EDA: Visa Dataset

Dataset Link: https://drive.google.com/file/d/1Fzzbf8Rj1NheQ-zfwFQHYY-T8FxB8ouT/view

1. EDA

- Data Profiling
- Stastical analysis
- Graphical Analysis

In [1]:
```
#importing necessary libraries
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import statistics as stat
%matplotlib inline
# To display maximum columns of dataframe on screen
pd.pandas.set_option('display.max_columns', None)
```

load the dataset and display basic info like shape, data types, basic statistical info like mean median mode etc

In [3]:
```
visa=pd.read_csv('Visadataset.csv')
visa.head()
```

Out[3]:

	case_id	continent	education_of_employee	has_job_experience	requires_job_training	no_of_employees	yr_(
0	EZYV01	Asia	High School	N	N	14513	
1	EZYV02	Asia	Master's	Y	N	2412	
2	EZYV03	Asia	Bachelor's	N	Y	44444	
3	EZYV04	Asia	Bachelor's	N	N	98	
4	EZYV05	Africa	Master's	Y	N	1082	

In [4]:
```
#data types
visa.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 25480 entries, 0 to 25479
Data columns (total 12 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   case_id                25480 non-null  object 
 1   continent              25480 non-null  object 
 2   education_of_employee  25480 non-null  object 
 3   has_job_experience     25480 non-null  object 
 4   requires_job_training  25480 non-null  object 
 5   no_of_employees        25480 non-null  int64  
 6   yr_of_estab            25480 non-null  int64  
 7   region_of_employment   25480 non-null  object 
 8   prevailing_wage        25480 non-null  float64
 9   unit_of_wage           25480 non-null  object 
 10  full_time_position     25480 non-null  object 
 11  case_status            25480 non-null  object 
dtypes: float64(1), int64(2), object(9)
memory usage: 2.3+ MB
```

In [6]:
```
#shape to display number of rows and columns
visa.shape
```

Out[6]:
```
(25480, 12)
```

Observation

- there are 25480 rows and 12 columns
- no_of_employees, yr_of_estab are numerical, prevailing_wage is float and rest are categorical features

Separating Numerical and Categorial features

In [13]:
```
numeric_feat=[feats for feats in visa.columns if visa[feats].dtype!='O' and feats!='case
categorical_feat=[feats for feats in visa.columns if visa[feats].dtype=='O' and feats!='
```

In [14]:
```
numeric_feat
```

Out[14]:
```
['no_of_employees', 'yr_of_estab', 'prevailing_wage']
```

In [15]:
```
categorical_feat
```

Out[15]:
```
['continent',
 'education_of_employee',
 'has_job_experience',
 'requires_job_training',
 'region_of_employment',
 'unit_of_wage',
 'full_time_position',
 'case_status']
```

In [16]:
```
visa[numeric_feat].head()
```

Out[16]:

	no_of_employees	yr_of_estab	prevailing_wage
0	14513	2007	592.2029
1	2412	2002	83425.6500
2	44444	2008	122996.8600
3	98	1897	83434.0300
4	1082	2005	149907.3900

Numerical Features

Discrete Numerical features

In [19]:
```
discrete_numeric_feats=[feat for feat in numeric_feat if len(visa[feat].unique())<25]
```

In [20]:
```
discrete_numeric_feats
```

Out[20]:
```
[]
```

Continuous Numerical Features

In [23]:
```
continuous_numeric_feats=[feat for feat in numeric_feat if len(visa[feat].unique())>25]
continuous_numeric_feats
```

Out[23]:
```
['no_of_employees', 'yr_of_estab', 'prevailing_wage']
```

Categorical Features

In [25]:
```
visa[categorical_feat]
```

Out[25]:

	continent	education_of_employee	has_job_experience	requires_job_training	region_of_employment	unit
0	Asia	High School	N	N	West	
1	Asia	Master's	Y	N	Northeast	
2	Asia	Bachelor's	N	Y	West	
3	Asia	Bachelor's	N	N	West	
4	Africa	Master's	Y	N	South	
...	...	...	...	...	...	
25475	Asia	Bachelor's	Y	Y	South	
25476	Asia	High School	Y	N	Northeast	
25477	Asia	Master's	Y	N	South	
25478	Asia	Master's	Y	Y	West	
25479	Asia	Bachelor's	Y	N	Midwest	

25480 rows × 8 columns

Missing Values

In [26]:
```
missing_val=[feat for feat in visa.columns if visa[feat].isnull().sum()>1]
```

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In [27]:
```
missing_val
```
Out[27]:
```
[]
```

Observation

- There is no missing value in the dataset

Statistical Analysis

Mean, Median, Mode of the numerical dataset

In [28]:
```
#Mean of the numeric features
visa[numeric_feat].mean()
```
Out[28]:
```
no_of_employees      5667.043210
yr_of_estab          1979.409929
prevailing_wage     74455.814592
dtype: float64
```

In [30]:
```
#Median of the numeric features
visa[numeric_feat].median()
```
Out[30]:
```
no_of_employees      2109.00
yr_of_estab          1997.00
prevailing_wage     70308.21
dtype: float64
```

In [33]:
```
#Mode of the numeric features
visa[numeric_feat].mode().loc[0]
```
Out[33]:
```
no_of_employees      183.00
yr_of_estab         1998.00
prevailing_wage      100.66
Name: 0, dtype: float64
```

Variance and Standard Deviation of the numerical dataset

In [35]:
```
#Variance
round(visa[numeric_feat].var(),2)
```
Out[35]:
```
no_of_employees     5.233996e+08
yr_of_estab         1.794960e+03
prevailing_wage     2.789524e+09
dtype: float64
```

In [37]:
```
# Standard Deviation
visa[numeric_feat].std()
```
Out[37]:
```
no_of_employees     22877.928848
yr_of_estab            42.366929
prevailing_wage     52815.942327
dtype: float64
```

Covariance of numeric dataset

In [38]:
```
visa[numeric_feat].cov()
```

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Out[38]:

	no_of_employees	yr_of_estab	prevailing_wage
no_of_employees	5.233996e+08	-17224.155003	-1.150624e+07
yr_of_estab	-1.722416e+04	1794.956681	2.761653e+04
prevailing_wage	-1.150624e+07	27616.530171	2.789524e+09

Correlation of numeric dataset

In [41]:

```
#Pearson correlation coefficient
visa[numeric_feat].corr()
```

Out[41]:

	no_of_employees	yr_of_estab	prevailing_wage
no_of_employees	1.000000	-0.017770	-0.009523
yr_of_estab	-0.017770	1.000000	0.012342
prevailing_wage	-0.009523	0.012342	1.000000

In [42]:

```
# 2. Spearman's rank correlation coefficient
visa[numeric_feat].corr(method='spearman')
```

Out[42]:

	no_of_employees	yr_of_estab	prevailing_wage
no_of_employees	1.000000	-0.006214	-0.015197
yr_of_estab	-0.006214	1.000000	0.019566
prevailing_wage	-0.015197	0.019566	1.000000

In [43]:

```
# 3. kendall rank correlation coefficient
visa[numeric_feat].corr(method='kendall')
```

Out[43]:

	no_of_employees	yr_of_estab	prevailing_wage
no_of_employees	1.000000	-0.004180	-0.010159
yr_of_estab	-0.004180	1.000000	0.013151
prevailing_wage	-0.010159	0.013151	1.000000

Five point summary for outliers

In [46]:

```
for feat in numeric_feat:
     print("Five Point Summary for {}".format(feat))
     print("1. Minimum value is: {}".format(visa[feat].min()))
     print("2. 1st quartile is: {}".format(np.percentile(visa[feat], 25)))
     print("3. Median is: {}".format(np.percentile(visa[feat], 50)))
     print("4. 3rd quartile is: {}".format(np.percentile(visa[feat], 75)))
     print("5. Maximum value is: {}".format(visa[feat].max()))
     print(" ")
```

```
Five Point Summary for no_of_employees
1. Minimum value is: -26
2. 1st quartile is: 1022.0
3. Median is: 2109.0
4. 3rd quartile is: 3504.0
5. Maximum value is: 602069

Five Point Summary for yr_of_estab
1. Minimum value is: 1800
2. 1st quartile is: 1976.0
3. Median is: 1997.0
4. 3rd quartile is: 2005.0
5. Maximum value is: 2016

Five Point Summary for prevailing_wage
1. Minimum value is: 2.1367
2. 1st quartile is: 34015.479999999996
3. Median is: 70308.20999999999
4. 3rd quartile is: 107735.51250000001
5. Maximum value is: 319210.27
```

Mode of Categorical Features

In [50]:
```
visa[categorical_feat].mode()
```

Out[50]:

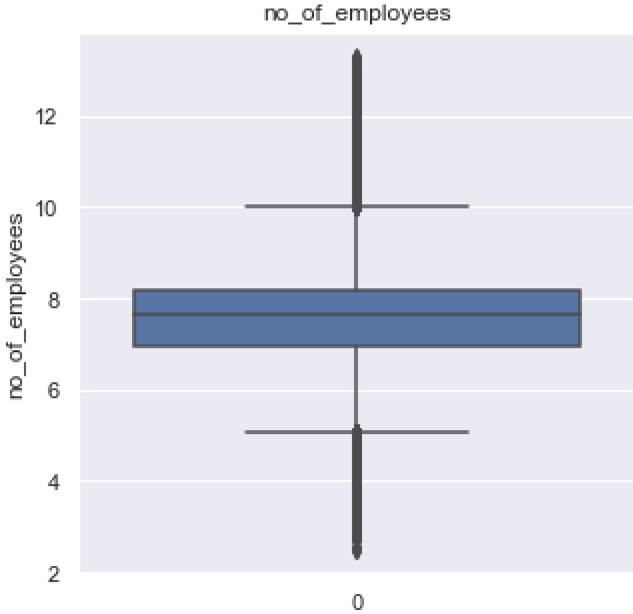
	continent	education_of_employee	has_job_experience	requires_job_training	region_of_employment	unit_of_
0	Asia	Bachelor's	Y	N	Northeast	

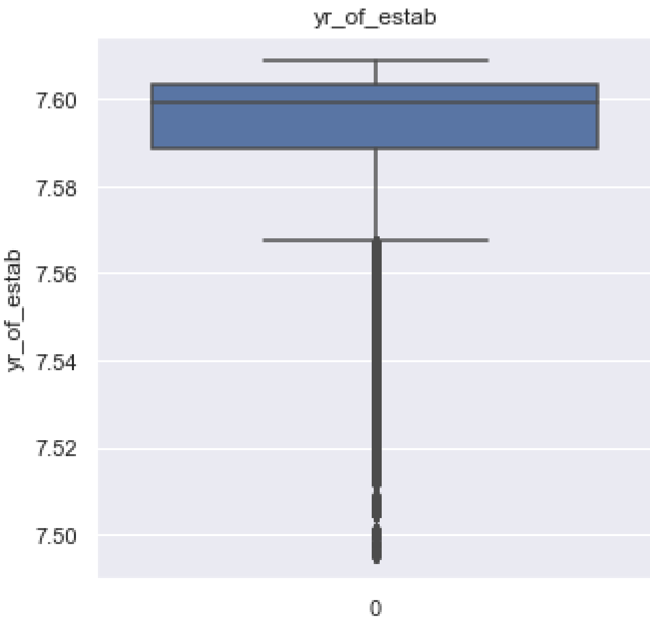
Graphical Analysis

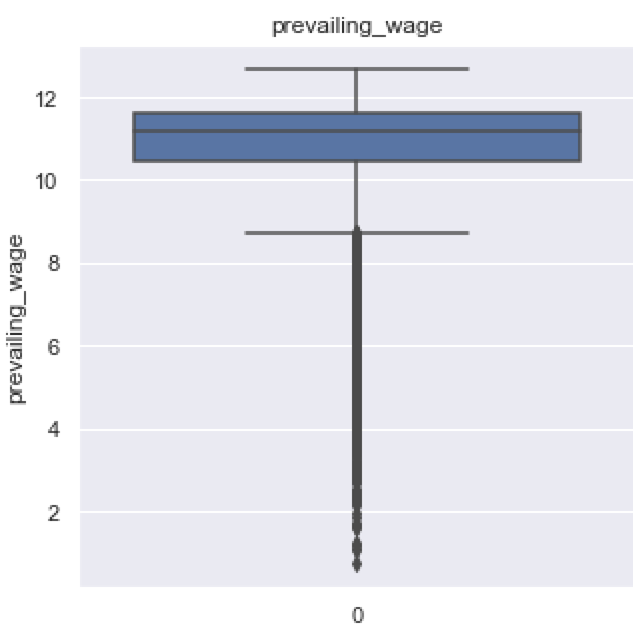
Box Plot for outliers

In [51]:
```
sns.set(rc={'figure.figsize':(5,5)})
for feat in continuous_numeric_feats:
    visa_copy=visa.copy()
    # here we are ignoring all zero values,since log(0) is undefined
    if 0 in visa_copy[feat].unique():
        pass
    else:
        visa_copy[feat]=np.log(visa_copy[feat])
        sns.boxplot(data=visa_copy[feat])
        plt.ylabel(feat)
        plt.title(feat)
        plt.show()
```

```
C:\Users\subho\anaconda3\lib\site-packages\pandas\core\arraylike.py:397: RuntimeWarning:
invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```







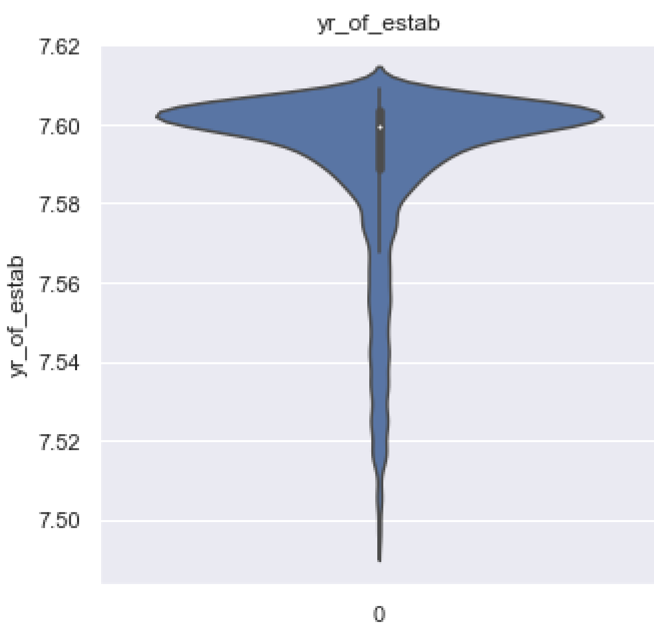
Observation

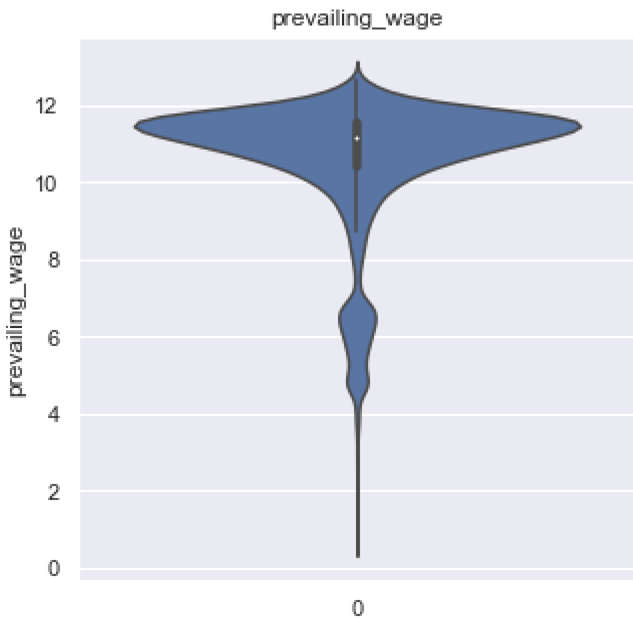
liers

In [53]:

```python
# violin plot for checking outliers
sns.set(rc={'figure.figsize':(5,5)})
for feat in continuous_numeric_feats:
    visa_copy=visa.copy()
    # here we are ignoring all zero values,since log(0) is undefined
    if 0 in visa_copy[feat].unique():
        pass
    else:
        visa_copy[feat]=np.log(visa_copy[feat])
        sns.violinplot(data=visa_copy[feat])
        plt.ylabel(feat)
        plt.title(feat)
        plt.show()
```

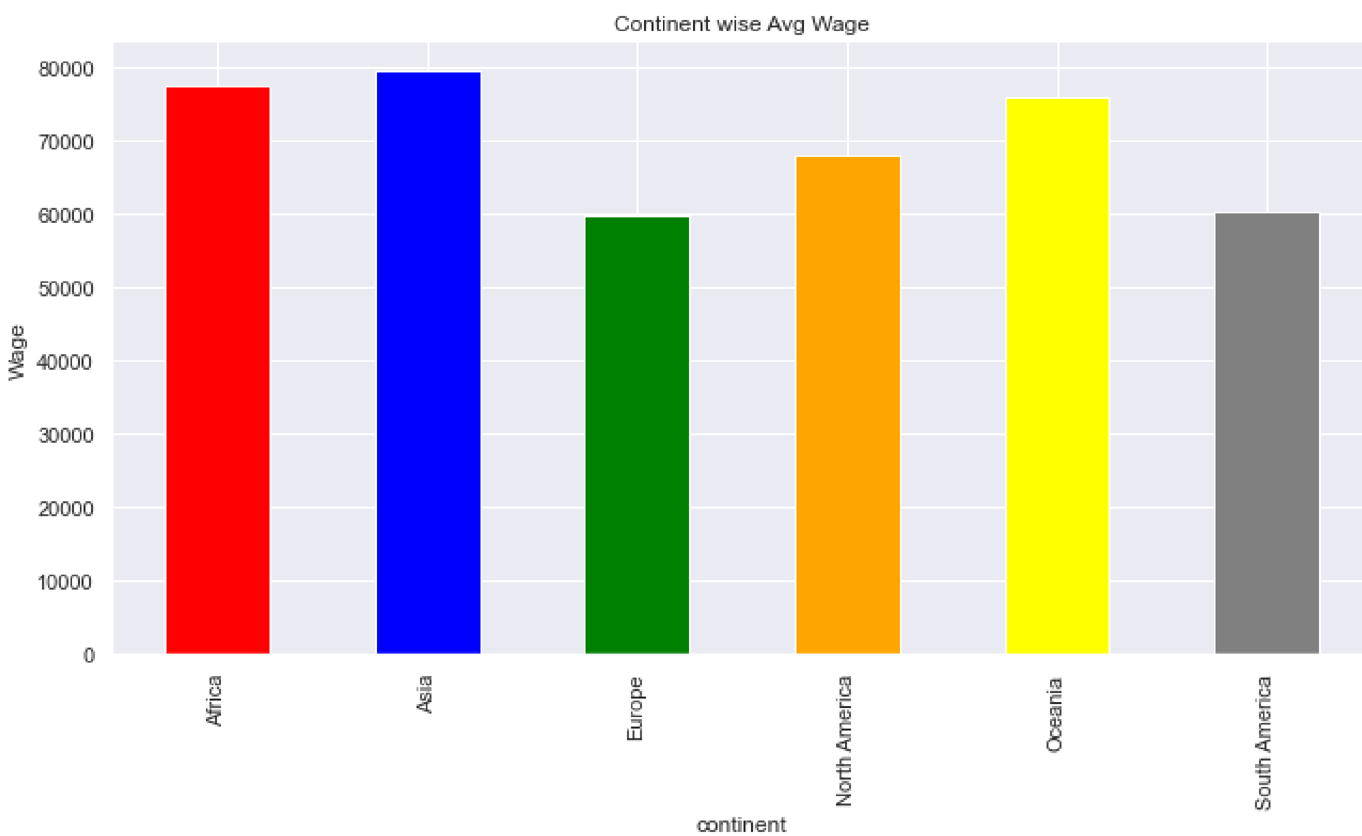
```
C:\Users\subho\anaconda3\lib\site-packages\pandas\core\arraylike.py:397: RuntimeWarning:
invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```





In [59]:

```
#continent wise mean salary
visa_copy=visa.copy()
visa_copy.groupby(by='continent')['prevailing_wage'].mean().plot.bar(figsize=(12,6),colo
plt.xlabel('continent')
plt.ylabel('Wage')
plt.title('Continent wise Avg Wage')
plt.show()
```



Observation

- Asia has highest average wage followed by africa

In [67]:

```
#education wise mean salary in each continents
visa_copy=visa.copy()
for continents in visa_copy['continent'].unique():
```

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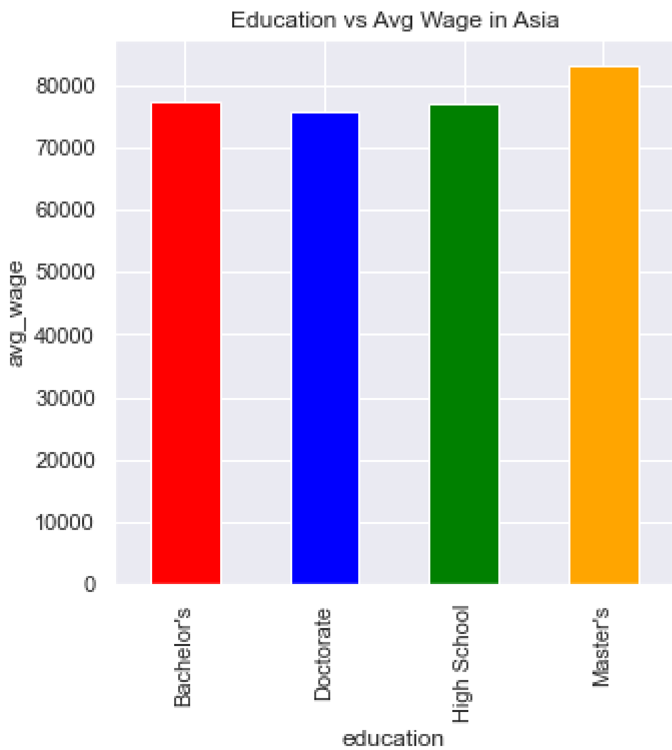
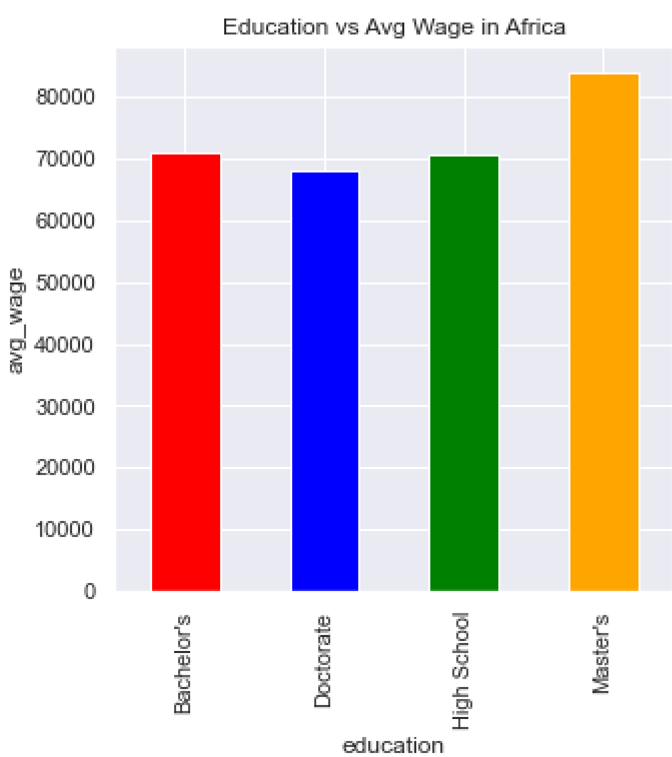
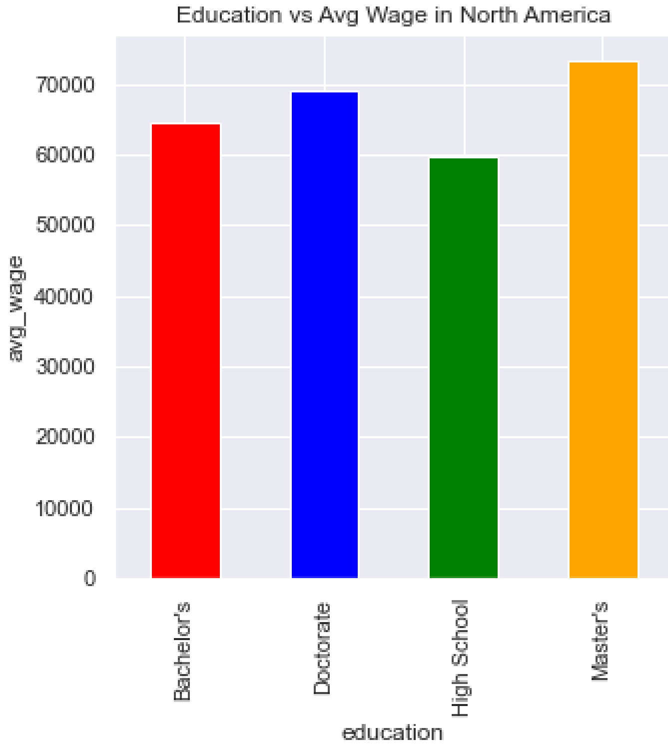
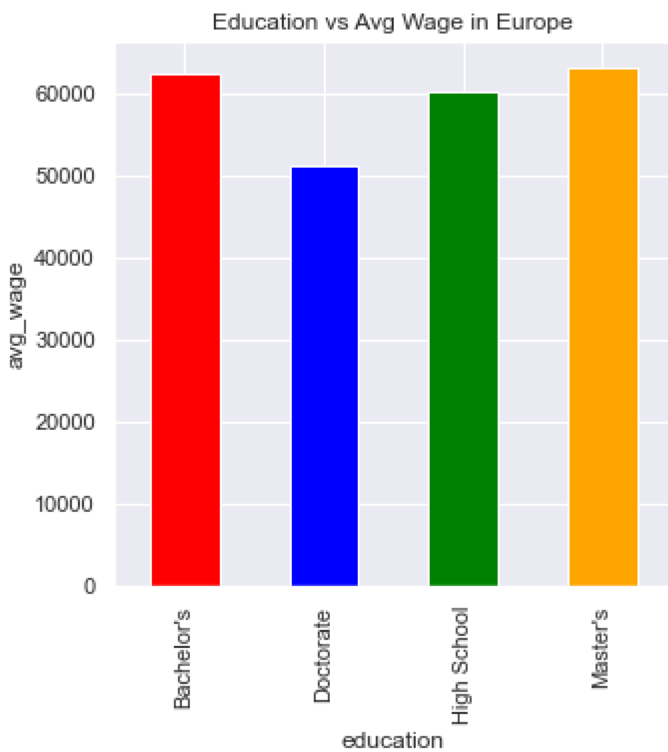
```
    visa_copy[visa_copy['continent']==continents].groupby(by='education_of_employee')['p
    plt.xlabel('education')
    plt.ylabel('avg_wage')
    plt.title('Education vs Avg Wage in {}'.format(continents))
    plt.show()
```









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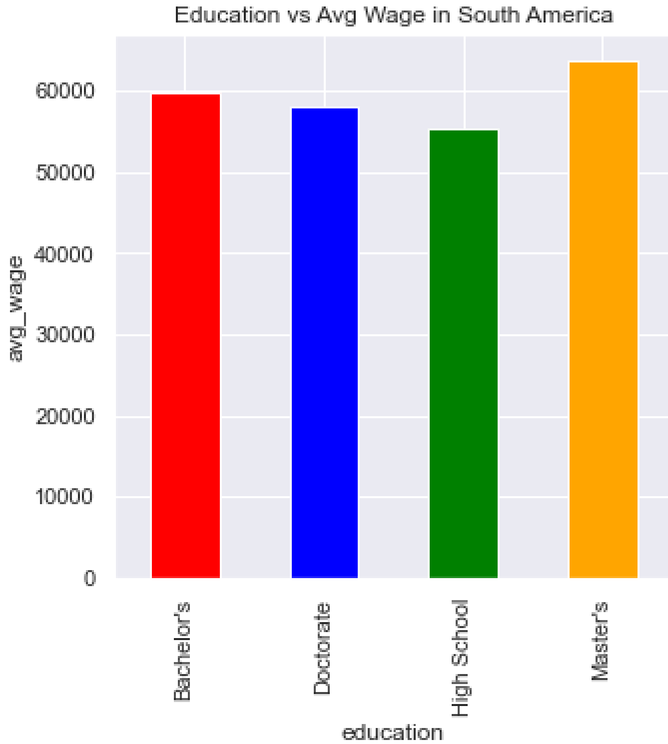

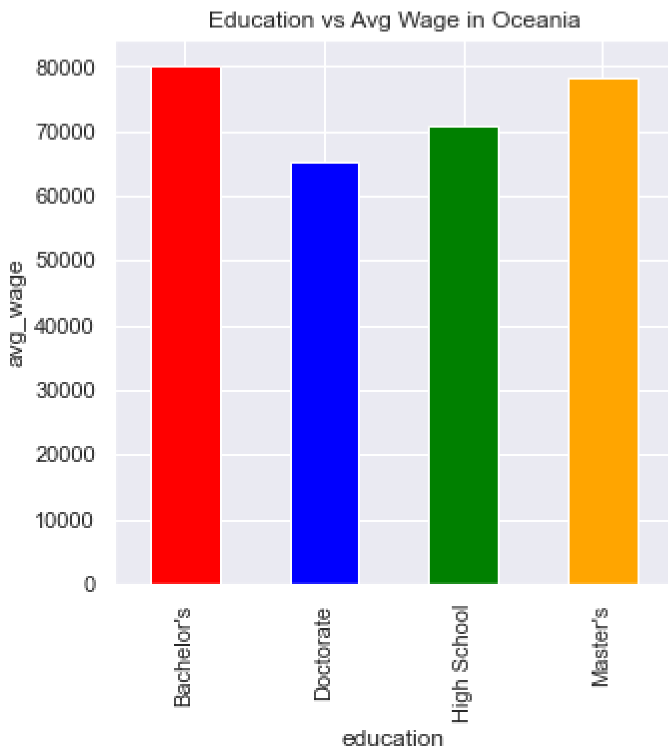

In [79]:

```
#Continent wise educaation of people
visa_copy=visa.copy()
for continents in visa_copy['continent'].unique():
    visa_copy[visa_copy['continent']==continents].groupby(by='education_of_employee').su
    plt.xlabel('education')
    plt.ylabel('no. of people')
    plt.title('Education status in {}'.format(continents))
    plt.show()
```

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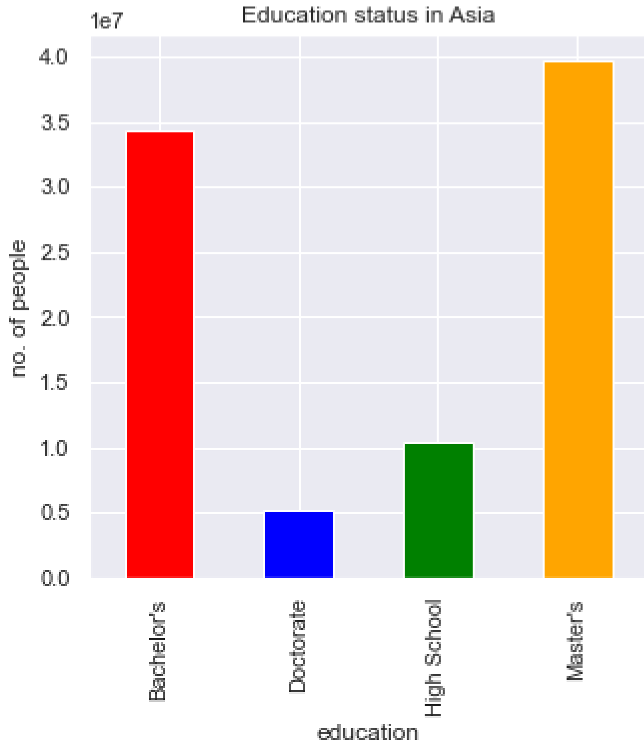
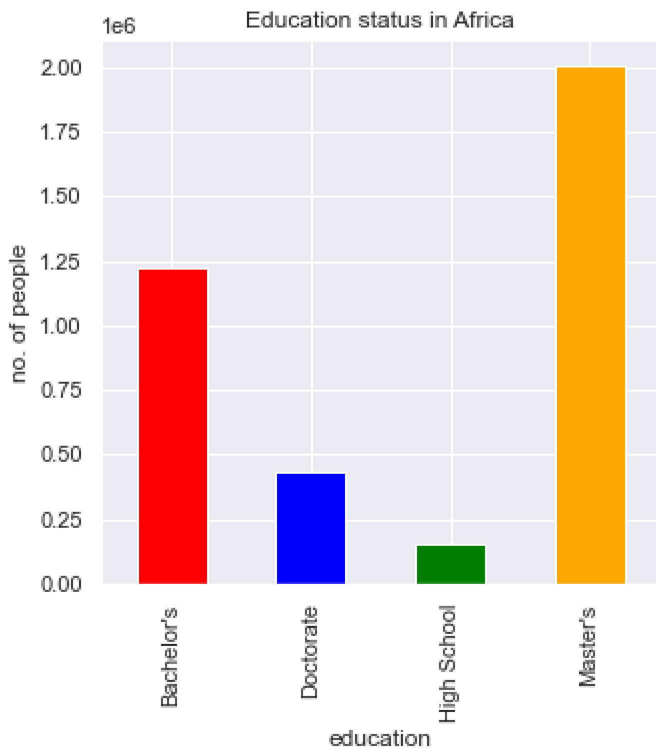
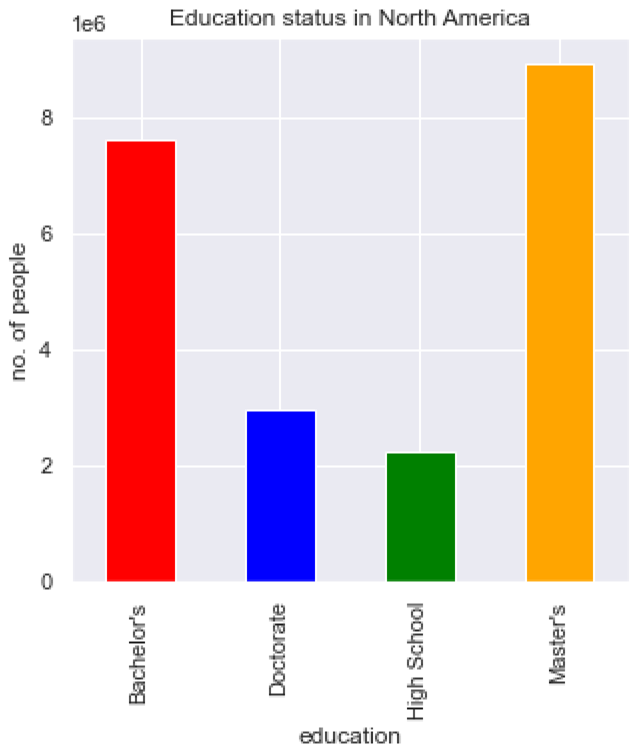
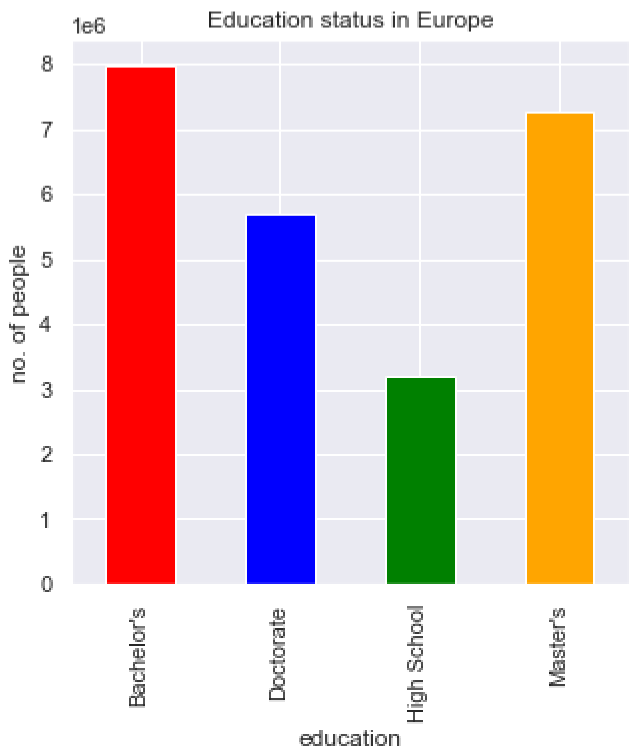

Education status in Asia
1e7
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
no. of people
Bachelor's
Doctorate
High School
Master's
education


Education status in Africa
1e6
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
no. of people
Bachelor's
Doctorate
High School
Master's
education





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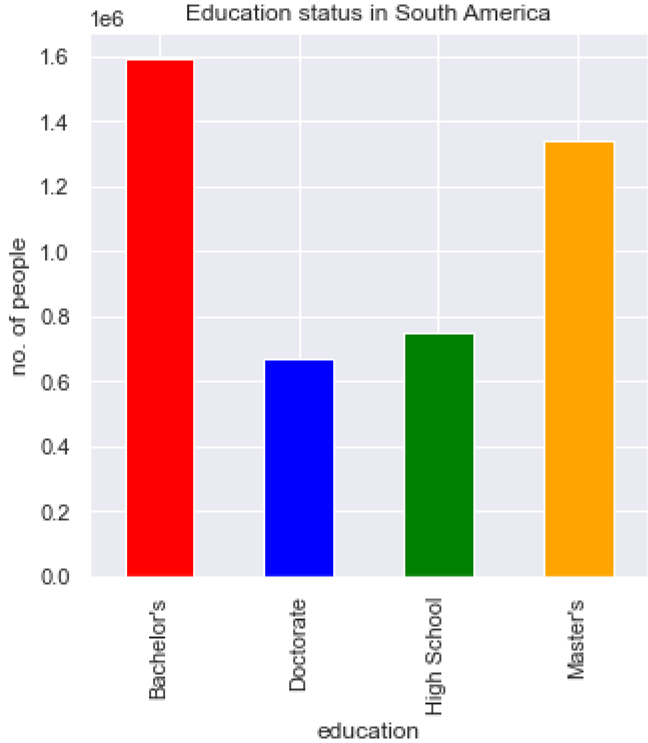

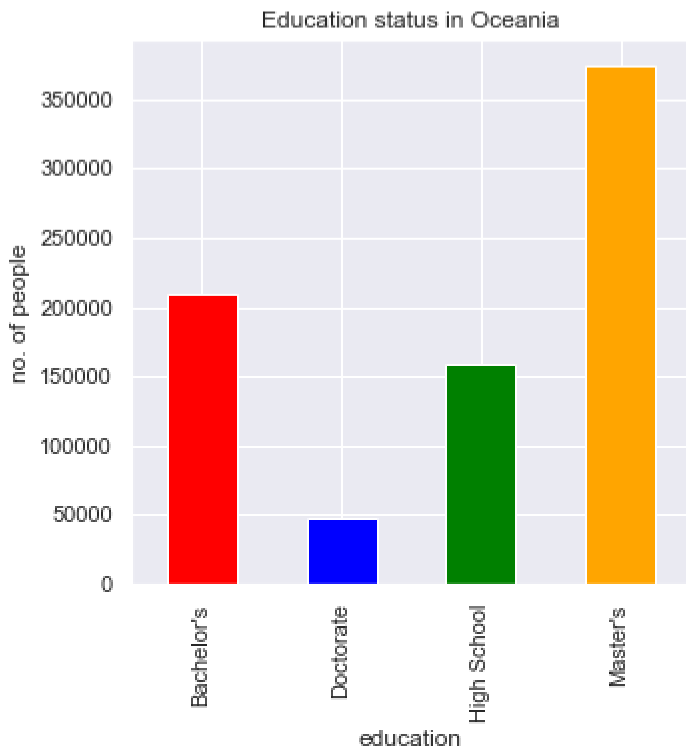

Observation

- It seems Masters' is the most popular education across all continents in terms of salary

In [110…

```
#Continent wise job experience vs Salary
#People having job experience
visa_copy=visa.copy()
for continents in visa_copy['continent'].unique():
    plt.figure(figsize=(10,8))
    visa_copy.loc[np.where((visa_copy['continent']==continents) & (visa_copy['has_job_ex
    visa_copy.loc[np.where((visa_copy['continent']==continents) & (visa_copy['has_job_ex
    plt.legend()
    plt.xlabel('education')
    plt.ylabel('avg_wage')
```

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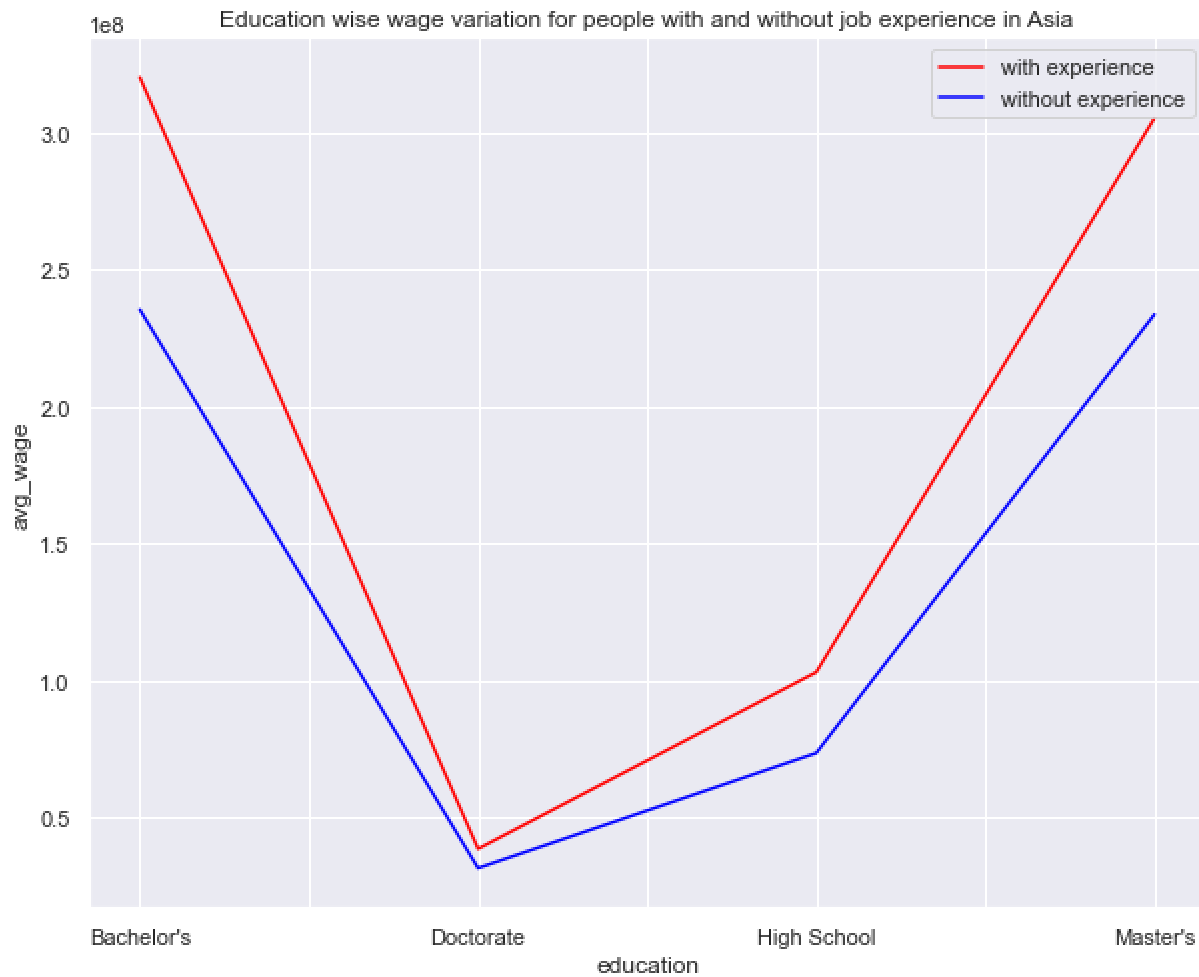
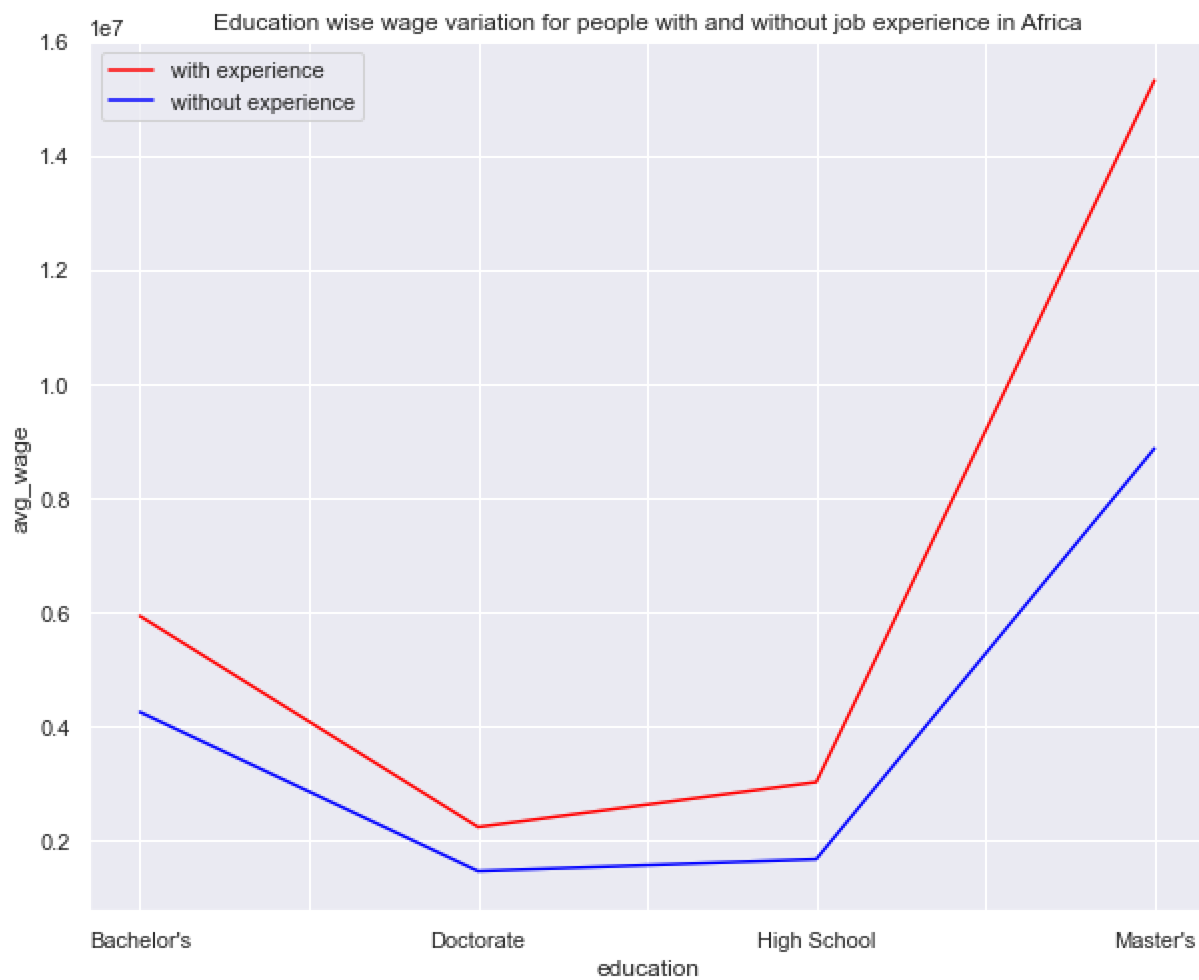
```
plt.title('Education wise wage variation for people with and without job experience
plt.show()
```





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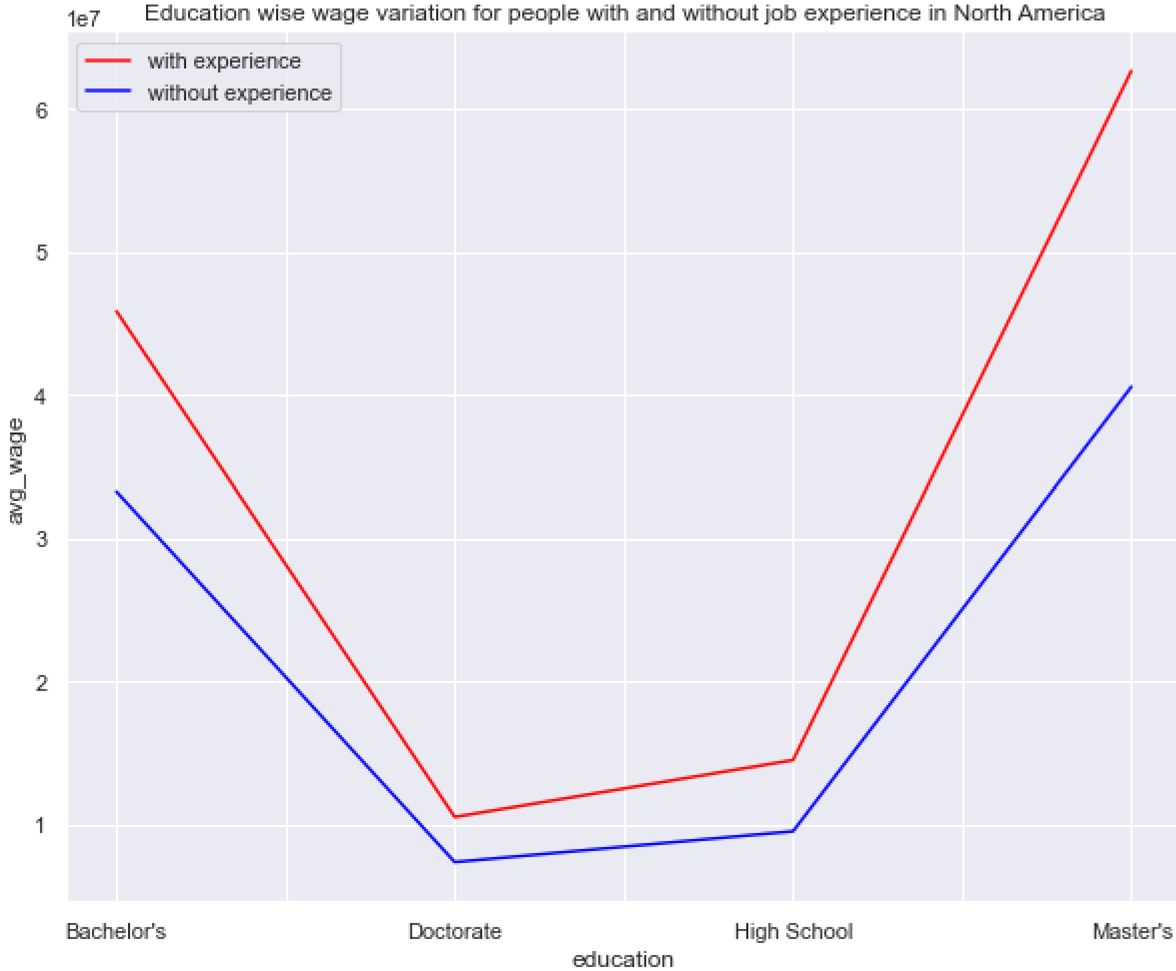

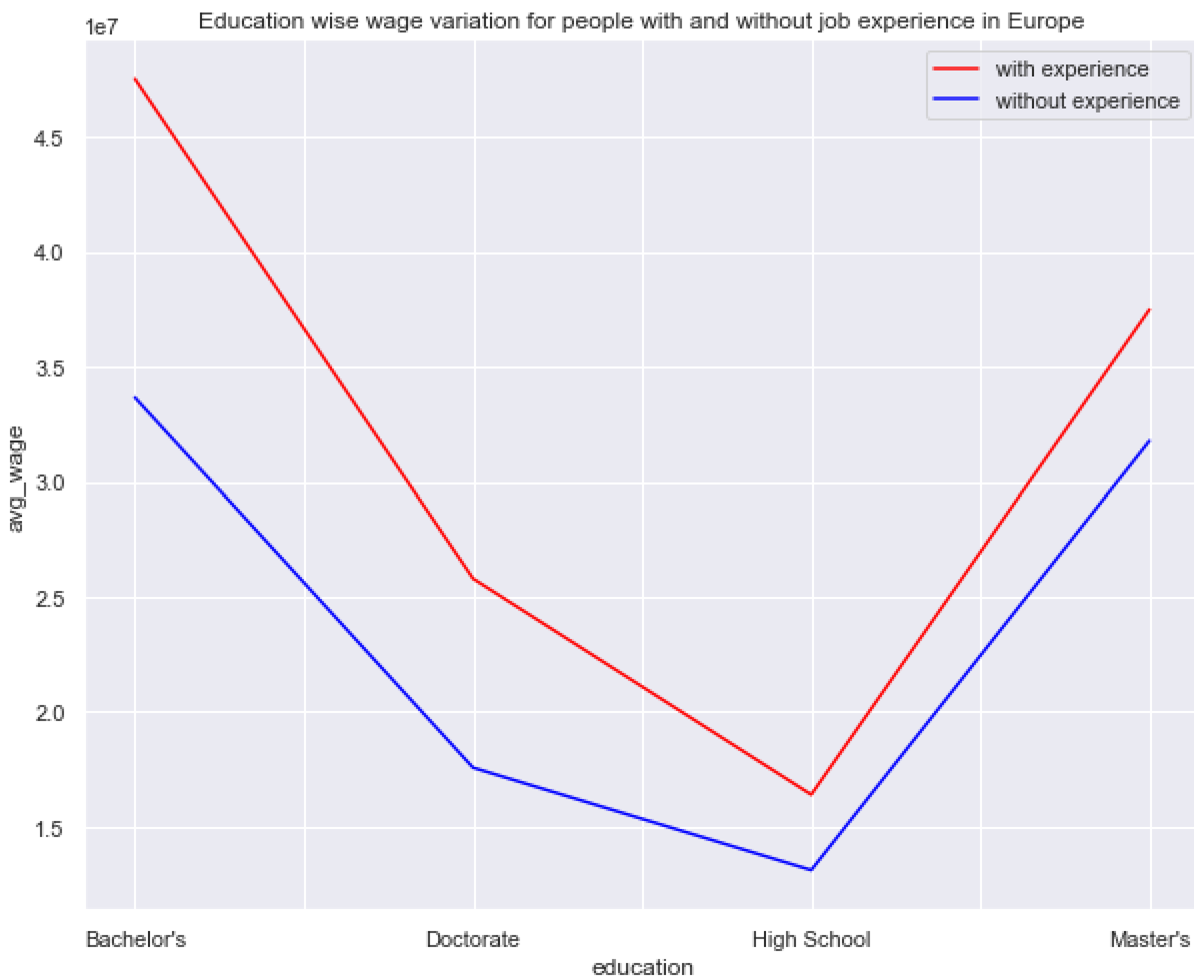

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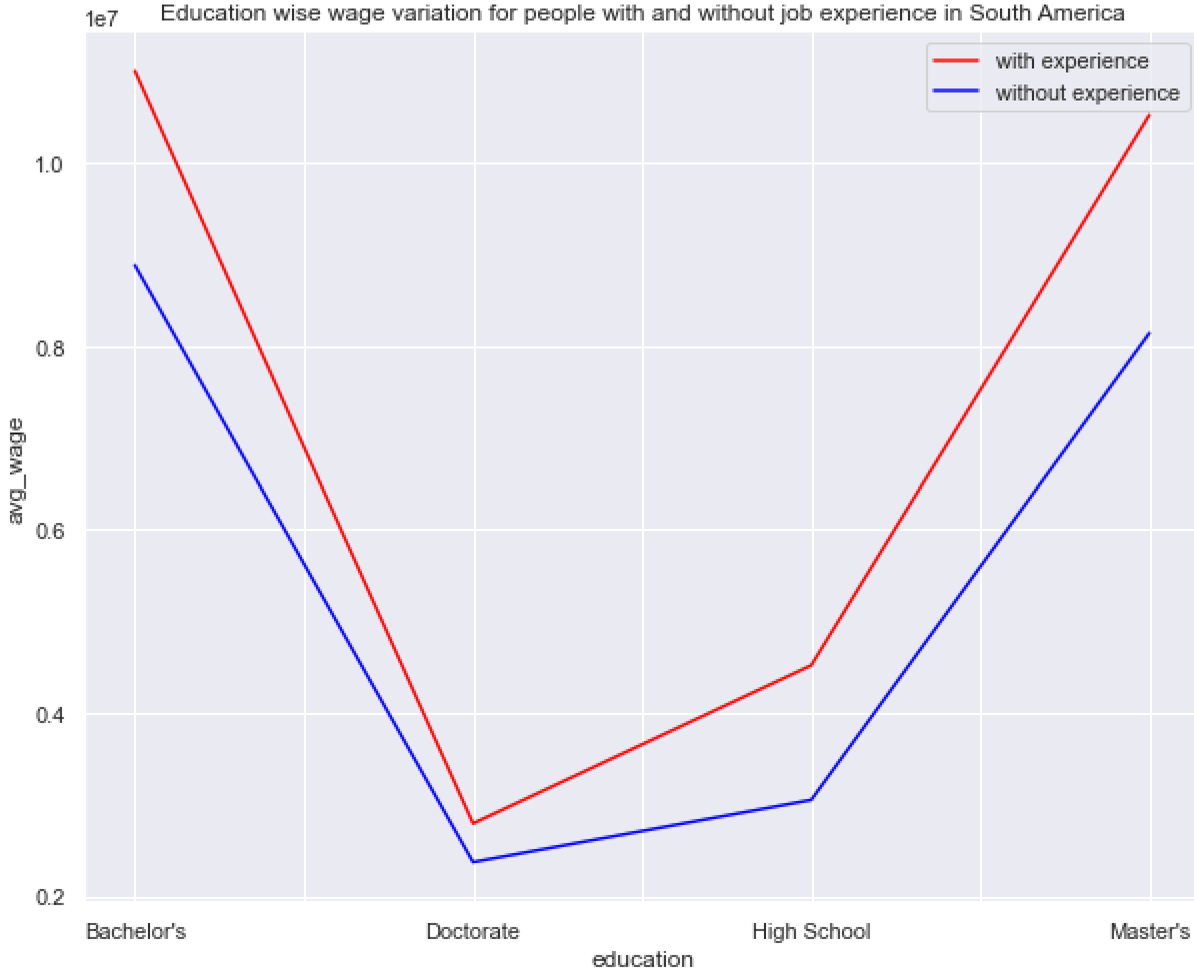
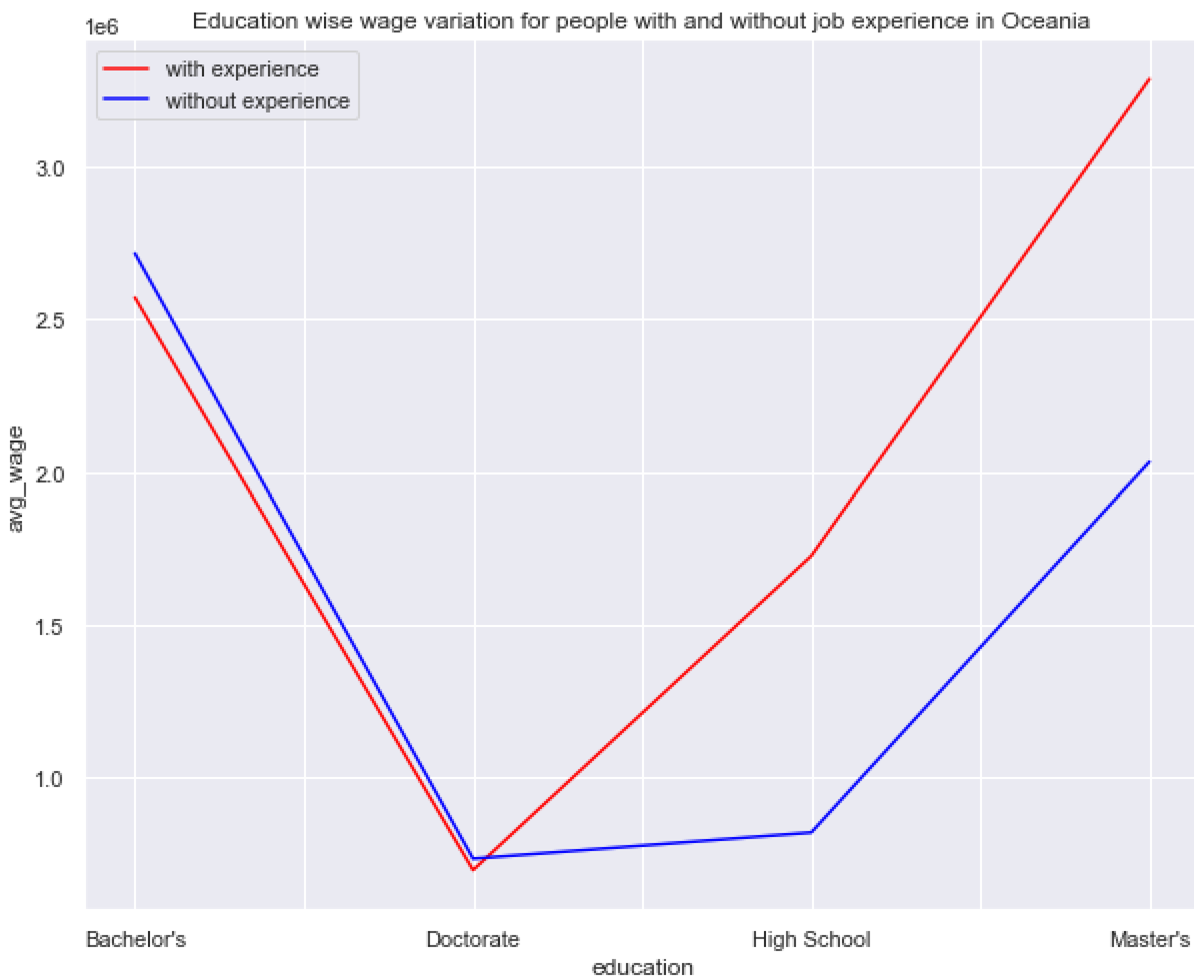


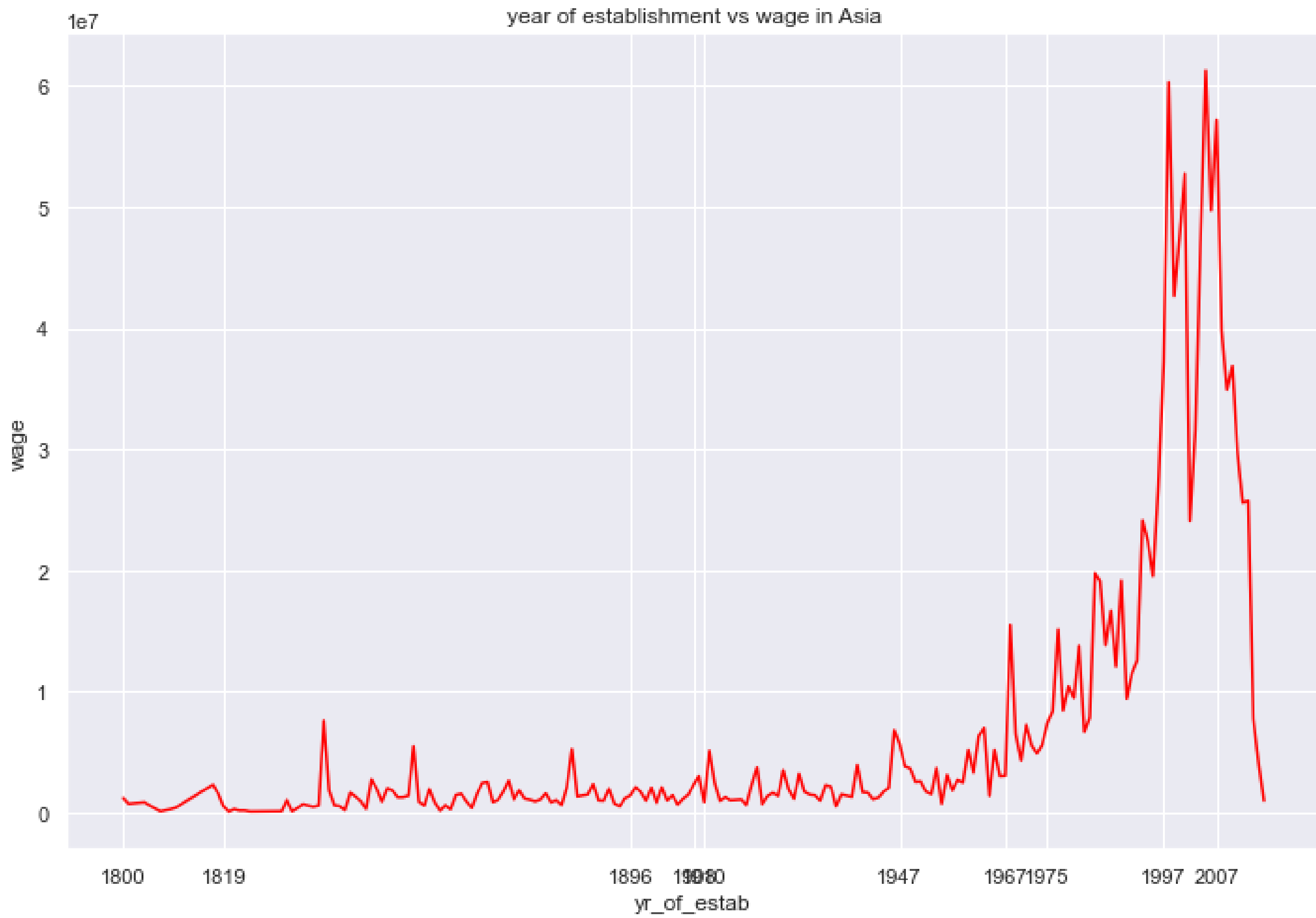


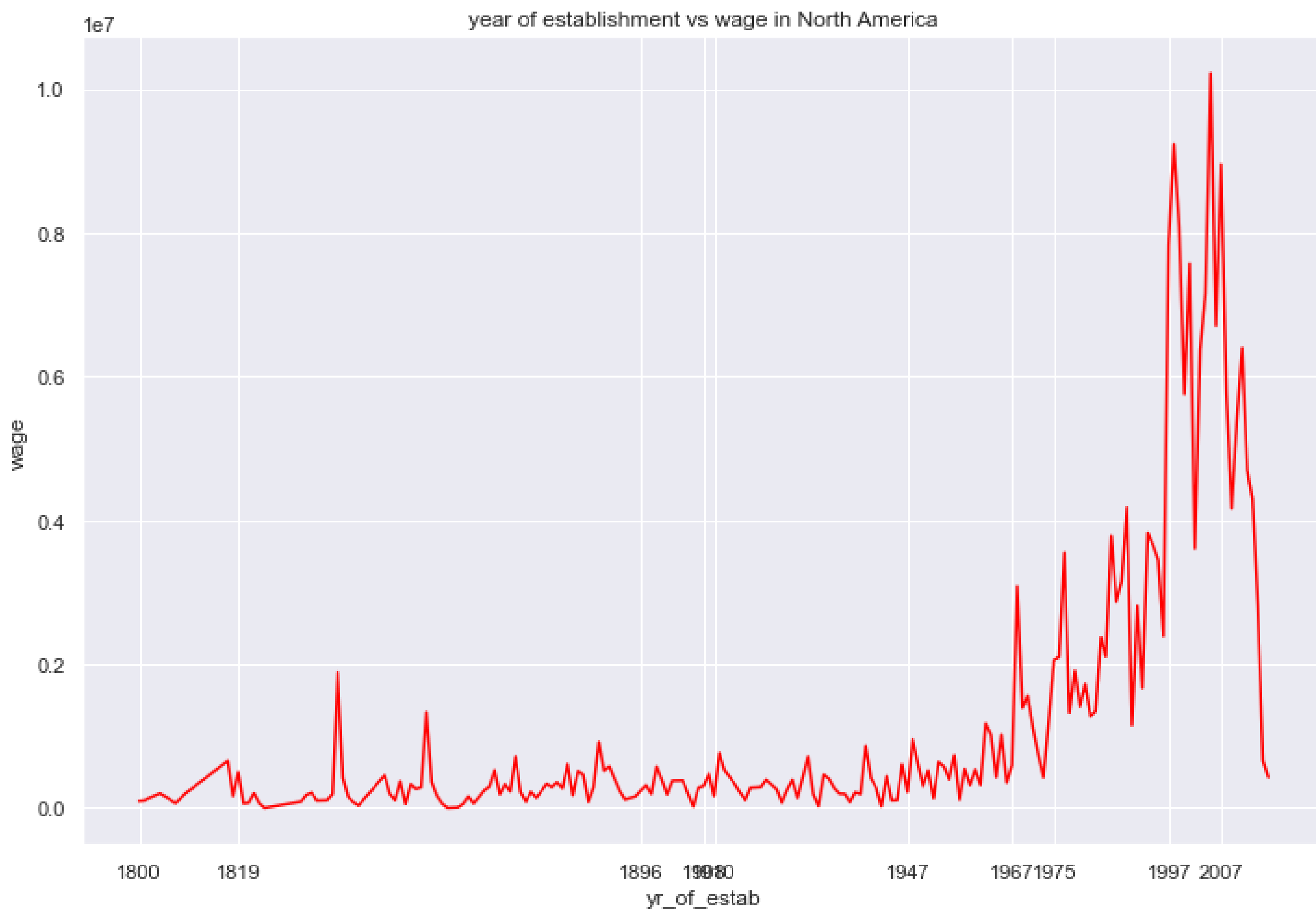
Observation

- from the above graphical analysis it is evident that people having job experience get more wage than those who don't.

In [122…

```
#year of establishment vs wage continent wise
visa_copy=visa.copy()
for continents in visa_copy['continent'].unique():
    visa_copy[visa_copy['continent']==continents].groupby(by='yr_of_estab').sum()['preva
    plt.xticks(visa_copy['yr_of_estab'].unique()[::20])
    plt.xlabel('yr_of_estab')
    plt.ylabel('wage')
    plt.title('year of establishment vs wage in {}'.format(continents))
    plt.show()
```





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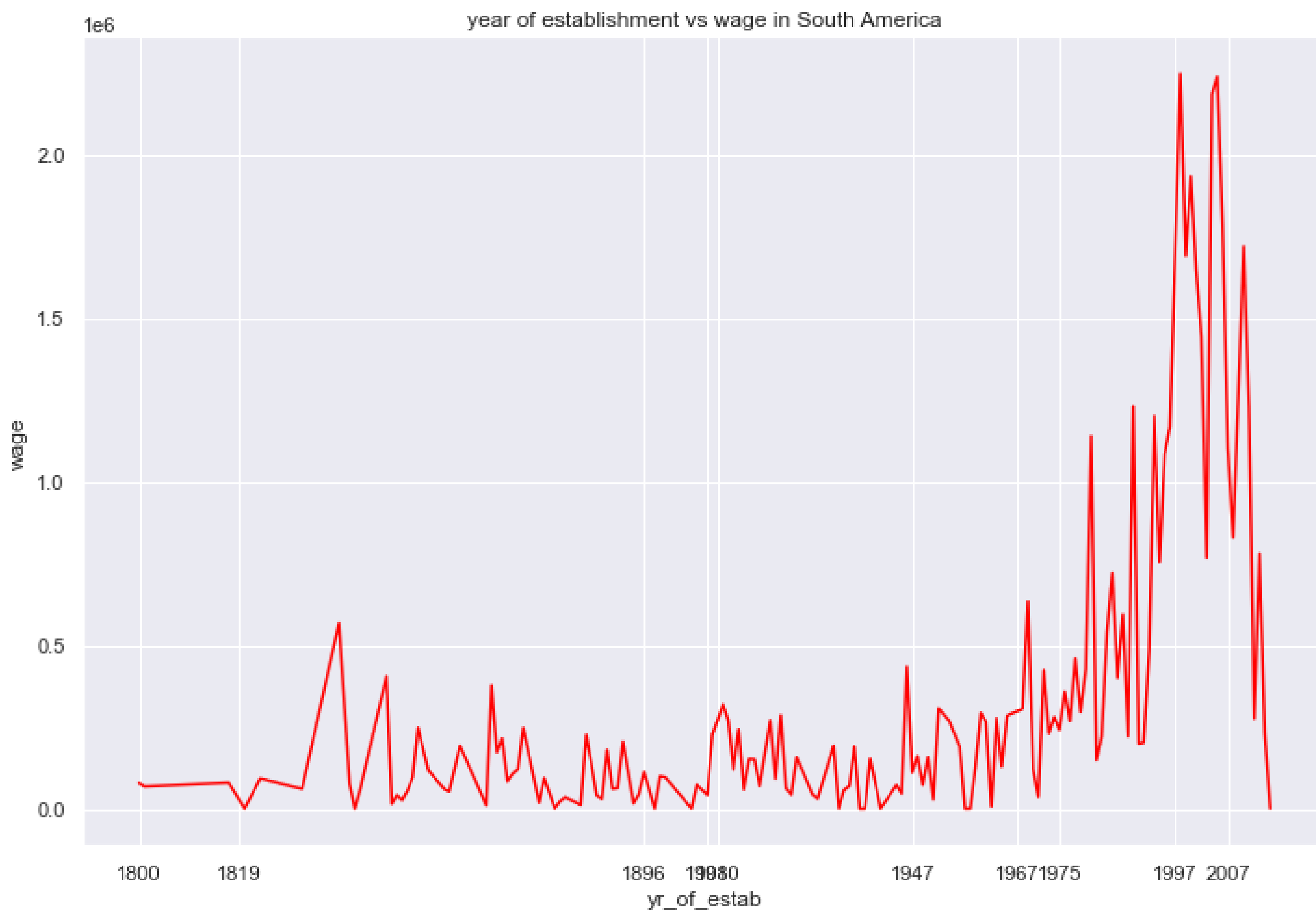
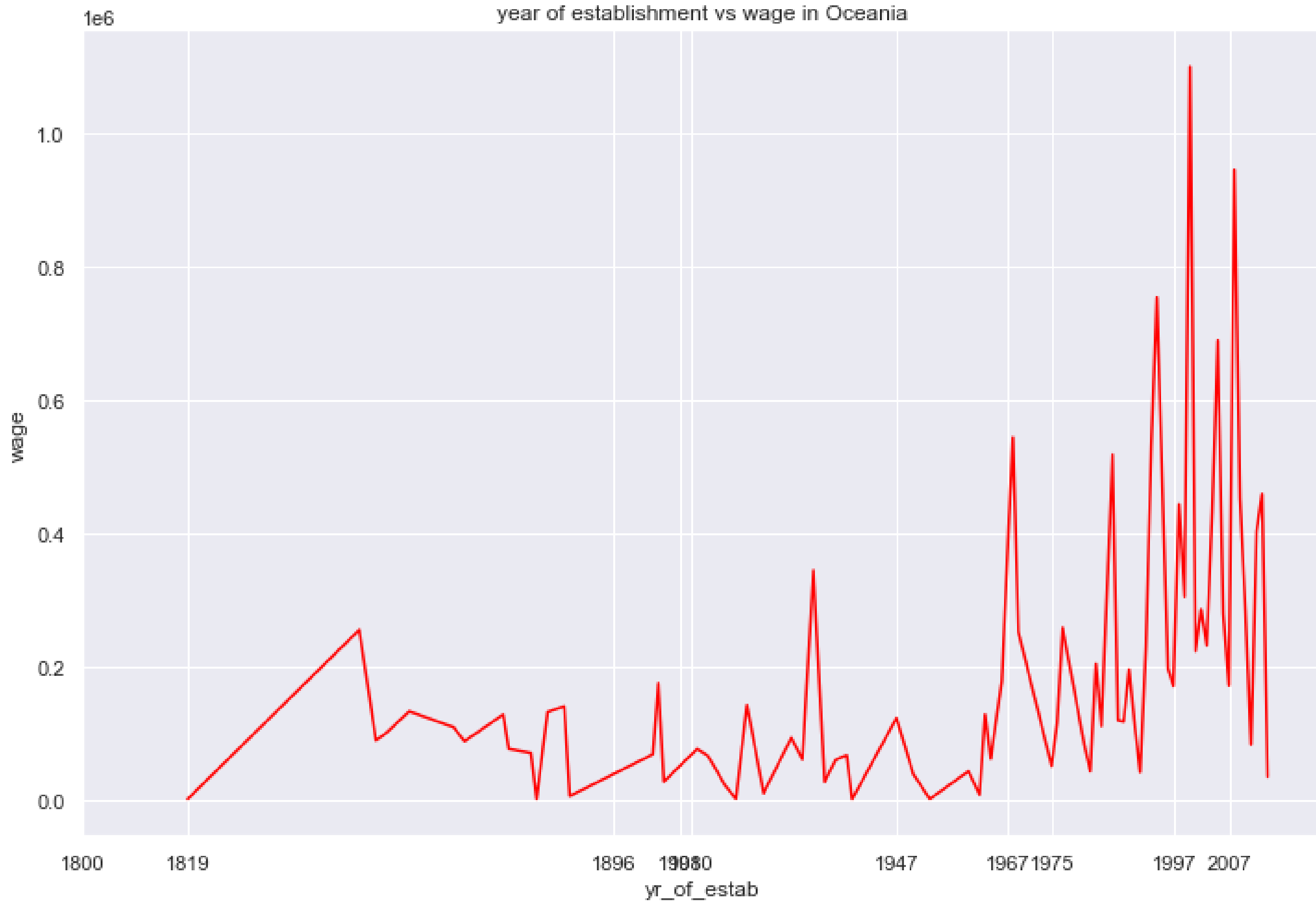
year of establishment vs wage in Europe
1e7
1.0
0.8
0.6
0.4
0.2
0.0
wage
1800
1819
1896
1947
1967
1975
1997
2007
yr_of_estab



year of establishment vs wage in South America
1e6
2.0
1.5
1.0
0.5
0.0
wage
1800
1819
1896
1947
1967
1975
1997
2007
yr_of_estab



Observation

- From the above graphical analysis it is evident that wage was highest during around 2007 and then there is a decline

In [125…

```
#region wise salary variation in each continents
visa_copy=visa.copy()
for continents in visa_copy['continent'].unique():
    visa_copy[visa_copy['continent']==continents].groupby(by='region_of_employment').sum
    plt.xlabel('region')
    plt.ylabel('wage')
    plt.title('region vs wage in {}'.format(continents))
    plt.show()
```

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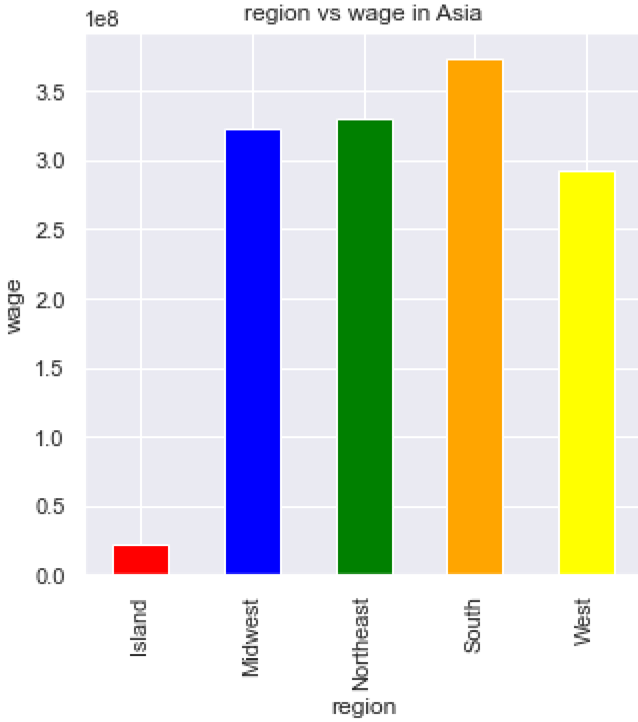

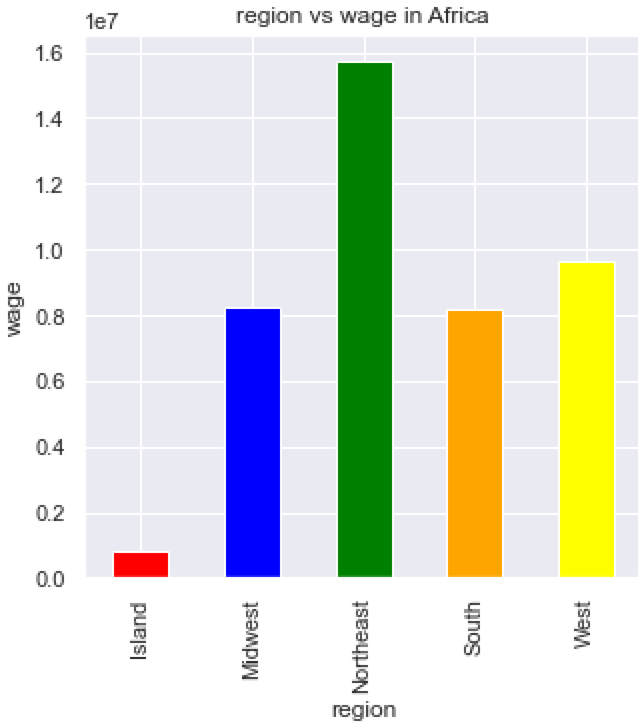

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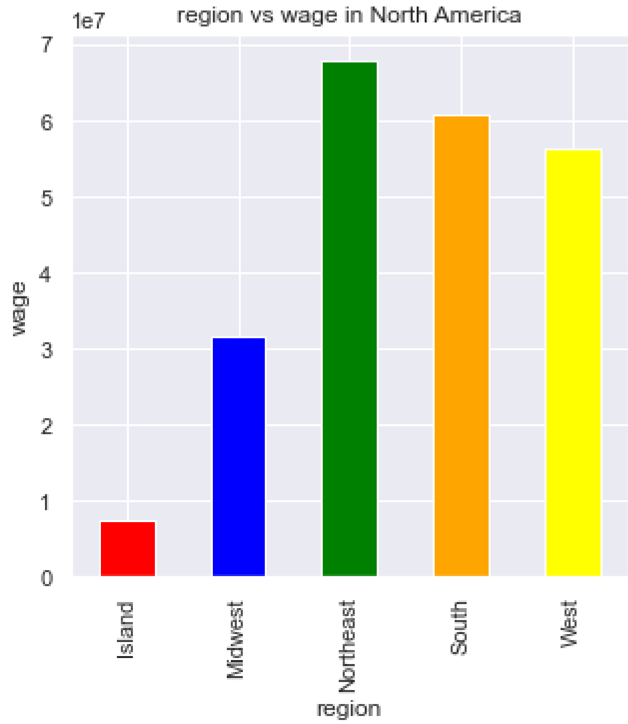
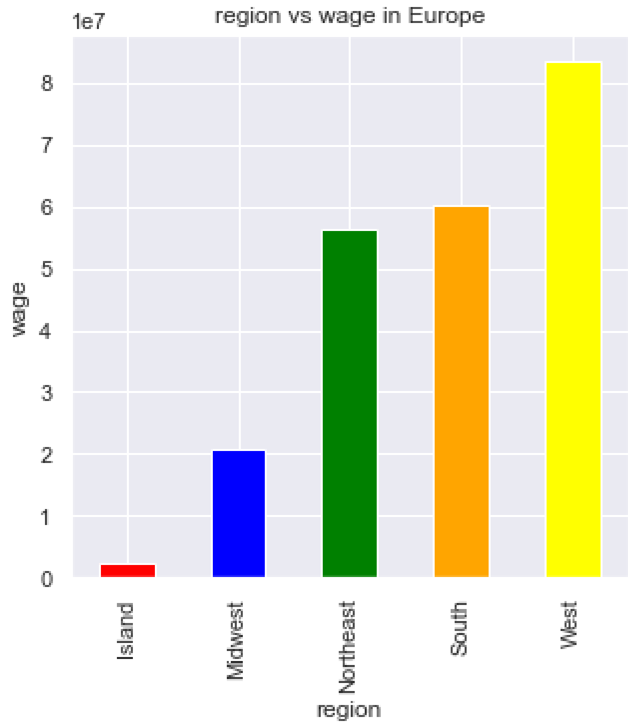
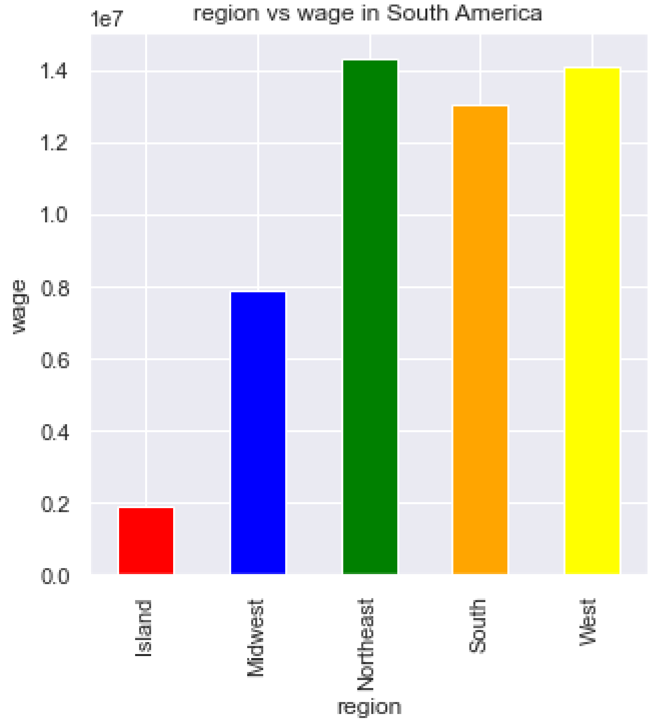
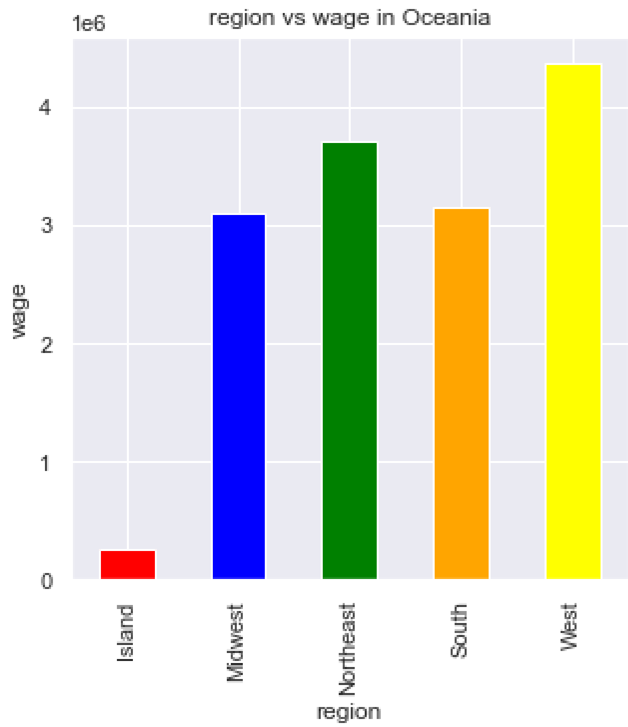

region vs wage in North America
1e7
wage
region
0
1
2
3
4
5
6
7
Island
Midwest
Northeast
South
West

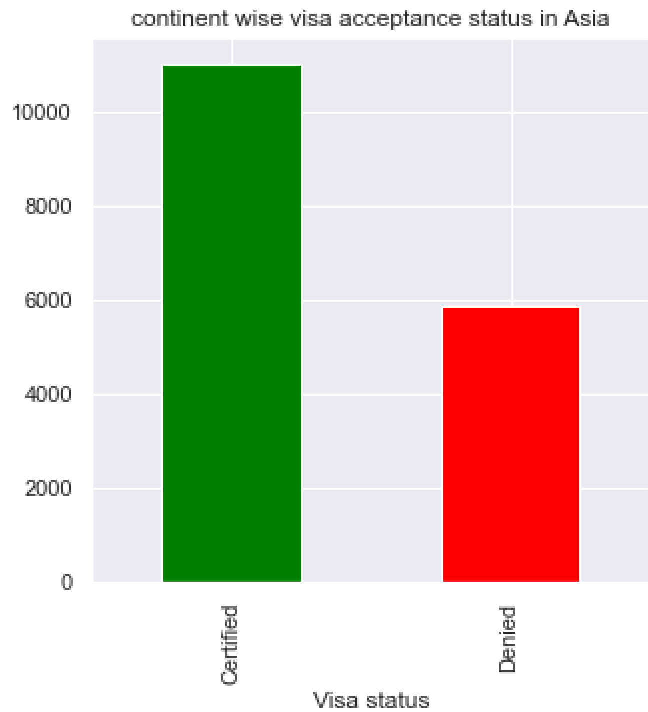

region vs wage in Europe
1e7
wage
region
0
1
2
3
4
5
6
7
8
Island
Midwest
Northeast
South
West

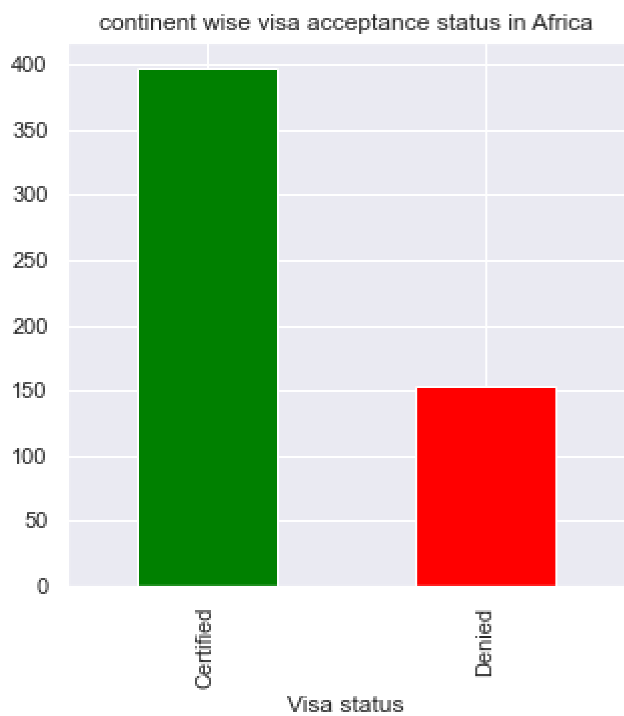


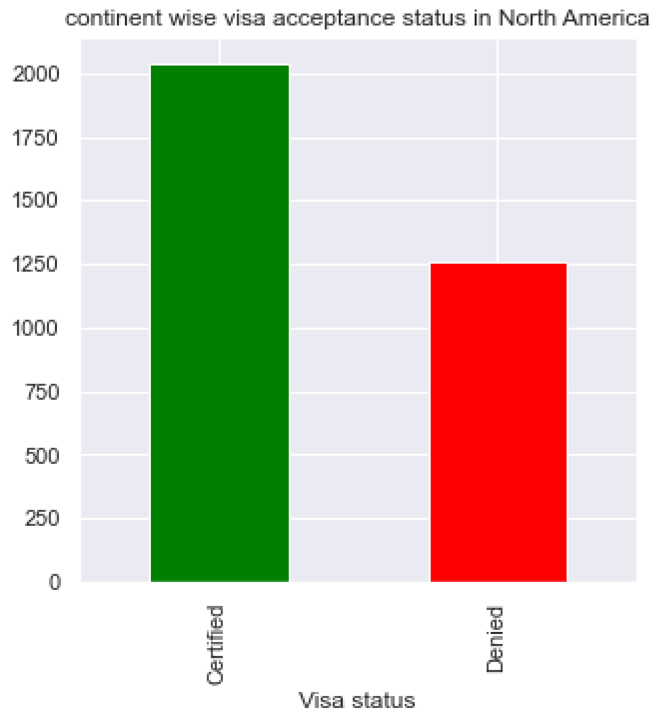


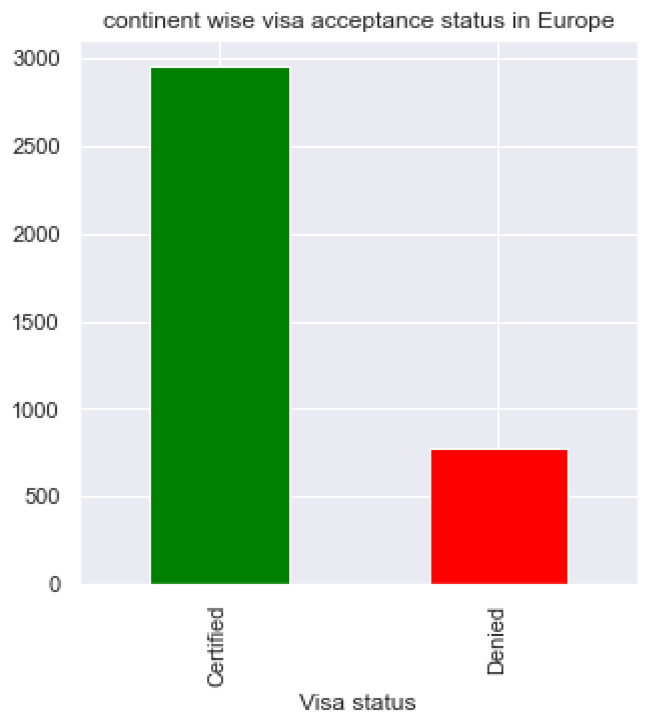
In [131…

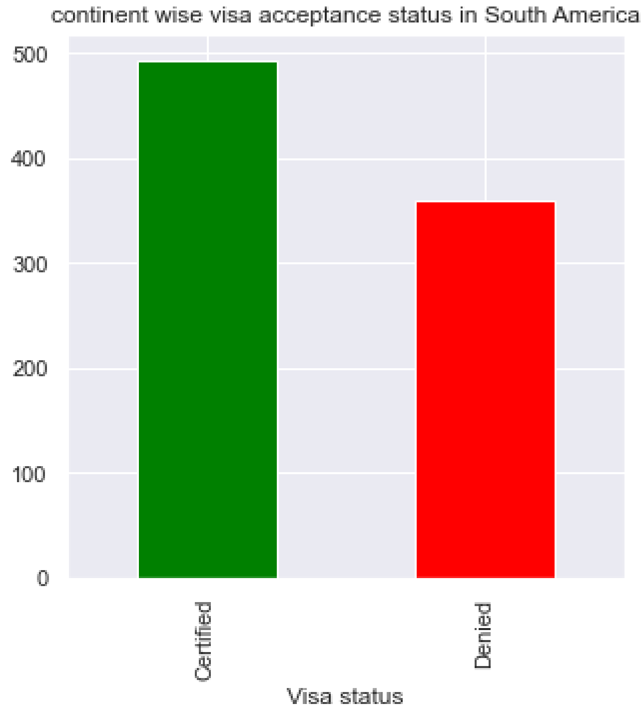
```
#continent wise visa acceptance status
visa_copy=visa.copy()
for continents in visa_copy['continent'].unique():
    visa_copy[visa_copy['continent']==continents].value_counts('case_status').plot.bar(c
    plt.xlabel('Visa status')
    plt.title('continent wise visa acceptance status in {}'.format(continents))
    plt.show()
```

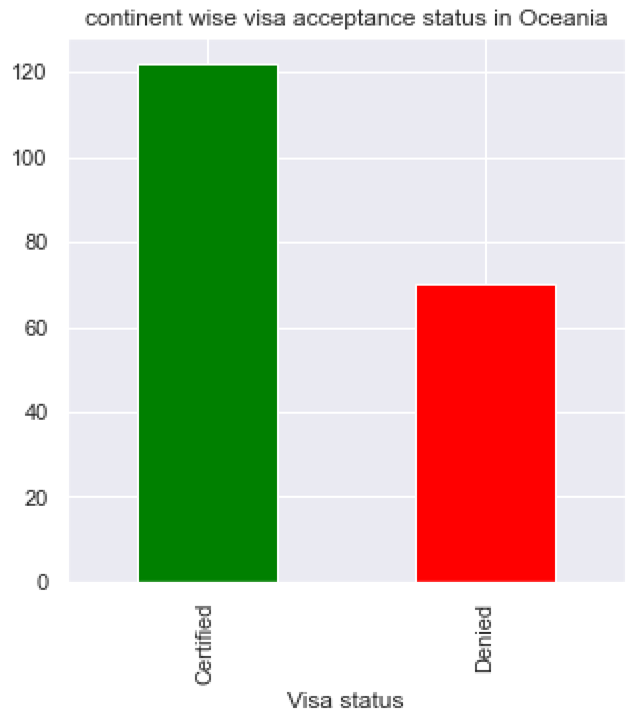

continent wise visa acceptance status in Asia
10000
8000
6000
4000
2000
0
Certified
Denied
Visa status


continent wise visa acceptance status in Africa
400
350
300
250
200
150
100
50
0
Certified
Denied
Visa status


continent wise visa acceptance status in North America
2000
1750
1500
1250
1000
750
500
250
0
Certified
Denied
Visa status


continent wise visa acceptance status in Europe
3000
2500
2000
1500
1000
500
0
Certified
Denied
Visa status





Observation

- Europe has highest acceptance rate
- South America has lowest acceptance rate

In [173…

```
#encoding the 'case_status' and 'has_job_experience' features for better analysis
visa_copy['case_status_new']=visa_copy['case_status'].apply(lambda x: 0 if x=='Denied' e
visa_copy['has_job_experience_new']=visa_copy['has_job_experience'].apply(lambda x: 0 if
```

In [195…

```
visa_copy.head()
```

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Out[195]:

	case_id	continent	education_of_employee	has_job_experience	requires_job_training	no_of_employees	yr_
0	EZYV01	Asia	High School	N	N	14513	
1	EZYV02	Asia	Master's	Y	N	2412	
2	EZYV03	Asia	Bachelor's	N	Y	44444	
3	EZYV04	Asia	Bachelor's	N	N	98	
4	EZYV05	Africa	Master's	Y	N	1082	

In [207…

```
#grouping the data by continents, education and job experience to analyse visa acceptanc
visa_acceptance=visa_copy.groupby(by=['continent','education_of_employee']).sum()
visa_acceptance.head()
```

Out[207]:

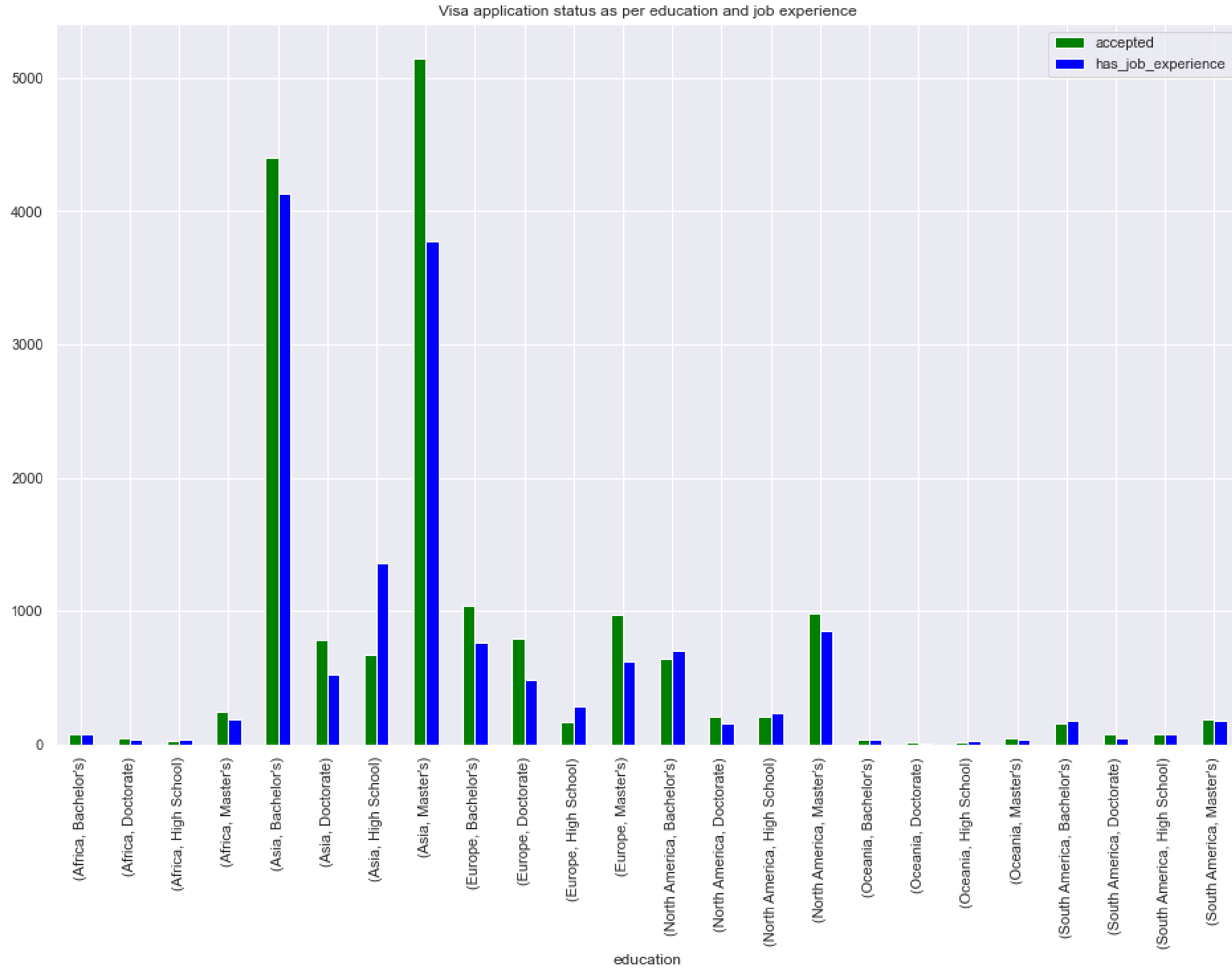
		no_of_employees	yr_of_estab	prevailing_wage	case_status_new	has_job_e
continent	education_of_employee					
Africa	Bachelor's	1219325	282763	1.015771e+07	81	
	Doctorate	436448	106362	3.668420e+06	43	
	High School	151351	130356	4.664011e+06	23	
	Master's	2004767	570045	2.417154e+07	250	
Asia	Bachelor's	34272894	14198534	5.556157e+08	4407	

In [211…

```
visa_acceptance.rename(columns={'case_status_new':'accepted','has_job_experience_new':'h
```

In [214…

```
#plotting the visa application status as per education and job experience across contine
visa_acceptance.iloc[:,3:].plot.bar(color=['green', 'blue'],figsize=(16,10))
plt.xlabel('education')
plt.title('Visa application status as per education and job experience')
plt.show()
```

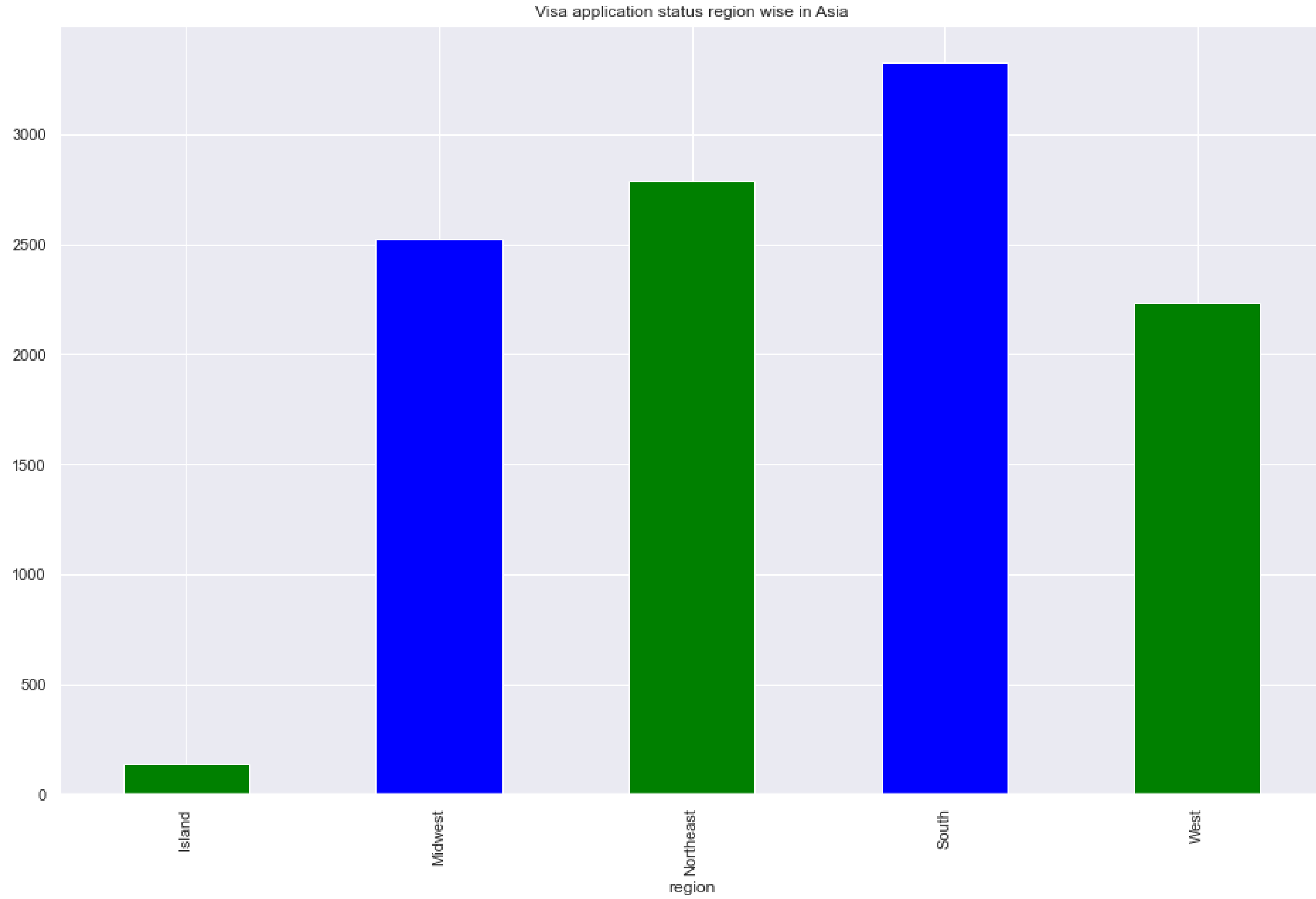


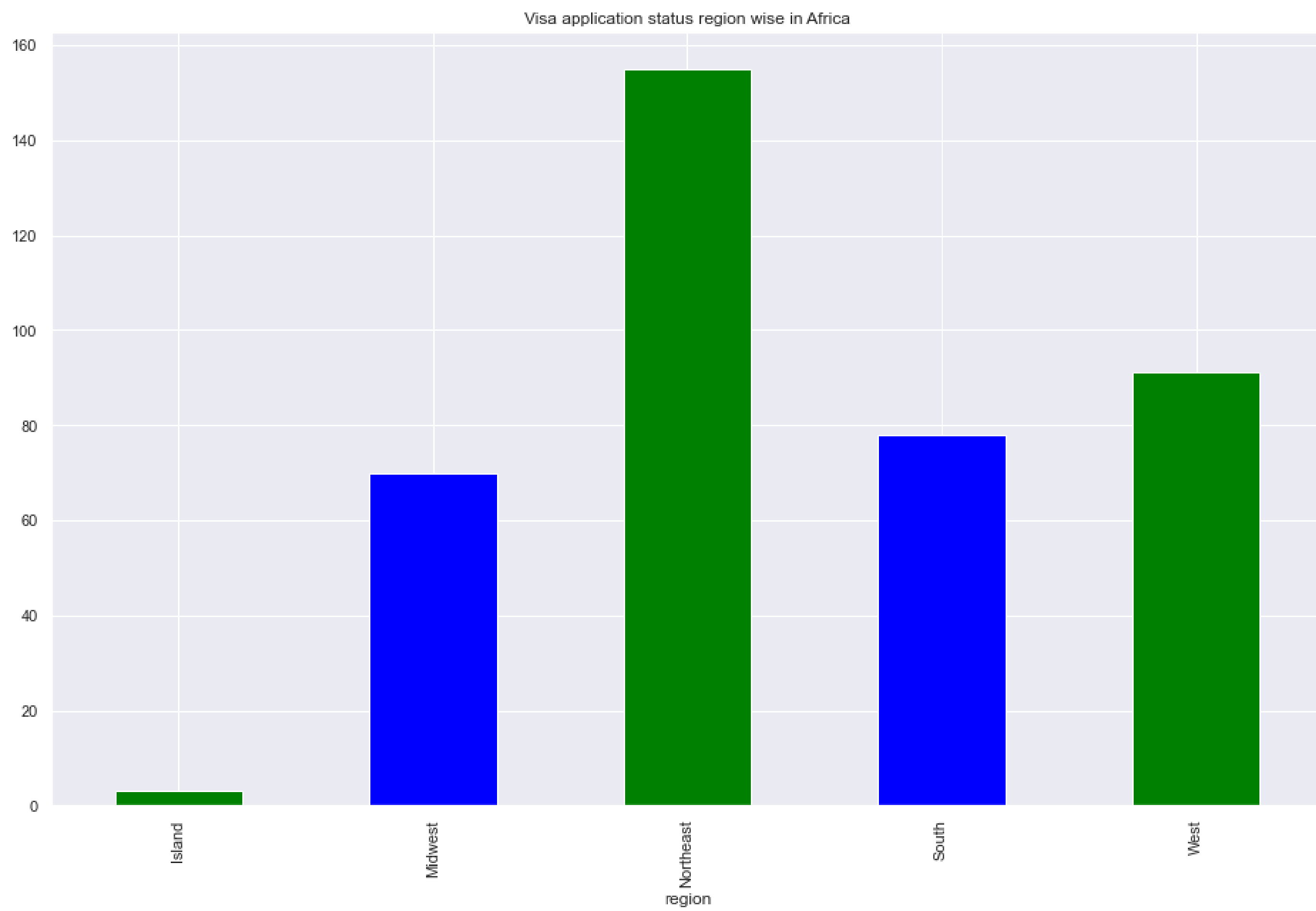
Observation

- It is quite evident from the above graphical analysis that people having job experience have upperhand in visa acceptance across all continents

In [233…

```
#region wise visa application status
visa_copy=visa.copy()
for continents in visa_copy['continent'].unique():
    visa_copy[visa_copy['continent']==continents].groupby(by='region_of_employment').sum
    plt.xlabel('region')
    plt.title('Visa application status region wise in {}'.format(continents))
    plt.show()
```





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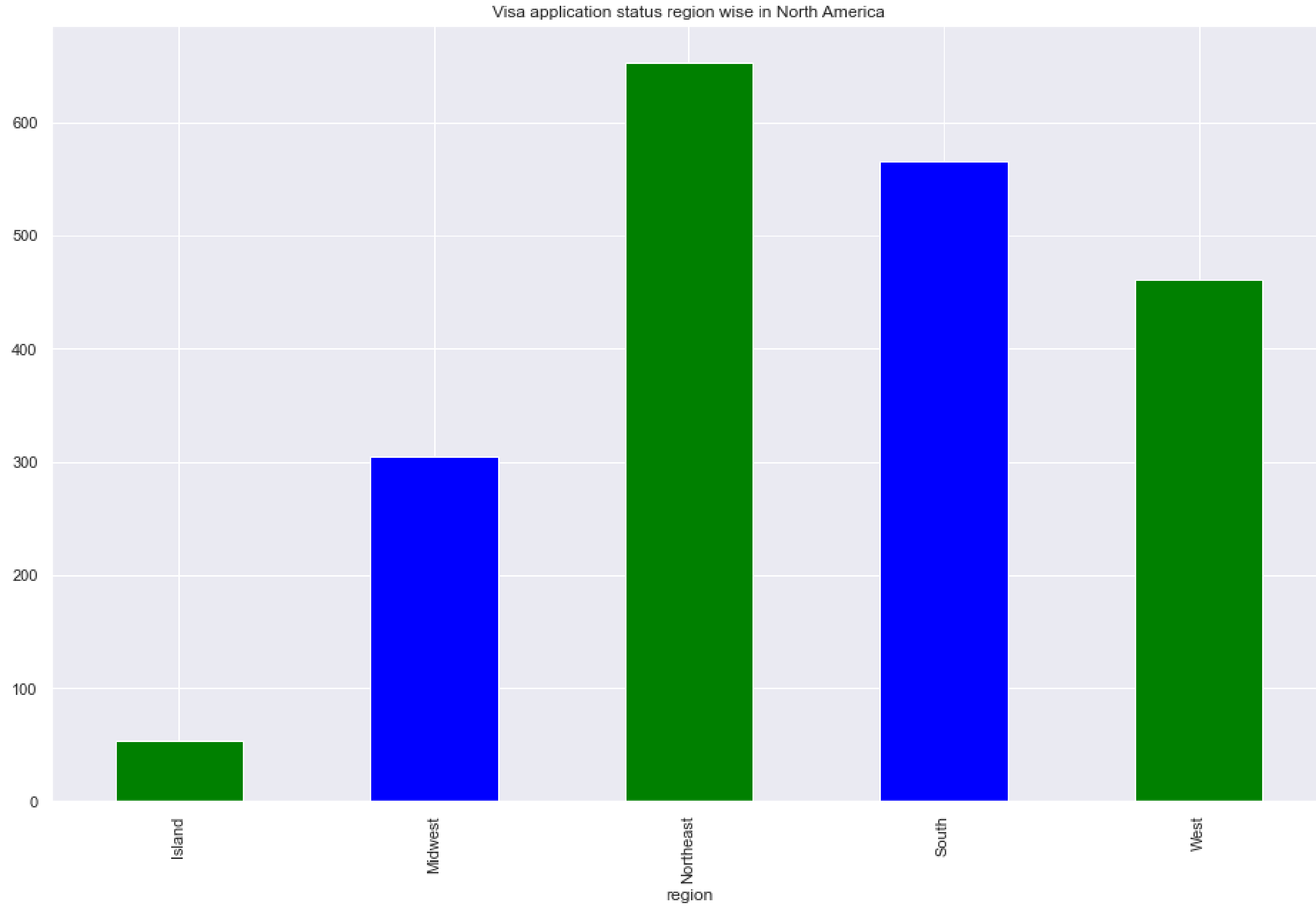

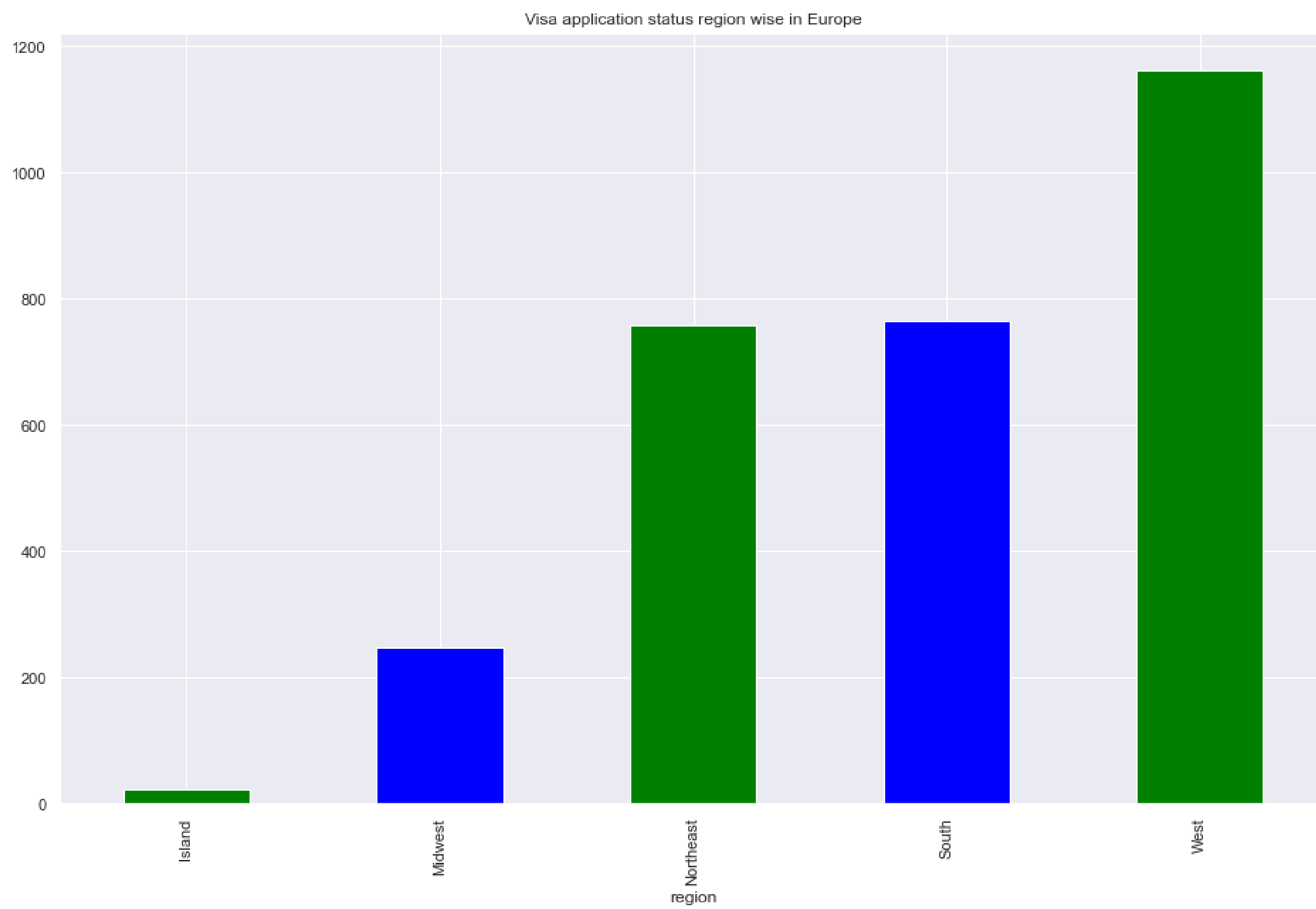

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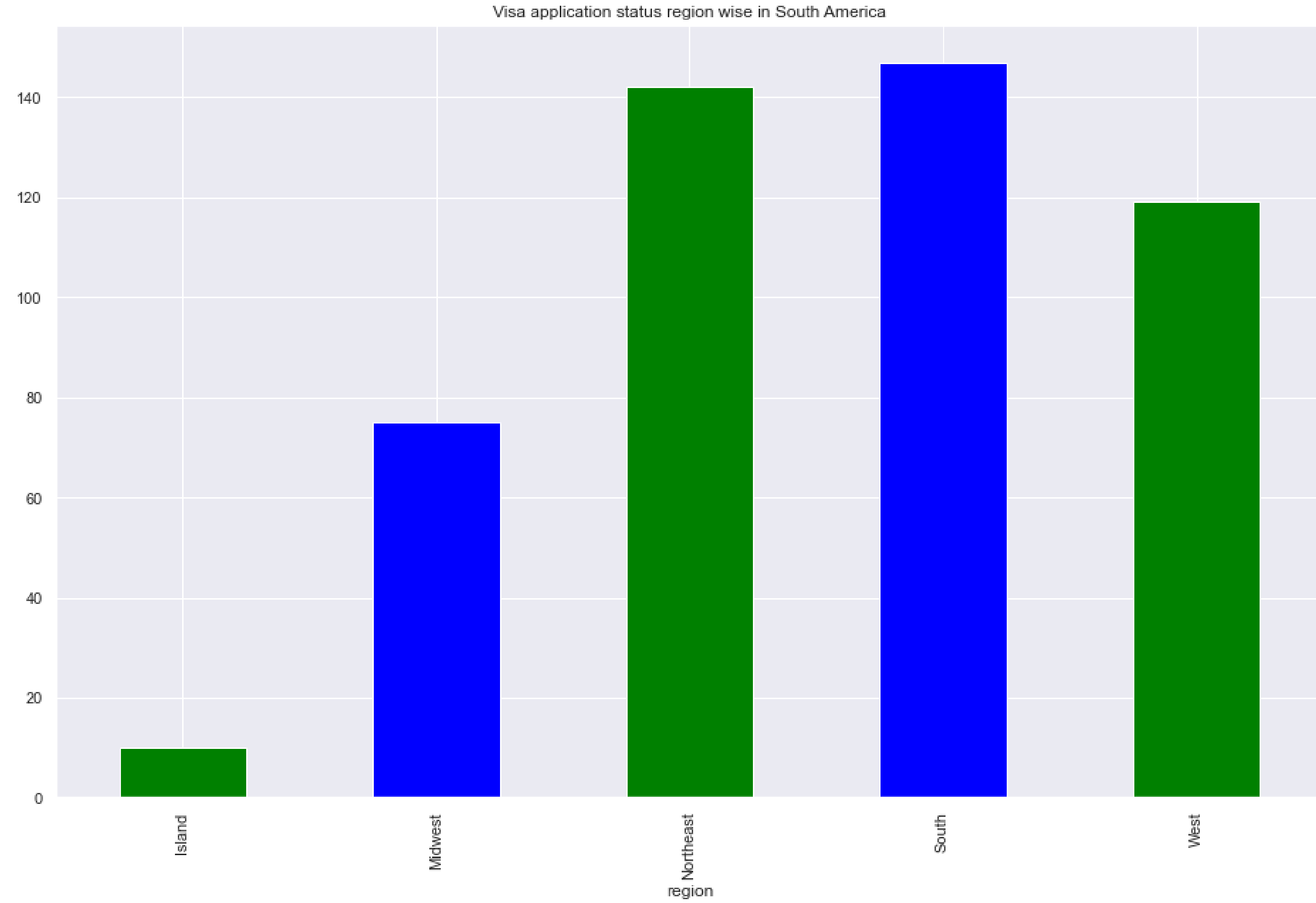

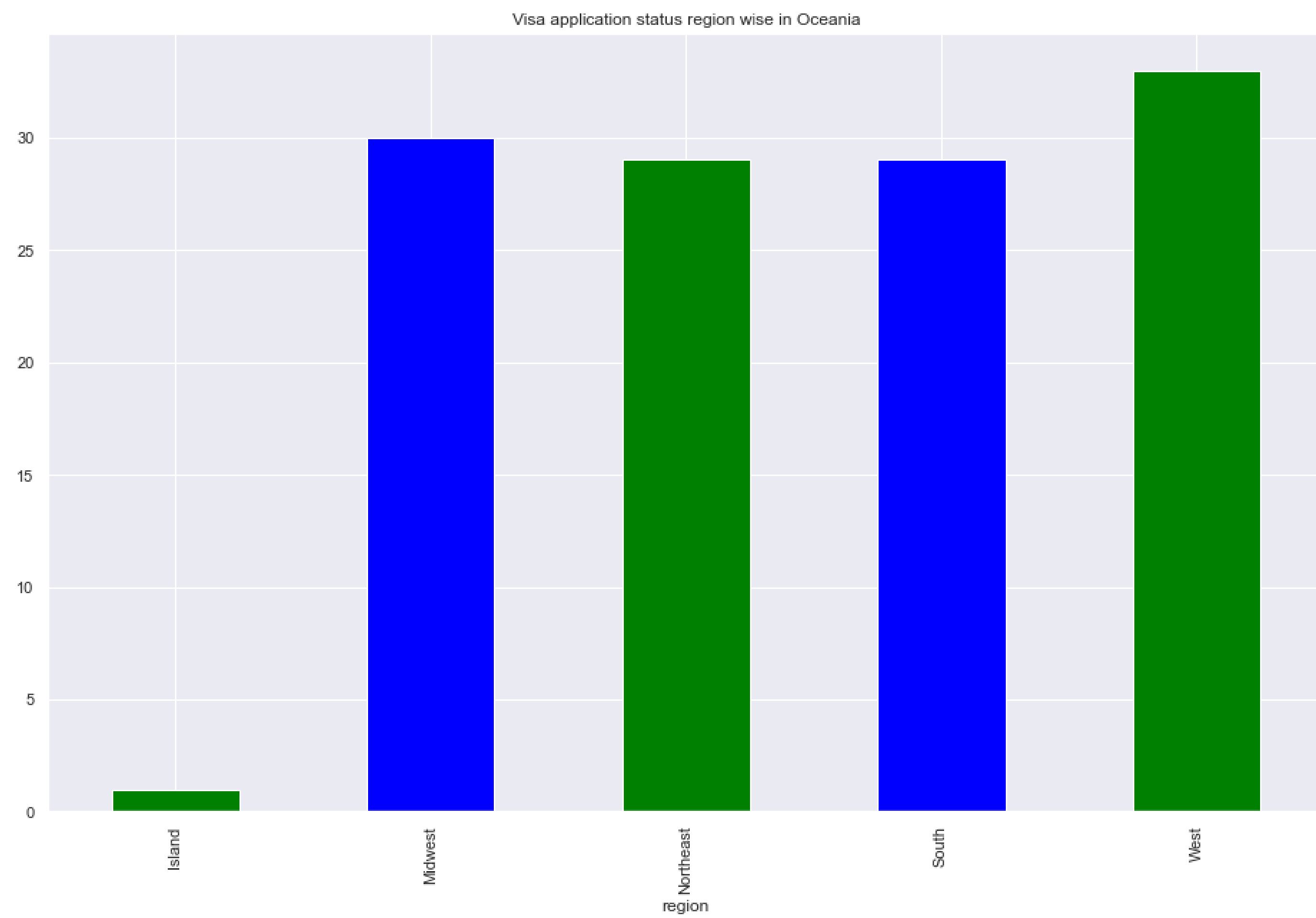

In [ ]:

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