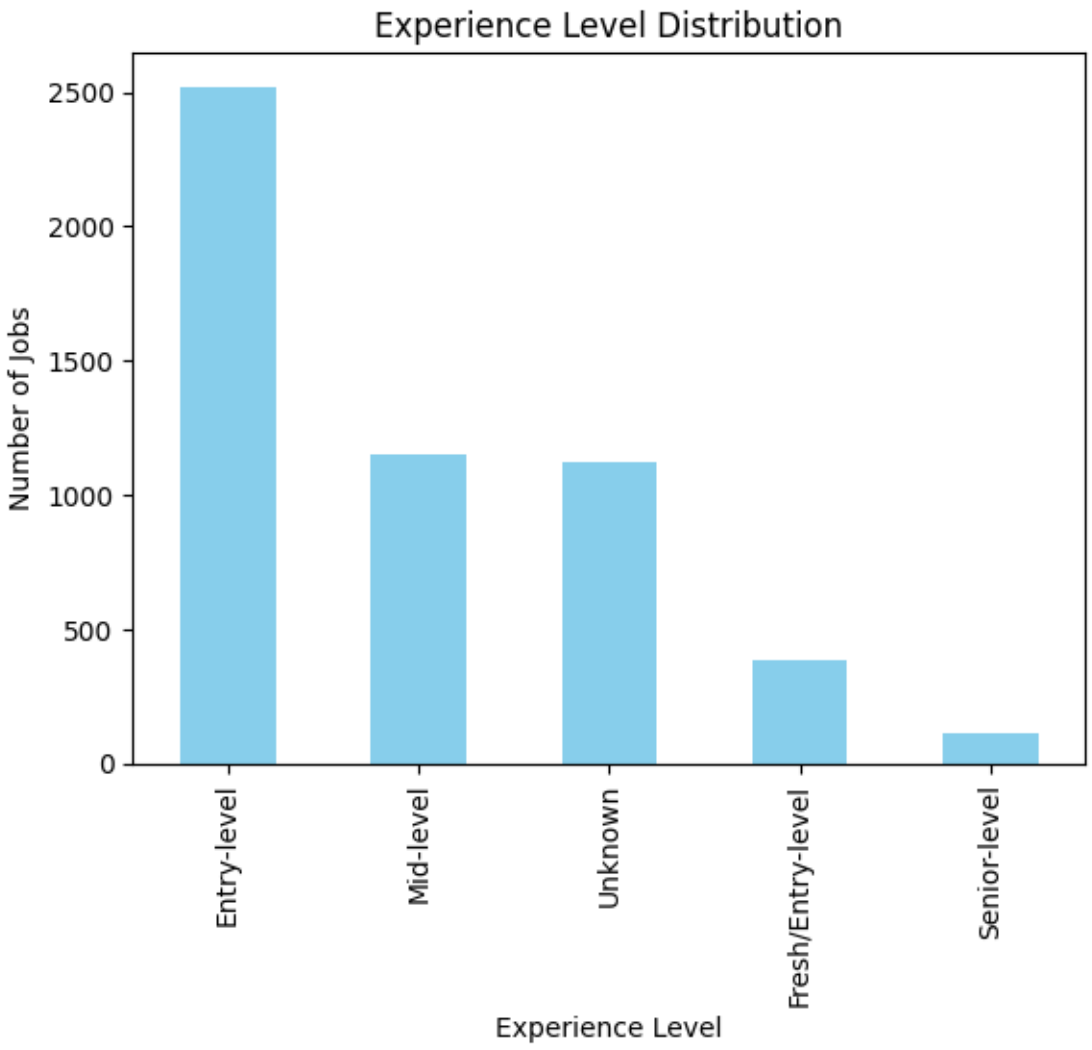
[29]:
```
def categorize_experience(years):
    if years == 0:
        return "Fresh/Entry-level"
    elif 0 < years <= 2:
        return "Entry-level"
    elif 2 < years <= 5:
        return "Mid-level"
    elif years > 5:
        return "Senior-level"
    else:
        return "Unknown"

df['Experience_level'] = df['Experience_cleaned'].apply(categorize_experience)

# Calculate distribution
distribution = df['Experience_level'].value_counts()

print("Experience Level Distribution:")
print(distribution)

# percentages
percentages = (distribution / distribution.sum()) * 100
print("\nPercentage Distribution:")
print(f'{percentages} %')
```

```
Experience Level Distribution:
Experience_level
Entry-level          2521
Mid-level            1153
Unknown              1121
Fresh/Entry-level     385
Senior-level          111
Name: count, dtype: int64
```

```
Percentage Distribution:
Experience_level
Entry-level          47.646948
Mid-level            21.791722
Unknown              21.186921
Fresh/Entry-level     7.276507
Senior-level          2.097902
Name: count, dtype: float64 %
```

```
C:\Users\progr\AppData\Local\Temp\ipykernel_10712\4064409129.py:13:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Experience_level'] = df['Experience_cleaned'].apply(categorize_experience)
```

[30]:
```
distribution.plot(kind='bar', color='skyblue')
plt.title("Experience Level Distribution")
plt.xlabel("Experience Level")
plt.ylabel("Number of Jobs")
plt.show()
```



[31]:
```
# Group by Job Type and calculate average experience
experience_by_job_type = df.groupby('Job Type')['Experience_cleaned'].mean()
print("Average Experience by Job Type:")
print(experience_by_job_type)

# Group by Department and calculate average experience
experience_by_department = df.groupby('Department')['Experience_cleaned'].mean()
print("\nAverage Experience by Department:")
print(experience_by_department)

# Optional: Combine results into a single DataFrame for better visualization
combined_results = df.groupby(['Department', 'Job Type'])['Experience_cleaned'].
  ↪mean().reset_index()
print("\nAverage Experience by Department and Job Type:")
```

```
print(combined_results)
```

```
Average Experience by Job Type:
Job Type
Full Time Job     2.259015
Full Time Jobs    1.619198
Name: Experience_cleaned, dtype: float64

Average Experience by Department:
Department
Accounting Job           1.978261
Accounting Jobs          1.978261
Admin Job                1.321839
Admin Jobs               1.115385
Agriculture Job          2.666667
                             …
Telecom Jobs             0.785714
Warehousing Job          3.055556
Warehousing Jobs         4.000000
Web & E-commerce Job     2.302222
Web & E-commerce Jobs    1.849727
Name: Experience_cleaned, Length: 109, dtype: float64

Average Experience by Department and Job Type:
                Department        Job Type  Experience_cleaned
0           Accounting Job   Full Time Job            1.978261
1          Accounting Jobs  Full Time Jobs            1.978261
2                Admin Job   Full Time Job            1.321839
3               Admin Jobs  Full Time Jobs            1.115385
4          Agriculture Job   Full Time Job            2.666667
..                     …             …                  …
104           Telecom Jobs  Full Time Jobs            0.785714
105        Warehousing Job   Full Time Job            3.055556
106       Warehousing Jobs  Full Time Jobs            4.000000
107   Web & E-commerce Job   Full Time Job            2.302222
108  Web & E-commerce Jobs  Full Time Jobs            1.849727

[109 rows x 3 columns]
```

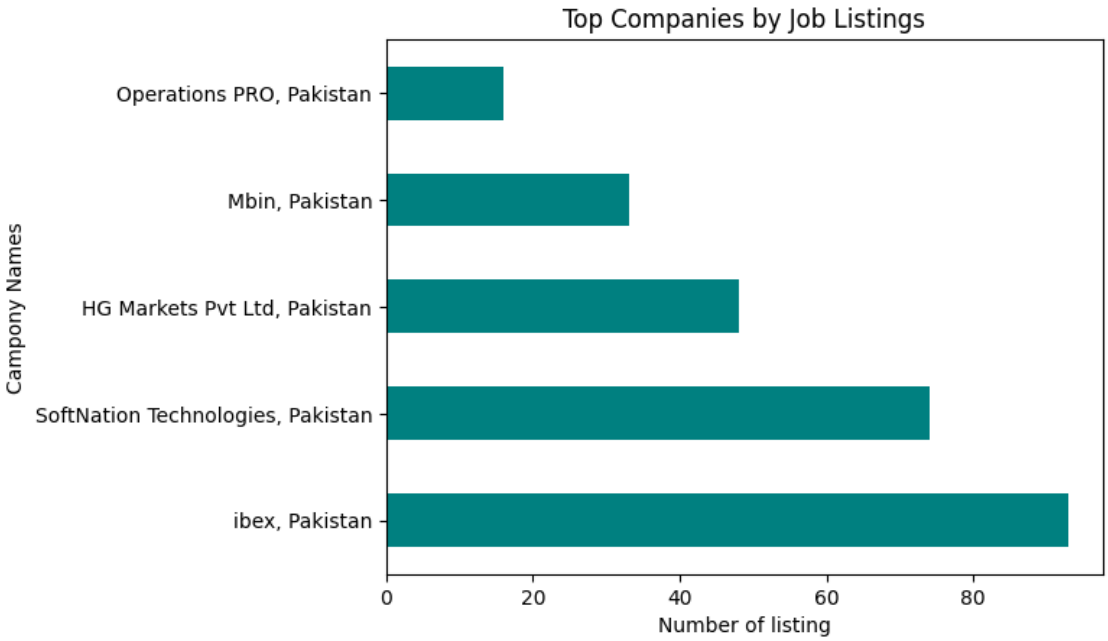
1.2.4 Company Insights

[36]:
```
# Count job listings by company
job_counts = df['Company Name'].value_counts()

print("Number of Job Listings by Company:")
print(job_counts)
```

```
Number of Job Listings by Company:
Company Name
ibex, Pakistan                                93
SoftNation Technologies, Pakistan             74
HG Markets Pvt Ltd, Pakistan                  48
Mbin, Pakistan                                33
Operations PRO, Pakistan                      16
                                              ..
Impressols, Pakistan                           1
Burraq Engineering Solutions , Pakistan        1
Websitoz, Pakistan                             1
JBD Press, Pakistan                            1
Rajput Builder & Developers, Pakistan          1
Name: count, Length: 2879, dtype: int64
```

[40]:
```
top_companies = job_counts.head(5)
print("\nTop Companies with Most Job Listings:")
print(top_companies)

top_companies.plot(kind='barh', color='teal', title='Top Companies by Job␣
 ↪Listings')
plt.xlabel('Number of listing')
plt.ylabel('Campony Names')
plt.xticks()
plt.show()
```

```
Top Companies with Most Job Listings:
Company Name
ibex, Pakistan                          93
SoftNation Technologies, Pakistan       74
HG Markets Pvt Ltd, Pakistan            48
Mbin, Pakistan                          33
Operations PRO, Pakistan                16
Name: count, dtype: int64
```



[42]:
```
# Count job postings by Company and Job Type
job_type_counts = df.groupby(['Job Type', 'Company Name']).size().
 ↪reset_index(name='Count')

# Find the top company for each job type
top_companies_by_job_type = job_type_counts.sort_values(['Job Type', 'Count'],␣
 ↪ascending=[True, False]).groupby('Job Type').head(1)

print("Top Companies by Job Type:")
print(top_companies_by_job_type)

# Count job postings by Company and Department
department_counts = df.groupby(['Department', 'Company Name']).size().
 ↪reset_index(name='Count')

# Find the top company for each department
top_companies_by_department = department_counts.sort_values(['Department',␣
 ↪'Count'], ascending=[True, False]).groupby('Department').head(1)

print("\nTop Companies by Department:")
print(top_companies_by_department)
```

```
Top Companies by Job Type:
            Job Type                       Company Name  Count
1335   Full Time Job  SoftNation Technologies, Pakistan     41
3239  Full Time Jobs                       ibex, Pakistan     93
```

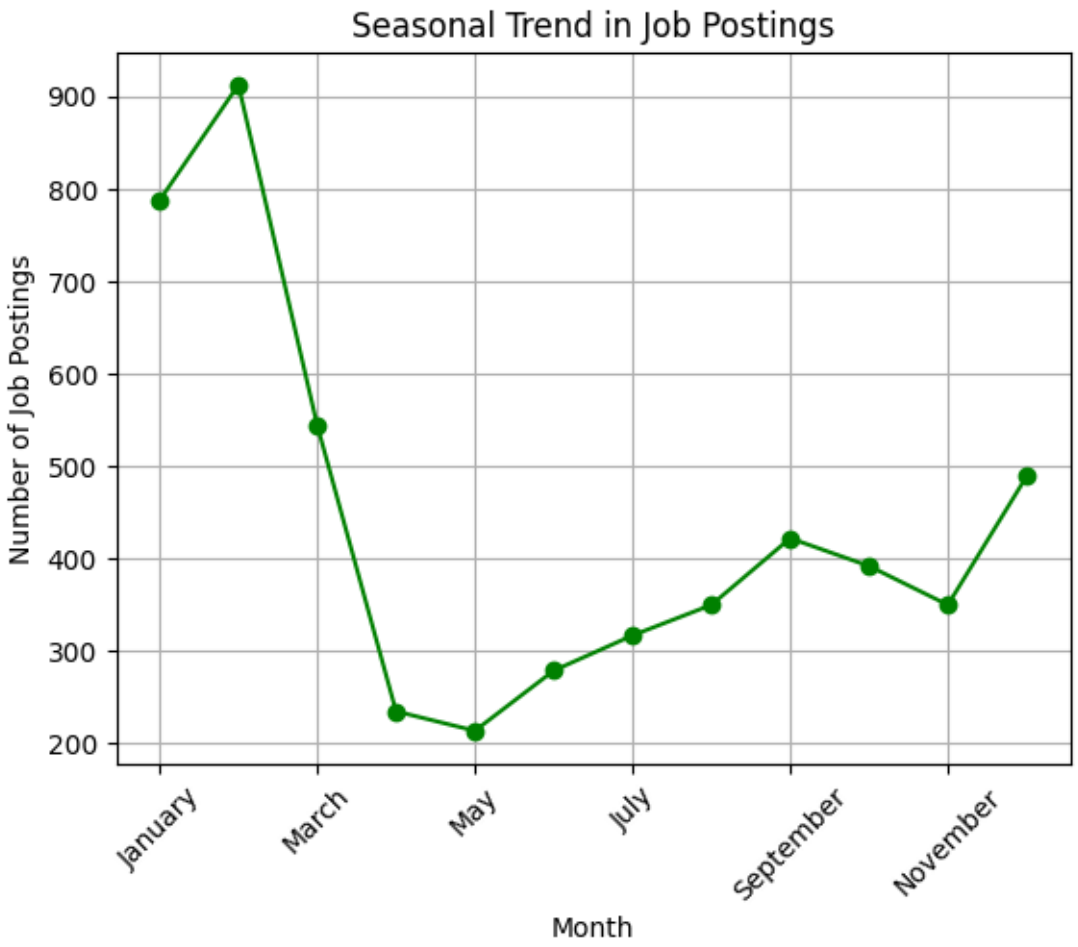
```
Top Companies by Department:
                Department                                        Company Name  \
12           Accounting Job  Deluxe Accountants and Tax Consultants, Pakistan
63          Accounting Jobs                          Silverstone & Co, Pakistan
80                Admin Job                              Confidential, Pakistan
156              Admin Jobs                                   40media, Pakistan
176         Agriculture Job                                 Haji Sons, Pakistan
…                      …                                                    …
3252           Telecom Jobs       Myson Engineering Systems Pvt Ltd, Pakistan
3267        Warehousing Job                      Texo Poly Industries, Pakistan
3269       Warehousing Jobs                                 Adweb Studio, Pakistan
3389   Web & E-commerce Job                          My Own Business, Pakistan
3555   Web & E-commerce Jobs                                      Mbin, Pakistan

      Count
12        2
63        4
80        7
156       1
176       2
…     …
3252      3
3267      3
3269      1
3389      7
3555     10

[109 rows x 3 columns]
```

1.2.5 Seasonal Trend in Job Posting in Pakistan

[45]:
```
#Convert Posting Date to datetime and extract the month
df['Date Posted'] = pd.to_datetime(df['Date Posted'])
df['Month'] = df['Date Posted'].dt.month

# Count job postings by month
monthly_job_counts = df['Month'].value_counts().sort_index()

# Map month numbers to names for better readability
monthly_job_counts.index = monthly_job_counts.index.map({
    1: "January", 2: "February", 3: "March", 4: "April", 5: "May",
    6: "June", 7: "July", 8: "August", 9: "September",
    10: "October", 11: "November", 12: "December"
})

# Plot the seasonal trend
```

```
monthly_job_counts.plot(kind='line', marker='o', title='Seasonal Trend in Job␣
 ↪Postings', color='green')
plt.xlabel('Month')
plt.ylabel('Number of Job Postings')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```

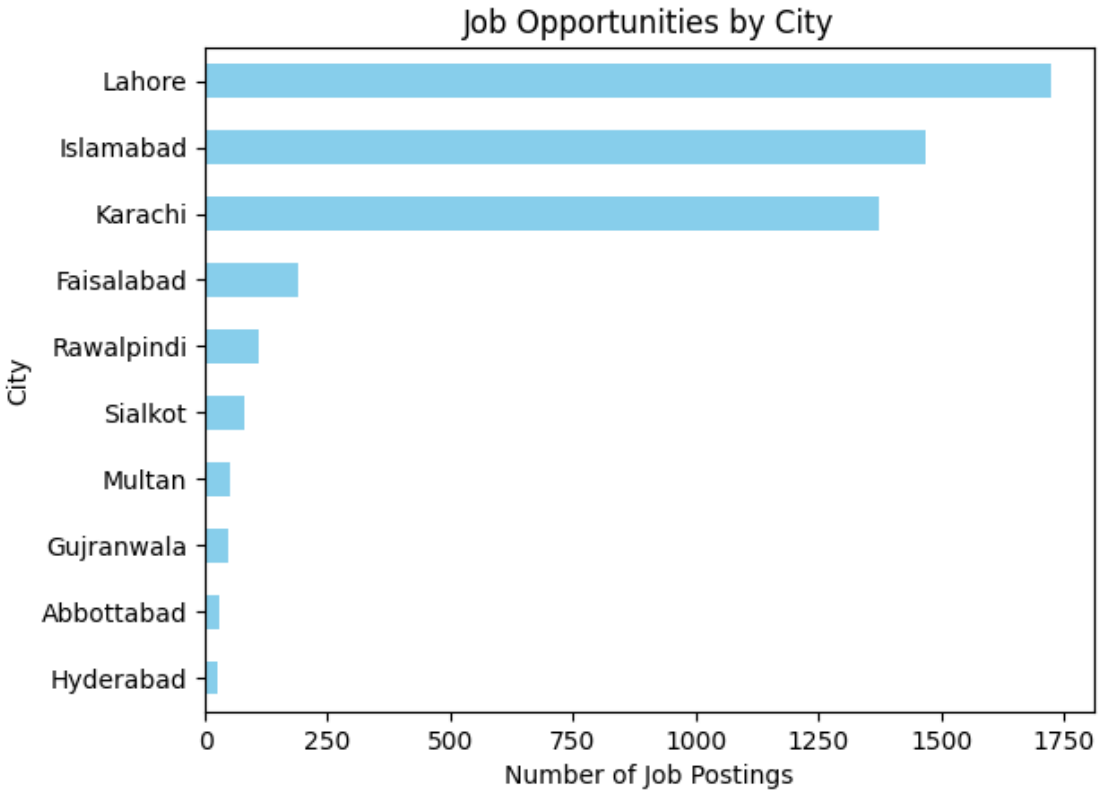
```
C:\Users\progr\AppData\Local\Temp\ipykernel_10712\614912028.py:2: UserWarning:
Could not infer format, so each element will be parsed individually, falling
back to `dateutil`. To ensure parsing is consistent and as-expected, please
specify a format.
  df['Date Posted'] = pd.to_datetime(df['Date Posted'])
C:\Users\progr\AppData\Local\Temp\ipykernel_10712\614912028.py:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Date Posted'] = pd.to_datetime(df['Date Posted'])
C:\Users\progr\AppData\Local\Temp\ipykernel_10712\614912028.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Month'] = df['Date Posted'].dt.month
```



[49]:
```
# Count job postings by city
city_job_counts = df['City'].value_counts().head(10)

print("Number of Job Postings by City:")
print(city_job_counts)

# Plot the cities with the highest job opportunities
city_job_counts.plot(kind='barh', color='skyblue', title='Job Opportunities by␣
 ↪City')
plt.xlabel('Number of Job Postings')
plt.ylabel('City')
plt.gca().invert_yaxis()
plt.show()
```

```
Number of Job Postings by City:
City
Lahore        1726
```

```
Islamabad     1469
Karachi       1372
Faisalabad     189
Rawalpindi     111
Sialkot         82
Multan          50
Gujranwala      47
Abbottabad      30
Hyderabad       25
Name: count, dtype: int64
```



[56]:
```python
# Convert Posting Date to datetime
df['Date Posted'] = pd.to_datetime(df['Date Posted'])

# Extract month and year from Posting Date for trend analysis
df['Month_Year'] = df['Date Posted'].dt.to_period('M')

# Count job postings by city and month
city_monthly_trends = df.groupby(['City', 'Month_Year']).size().
  ↪unstack(fill_value=0)

print("Job Posting Trends by City Over Time:")
```

```
print(city_monthly_trends)

# Plot the trends
plt.figure(figsize=(10,10))
city_monthly_trends.T.plot(kind='line', marker='o', title='Job Postings Trends␣
 ↪by City Over Time')
plt.xlabel('Month/Year')
plt.ylabel('Number of Job Postings')
plt.xticks(rotation=45)
plt.legend(title='City', loc='upper left' , bbox_to_anchor=(1, 1))
plt.grid(True)
plt.show()
```

```
C:\Users\progr\AppData\Local\Temp\ipykernel_10712\146363480.py:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Date Posted'] = pd.to_datetime(df['Date Posted'])
C:\Users\progr\AppData\Local\Temp\ipykernel_10712\146363480.py:5:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Month_Year'] = df['Date Posted'].dt.to_period('M')
```

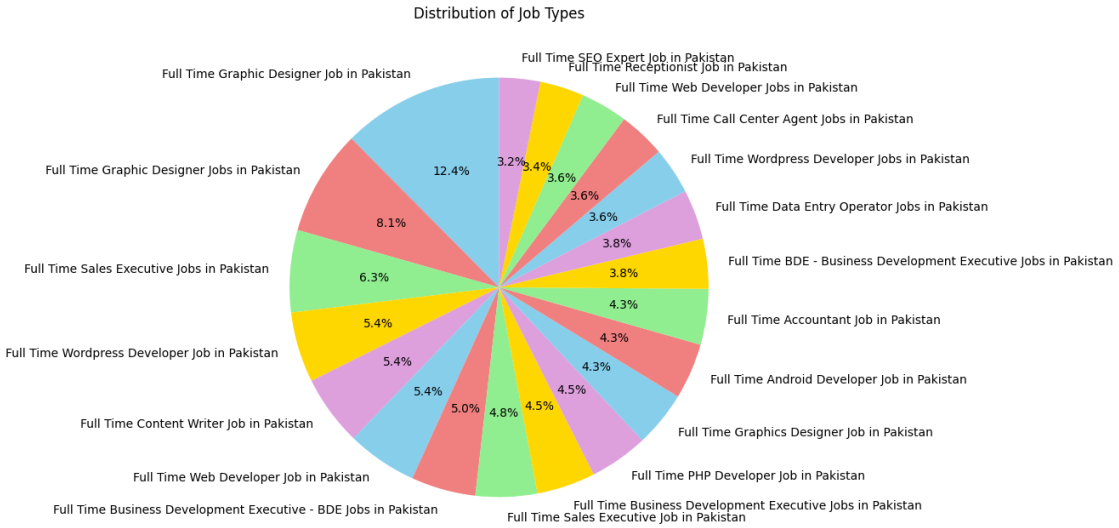
```
Job Posting Trends by City Over Time:
Month_Year     2019-12  2020-01  2020-02  2020-03  2020-04  2020-05  2020-06  \
City
Abbottabad           0        0        1        3        2        0        0
Ahmadpur East        0        0        0        0        0        0        0
Ali Khan Abad        0        0        0        0        0        0        0
Arifwala             0        0        1        0        0        0        0
Attock               0        2        0        0        2        0        0
…                  …        …        …        …        …        …        …
Shikarpur            0        0        0        1        0        0        0
Sialkot              1        1        3        3        3        1        3
Sukkur               0        0        0        0        0        0        0
Swat                 0        0        0        0        0        0        0
Wah                  0        1        1        0        0        0        2

Month_Year     2020-07  2020-08  2020-09  2020-10  2020-11  2020-12  2021-01  \
City
Abbottabad           3        4        3        5        0        0        0
```

```
Ahmadpur East        0        0        0        0        0        0        1
Ali Khan Abad        0        0        0        0        1        0        0
Arifwala             0        0        0        0        0        0        0
Attock               1        0        0        1        2        0        1
…                  …      …      …      …      …      …      …
Shikarpur            1        0        0        0        0        0        0
Sialkot              0        3        1       10        2        4       23
Sukkur               1        0        0        0        0        0        0
Swat                 0        0        0        0        1        0        0
Wah                  0        0        0        2        2        0        1

Month_Year     2021-02  2021-03
City
Abbottabad           5        4
Ahmadpur East        1        0
Ali Khan Abad        0        0
Arifwala             0        0
Attock               0        2
…                  …      …
Shikarpur            0        0
Sialkot             12       12
Sukkur               0        0
Swat                 2        2
Wah                  0        0

[72 rows x 16 columns]
```

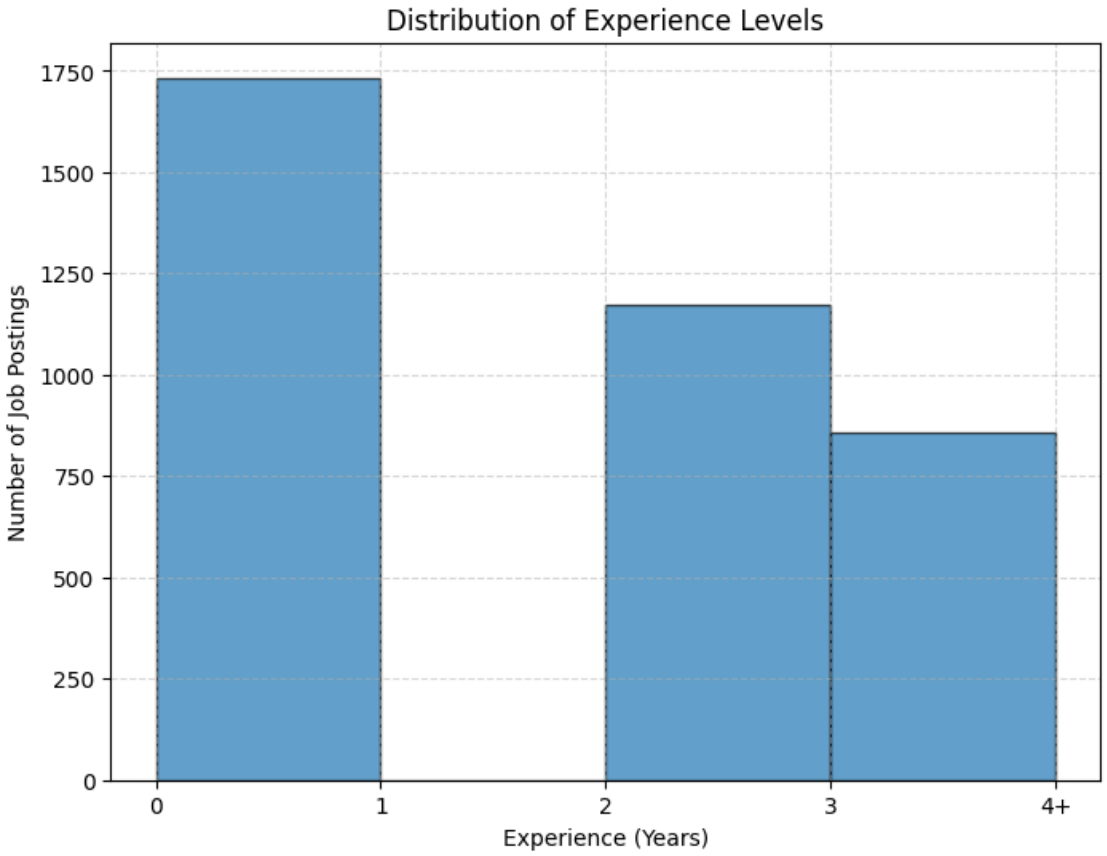
<Figure size 1000x1000 with 0 Axes>


Job Postings Trends by City Over Time
Number of Job Postings
Month/Year
Jan 2020
Apr
Jul
Oct
Jan 2021
City
Abbottabad
Ahmadpur East
Ali Khan Abad
Arifwala
Attock
Badin
Bahawalnagar
Bahawalpur
Bajaur
Besham
Bhakkar
Bhurban
Burewala
Chakwal
Chiniot
Chitral
Dadu
Daska
Dera Ismail Khan
Dera Murad Jamali
Dina
Dipalpur
Faisalabad
Ghakhar Mandi
Gilgit
Gojra
Gujar Khan
Gujranwala
Gujrat
Haripur
Hasan Abdal
Hazara
Hyderabad
Islamabad
Jhang
Jhelum
Kamalia
Kamoke
Kamra
Karachi
Kasur
Khanewal
Kharian
Khushab
Kohat
Lahore
Layyah
Mailsi
Malakand
Malakwal
Mardan
Mianwali
Mirpur
Mirpur Khas
Multan
Muridke
Muzaffargarh
Nankana Sahib
Pattoki
Peshawar
Quetta
Rahim Yar Khan
Rawalpindi
Sadiqabad
Sahiwal
Sargodha
Sheikhupura
Shikarpur
Sialkot
Sukkur
Swat
Wah

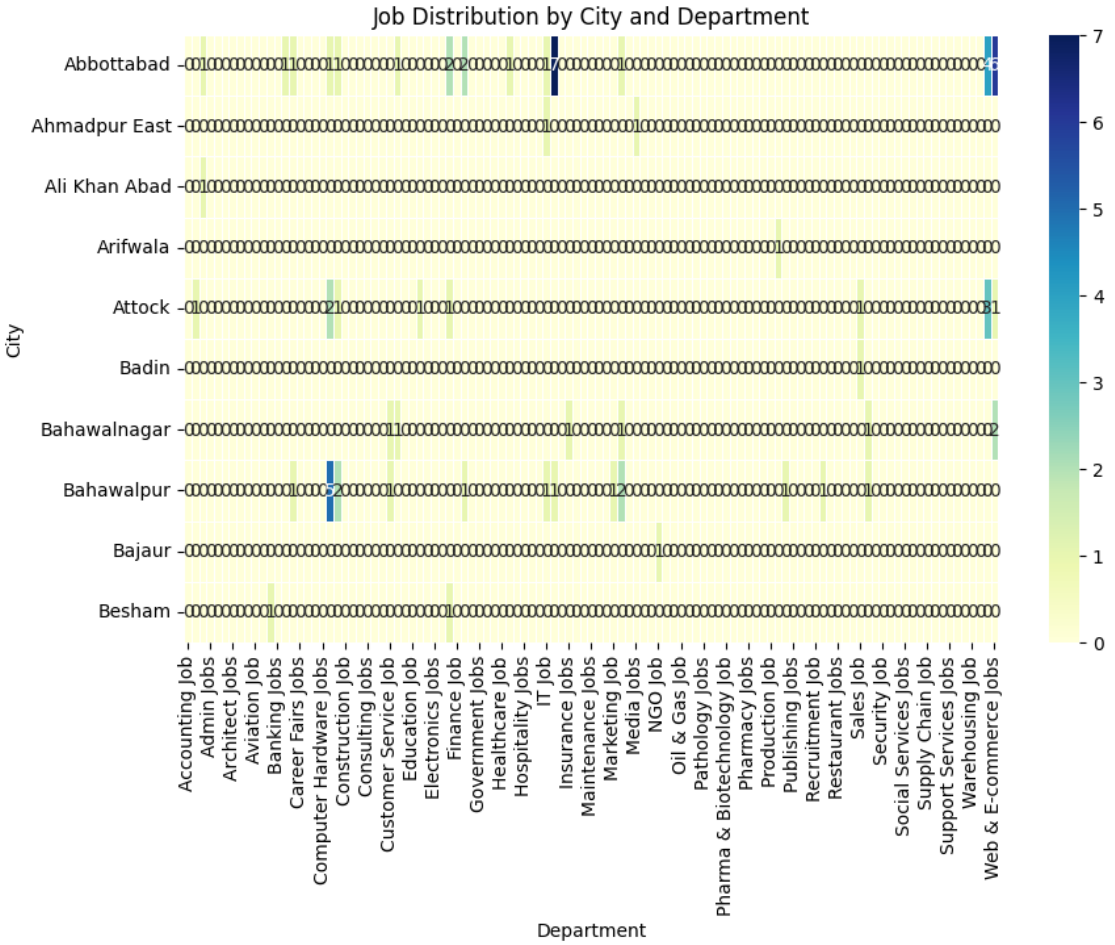
[59]:
```
# Count the job types
job_type_counts = df['Job Name'].value_counts().head(20)

# Plot a pie chart
plt.figure(figsize=(8, 8))
job_type_counts.plot(kind='pie', autopct='%1.1f%%', startangle=90,␣
 ↪colors=['skyblue', 'lightcoral', 'lightgreen', 'gold', 'plum'])
plt.title('Distribution of Job Types')
plt.ylabel('')  # To remove the y-axis label (empty string)
plt.show()
```



[61]:
```
# Plot histogram
plt.figure(figsize=(8, 6))
plt.hist(df['Experience_cleaned'], bins=range(0, 5), edgecolor='black', alpha=0.
 ↪7)
plt.title('Distribution of Experience Levels')
plt.xlabel('Experience (Years)')
plt.ylabel('Number of Job Postings')
plt.xticks([0, 1, 2, 3, 4], ['0', '1', '2', '3', '4+'])
plt.grid(True, linestyle='--', alpha=0.5)
plt.show()
```



[63]:
```
# Create a pivot table: count job postings by city and department
pivot_table = df.pivot_table(index="City", columns="Department",␣
 ↪aggfunc="size", fill_value=0).head(10)

# Plot the heatmap
plt.figure(figsize=(10, 6))
sns.heatmap(pivot_table, annot=True, cmap="YlGnBu", fmt="d", cbar=True,␣
 ↪linewidths=0.5)
plt.title('Job Distribution by City and Department')
plt.ylabel('City')
plt.xlabel('Department')
plt.show()
```



2 Recommendations for Job Seekers:

2.0.1 Focus on In-Demand Job Types:

If certain job types, such as "Software Engineer," "Data Scientist," or "HR Manager," appear frequently in the dataset, these roles are likely in high demand. Job seekers should consider upskilling in these areas by taking relevant courses, obtaining certifications, or gaining hands-on experience in the field. ### Skill Development: If there's a trend where specific skills or tools (e.g., Python, Machine Learning, Data Analysis, or Cloud Computing) are mentioned across job postings, job seekers should prioritize acquiring these skills. Job seekers should explore platforms like DataCamp, Coursera, or Udemy to learn these in-demand skills. Staying updated with industry trends and technological advancements will be valuable.

2.1 High-Demand Skills or Qualifications:

2.1.1 Technical Skills:

For roles like "Software Engineer" or "Data Scientist," proficiency in programming languages (e.g., Python, R, Java) and data analysis tools (e.g., Pandas, Scikit-Learn, SQL) can be key qualifications. Specialized knowledge in AI, machine learning, cloud platforms (e.g., AWS, Google Cloud), and DevOps are emerging trends. ### Soft Skills: Communication, teamwork, and adaptability are likely to be important across job postings, especially for managerial and leadership roles. ### Certifications and Degrees: A bachelor's or master's degree in fields like Computer Science, Data Science, Business Administration, or Engineering can be an asset. Additionally, certifications from recognized bodies (e.g., Google's IT Support, Microsoft Azure) could help job seekers stand out.

2.2 Regions or Cities to Focus on:

2.2.1 Major Hubs:

Karachi: As a commercial and tech hub, Karachi is likely to offer the most job opportunities, particularly for IT-related roles, financial services, and tech startups. #### Lahore: With a strong presence of tech startups, educational institutions, and growing industries, Lahore presents good opportunities for software engineering, data analysis, marketing, and HR roles. #### Islamabad: The capital offers a concentration of government jobs, as well as positions in the tech, finance, and NGO sectors. ### Emerging Cities: #### Peshawar: Although smaller in comparison, cities like Peshawar may have job opportunities in sectors like education, healthcare, and NGOs, where demand is rising. Job seekers should consider moving to or focusing on cities with high concentrations of the job roles they are interested in. For example, those pursuing careers in software development might want to prioritize Karachi or Lahore due to the presence of tech companies.

2.3 Seasonal Trends:

2.3.1 Postings by Season/Month:

Job postings can fluctuate throughout the year. For example, job seekers might notice a surge in job openings in certain months, likely following fiscal year cycles or after the graduation season. Based on the data, job seekers should align their application timing with peak hiring seasons. For example, many companies may ramp up hiring in January-March or post-fiscal-year results, leading to more job openings.

2.4 Job Seekers' Strategy:

2.4.1 Align with Industry Growth:

If specific industries are expanding (e.g., tech, e-commerce, finance), job seekers should tailor their resumes to emphasize skills relevant to these sectors and apply for roles in companies within those industries. ### Network and Engage with Employers: Job seekers should actively participate in local industry events, webinars, or meetups (both physical and virtual), where they can connect with hiring managers and peers. ### Freelancing Opportunities: With the rise of remote work and freelance roles, especially in tech and creative fields, job seekers can consider freelancing as an option through platforms like Upwork or Fiverr. Freelancing opportunities may be prominent in urban cities like Karachi and Lahore.

2.5 Summary of Key Recommendations:

Upskill in high-demand areas like software engineering, data science, and cloud technologies. Focus on cities like Karachi, Lahore, and Islamabad for greater job opportunities in IT, finance, and government sectors. Plan applications around peak hiring seasons, such as early in the year after graduation or fiscal reporting periods. Engage with industry networks to stay updated on job opportunities and connect with potential employers.

[ ]: