In [2]:

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

sns.set(style="whitegrid")
```

In [5]:

```
df = pd.read_csv('project_cleaned_V1.0.csv')
```

In [6]:

```
df['state'] = df['state'].fillna('N/A')
```

In [7]:

```
df['city'] = df['city'].fillna('Not Specified')
```

In [8]:

```
df.head()
```

Out[8]:

	timestamp	age_group	industry	job_title	annual_salary_usd	compe
0	2021-04-27 11:02:10	25-34	Education	Research And Instruction Librarian	55000.0	
1	2021-04-27 11:02:22	25-34	Technology & IT	Change & Internal Communications Manager	72897.0	
2	2021-04-27 11:02:38	25-34	Finance	Marketing Specialist	34000.0	
3	2021-04-27 11:02:41	25-34	Non-Profit Organization	Program Manager	62000.0	
4	2021-04-27 11:02:42	25-34	Finance	Accounting Manager	60000.0	

In [9]:

```
# If you want to see full numbers without e+, you can do:
pd.set_option('display.float_format', '{:,.2f}'.format)
df['annual_salary_usd'].describe()
```

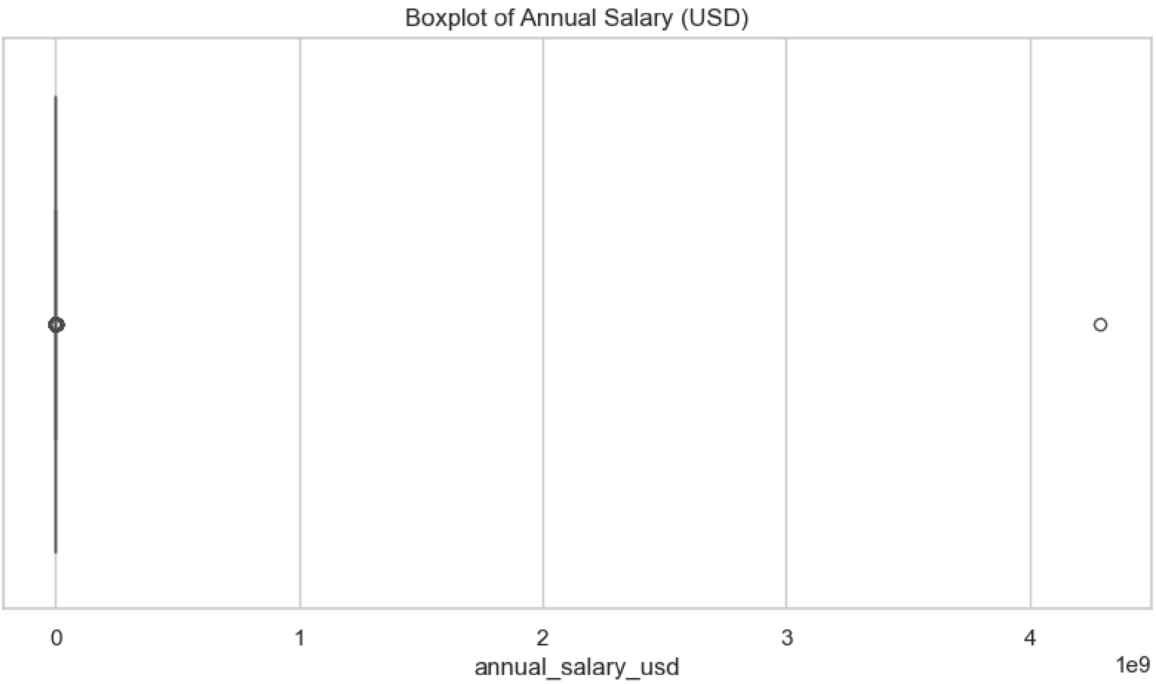
Out[9]:

```
count           28,727.00
mean           236,149.84
std         25,285,788.31
min                  0.00
25%             52,100.00
50%             73,000.00
75%            105,000.00
max      4,285,764,286.00
Name: annual_salary_usd, dtype: float64
```

Data has huge Outliers

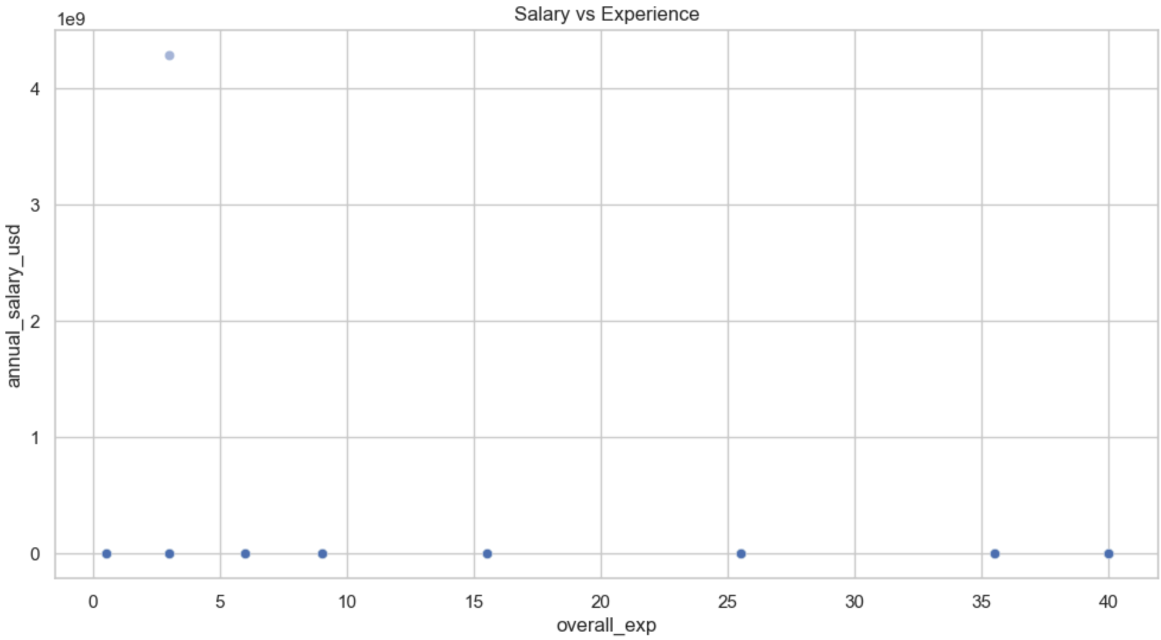
In [10]:

```
plt.figure(figsize=(10,5))
sns.boxplot(x=df['annual_salary_usd'])
plt.title("Boxplot of Annual Salary (USD)")
plt.show()
```



as seen in the boxplot huge outlier on the right

```
In [11]: plt.figure(figsize=(12,6))
         sns.scatterplot(
             x='overall_exp',
             y='annual_salary_usd',
             data=df,
             alpha=0.5
         )
         plt.title("Salary vs Experience")
         plt.show()
```



as there is one huge outlier we will delete the max outlier and plot again

In [171…

```
df_raw = df.copy()
```

In [12]:

```
# See the extremes
print(df['annual_salary_usd'].describe())

# Check lowest salaries
print("\nLowest 20 salaries:")
print(df.nsmallest(20, 'annual_salary_usd')[['annual_salary_usd', 'job_ti

# Check highest salaries
print("\nHighest 20 salaries:")
print(df.nlargest(20, 'annual_salary_usd')[['annual_salary_usd', 'job_tit
count          28,727.00
mean          236,149.84
std        25,285,788.31
min                 0.00
25%            52,100.00
50%            73,000.00
75%           105,000.00
max     4,285,764,286.00
Name: annual_salary_usd, dtype: float64

Lowest 20 salaries:
       annual_salary_usd                       job_title  overall_exp  \
8962                0.00                       "Mum" ;)        25.50
10614               0.00              Executive Director        15.50
12900               0.00                        Attorney        15.50
13837               0.00                 Student Teacher         3.00
15567               0.00                Product Marketer         0.50
15666               0.00                    Househusband         6.00
20612               0.00                         Founder        25.50
20874               0.00                      Unemployed        25.50
23472               0.00  Government Relations Director         9.00
24436               0.00                         Realtor         9.00
27284               0.00                  College Senior         6.00
28317               0.00                         Student         3.00
28386               0.00                       Homemaker         6.00
28480               0.00            Data Science Student        15.50
28545               0.00                          Ibterb         3.00
28645               0.00                   Bi Consultant         3.00
28669               0.00                         Student         3.00
28670               0.00                         Student         6.00
28674               0.00                         Student         0.50
28708               0.00                         Student         0.50

             country
8962   United States
10614  United States
12900  United States
13837  United States
15567  United States
15666  United States
20612  United States
20874  United States
23472  United States
24436  United States
27284  United States
28317  United States
28386  United States
28480  United States
28545        Nigeria
28645          India
28669  United States
28670  United States
28674  United States
28708  United States

Highest 20 salaries:
       annual_salary_usd                                          job_title
\
28605   4,285,764,286.00                         Investment Banking Analyst
26994       5,000,044.00                               Inside Sales Manager
```

```
26995       5,000,044.00                             Inside Sales Manager
16134       3,600,000.00                   Japanese To English Translator
2187        3,000,000.00                                    Owner And Ceo
28593       2,600,000.00                                             Lead
5919        1,900,000.00  Attending Physician (General Internal Medicine)
28643       1,740,139.00                        Cyber Security Management
6976        1,650,000.00                      Principal Software Engineer
15841       1,624,260.00                                  Product Manager
9473        1,334,782.00                            Senior Policy Advisor
27090       1,300,000.00                                          Partner
14518       1,268,358.00                                       Consultant
18085       1,260,000.00                                Senior Consultant
25441       1,250,000.00                                Marketing Manager
5743        1,214,953.00  Agricultural Supply Line Negotiating Consultant
11400       1,200,000.00                                          Partner
4326        1,100,000.00                                Software Engineer
16508       1,100,000.00                                          Partner
16493         986,079.00                                   Lead Developer

       overall_exp         country
28605         3.00          Canada
26994        35.50   United States
26995        35.50   United States
16134         9.00   United States
2187         25.50   United States
28593         9.00   United States
5919          6.00   United States
28643         3.00         Germany
6976          9.00   United States
15841        15.50       Singapore
9473         15.50   United States
27090        25.50   United States
14518         9.00  United Kingdom
18085         6.00   United States
25441         9.00   United States
5743          3.00  United Kingdom
11400        25.50   United States
4326          6.00   United States
16508        15.50   United States
16493        15.50         Germany
```

In [ ]:

```
# from analyzing the data
# I will keep minimum salary 15000 and maximum 500000usd
df_clean  = df[(df['annual_salary_usd'] >= 15000) &
                (df['annual_salary_usd'] <= 500000)].copy()

df_clean = df_clean[df_clean['year'] == 2021].copy()
# filtering only to 2021 values because 98% of the values are from 2021
```

In [14]:

```
original_count = len(df)

cleaned_count = len(df_clean)

remove_count = original_count - cleaned_count

percentage = (remove_count/original_count)*100

print(f"Original: {original_count} rows")
print(f"Cleaned: {cleaned_count} rows")
print(f"Removed: {remove_count} rows ({percentage:.1f}%)")
```

```
Original: 28727 rows
Cleaned: 28306 rows
Removed: 421 rows (1.5%)
```

In [15]:

```
# Look at the 135 high bonus rows
high_bonuses = df_clean[df_clean['compensation_usd'] > 200000]['compensat
print(high_bonuses.describe())
print("\nTop 10 highest bonuses:")
print(high_bonuses.sort_values(ascending=False).head(10).values)
```

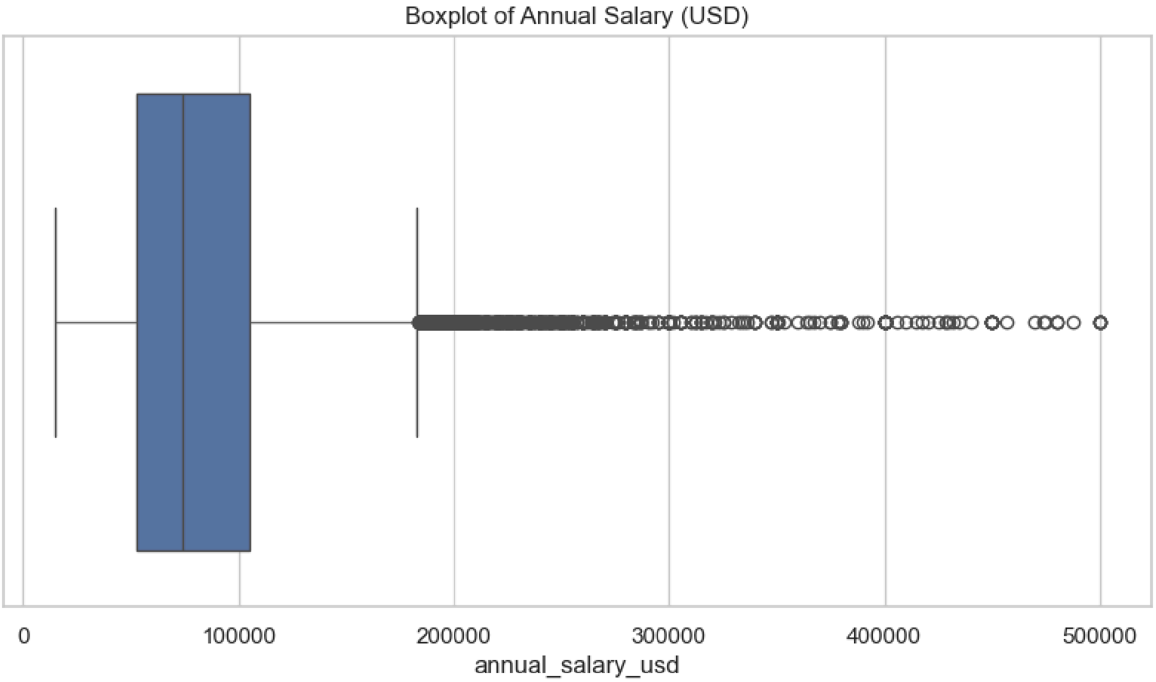
```
count         135.00
mean      421,156.69
std       282,687.70
min       200,267.00
25%       247,750.00
50%       303,571.00
75%       480,000.00
max     1,500,000.00
Name: compensation_usd, dtype: float64

Top 10 highest bonuses:
[1500000. 1400000. 1400000. 1335113. 1335113. 1200000. 1200000. 1000000.
 1000000.  900000.]
```

In [16]:

```
df_clean = df_clean[df_clean['compensation_usd'] <= 300000].copy()
```

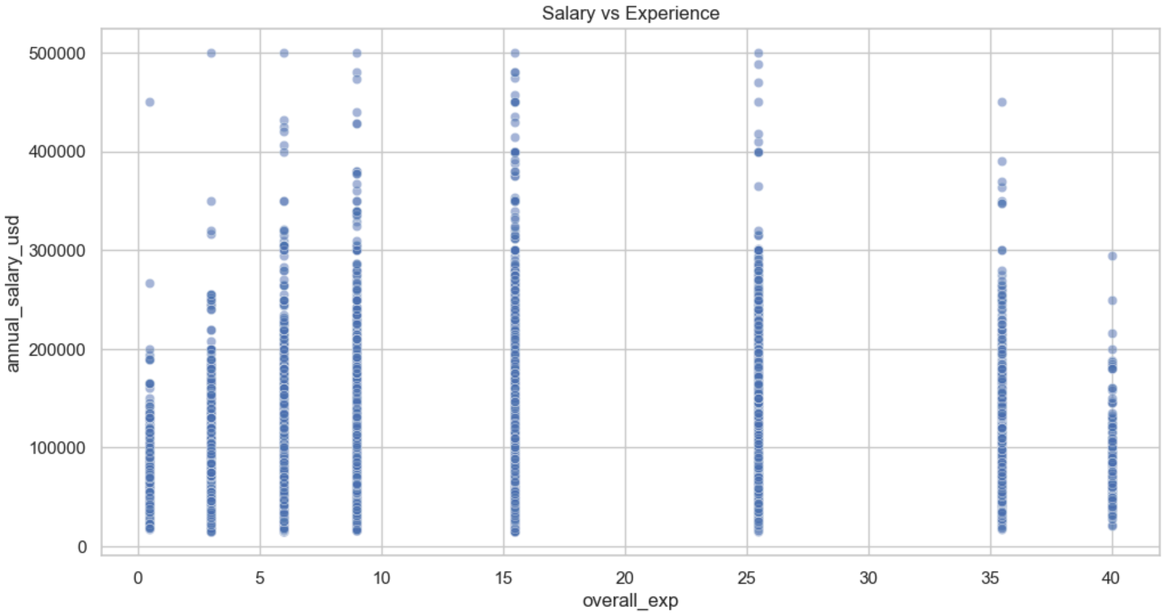
In [127…

```
# Now let's check again
plt.figure(figsize=(10,5))
sns.boxplot(x=df_clean['annual_salary_usd'])
plt.title("Boxplot of Annual Salary (USD)")
plt.show()
```



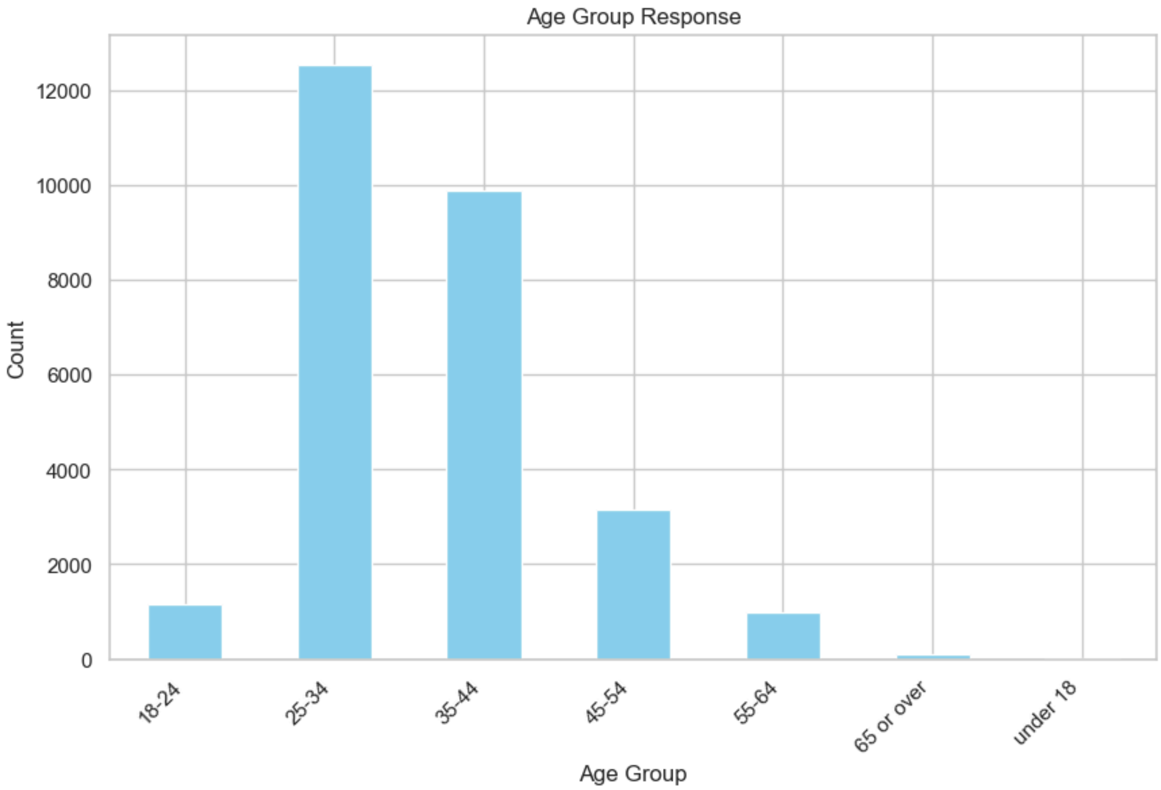
In [128…

```
plt.figure(figsize=(12,6))
sns.scatterplot(
    x='overall_exp',
    y='annual_salary_usd',
    data=df_clean,
    alpha=0.5
)
plt.title("Salary vs Experience")
plt.show()
```



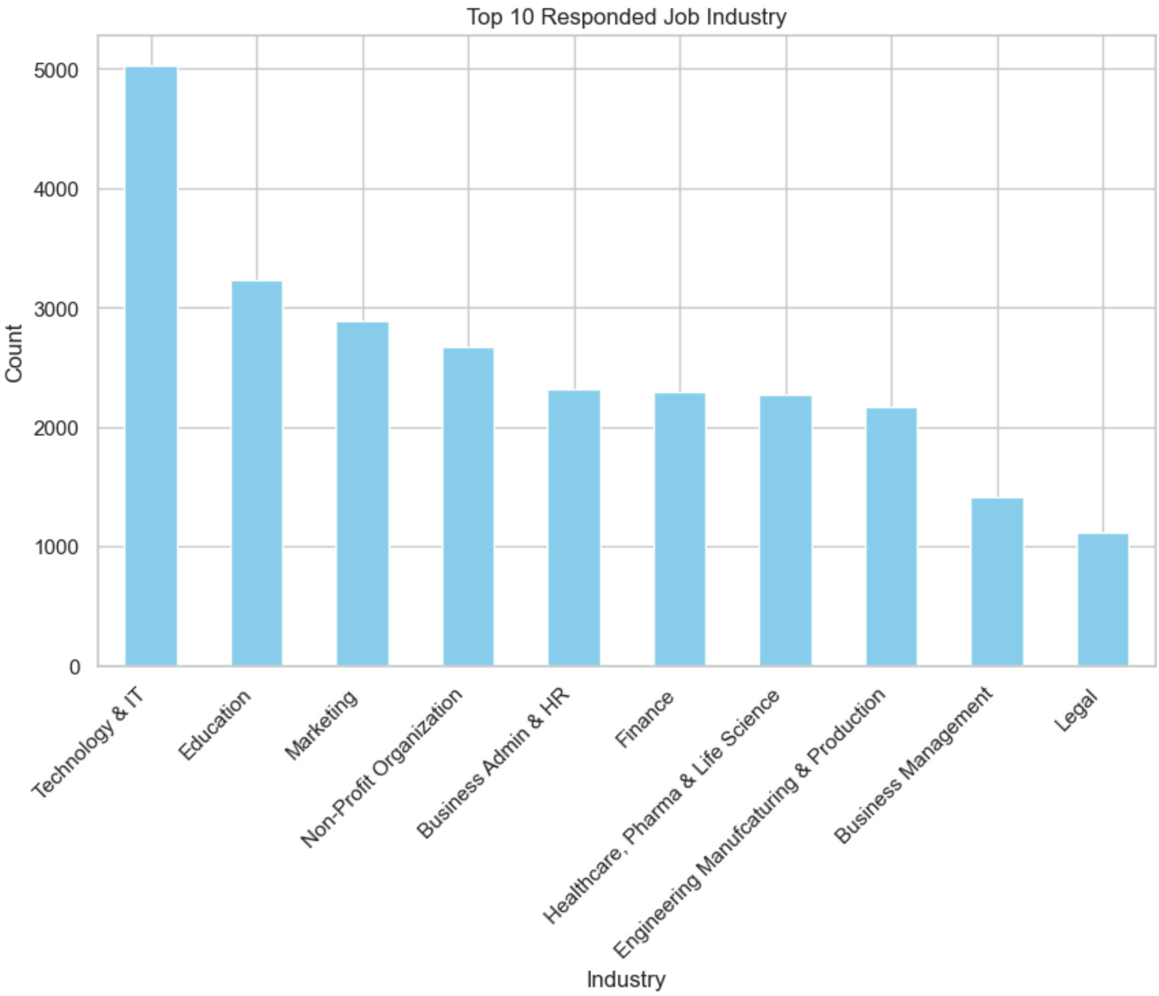
In [129…

```
plt.figure(figsize=(10,6))
df_clean['age_group'].value_counts().sort_index().plot(kind = 'bar', colo
plt.xlabel('Age Group')
plt.ylabel('Count')
plt.title('Age Group Response')
plt.xticks(rotation = 45, ha ='right')
plt.show()
```



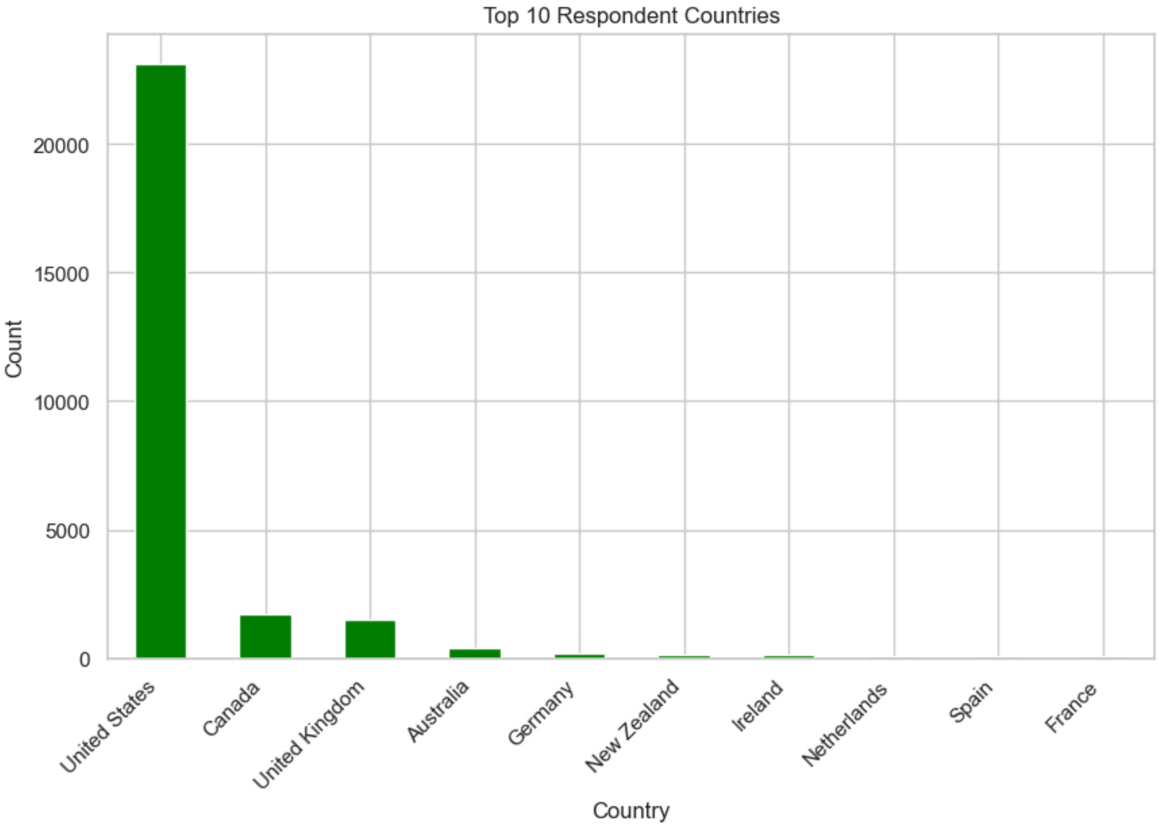
In [130…

```
plt.figure(figsize=(10,6))
df_clean['industry'].value_counts().head(10).plot(kind = 'bar', color ='s
plt.xlabel('Industry')
plt.ylabel('Count')
plt.title('Top 10 Responded Job Industry')
plt.xticks(rotation = 45, ha ='right')
plt.show()
```



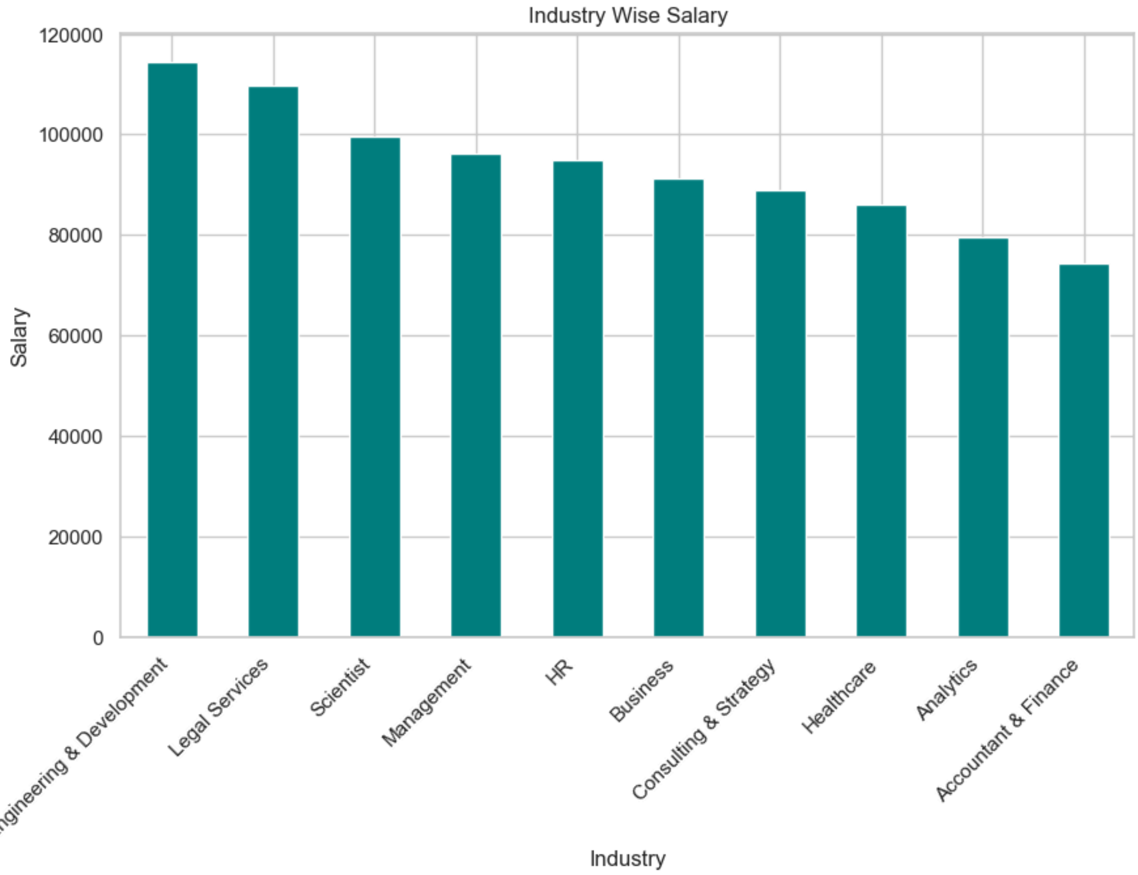
In [131…

```
plt.figure(figsize=(10,6))
df_clean['country'].value_counts().head(10).plot(kind='bar', color='green
plt.title("Top 10 Respondent Countries")
plt.xlabel("Country")
plt.ylabel("Count")
plt.xticks(rotation=45, ha='right')
plt.show()
```



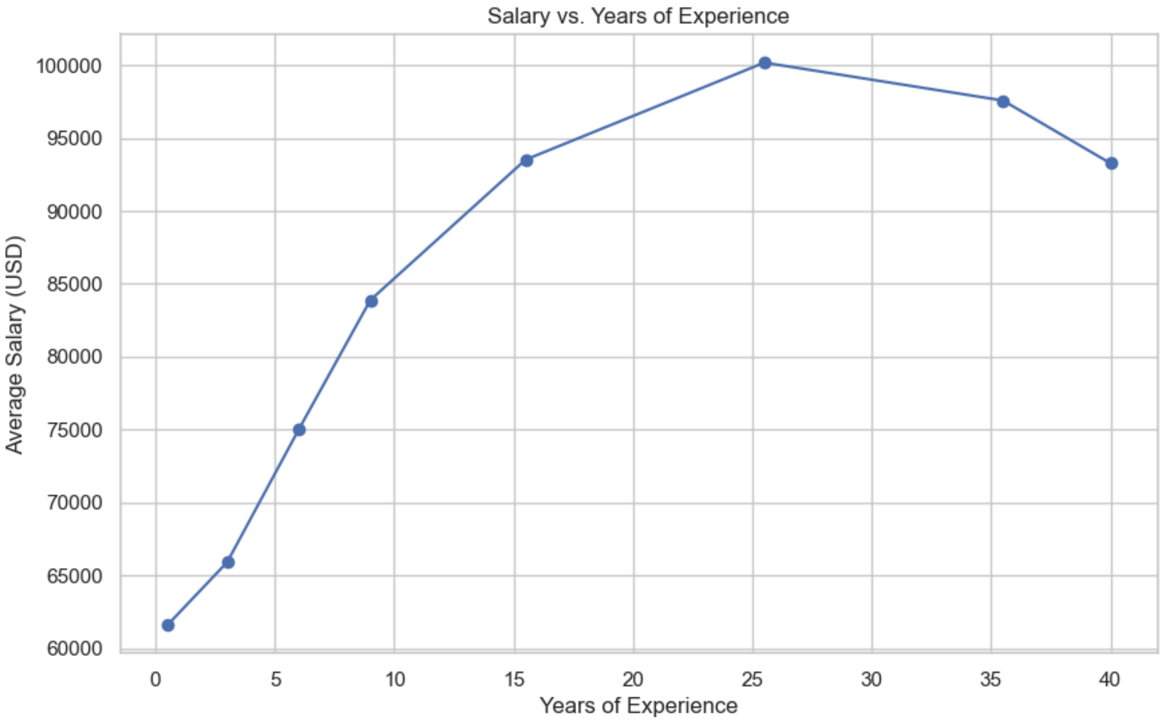
In [194…

```
plt.figure(figsize=(10,6))
plt.title("Industry Wise Salary")
df_clean.groupby('job_category')['annual_salary_usd'].mean().sort_values(
plt.xlabel("Industry")
plt.ylabel("Salary")
plt.xticks(rotation=45, ha='right')
plt.show()
```



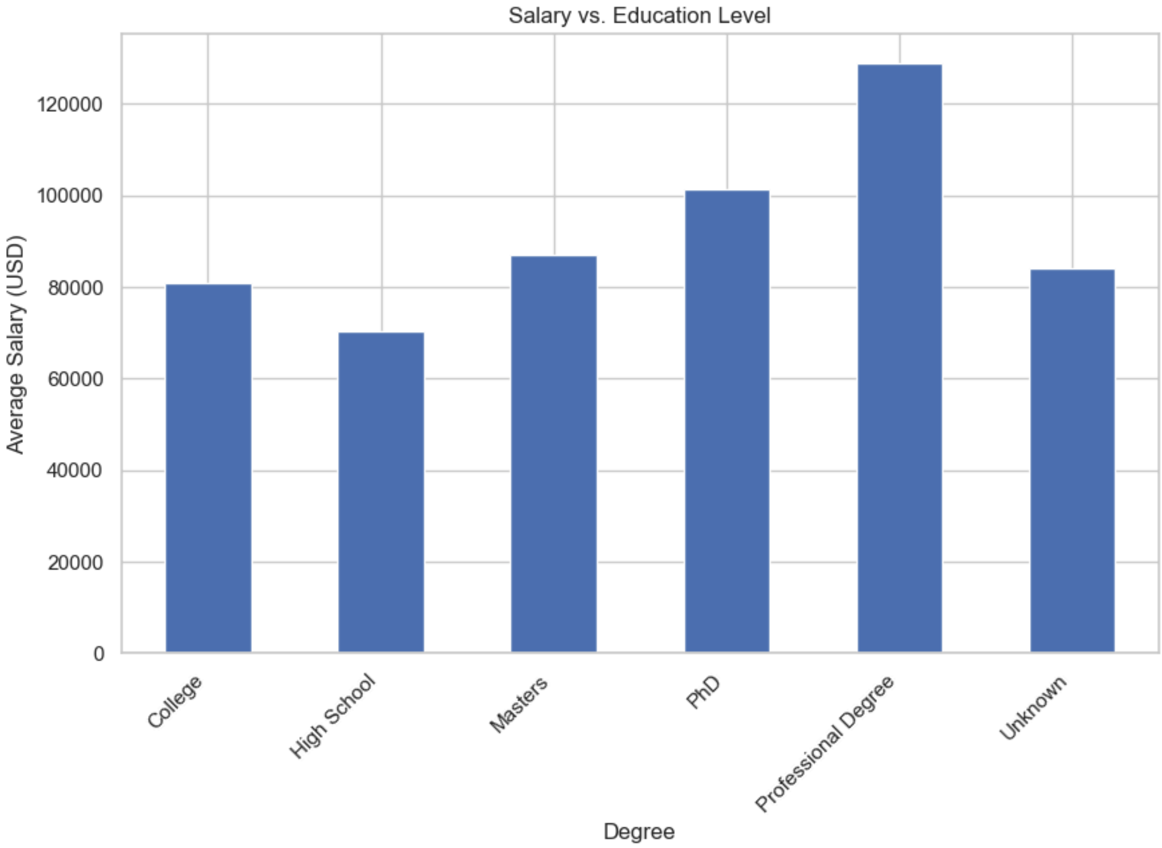
In [133…

```
plt.figure(figsize=(10,6))
df_clean.groupby('overall_exp')['annual_salary_usd'].mean().plot(kind='li
plt.title("Salary vs. Years of Experience")
plt.xlabel("Years of Experience")
plt.ylabel("Average Salary (USD)")
plt.show()
```



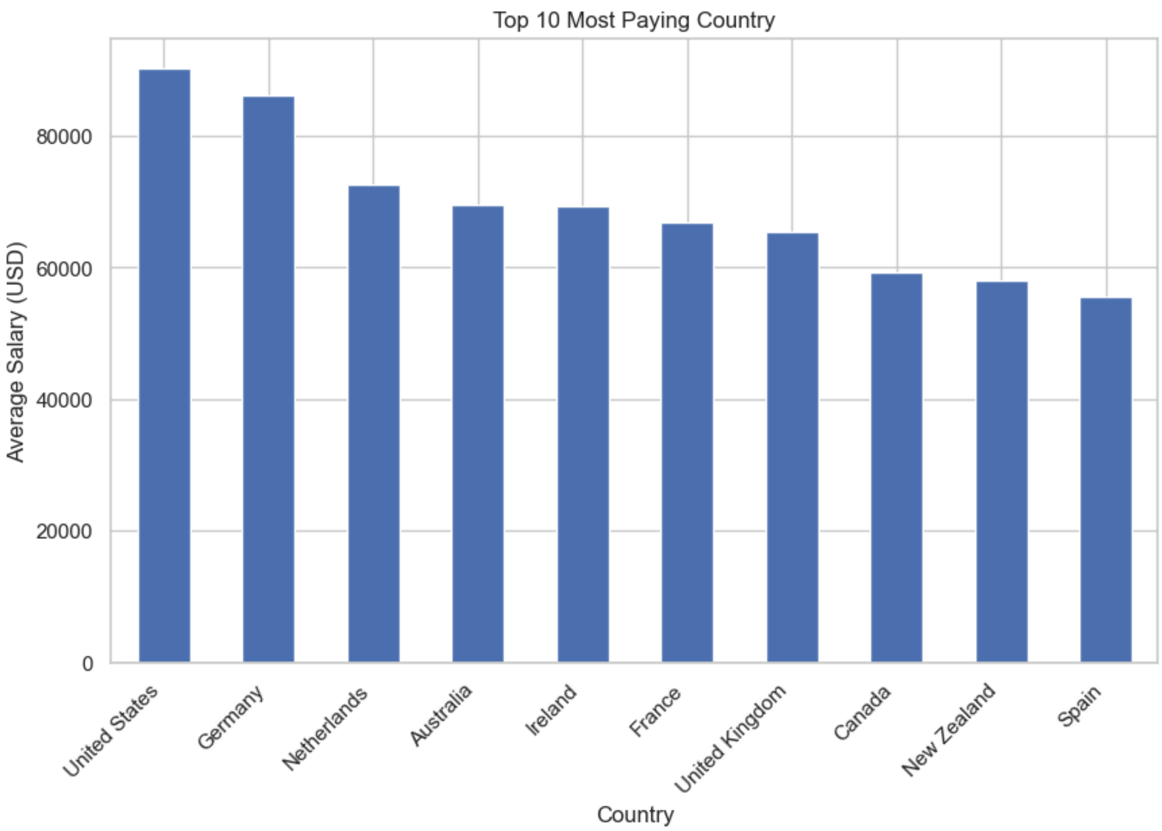
In [134…

```
plt.figure(figsize=(10,6))
df_clean.groupby('degree')['annual_salary_usd'].mean().plot(kind='bar')
plt.title("Salary vs. Education Level")
plt.xlabel("Degree")
plt.ylabel("Average Salary (USD)")
plt.xticks(rotation=45, ha='right')
plt.show()
```

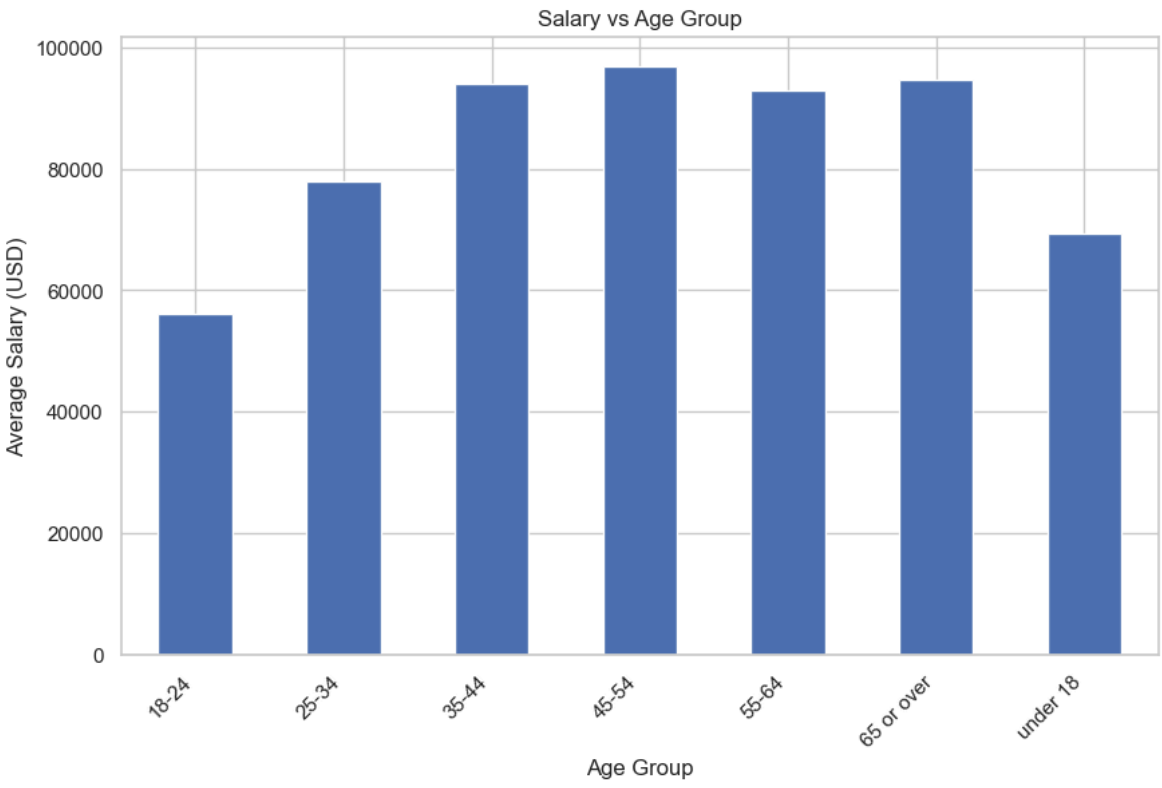


In [135…

```
# here i can't do normal group and find the original mean. because
# many countries have very high pay but only appeare few times which will

country_counts = df_clean['country'].value_counts()
countries_with50 = country_counts[country_counts>=50].index

df_filtered = df_clean[df_clean['country'].isin(countries_with50)]

plt.figure(figsize=(10,6))
df_filtered.groupby('country')['annual_salary_usd'].mean().sort_values(as
plt.title("Top 10 Most Paying Country")
plt.xlabel("Country")
plt.ylabel("Average Salary (USD)")
plt.xticks(rotation=45, ha='right')
plt.show()
```

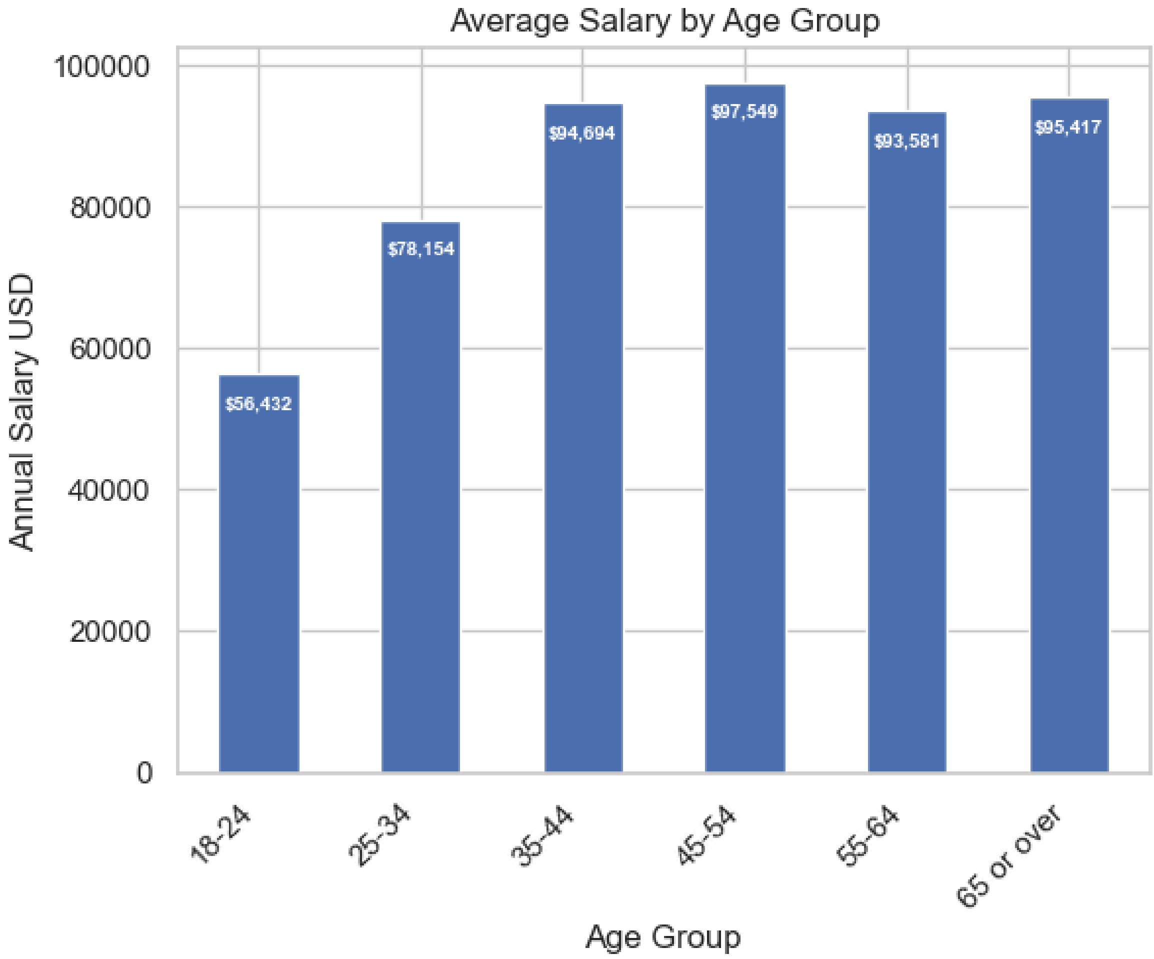


```
In [26]: plt.figure(figsize=(10,6))
         df_clean.groupby('age_group')['annual_salary_usd'].mean().plot(kind='bar'
         plt.title("Salary vs Age Group")
         plt.xlabel("Age Group")
         plt.ylabel("Average Salary (USD)")
         plt.xticks(rotation=45, ha='right')
         plt.show()

         # Can't use this as you can see under 18 is greater than 18-24 so by chec
```



In [136…

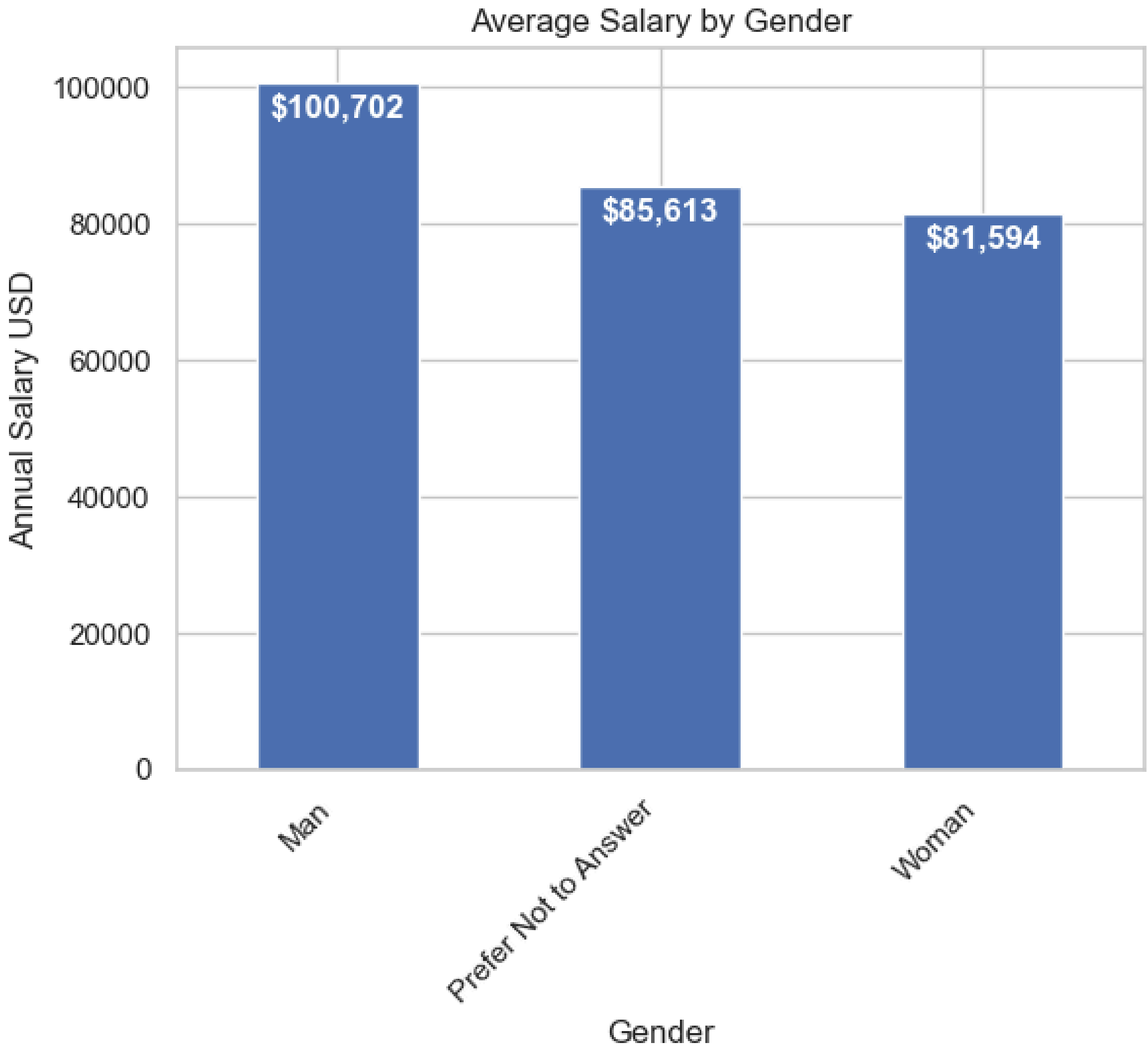
```
valuec = df_clean['age_group'].value_counts()
df_age_filter = df_clean[df_clean['age_group'].isin(valuec[valuec >= 50].

age_salary = df_age_filter.groupby('age_group')['annual_salary_usd'].mean
plt.Figure(figsize=(10,6))
age_salary.plot(kind = 'bar')
for i, value in enumerate(age_salary):
    plt.text(i, value - 5000, f'${value:,.0f}', ha='center', fontsize = '

plt.title('Average Salary by Age Group')
plt.xlabel('Age Group')
plt.ylabel('Annual Salary USD')
plt.xticks(rotation = 45, ha = 'right')
plt.show()


agec = df_age_filter['age_group'].value_counts()

print('==='*20)
print('Age Group Analysis')
print('==='*20)

print('\nSample Sizes:')
for age in age_salary.index:
    count = agec[age]
    salary = age_salary[age]
    print(f'{age}   : {count} people (avg: {salary:,.0f})')

print('\nKey Insights:')
print(f'Entry Level (18-24):    ${age_salary['18-24']:,.0f}')
print(f'Peak Level (45-54):    ${age_salary['45-54']:,.0f}')
print(f'Growth from entry to peak: {age_salary['45-54'] - age_salary['18-
print('==='*20)
```



```
============================================================
Age Group Analysis
============================================================

Sample Sizes:
18-24    : 1150 people (avg: 56,432)
25-34    : 12548 people (avg: 78,154)
35-44    : 9872 people (avg: 94,694)
45-54    : 3162 people (avg: 97,549)
55-64    : 975 people (avg: 93,581)
65 or over    : 90 people (avg: 95,417)

Key Insights:
Entry Level (18-24):    $56,432
Peak Level (45-54):    $97,549
Growth from entry to peak: 41,116 (72.9%)
============================================================
```

In [137…

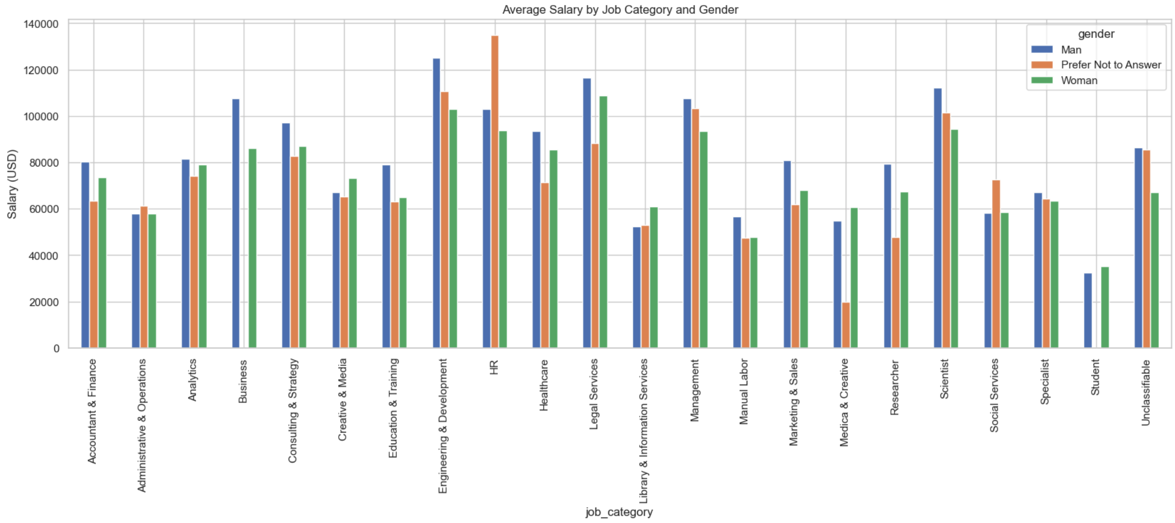
```
plt.Figure(figsize=(10,6))
gender_pay = df_clean.groupby('gender')['annual_salary_usd'].mean()
gender_pay.plot(kind = 'bar')
for i, value in enumerate(gender_pay):
    plt.text(i, value -5000, f'${value:,.0f}', ha='center', fontweight =
plt.title('Average Salary by Gender')
plt.xlabel('Gender')
plt.ylabel('Annual Salary USD')
plt.xticks(rotation = 45, ha = 'right')
plt.show()


print('==='*25)
print('Insights:')
print('==='*25)

if gender_pay['Man'] < gender_pay['Woman']:
    print(f'Woman Earns more than Man by {(gender_pay["Woman"]/gender_pay
else:
    print(f'Man Earns more than Woman by {(gender_pay["Man"]/gender_pay['
```



```
==========================================================================
=
Insights:
==========================================================================
=
Man Earns more than Woman by 23%
```

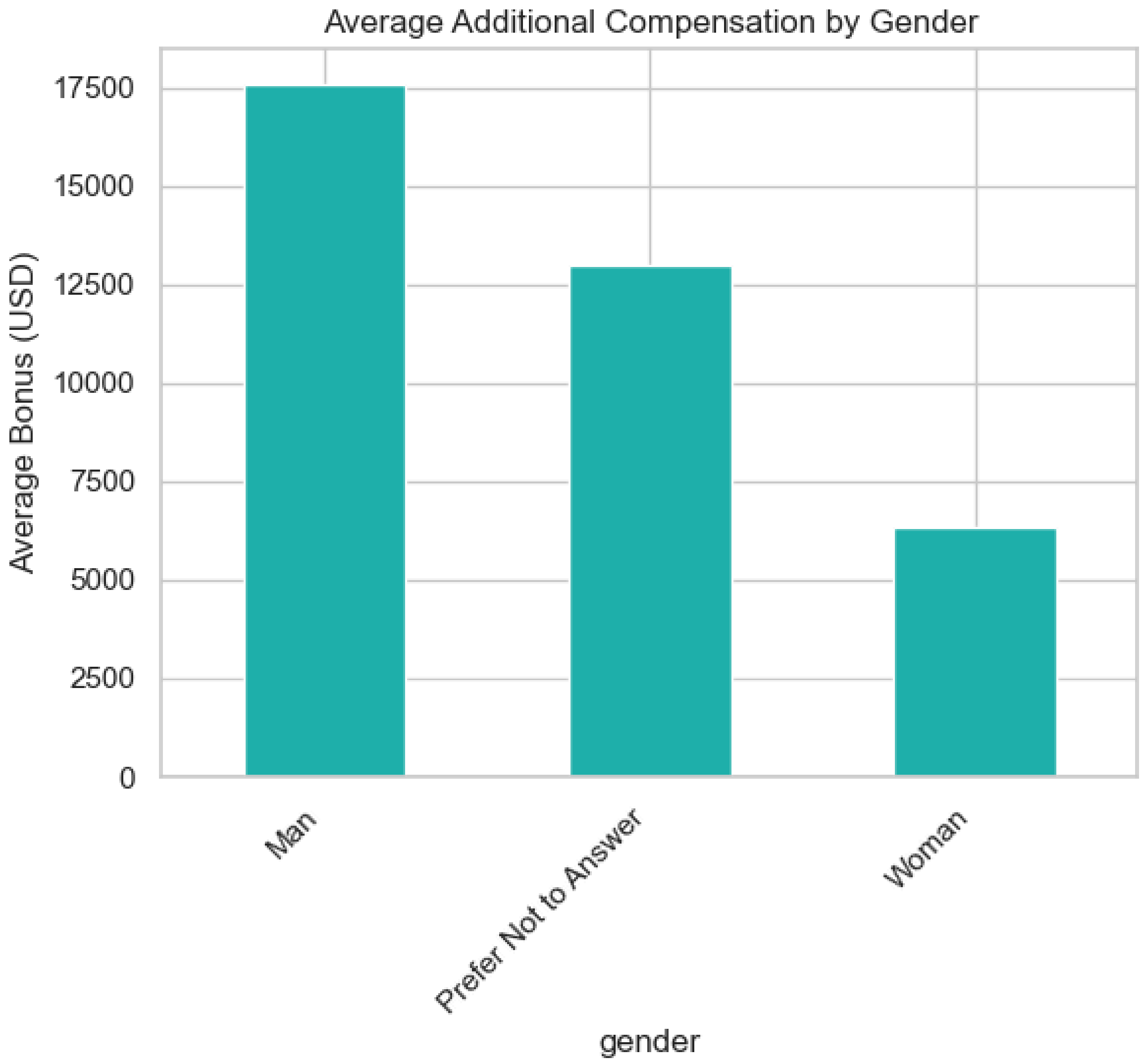
In [207…

```
df_clean.groupby(['job_category','gender'])['annual_salary_usd'].mean().u
plt.title("Average Salary by Job Category and Gender")
plt.ylabel("Salary (USD)")
plt.xticks(rotation=90)
plt.show()
```



In [139…

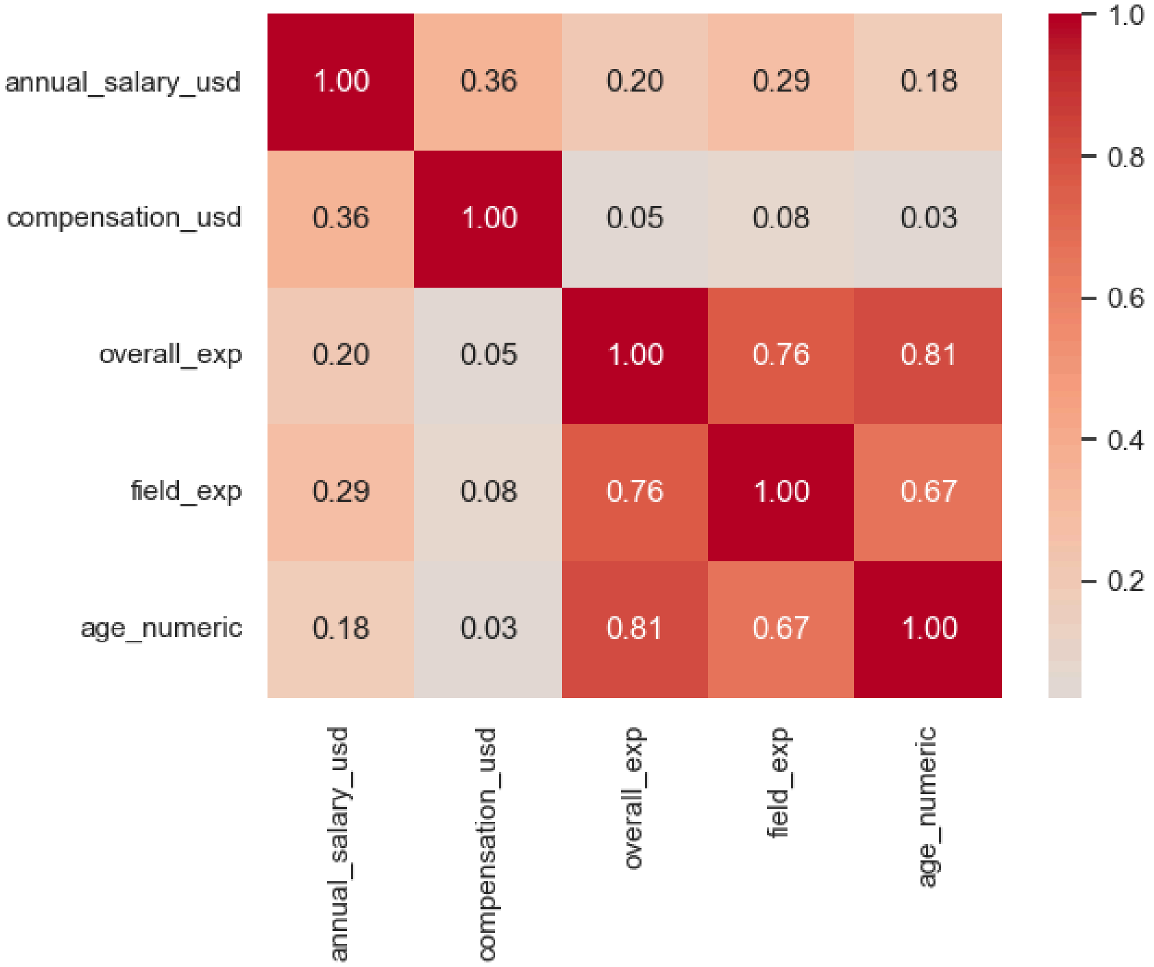
```
df_clean.groupby('gender')['compensation_usd'].mean().plot(kind='bar', co
plt.title("Average Additional Compensation by Gender")
plt.ylabel("Average Bonus (USD)")
plt.xticks(rotation = 45, ha='right')
plt.show()
```



In [140…

```
# print(df_clean.columns[df_clean.dtypes != 'O'])
numeric_cols = ['annual_salary_usd', 'compensation_usd', 'overall_exp', '

corr_matrix = df_clean[numeric_cols].corr()
```

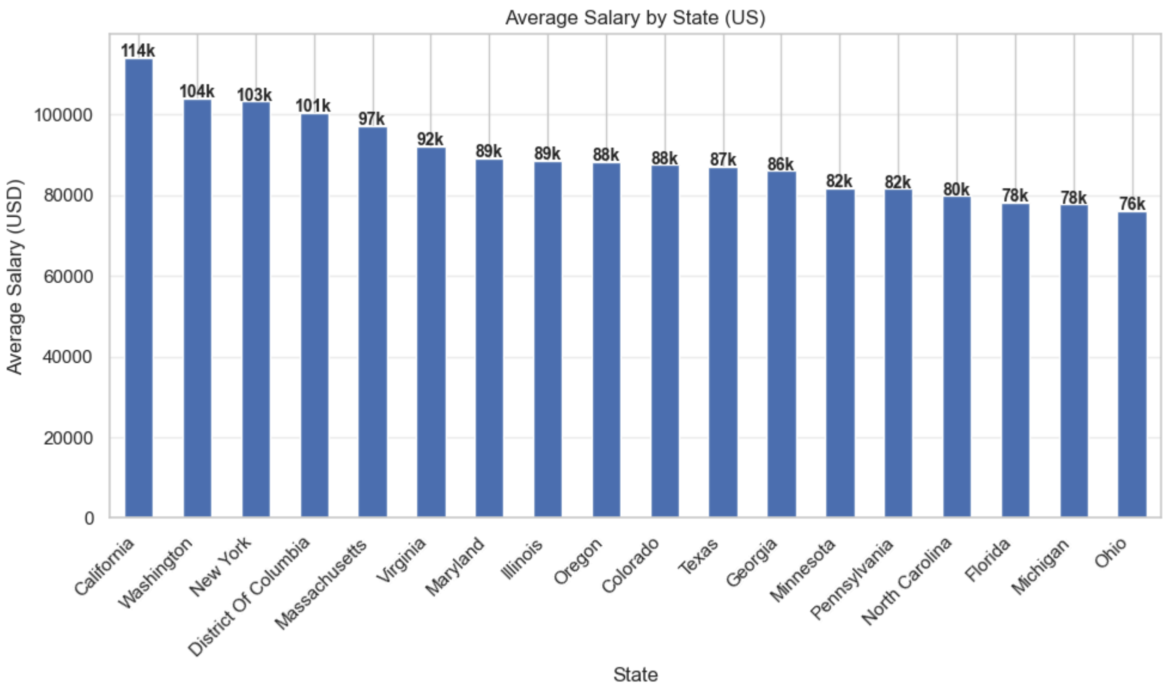
```
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', fmt='.2f', center=0
plt.show()
if corr_matrix.loc['annual_salary_usd', 'overall_exp'] > 0.3:
    print("Moderate Positive Correlation between Salary and Experience")
else:
    print("Weak Correlation between Salary and Experience")
```



```
Weak Correlation between Salary and Experience
```

In [141…

```
df_us = df_clean[df_clean['country'] == 'United States']
statee = df_us['state'].value_counts()
state_10 = statee[statee >= 500].index
new_filter = df_us[df_us['state'].isin(state_10)]

state_salary = new_filter.groupby('state')['annual_salary_usd'].mean().so

plt.figure(figsize=(10,6))
state_salary.plot(kind='bar')
for i, value in enumerate(state_salary):
    plt.text(i, value+200, f'{value/1000:.0f}k', ha='center', fontsize =
plt.title('Average Salary by State (US)')
plt.xlabel('State', fontsize=12)
plt.ylabel('Average Salary (USD)', fontsize=12)
plt.xticks(rotation=45, ha='right')
plt.grid(axis='y', alpha=0.3)
plt.tight_layout()
plt.show()
```

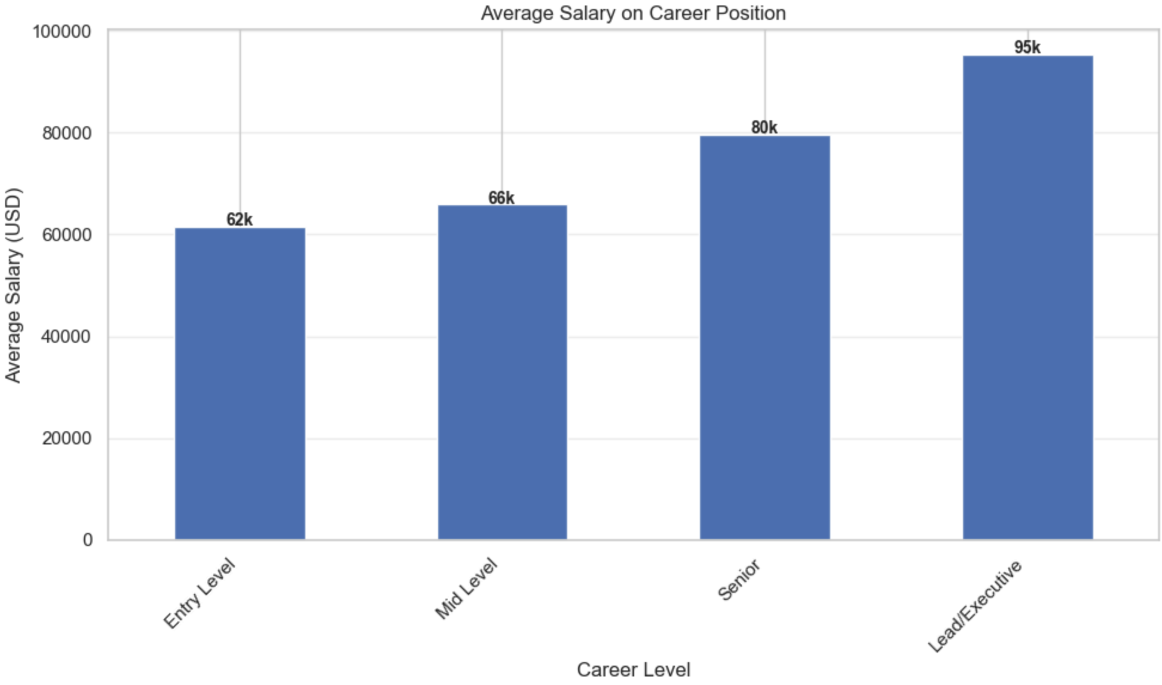


In [142…

```
def assign_career_level(experience):
    if experience < 0:
        return 'Unknown'
    elif experience <= 2:
        return 'Entry Level'
    elif experience <= 5:
        return 'Mid Level'
    elif experience <= 10:
        return 'Senior'
    else:
        return 'Lead/Executive'

df_clean['career_level'] = df_clean['overall_exp'].apply(assign_career_le
```

In [143…

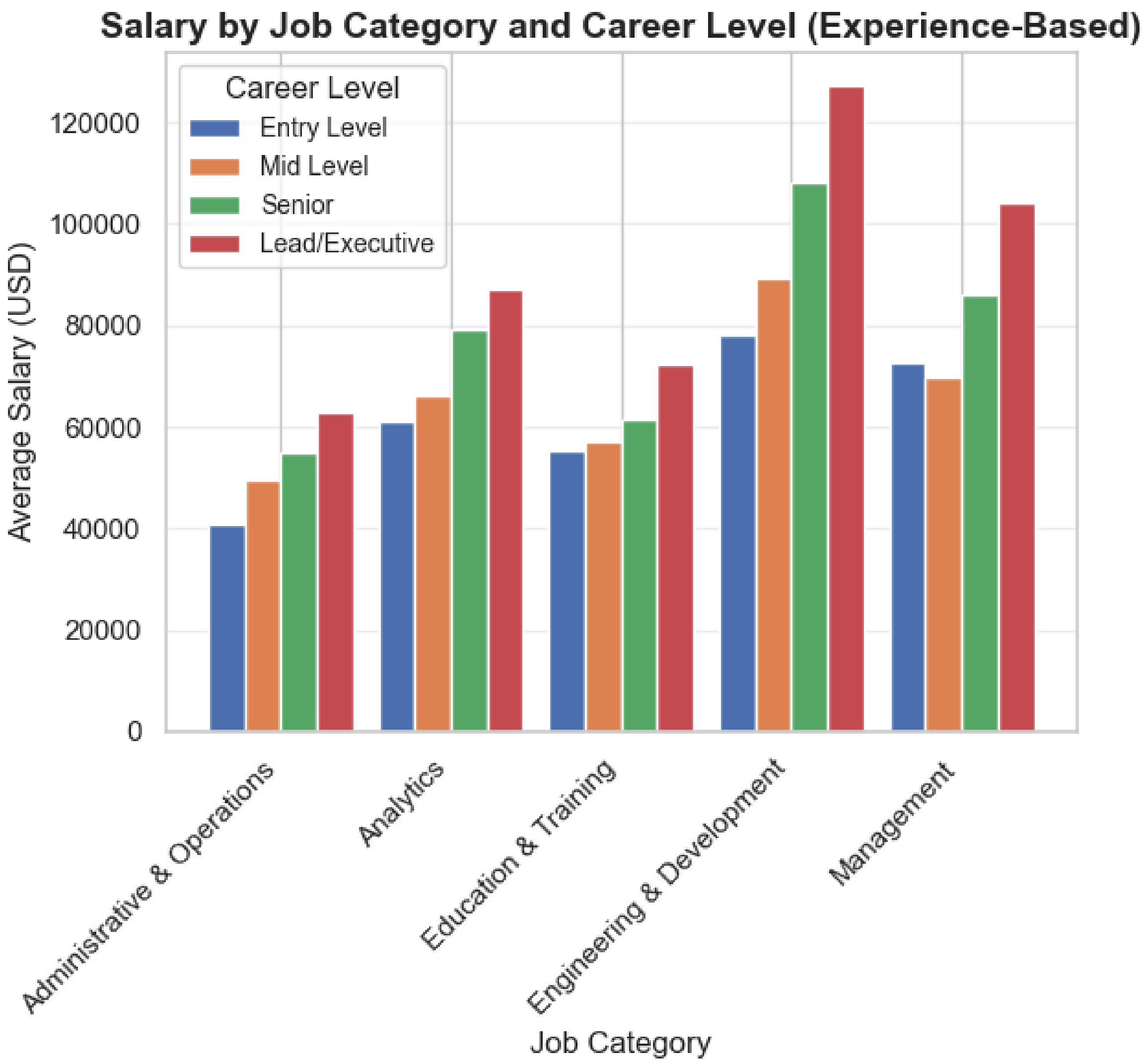
```
levelsalary = df_clean.groupby('career_level')['annual_salary_usd'].mean(

plt.figure(figsize=(10,6))
levelsalary.plot(kind='bar')
for i, value in enumerate(levelsalary):
    plt.text(i, value+200, f'{value/1000:.0f}k', ha='center', fontsize =
plt.title('Average Salary on Career Position')
plt.xlabel('Career Level', fontsize=12)
plt.ylabel('Average Salary (USD)', fontsize=12)
plt.xticks(rotation=45, ha='right')
plt.grid(axis='y', alpha=0.3)
plt.tight_layout()
plt.show()
```



In [144…

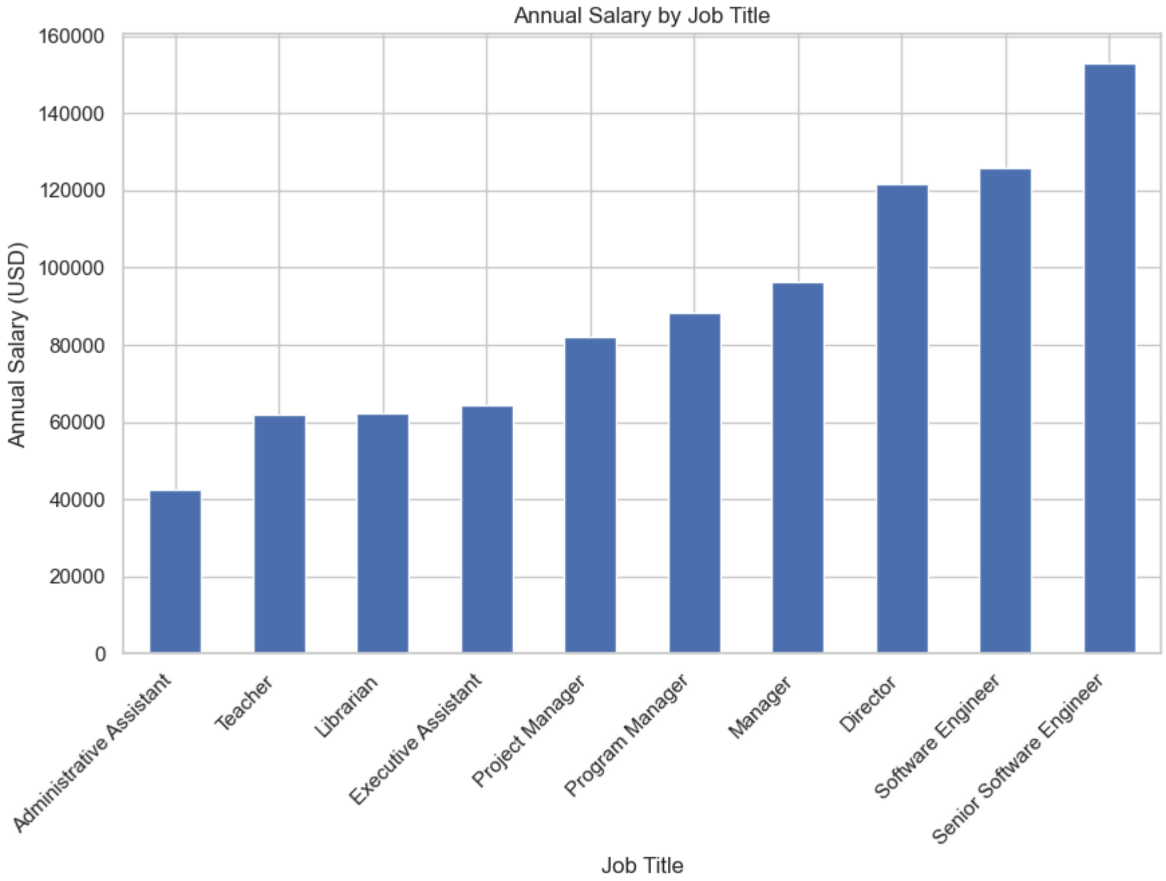
```
top10_category = df_clean['job_category'].value_counts().head(6).index
new_category = df_clean[df_clean['job_category'].isin(top10_category)]
new_category = new_category[new_category['job_category'] != 'Unclassifiab

industry_levelwise_salary = new_category.groupby(['job_category', 'career

level_order = ['Entry Level', 'Mid Level', 'Senior', 'Lead/Executive']
industry_levelwise_salary = industry_levelwise_salary[[col for col in lev

plt.figure(figsize=(20, 10))
industry_levelwise_salary.plot(kind ='bar', width = 0.85)
plt.title('Salary by Job Category and Career Level (Experience-Based)', f
plt.xlabel('Job Category', fontsize=12)
plt.ylabel('Average Salary (USD)', fontsize=12)
plt.xticks(rotation=45, ha='right')
plt.legend(title='Career Level', fontsize=10)
plt.grid(axis='y', alpha=0.3)
# plt.tight_layout()
plt.show()
```

```
<Figure size 2000x1000 with 0 Axes>
```



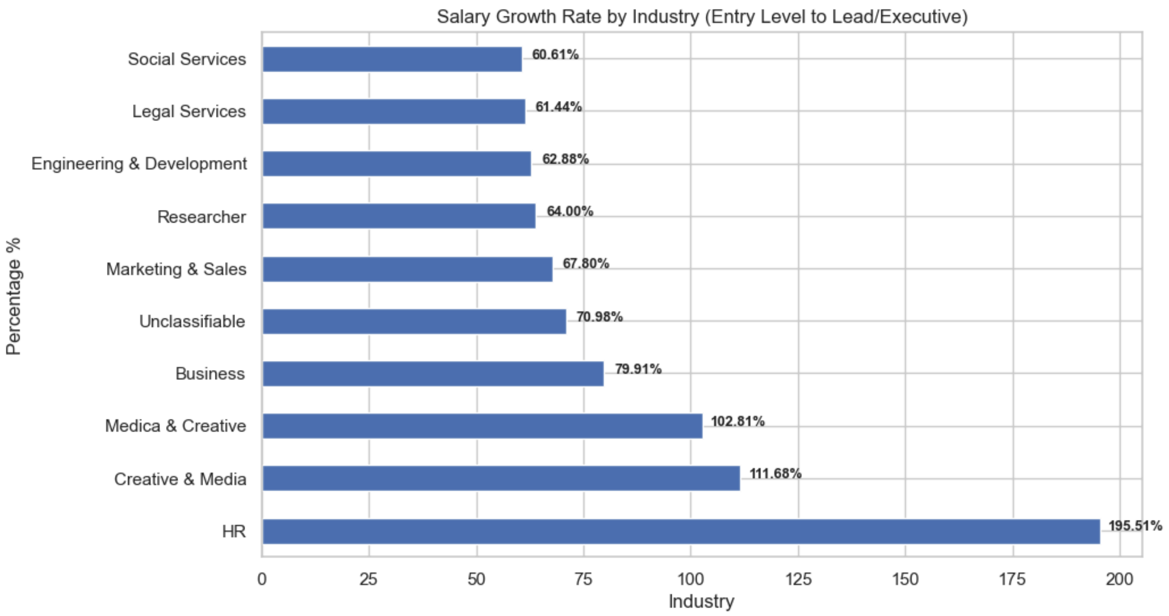
In [157…

```
jobtitle = df_clean['job_title'].value_counts().head(10).index
jobtitle
jobtitle_df = df_clean[df_clean['job_title'].isin(jobtitle)]

title_salary = jobtitle_df.groupby('job_title')['annual_salary_usd'].mean

plt.figure(figsize=(10,6))
title_salary.plot(kind='bar')
plt.title('Annual Salary by Job Title')
plt.xlabel('Job Title')
plt.ylabel('Annual Salary (USD)')
plt.xticks(rotation = 45, ha ='right')
plt.show()
```



In [193…

```
# I want to find out the salary growth rate by industry

df_clean['job_category'].value_counts().head(10)

industry_growth = df_clean.groupby(['job_category', 'career_level'])['ann
industry_growth['growth_rate'] = ((industry_growth['Lead/Executive'] - in
top_growth = industry_growth['growth_rate'].sort_values(ascending=False).
plt.figure(figsize = (10,6))
top_growth.plot(kind='barh')
for i, value in enumerate(top_growth):
    plt.text(value+8, i, f'{value:.2f}%', ha='center', fontsize = 9, font
plt.title('Salary Growth Rate by Industry (Entry Level to Lead/Executive)
plt.xlabel('Industry')
plt.ylabel('Percentage %')
plt.show()
```



In [198…

```
df_clean['industry'].unique()
df_clean['job_category'].unique()
```

Out[198…

```
array(['Management', 'Marketing & Sales',
       'Library & Information Services', 'Administrative & Operations',
       'Analytics', 'Accountant & Finance', 'Legal Services',
       'Specialist', 'Creative & Media', 'Researcher',
       'Engineering & Development', 'Consulting & Strategy',
       'Education & Training', 'Scientist', 'Student', 'Unclassifiable',
       'Business', 'Social Services', 'Manual Labor', 'Medica & Creativ
e',
       'Healthcare', 'HR'], dtype=object)
```

In [ ]:

```
df_clean.head
```

Out[ ]:

	timestamp	age_group	industry	job_title	annual_salary_usd	compe
0	2021-04-27 11:02:10	25-34	Education	Research And Instruction Librarian	55,000.00	
1	2021-04-27 11:02:22	25-34	Technology & IT	Change & Internal Communications Manager	72,897.00	
2	2021-04-27 11:02:38	25-34	Finance	Marketing Specialist	34,000.00	
3	2021-04-27 11:02:41	25-34	Non-Profit Organization	Program Manager	62,000.00	
4	2021-04-27 11:02:42	25-34	Finance	Accounting Manager	60,000.00	

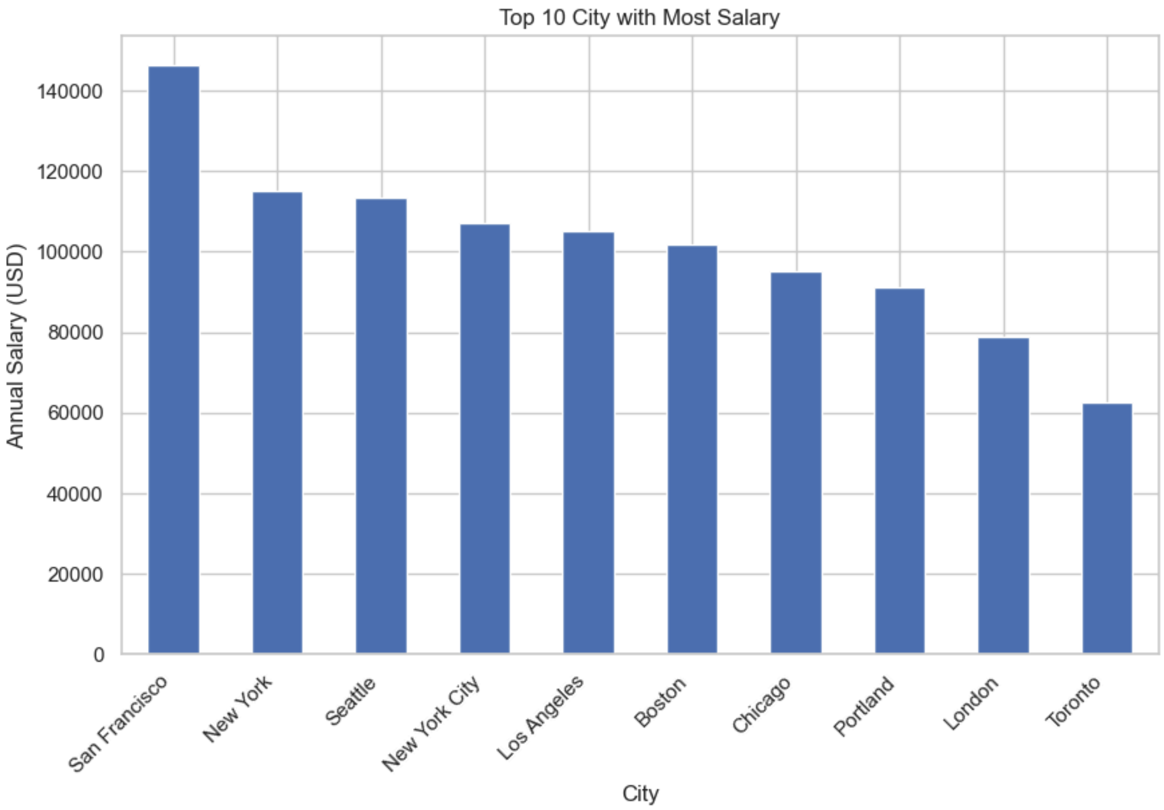
In [ ]:

```
columns_to_drop = [
    'timestamp',
    'industry',
    'level',
    'year',
    'month',
    'age_numeric'
]

df_clean = df_clean.drop(columns=columns_to_drop, errors='ignore')

print(f"Remaining columns: {df_clean.shape[1]}")
print(df_clean.columns.tolist())
```

```
Remaining columns: 14
['age_group', 'job_title', 'annual_salary_usd', 'compensation_usd', 'curre
ncy', 'country', 'state', 'city', 'overall_exp', 'field_exp', 'degree', 'g
ender', 'job_category', 'career_level']
```

In [208…

```
top_city = df_clean['city'].value_counts().head(10).index

top_city_salary = df_clean[df_clean['city'].isin(top_city)]

plt.figure(figsize = (10,6))
plt.title('Top 10 City with Most Salary')
top_city_salary.groupby('city')['annual_salary_usd'].mean().sort_values(a
plt.xlabel('City')
plt.ylabel('Annual Salary (USD)')
plt.xticks(rotation = 45, ha='right')
plt.show()
```



In [206…

```
df_clean.to_csv('project_cleaned_v2.0.csv', index=False)
```

In [ ]: