```
pip install ucimlrepo
```

```
Requirement already satisfied: ucimlrepo in /usr/local/lib/python3.10/dist-packages (0.0.6)
```

```
from ucimlrepo import fetch_ucirepo

# fetch dataset
census_income = fetch_ucirepo(id=20)

# data (as pandas dataframes)
X = census_income.data.features
y = census_income.data.targets

# metadata
print(census_income.metadata)

# variable information
print(census_income.variables)
```

```
{'uci_id': 20, 'name': 'Census Income', 'repository_url': 'https://archive.ics.uci.edu/dataset/20/census+income', 'data_url': 'https://archive.ics.uci.edu/static/public/20/data.csv',
              name     role         type      demographic  \
0              age  Feature      Integer              Age
1        workclass  Feature  Categorical           Income
2           fnlwgt  Feature      Integer             None
3        education  Feature  Categorical  Education Level
4    education-num  Feature      Integer  Education Level
5   marital-status  Feature  Categorical            Other
6       occupation  Feature  Categorical            Other
7     relationship  Feature  Categorical            Other
8             race  Feature  Categorical             Race
9              sex  Feature       Binary              Sex
10    capital-gain  Feature      Integer             None
11    capital-loss  Feature      Integer             None
12  hours-per-week  Feature      Integer             None
13  native-country  Feature  Categorical            Other
14          income   Target       Binary           Income

                                      description units missing_values
0                                             N/A  None             no
1   Private, Self-emp-not-inc, Self-emp-inc, Feder...  None            yes
2                                            None  None             no
3    Bachelors, Some-college, 11th, HS-grad, Prof-...  None             no
4                                            None  None             no
5   Married-civ-spouse, Divorced, Never-married, S...  None             no
6   Tech-support, Craft-repair, Other-service, Sal...  None            yes
7   Wife, Own-child, Husband, Not-in-family, Other...  None             no
8   White, Asian-Pac-Islander, Amer-Indian-Eskimo,...  None             no
9                                  Female, Male.  None             no
10                                           None  None             no
11                                           None  None             no
12                                           None  None             no
13  United-States, Cambodia, England, Puerto-Rico,...  None            yes
14                                  >50K, <=50K.  None             no
```

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
x1 = pd.DataFrame(X)
```

```
y1 = pd.DataFrame(y)


df = pd.concat([x1, y1], axis= 1)
df
```

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	race	sex	capital-gain	cap
0	39	State-gov	77516	Bachelors	13	Never-married	Adm-clerical	Not-in-family	White	Male	2174	
1	50	Self-emp-not-inc	83311	Bachelors	13	Married-civ-spouse	Exec-managerial	Husband	White	Male	0	
2	38	Private	215646	HS-grad	9	Divorced	Handlers-cleaners	Not-in-family	White	Male	0	
3	53	Private	234721	11th	7	Married-civ-spouse	Handlers-cleaners	Husband	Black	Male	0	
4	28	Private	338409	Bachelors	13	Married-civ-spouse	Prof-specialty	Wife	Black	Female	0	
...	...	...	...	...	...	...	...	...	...	...	...	
48837	39	Private	215419	Bachelors	13	Divorced	Prof-	Not-in-family	White	Female	0	

Next steps: View recommended plots

```
df.dtypes
```

```
age               int64
workclass        object
fnlwgt            int64
education        object
education-num     int64
marital-status   object
occupation       object
relationship     object
race             object
sex              object
capital-gain      int64
capital-loss      int64
hours-per-week    int64
native-country   object
income           object
dtype: object
```

```
# Check if there is a duplicated rows in the dataset
def check_duplicates(df):
    if df.duplicated().any():
        return "DataFrame has duplicate rows."
    else:
        return "DataFrame has no duplicate rows."
```

```
print(check_duplicates(df))
```

```
DataFrame has duplicate rows.
```

there is a duplicated row so we need to remove all of the duplicated row

```
#remove the duplicated row
df = df.drop_duplicates()
```

```
#check again if there is any duplicated row
print(check_duplicates(df))
```

```
DataFrame has no duplicate rows.
```

I can be notice that there is no more duplicated row

```
def has_null(df):
    if df.isnull().any().any():
      return "DataFrame has null values."
    else:
      return "DataFrame has no null values."
```

```
print(has_null(df))
```

```
DataFrame has null values.
```

```
# Check what are the column have a null value
df.isnull().any()
```

```
age              False
workclass         True
fnlwgt           False
education        False
education-num    False
marital-status   False
occupation        True
relationship     False
race             False
sex              False
capital-gain     False
capital-loss     False
hours-per-week   False
native-country    True
income           False
dtype: bool
```

```
import numpy as np
```

```
df['workclass'].unique()
```

```
array(['State-gov', 'Self-emp-not-inc', 'Private', 'Federal-gov',
       'Local-gov', '?', 'Self-emp-inc', 'Without-pay', 'Never-worked',
       nan], dtype=object)
```

```
df['workclass'].value_counts()
```

```
workclass
Private             33879
Self-emp-not-inc     3861
Local-gov            3136
State-gov            1981
?                    1836
Self-emp-inc         1694
Federal-gov          1432
Without-pay            21
Never-worked           10
Name: count, dtype: int64
```

```
df['workclass'].replace('?', np.nan, inplace=True)
```

```
df['workclass'].fillna("Private", inplace=True)
```

```
<ipython-input-337-4e2f09ad67e4>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['workclass'].replace('?', np.nan, inplace=True)
<ipython-input-337-4e2f09ad67e4>:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['workclass'].fillna("Private", inplace=True)
```

```
df['native-country'].unique()
```

```
array(['United-States', 'Cuba', 'Jamaica', 'India', '?', 'Mexico',
       'South', 'Puerto-Rico', 'Honduras', 'England', 'Canada', 'Germany',
       'Iran', 'Philippines', 'Italy', 'Poland', 'Columbia', 'Cambodia',
       'Thailand', 'Ecuador', 'Laos', 'Taiwan', 'Haiti', 'Portugal',
       'Dominican-Republic', 'El-Salvador', 'France', 'Guatemala',
       'China', 'Japan', 'Yugoslavia', 'Peru',
       'Outlying-US(Guam-USVI-etc)', 'Scotland', 'Trinadad&Tobago',
       'Greece', 'Nicaragua', 'Vietnam', 'Hong', 'Ireland', 'Hungary',
       'Holand-Netherlands', nan], dtype=object)
```

```
df['native-country'].value_counts()
```

```
native-country
United-States                 43810
Mexico                          947
?                               582
Philippines                     295
Germany                         206
Puerto-Rico                     184
Canada                          182
El-Salvador                     155
India                           151
Cuba                            138
England                         127
China                           122
South                           115
Jamaica                         106
Italy                           105
```

```
Dominican-Republic             103
Japan                           92
Poland                          87
Guatemala                       86
Vietnam                         86
Columbia                        85
Haiti                           75
Portugal                        67
Taiwan                          65
Iran                            59
Greece                          49
Nicaragua                       49
Peru                            46
Ecuador                         45
France                          38
Ireland                         37
Hong                            30
Thailand                        30
Cambodia                        28
Trinadad&Tobago                 27
Laos                            23
Yugoslavia                      23
Outlying-US(Guam-USVI-etc)      23
Scotland                        21
Honduras                        20
Hungary                         19
Holand-Netherlands               1
Name: count, dtype: int64
```

```
df['native-country'].replace('?', np.nan, inplace=True)
```

```
df['native-country'].fillna("United-States", inplace=True)
```

```
<ipython-input-340-4c06d4398622>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['native-country'].replace('?', np.nan, inplace=True)
<ipython-input-340-4c06d4398622>:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['native-country'].fillna("United-States", inplace=True)
```

```
df['occupation'].unique()
```

```
array(['Adm-clerical', 'Exec-managerial', 'Handlers-cleaners',
       'Prof-specialty', 'Other-service', 'Sales', 'Craft-repair',
       'Transport-moving', 'Farming-fishing', 'Machine-op-inspct',
       'Tech-support', '?', 'Protective-serv', 'Armed-Forces',
       'Priv-house-serv', nan], dtype=object)
```

```
df['occupation'].value_counts()
```

```
occupation
Prof-specialty       6167
Craft-repair         6107
Exec-managerial      6084
Adm-clerical         5608
Sales                5504
```

```
Other-service        4919
Machine-op-inspct    3019
Transport-moving     2355
Handlers-cleaners    2071
?                    1843
Farming-fishing      1487
Tech-support         1445
Protective-serv       983
Priv-house-serv       240
Armed-Forces           15
Name: count, dtype: int64
```

```
df['occupation'].replace('?', np.nan, inplace=True)
```

```
df['occupation'].fillna("Prof-specialty", inplace=True)
```

```
<ipython-input-343-b2359ae89a5e>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['occupation'].replace('?', np.nan, inplace=True)
<ipython-input-343-b2359ae89a5e>:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['occupation'].fillna("Prof-specialty", inplace=True)
```

```
print(has_null(df))
```

```
DataFrame has no null values.
```

```
df.head()
```

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	race	sex	capital-gain	capital-loss
0	39	State-gov	77516	Bachelors	13	Never-married	Adm-clerical	Not-in-family	White	Male	2174	0
1	50	Self-emp-not-inc	83311	Bachelors	13	Married-civ-spouse	Exec-managerial	Husband	White	Male	0	0

Next steps: View recommended plots

Double-click (or enter) to edit

It can be notice that education and education-num have the same list size so expect of making the education object into numerical I just deleted the education column make the education-num category for education.

```
df['income'] = df['income'].replace('<=50K.', '<=50K')
df['income'] = df['income'].replace('>50K.', '>50K')
```

```
<ipython-input-346-0ceeff79e365>:1: 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['income'] = df['income'].replace('<=50K.', '<=50K')
<ipython-input-346-0ceeff79e365>: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['income'] = df['income'].replace('>50K.', '>50K')
```

```
df.dtypes
```

```
age               int64
workclass        object
fnlwgt            int64
education        object
education-num     int64
marital-status   object
occupation       object
relationship     object
race             object
sex              object
capital-gain      int64
capital-loss      int64
hours-per-week    int64
native-country   object
income           object
dtype: object
```

```
def objecttonumerical(dFrame, List):
    if dFrame[List].dtypes == 'object':
        cat_values = dFrame[List].unique()
        range_values = range(1, len(cat_values) + 1)
        map = dict(zip(cat_values, range_values))
        print(f"{List}:", map)
        df_category_num = dFrame[List].map(map)
    return df_category_num

for i in df.select_dtypes(include=['object']).columns:
  objecttonumerical(df, i)
```

```
workclass: {'State-gov': 1, 'Self-emp-not-inc': 2, 'Private': 3, 'Federal-gov': 4, 'Local-gov': 5, 'Self-emp-inc': 6, 'Without-pay': 7, 'Never-worked': 8}
education: {'Bachelors': 1, 'HS-grad': 2, '11th': 3, 'Masters': 4, '9th': 5, 'Some-college': 6, 'Assoc-acdm': 7, 'Assoc-voc': 8, '7th-8th': 9, 'Doctorate': 10, 'Prof-school': 11, '5th
marital-status: {'Never-married': 1, 'Married-civ-spouse': 2, 'Divorced': 3, 'Married-spouse-absent': 4, 'Separated': 5, 'Married-AF-spouse': 6, 'Widowed': 7}
occupation: {'Adm-clerical': 1, 'Exec-managerial': 2, 'Handlers-cleaners': 3, 'Prof-specialty': 4, 'Other-service': 5, 'Sales': 6, 'Craft-repair': 7, 'Transport-moving': 8, 'Farming-f
relationship: {'Not-in-family': 1, 'Husband': 2, 'Wife': 3, 'Own-child': 4, 'Unmarried': 5, 'Other-relative': 6}
race: {'White': 1, 'Black': 2, 'Asian-Pac-Islander': 3, 'Amer-Indian-Eskimo': 4, 'Other': 5}
sex: {'Male': 1, 'Female': 2}
native-country: {'United-States': 1, 'Cuba': 2, 'Jamaica': 3, 'India': 4, 'Mexico': 5, 'South': 6, 'Puerto-Rico': 7, 'Honduras': 8, 'England': 9, 'Canada': 10, 'Germany': 11, 'Iran':
income: {'<=50K': 1, '>50K': 2}
```

```
df.head()
```

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	race	sex	capital-gain	capital-loss
0	39	State-gov	77516	Bachelors	13	Never-married	Adm-clerical	Not-in-family	White	Male	2174	0
1	50	Self-emp-not-inc	83311	Bachelors	13	Married-civ-spouse	Exec-managerial	Husband	White	Male	0	0

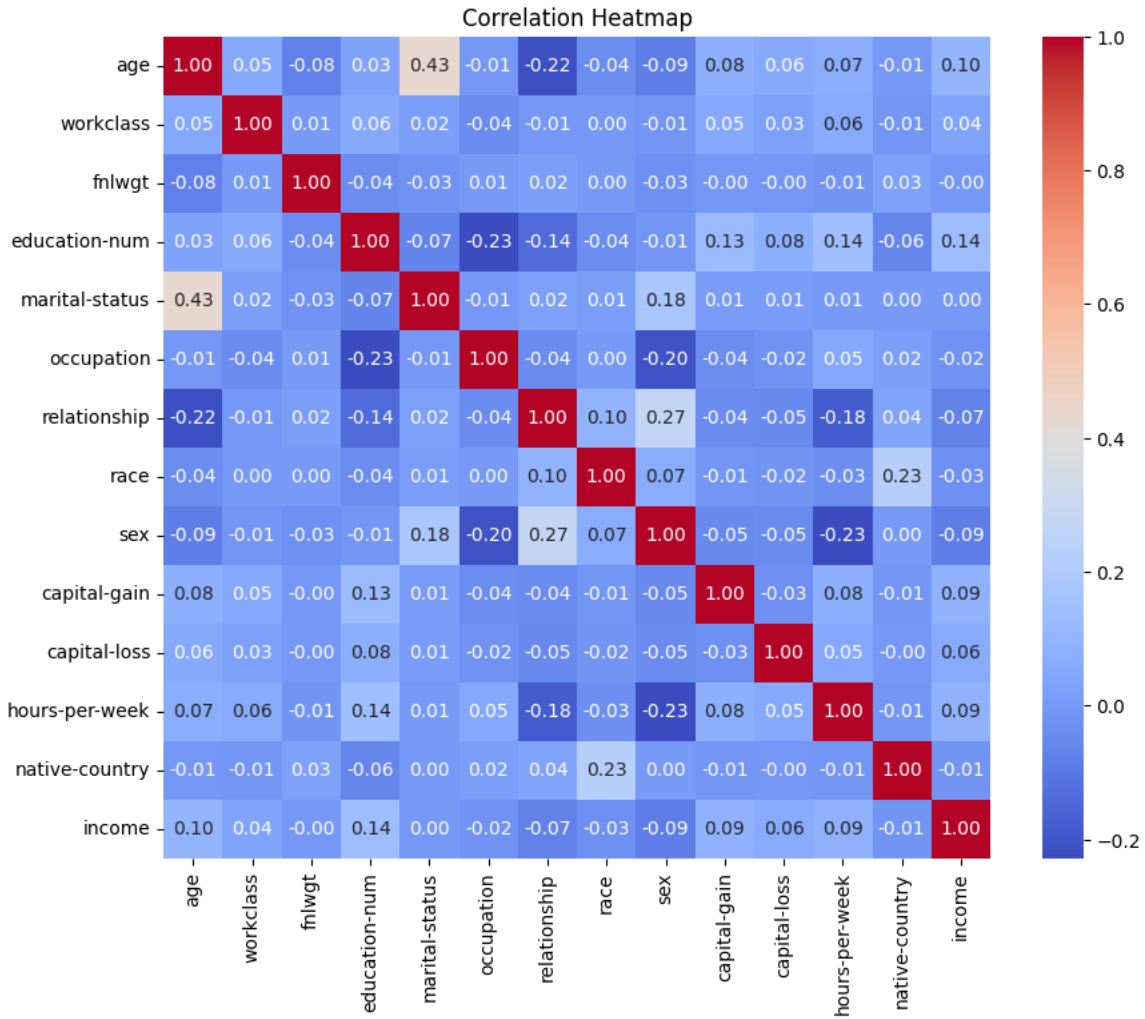
Handlers-

Next steps: View recommended plots

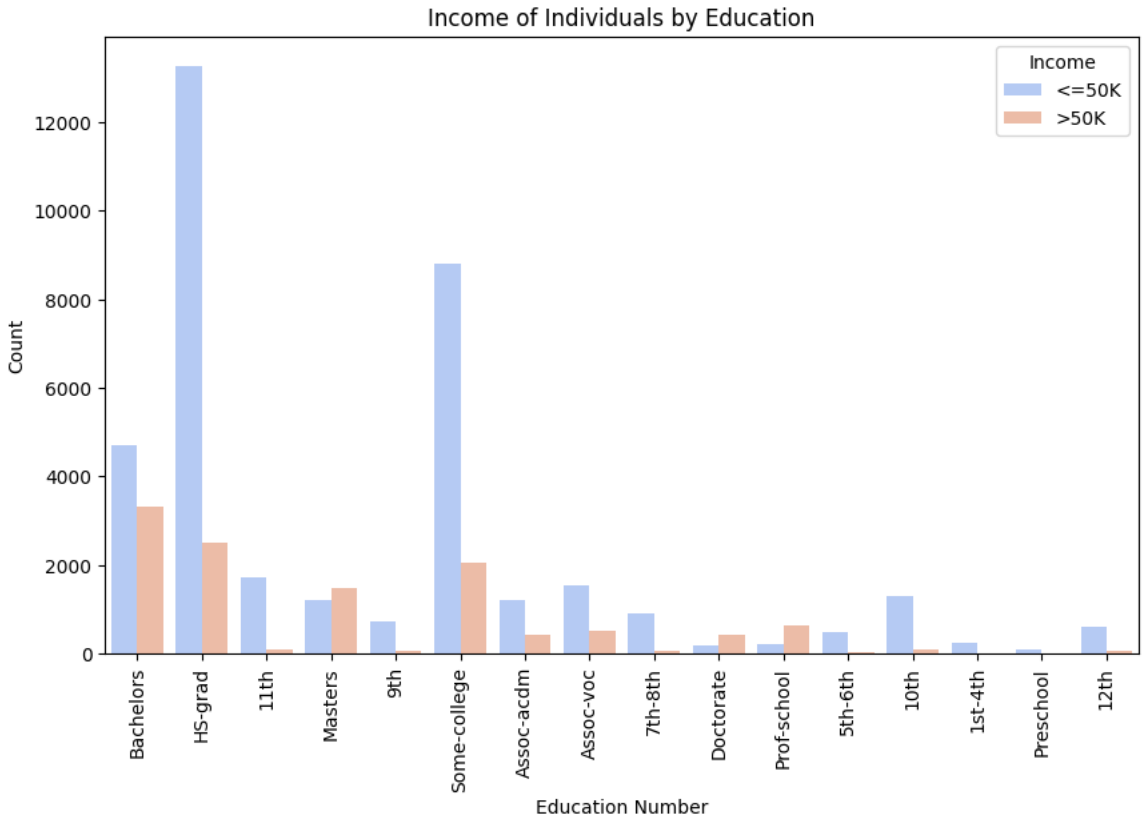
```
df['income'].unique()
```

```
array(['<=50K', '>50K'], dtype=object)
```

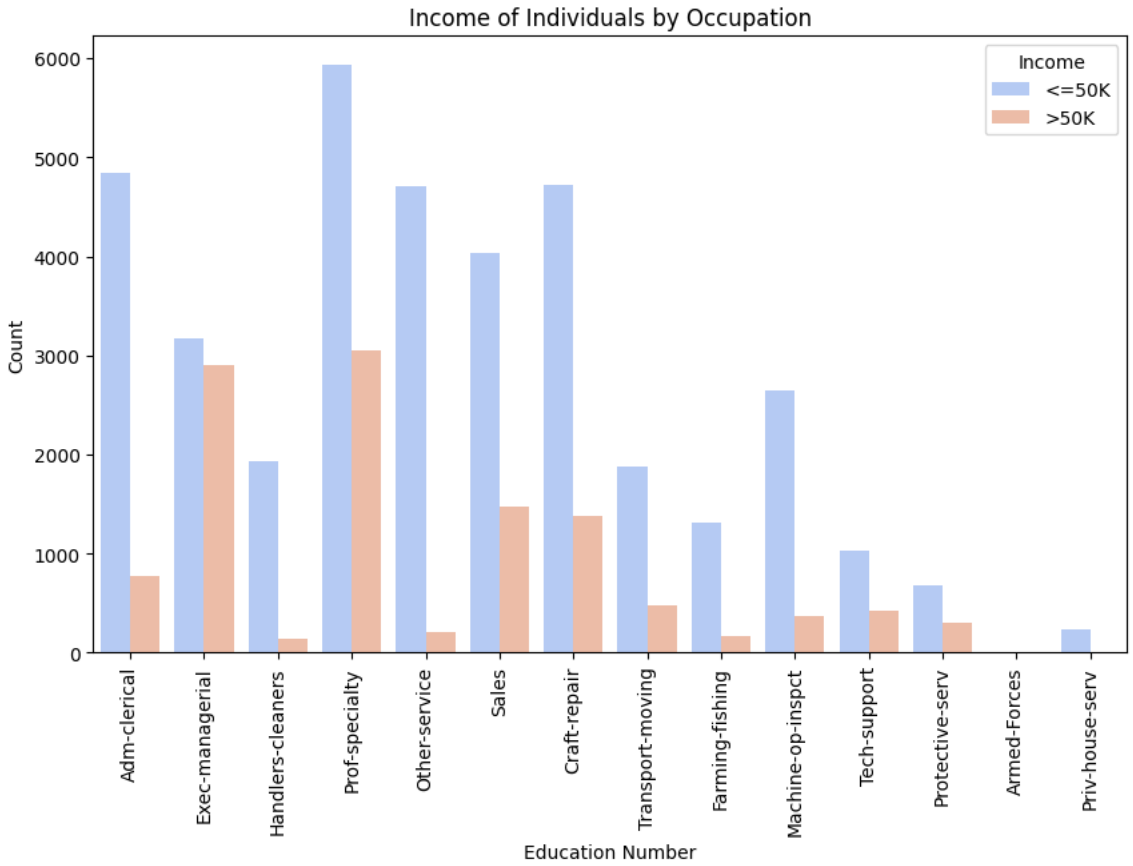
```
corr_matrix = df_category_num.corr()

# Plot the heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(corr_matrix, cmap='coolwarm', annot=True, fmt='.2f')
plt.title('Correlation Heatmap')
plt.show()
```




```
plt.figure(figsize=(10, 6))
sns.countplot(x='education', hue='income', data=df, palette='coolwarm')
plt.xlabel('Education Number')
plt.ylabel('Count')
plt.title('Income of Individuals by Education')
plt.legend(title='Income', loc='upper right')
plt.xticks(rotation=90)
plt.show()
```




```
plt.figure(figsize=(10, 6))
sns.countplot(x='occupation', hue='income', data=df, palette='coolwarm')
plt.xlabel('Education Number')
plt.ylabel('Count')
plt.title('Income of Individuals by Occupation')
plt.legend(title='Income', loc='upper right')
plt.xticks(rotation=90)
plt.show()
```




```
# Filter the DataFrame to include only >50K income
df_high_income = df[df['income'] == '>50K']

# Count plot for income by education level (only >50K)
plt.figure(figsize=(10, 6))
sns.countplot(x='sex', data=df_high_income, palette='coolwarm')
plt.xlabel('Education Number')
plt.ylabel('Count')
plt.title('Income of Individuals with >50K Income by Education Level')
plt.xticks(rotation=45)
plt.show()
```

```
<ipython-input-369-a1bfe37908bf>:6: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.countplot(x='sex', data=df_high_income, palette='coolwarm')
```