In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

In [2]:

```
data = pd.read_csv('salary.csv')
```

In [3]:

```
data.head()
```

Out[3]:

	timestamp	company	level	title	totalyearlycompensation	location	yearsofexperien
0	06-07-2017 11:33	Oracle	L3	Product Manager	127000	Redwood City, CA	1
1	06-10-2017 17:11	eBay	SE 2	Software Engineer	100000	San Francisco, CA	5
2	06-11-2017 14:53	Amazon	L7	Product Manager	310000	Seattle, WA	8
3	6/17/2017 0:23:14	Apple	M1	Software Engineering Manager	372000	Sunnyvale, CA	7
4	6/20/2017 10:58:51	Microsoft	60	Software Engineer	157000	Mountain View, CA	5

5 rows × 29 columns

In [4]:

```
data.tail()
```

Out[4]:

	timestamp	company	level	title	totalyearlycompensation	location	yearsofexperi
62637	09-09-2018 11:52	Google	T4	Software Engineer	327000	Seattle, WA	
62638	9/13/2018 8:23:32	Microsoft	62	Software Engineer	237000	Redmond, WA	
62639	9/13/2018 14:35:59	MSFT	63	Software Engineer	220000	Seattle, WA	
62640	9/16/2018 16:10:35	Salesforce	Lead MTS	Software Engineer	280000	San Francisco, CA	
62641	1/29/2019 5:12:59	apple	ict3	Software Engineer	200000	Sunnyvale, CA	

5 rows × 29 columns

In [5]:

```
data.shape
```

Out[5]:

```
(62642, 29)
```

In [6]:

```
data.columns
```

Out[6]:

```
Index(['timestamp', 'company', 'level', 'title', 'totalyearlycompensation',
       'location', 'yearsofexperience', 'yearsatcompany', 'tag', 'basesalar
y',
       'stockgrantvalue', 'bonus', 'gender', 'otherdetails', 'cityid', 'dmai
d',
       'rowNumber', 'Masters_Degree', 'Bachelors_Degree', 'Doctorate_Degre
e',
       'Highschool', 'Some_College', 'Race_Asian', 'Race_White',
       'Race_Two_Or_More', 'Race_Black', 'Race_Hispanic', 'Race', 'Educatio
n'],
      dtype='object')
```

In [7]:

```
data.duplicated().sum()
```

Out[7]:

```
0
```

In [8]:

```
data.isnull().sum()
```

Out[8]:

```
timestamp                      0
company                        5
level                        119
title                          0
totalyearlycompensation        0
location                       0
yearsofexperience              0
yearsatcompany                 0
tag                          854
basesalary                     0
stockgrantvalue                0
bonus                          0
gender                     19540
otherdetails               22505
cityid                         0
dmaid                          2
rowNumber                      0
Masters_Degree                 0
Bachelors_Degree               0
Doctorate_Degree               0
Highschool                     0
Some_College                   0
Race_Asian                     0
Race_White                     0
Race_Two_Or_More               0
Race_Black                     0
Race_Hispanic                  0
Race                       40215
Education                  32272
dtype: int64
```

In [9]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 62642 entries, 0 to 62641
Data columns (total 29 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   timestamp              62642 non-null  object 
 1   company                62637 non-null  object 
 2   level                  62523 non-null  object 
 3   title                  62642 non-null  object 
 4   totalyearlycompensation 62642 non-null  int64  
 5   location               62642 non-null  object 
 6   yearsofexperience      62642 non-null  float64
 7   yearsatcompany         62642 non-null  float64
 8   tag                    61788 non-null  object 
 9   basesalary             62642 non-null  int64  
 10  stockgrantvalue        62642 non-null  float64
 11  bonus                  62642 non-null  float64
 12  gender                 43102 non-null  object 
 13  otherdetails           40137 non-null  object 
 14  cityid                 62642 non-null  int64  
 15  dmaid                  62640 non-null  float64
 16  rowNumber              62642 non-null  int64  
 17  Masters_Degree         62642 non-null  int64  
 18  Bachelors_Degree       62642 non-null  int64  
 19  Doctorate_Degree       62642 non-null  int64  
 20  Highschool             62642 non-null  int64  
 21  Some_College           62642 non-null  int64  
 22  Race_Asian             62642 non-null  int64  
 23  Race_White             62642 non-null  int64  
 24  Race_Two_Or_More       62642 non-null  int64  
 25  Race_Black             62642 non-null  int64  
 26  Race_Hispanic          62642 non-null  int64  
 27  Race                   22427 non-null  object 
 28  Education              30370 non-null  object 
dtypes: float64(5), int64(14), object(10)
memory usage: 13.9+ MB
```

In [10]:

```
data.describe()
```

Out[10]:

	totalyearlycompensation	yearsofexperience	yearsatcompany	basesalary	stockgrantval
count	6.264200e+04	62642.000000	62642.000000	6.264200e+04	6.264200e+
mean	2.163004e+05	7.204135	2.702093	1.366873e+05	5.148608e+
std	1.380337e+05	5.840375	3.263656	6.136928e+04	8.187457e+
min	1.000000e+04	0.000000	0.000000	0.000000e+00	0.000000e+
25%	1.350000e+05	3.000000	0.000000	1.080000e+05	0.000000e+
50%	1.880000e+05	6.000000	2.000000	1.400000e+05	2.500000e+
75%	2.640000e+05	10.000000	4.000000	1.700000e+05	6.500000e+
max	4.980000e+06	69.000000	69.000000	1.659870e+06	2.800000e+

In [11]:

```
data.nunique()
```

Out[11]:

```
timestamp                  61755
company                     1631
level                       2916
title                         15
totalyearlycompensation      893
location                    1050
yearsofexperience             65
yearsatcompany                81
tag                         3058
basesalary                   482
stockgrantvalue              612
bonus                        335
gender                         4
otherdetails               12839
cityid                      1045
dmaid                        149
rowNumber                  62642
Masters_Degree                 2
Bachelors_Degree               2
Doctorate_Degree               2
Highschool                     2
Some_College                   2
Race_Asian                     2
Race_White                     2
Race_Two_Or_More               2
Race_Black                     2
Race_Hispanic                  2
Race                           5
Education                      5
dtype: int64
```

In [12]:

```
data_cat = data[['title', 'gender', 'Masters_Degree', 'Bachelors_Degree', 'Doctorate_Degree
                 'Highschool', 'Some_College', 'Race_Asian', 'Race_White','Race_Two_Or_More
                 'Race_Black', 'Race_Hispanic', 'Race', 'Education']]
```

In [13]:

```
for i in data_cat.columns:
    print(data_cat[i].unique())
```

```
['Product Manager' 'Software Engineer' 'Software Engineering Manager'
 'Data Scientist' 'Solution Architect' 'Technical Program Manager'
 'Human Resources' 'Product Designer' 'Marketing' 'Business Analyst'
 'Hardware Engineer' 'Sales' 'Recruiter' 'Mechanical Engineer'
 'Management Consultant']
[nan 'Male' 'Female' 'Other' 'Title: Senior Software Engineer']
[0 1]
[0 1]
[0 1]
[0 1]
[0 1]
[0 1]
[0 1]
[0 1]
[0 1]
[0 1]
[nan 'White' 'Asian' 'Black' 'Two Or More' 'Hispanic']
[nan 'PhD' "Master's Degree" "Bachelor's Degree" 'Some College'
 'Highschool']
```

In [14]:

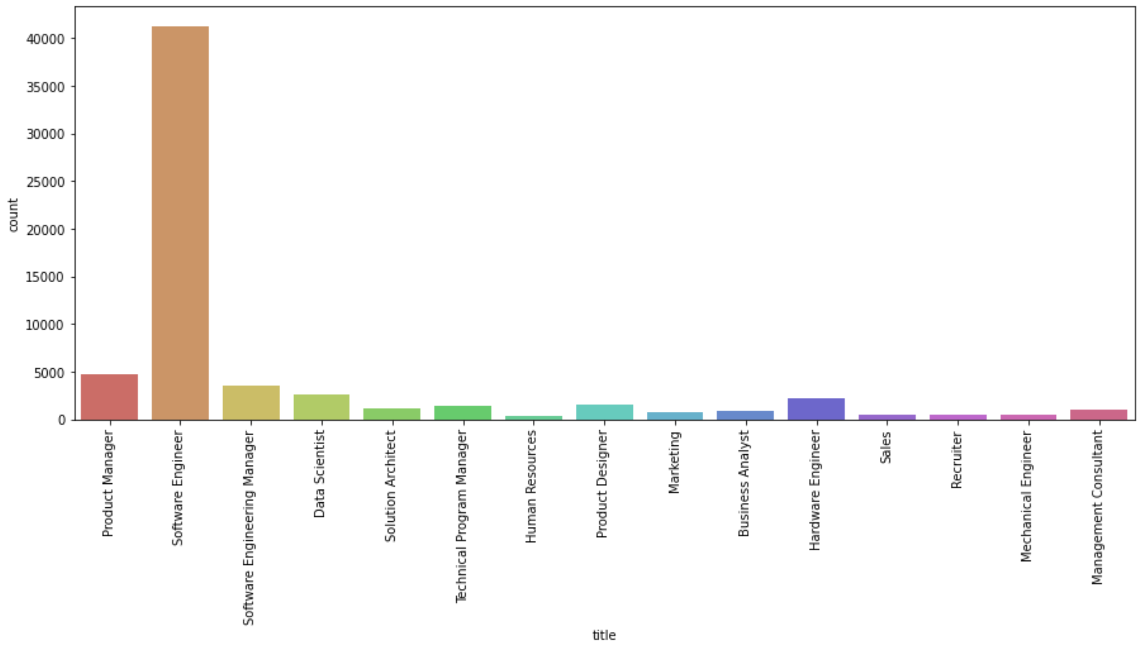
```
for i in data_cat.columns:
    print(data_cat[i].value_counts())
```

```
Software Engineer               41231
Product Manager                  4673
Software Engineering Manager     3569
Data Scientist                   2578
Hardware Engineer                2200
Product Designer                 1516
Technical Program Manager        1381
Solution Architect               1157
Management Consultant             976
Business Analyst                  885
Marketing                         710
Mechanical Engineer               490
Sales                             461
Recruiter                         451
Human Resources                   364
Name: title, dtype: int64
Male                               35702
Female                              6999
Other                                400
Title: Senior Software Engineer        1
Name: gender, dtype: int64
0    47251
1    15391
Name: Masters_Degree, dtype: int64
0    50037
1    12605
Name: Bachelors_Degree, dtype: int64
0    60839
1     1803
Name: Doctorate_Degree, dtype: int64
0    62322
1      320
Name: Highschool, dtype: int64
0    62287
1      355
Name: Some_College, dtype: int64
0    50870
1    11772
Name: Race_Asian, dtype: int64
0    54610
1     8032
Name: Race_White, dtype: int64
0    61838
1      804
Name: Race_Two_Or_More, dtype: int64
0    61952
1      690
Name: Race_Black, dtype: int64
0    61512
1     1130
Name: Race_Hispanic, dtype: int64
Asian          11772
White           8032
Hispanic        1129
Two Or More      804
```

```
Black            690
Name: Race, dtype: int64
Master's Degree      15391
Bachelor's Degree    12601
PhD                   1703
Some College           355
Highschool             320
Name: Education, dtype: int64
```

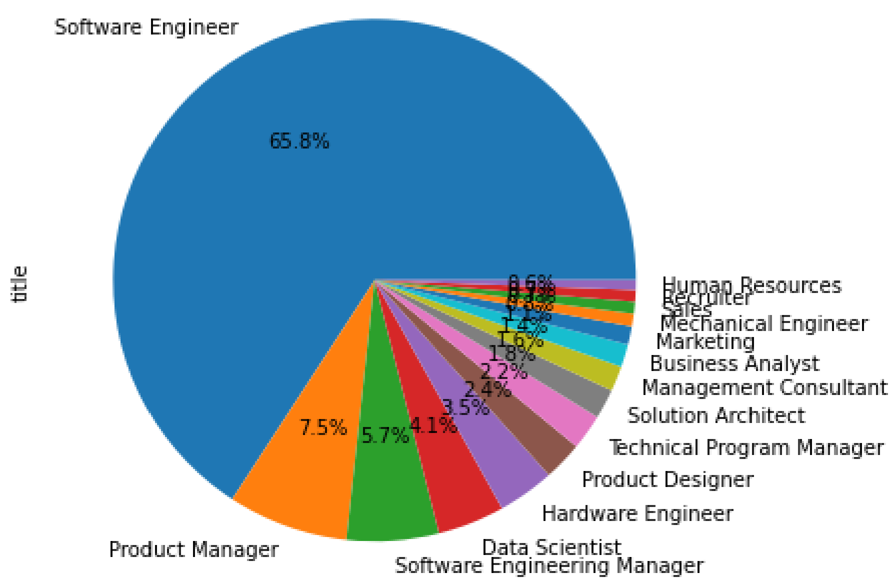
In [15]:

```
for i in data_cat.columns:
    plt.figure(figsize = (15,6))
    sns.countplot(data_cat[i], data = data_cat, palette = 'hls')
    plt.xticks(rotation = 90)
    plt.show()
```



In [16]:

```
for i in data_cat.columns:
    plt.figure(figsize = (15,6))
    data_cat[i].value_counts().plot(kind = 'pie', autopct = '%1.1f%%')
    plt.xticks(rotation = 90)
    plt.show()
```



In [17]:

```
data_salaries = data[['company', 'title', 'totalyearlycompensation','location',
                      'yearsofexperience', 'yearsatcompany', 'gender','Race', 'Education']]
```

In [18]:

```
data_salaries = pd.DataFrame(data_salaries)
```

In [19]:

```
data_salaries.head()
```

Out[19]:

	company	title	totalyearlycompensation	location	yearsofexperience	yearsatcompan
0	Oracle	Product Manager	127000	Redwood City, CA	1.5	1.
1	eBay	Software Engineer	100000	San Francisco, CA	5.0	3.
2	Amazon	Product Manager	310000	Seattle, WA	8.0	0.
3	Apple	Software Engineering Manager	372000	Sunnyvale, CA	7.0	5.
4	Microsoft	Software Engineer	157000	Mountain View, CA	5.0	3.

In [20]:

```
data_salaries.tail()
```

Out[20]:

	company	title	totalyearlycompensation	location	yearsofexperience	yearsatcomp
62637	Google	Software Engineer	327000	Seattle, WA	10.0	
62638	Microsoft	Software Engineer	237000	Redmond, WA	2.0	
62639	MSFT	Software Engineer	220000	Seattle, WA	14.0	
62640	Salesforce	Software Engineer	280000	San Francisco, CA	8.0	
62641	apple	Software Engineer	200000	Sunnyvale, CA	0.0	

In [21]:

```
data_salaries['title'].value_counts()
```

Out[21]:

```
Software Engineer             41231
Product Manager                4673
Software Engineering Manager   3569
Data Scientist                 2578
Hardware Engineer              2200
Product Designer               1516
Technical Program Manager      1381
Solution Architect             1157
Management Consultant           976
Business Analyst                885
Marketing                       710
Mechanical Engineer             490
Sales                           461
Recruiter                       451
Human Resources                 364
Name: title, dtype: int64
```

In [22]:

```
undesired_titles = ['Marketing', 'Mechanical Engineer', 'Sales', 'Recruiter', 'Human Resour
data_salaries_original = data_salaries.copy()
data_salaries = data_salaries[data_salaries['title'].apply(lambda x: x not in undesired_tit
data_salaries['title'].value_counts()
```

Out[22]:

```
Software Engineer             41231
Product Manager                4673
Software Engineering Manager   3569
Data Scientist                 2578
Hardware Engineer              2200
Product Designer               1516
Technical Program Manager      1381
Solution Architect             1157
Management Consultant           976
Business Analyst                885
Name: title, dtype: int64
```

In [23]:

```
data_salaries.shape
```

Out[23]:

```
(60166, 9)
```

In [24]:

```
data_salaries.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 60166 entries, 0 to 62641
Data columns (total 9 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   company                  60161 non-null  object 
 1   title                    60166 non-null  object 
 2   totalyearlycompensation  60166 non-null  int64  
 3   location                 60166 non-null  object 
 4   yearsofexperience        60166 non-null  float64
 5   yearsatcompany           60166 non-null  float64
 6   gender                   41614 non-null  object 
 7   Race                     21160 non-null  object 
 8   Education                28922 non-null  object 
dtypes: float64(2), int64(1), object(6)
memory usage: 4.6+ MB
```

In [25]:

```
data_salaries.isnull().sum()
```

Out[25]:

```
company                        5
title                          0
totalyearlycompensation        0
location                       0
yearsofexperience              0
yearsatcompany                 0
gender                     18552
Race                       39006
Education                  31244
dtype: int64
```

In [26]:

```
null_data = pd.DataFrame(data_salaries.isnull().sum(), columns = ['Count of Nulls'])
null_data.index.name = 'Column Name'
null_data[null_data ['Count of Nulls'] > 0].sort_values('Count of Nulls', ascending=False)
```

Out[26]:

	Count of Nulls
Column Name	
Race	39006
Education	31244
gender	18552
company	5

In [27]:

```
data_salaries.fillna({'company':'NA', 'gender':'NA','Race': 'NA', 'Education': 'NA'}, inpla
```

In [28]:

```
data_salaries.isnull().sum()
```

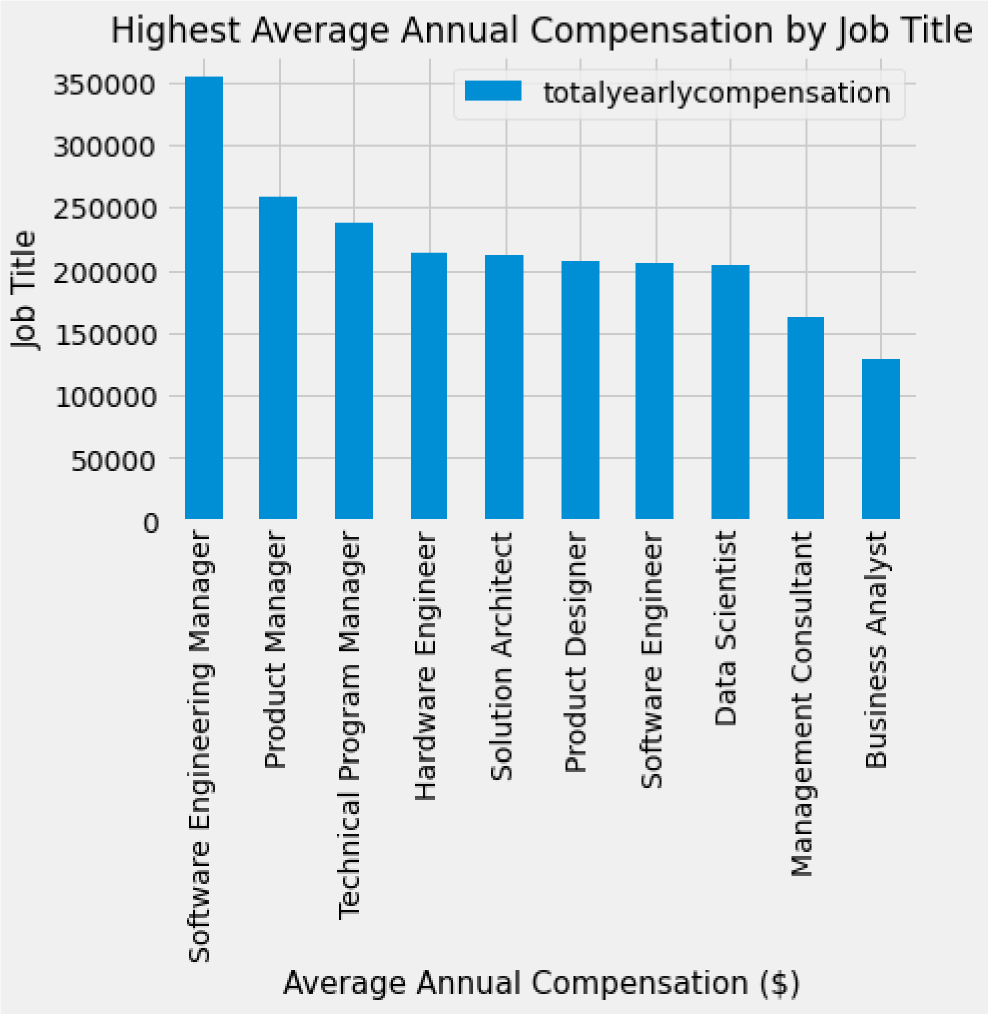
Out[28]:

```
company                    0
title                      0
totalyearlycompensation    0
location                   0
yearsofexperience          0
yearsatcompany             0
gender                     0
Race                       0
Education                  0
dtype: int64
```

In [29]:

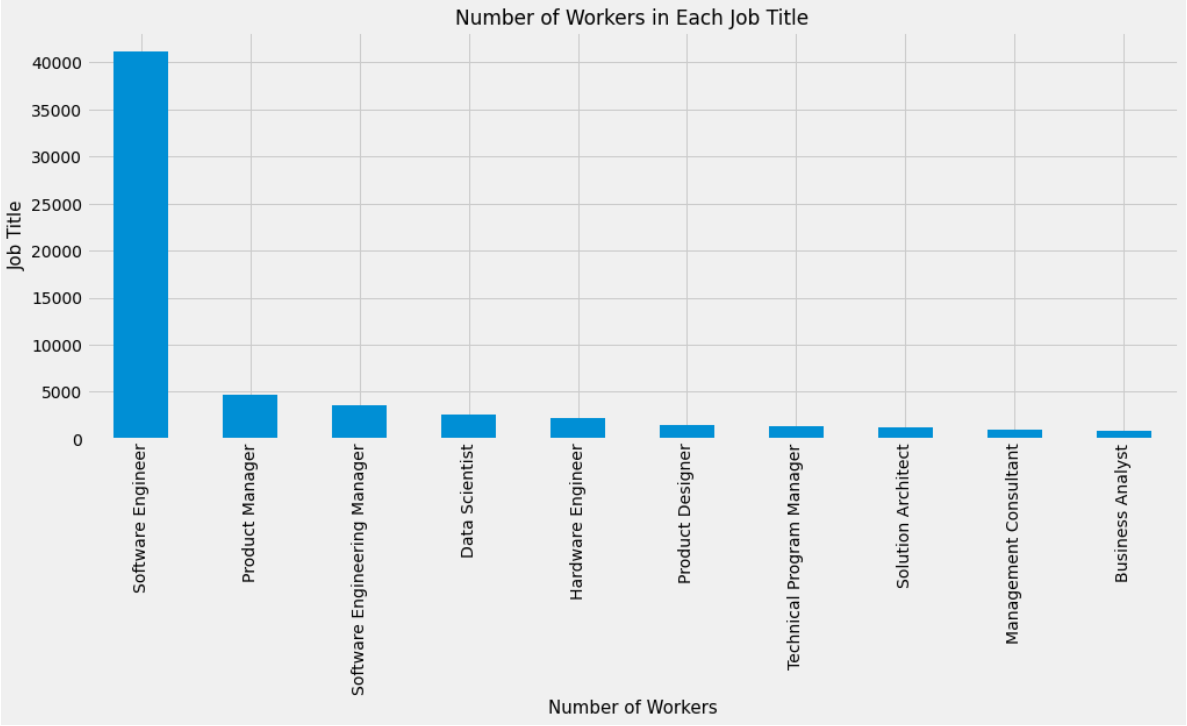
```
job_titles = data_salaries[['company','title', 'totalyearlycompensation']].groupby(['title'
                                                                          .mean()\
                                                                          .round(2)\
                                                                          .sort_values('tot
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
job_titles.plot.bar()
plt.title('Highest Average Annual Compensation by Job Title', size=17)
plt.xlabel('Average Annual Compensation ($)', size = 15)
plt.ylabel('Job Title', size = 15)
plt.show()
```

```
<Figure size 1080x432 with 0 Axes>
```



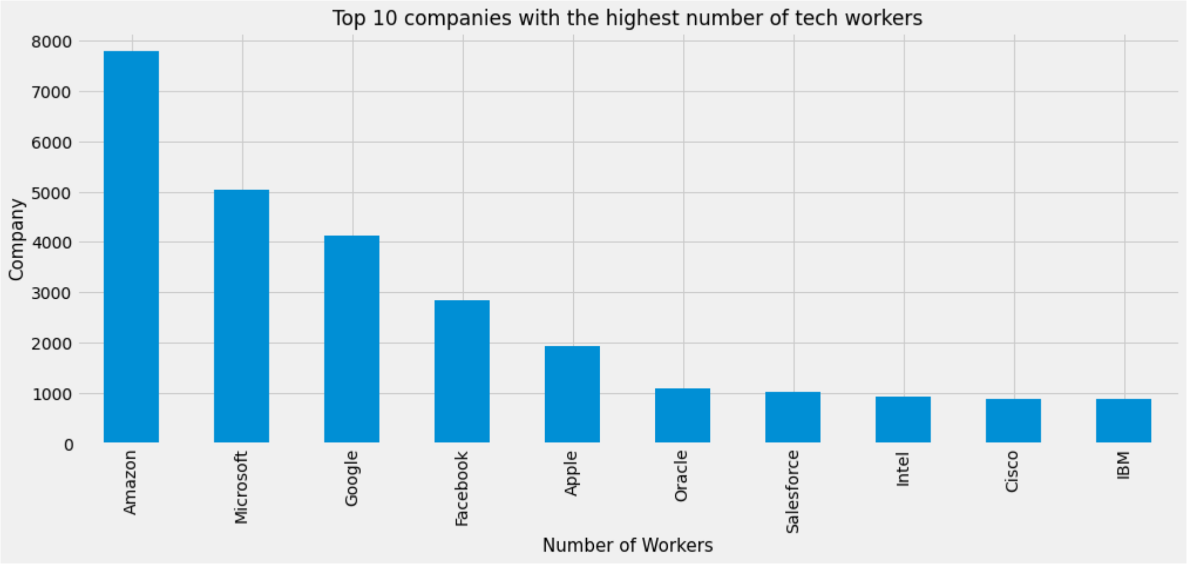
In [30]:

```
top_jobs = data_salaries['title'].value_counts()
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
top_jobs.plot.bar()
plt.title("Number of Workers in Each Job Title", size=17)
plt.xlabel('Number of Workers', size = 15)
plt.ylabel('Job Title', size = 15)
plt.show();
```



In [31]:

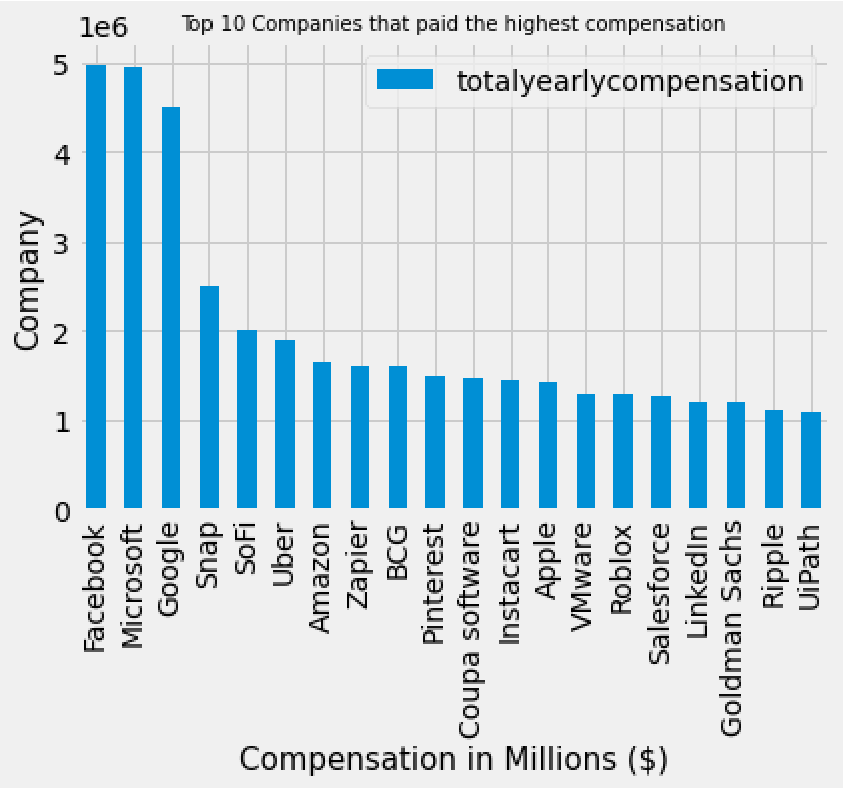
```
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
companies_with_most_tech_workers = data_salaries['company'].value_counts()[:10].plot.bar();
plt.title('Top 10 companies with the highest number of tech workers', size=17)
plt.xlabel('Number of Workers', size = 15)
plt.ylabel('Company', size = 15)
plt.show();
```



In [32]:

```
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
highest_paying_companies = data_salaries[['company','title','totalyearlycompensation']].gro
                                                                                       .max
                                                                                       .hea

plt.title('Top 10 Companies that paid the highest compensation', size=10)
plt.xlabel('Compensation in Millions ($)', size = 15)
plt.ylabel('Company', size = 15)
plt.show();
```

```
<Figure size 1080x432 with 0 Axes>
```



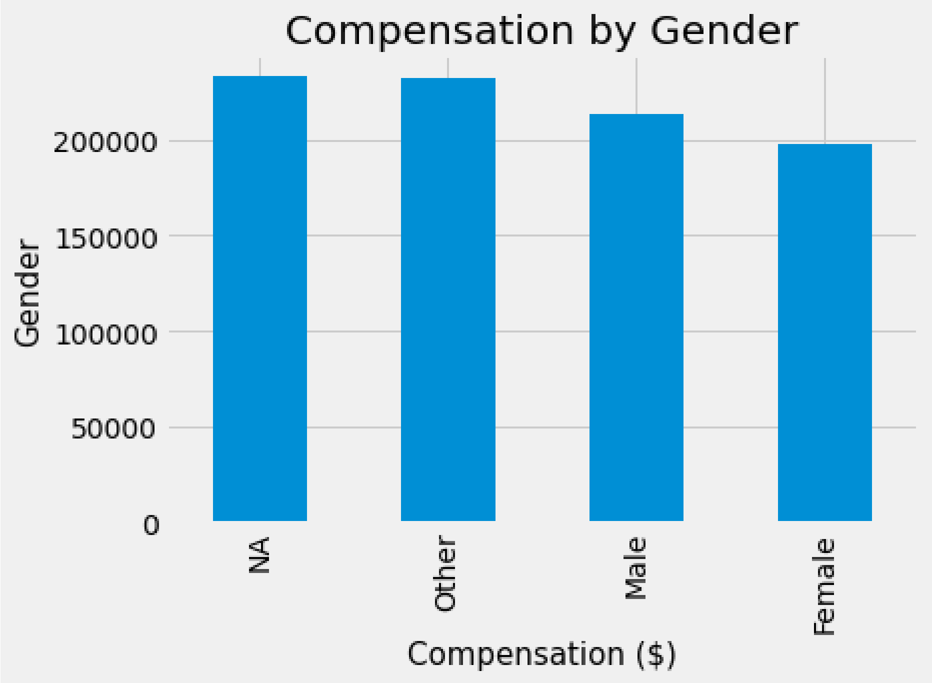
In [33]:

```
data_salaries['gender'].replace('Title: Senior Software Engineer', 'NA', inplace = True)
```

In [34]:

```
pay_by_gender = data_salaries[['totalyearlycompensation', 'gender']].groupby(['gender']).me
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
pay_by_gender.sort_values('totalyearlycompensation', ascending = False).head(10).plot.bar(l
plt.title('Compensation by Gender', size=20)
plt.xlabel('Compensation ($)', size = 15)
plt.ylabel('Gender', size = 15)
plt.show();
```

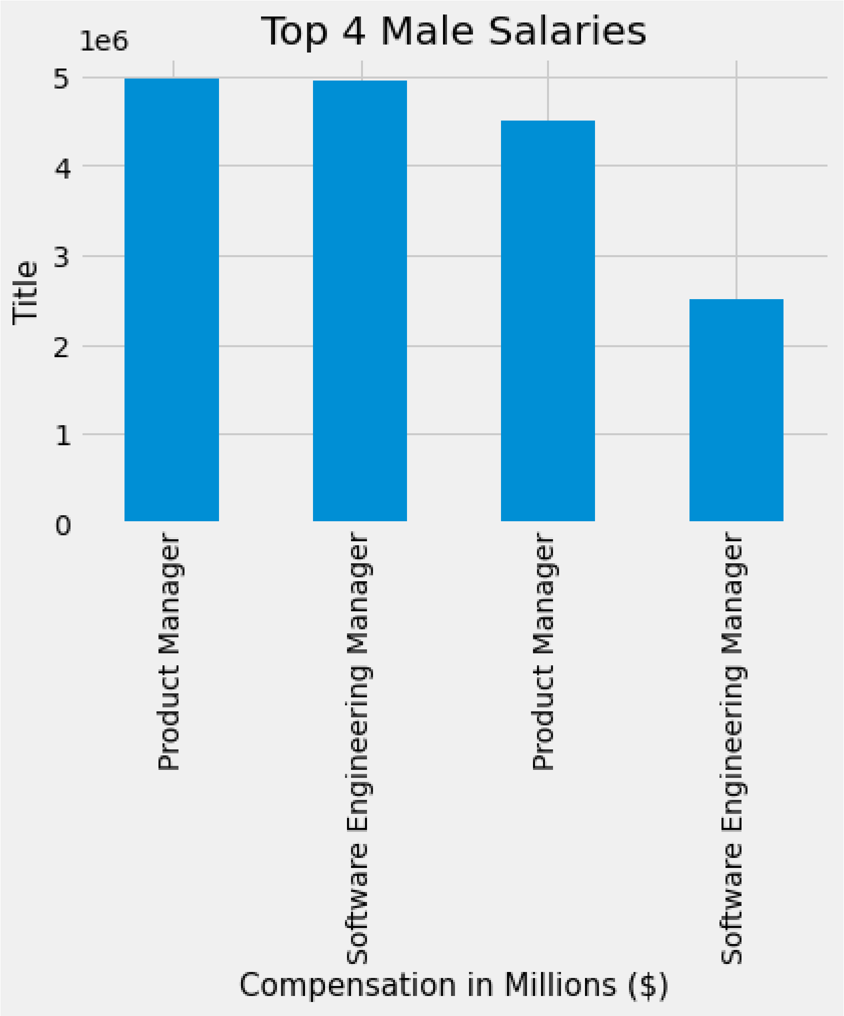
```
<Figure size 1080x432 with 0 Axes>
```



In [35]:

```
male_salaries = data_salaries[data_salaries.gender == 'Male'].copy()
top4_male_salaries = male_salaries.nlargest(4,'totalyearlycompensation')
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
top4_male_salaries.plot.bar(x = 'title', y = 'totalyearlycompensation', legend = False);
plt.title('Top 4 Male Salaries', size=20)
plt.xlabel('Compensation in Millions ($)', size = 15)
plt.ylabel('Title', size = 15)
plt.show();
```

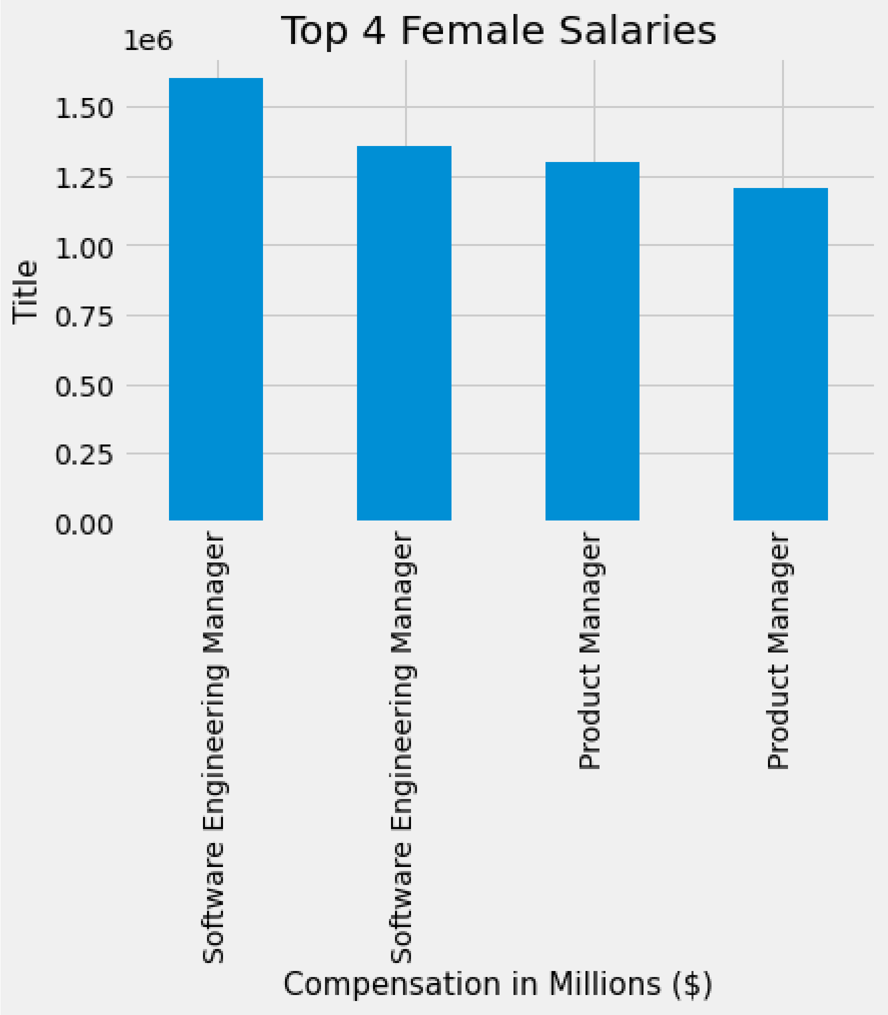
```
<Figure size 1080x432 with 0 Axes>
```



In [36]:

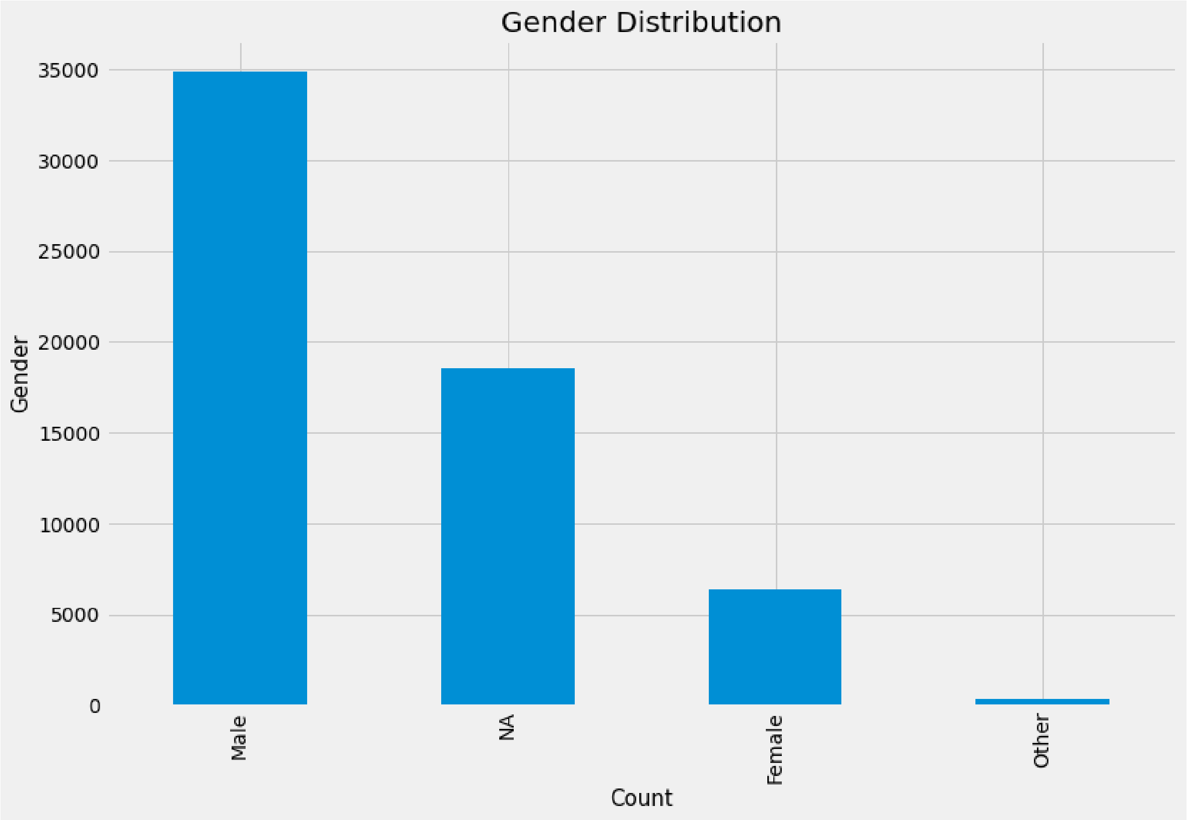
```
female_salaries = data_salaries[data_salaries.gender == 'Female'].copy()
top4_female_salaries = female_salaries.nlargest(4,'totalyearlycompensation')
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
top4_female_salaries.plot.bar(x = 'title', y = 'totalyearlycompensation', legend = False);
plt.title('Top 4 Female Salaries', size=20)
plt.xlabel('Compensation in Millions ($)', size = 15)
plt.ylabel('Title', size = 15)
plt.show();
```

```
<Figure size 1080x432 with 0 Axes>
```



In [37]:

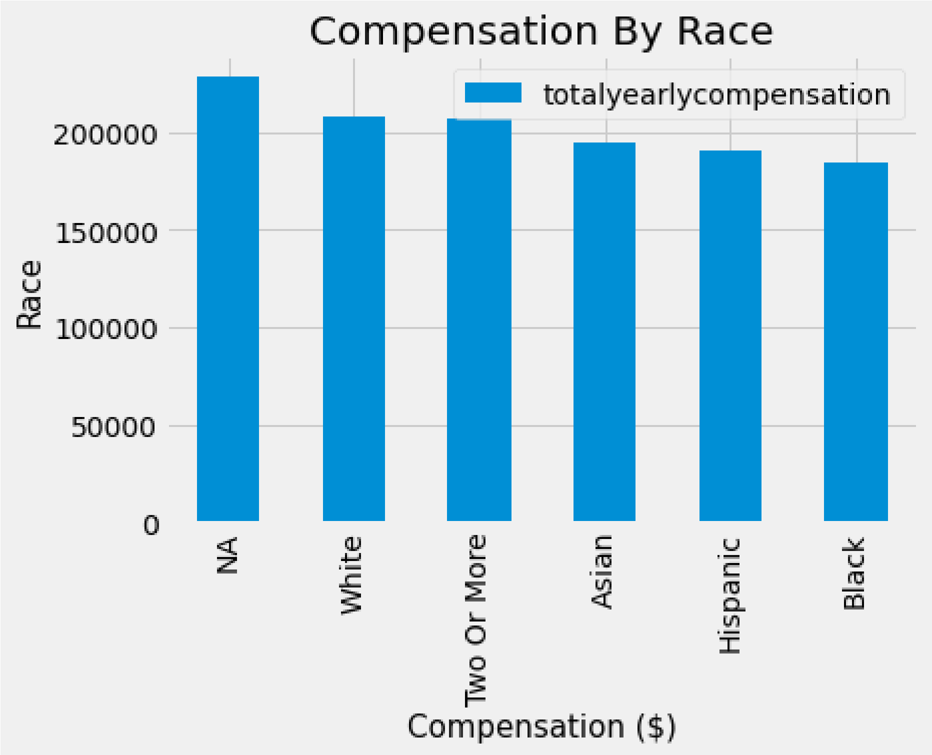
```
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
gender_distribution = data_salaries['gender'].value_counts().plot.bar(figsize = (12,8));
plt.title('Gender Distribution', size=20)
plt.xlabel('Count', size = 15)
plt.ylabel('Gender', size = 15)
plt.show();
```



In [38]:

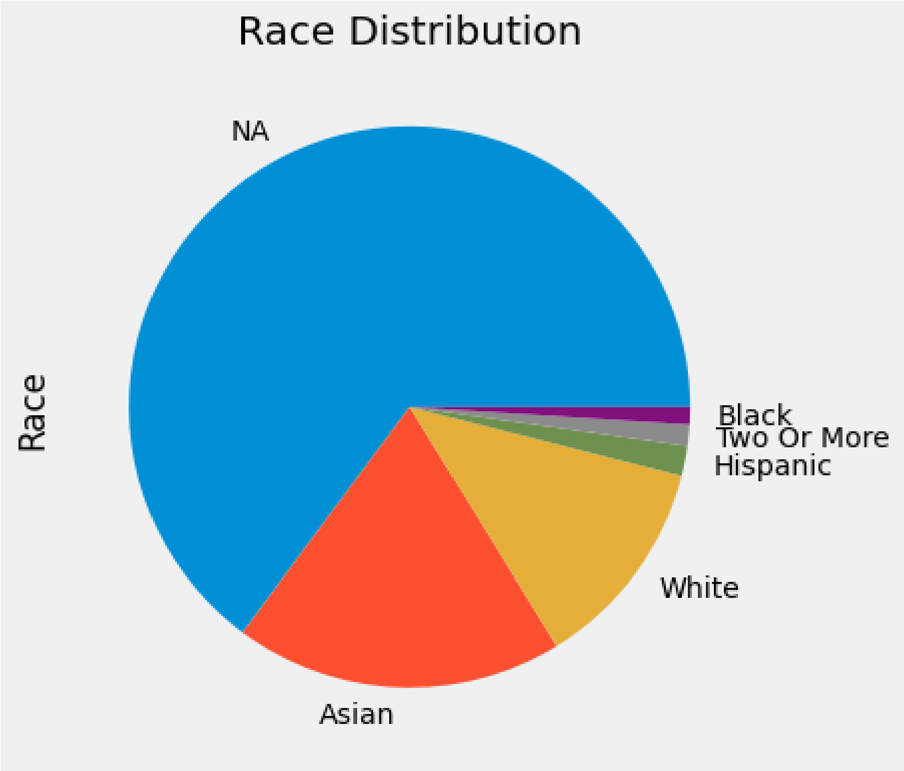
```
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
pay_by_race = data_salaries[['totalyearlycompensation','Race']].groupby(['Race'])\
                                                               .mean()\
                                                               .round(2)\
                                                               .sort_values('totalyearlycom
                                                               .plot.bar()
plt.title('Compensation By Race', size=20)
plt.xlabel('Compensation ($)', size = 15)
plt.ylabel('Race', size = 15)
plt.show();
```

```
<Figure size 1080x432 with 0 Axes>
```



In [39]:

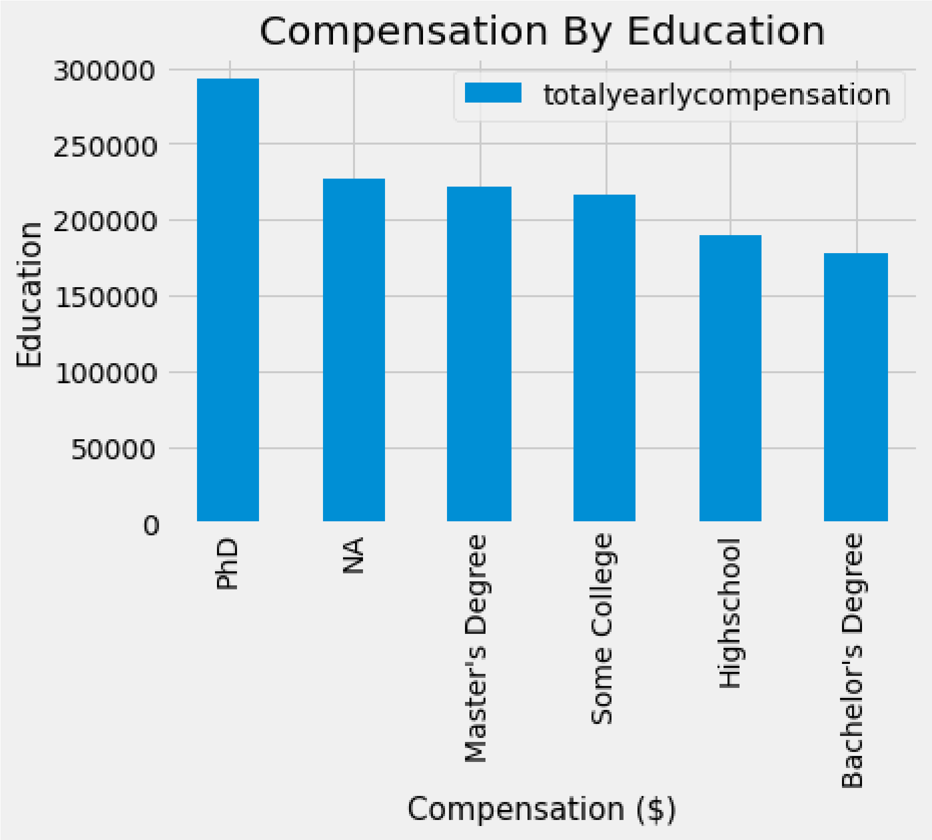
```
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
race_distribution = data_salaries['Race'].value_counts().plot.pie();
plt.title('Race Distribution', size=20)
plt.show();
```



In [40]:

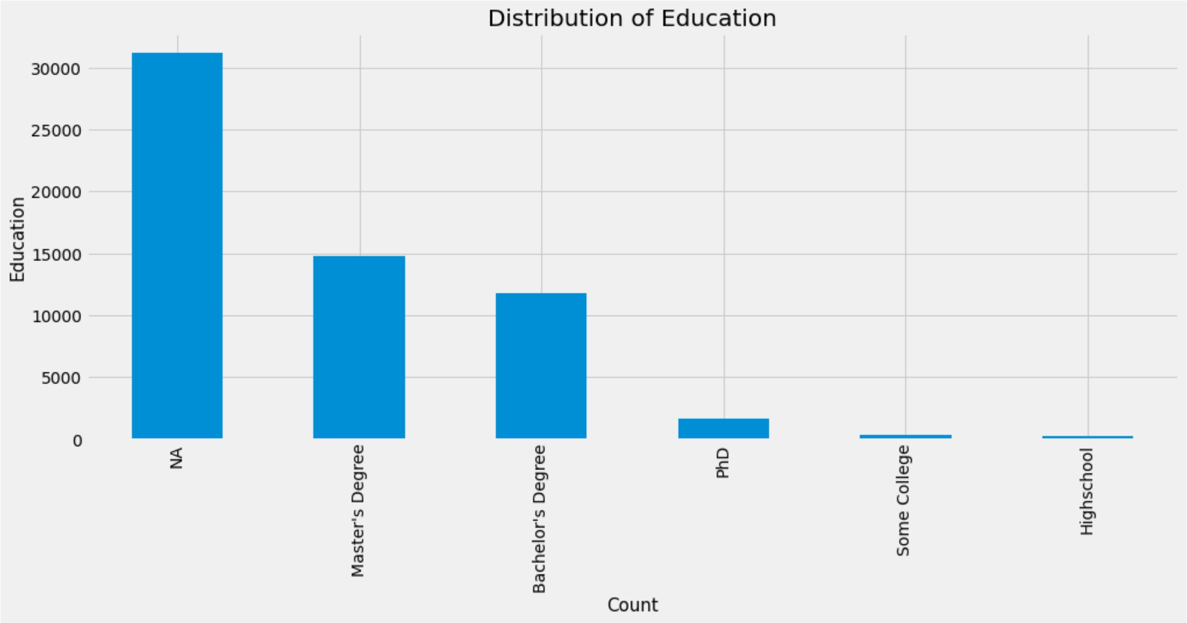
```
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
pay_by_education = data_salaries[['totalyearlycompensation','Education']].groupby(['Educati
plt.title('Compensation By Education', size=20)
plt.xlabel('Compensation ($)', size = 15)
plt.ylabel('Education', size = 15)
plt.show();
```

```
<Figure size 1080x432 with 0 Axes>
```



In [41]:

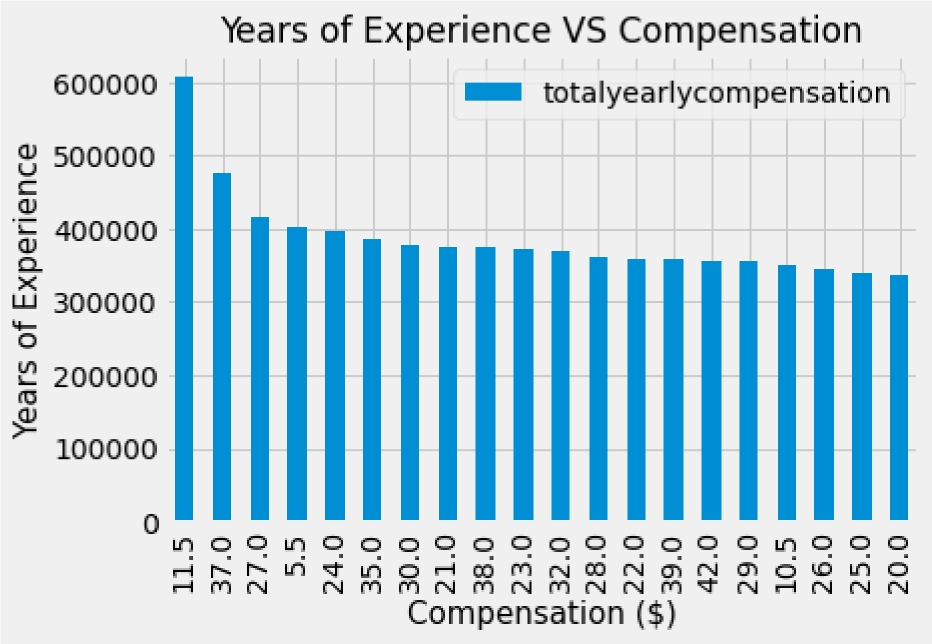
```
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
education_distribution = data_salaries['Education'].value_counts().plot.bar()
plt.title('Distribution of Education', size=20)
plt.xlabel('Count', size = 15)
plt.ylabel('Education', size = 15)
plt.show();
```



In [42]:

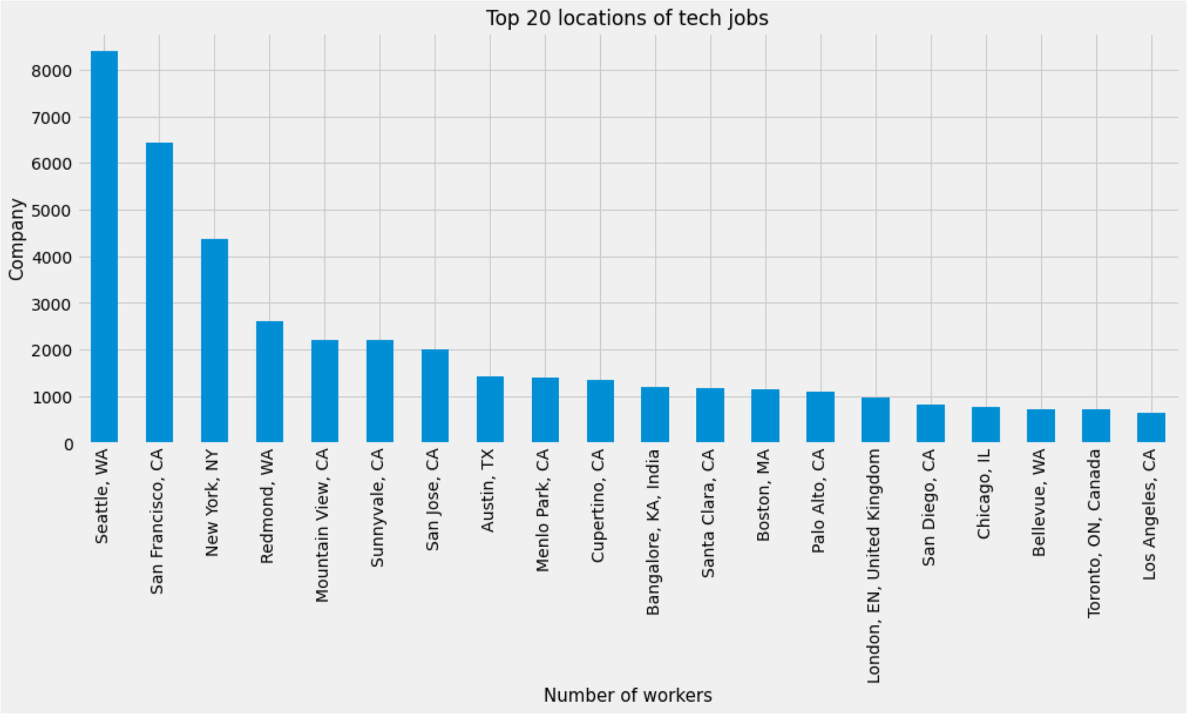
```
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
years_of_experience = data_salaries[['title', 'totalyearlycompensation','yearsofexperience'




plt.title('Years of Experience VS Compensation', size=17)
plt.xlabel('Compensation ($)', size = 15)
plt.ylabel('Years of Experience', size = 15)
plt.show();
```

```
<Figure size 1080x432 with 0 Axes>
```



In [43]:

```
plt.figure(figsize = (15,6))
plt.style.use('fivethirtyeight')
location = data_salaries['location'].value_counts().iloc[:20].plot.bar()
plt.title('Top 20 locations of tech jobs', size=17)
plt.xlabel('Number of workers', size = 15)
plt.ylabel('Company', size = 15)
plt.show();
```


Top 20 locations of tech jobs
Company
Seattle, WA
San Francisco, CA
New York, NY
Redmond, WA
Mountain View, CA
Sunnyvale, CA
San Jose, CA
Austin, TX
Menlo Park, CA
Cupertino, CA
Bangalore, KA, India
Santa Clara, CA
Boston, MA
Palo Alto, CA
London, EN, United Kingdom
San Diego, CA
Chicago, IL
Bellevue, WA
Toronto, ON, Canada
Los Angeles, CA
Number of workers