Министерство образования Республики Беларусь
Учреждение образования
“Брестский государственный университет”
Кафедра ИИТ

# Лабораторная работа №11

По дисциплине “Языки программирования”

Вариант №7

Выполнил:
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Дата выполнения:
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Ход работы:

1. Загрузить датасет в pandas и проверить на доступность

2. Вывести общую информацию о датасете

```
dataframe = pd.read_csv('pandas.csv', delimiter='\t')
dataframe
```

| | ID | Year_Birth | Education | Marital_Status | Income | Kidhome | Teenhome | Dt_Customer | Recency | MntWines | ... | NumWebVisitsMonth | AcceptedCmp3 | AcceptedCmp4 | AcceptedCmp5 | AcceptedCmp1 | AcceptedCmp2 | Comp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 5524 | 1957 | Graduation | Single | 58138.0 | 0 | 0 | 04-09-2012 | 58 | 635 | ... | 7 | 0 | 0 | 0 | 0 | 0 | |
| **1** | 2174 | 1954 | Graduation | Single | 46344.0 | 1 | 1 | 08-03-2014 | 38 | 11 | ... | 5 | 0 | 0 | 0 | 0 | 0 | |
| **2** | 4141 | 1965 | Graduation | Together | 71613.0 | 0 | 0 | 21-08-2013 | 26 | 426 | ... | 4 | 0 | 0 | 0 | 0 | 0 | |
| **3** | 6182 | 1984 | Graduation | Together | 26646.0 | 1 | 0 | 10-02-2014 | 26 | 11 | ... | 6 | 0 | 0 | 0 | 0 | 0 | |
| **4** | 5324 | 1981 | PhD | Married | 58293.0 | 1 | 0 | 19-01-2014 | 94 | 173 | ... | 5 | 0 | 0 | 0 | 0 | 0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **2235** | 10870 | 1967 | Graduation | Married | 61223.0 | 0 | 1 | 13-06-2013 | 46 | 709 | ... | 5 | 0 | 0 | 0 | 0 | 0 | |
| **2236** | 4001 | 1946 | PhD | Together | 64014.0 | 2 | 1 | 10-06-2014 | 56 | 406 | ... | 7 | 0 | 0 | 0 | 1 | 0 | |
| **2237** | 7270 | 1981 | Graduation | Divorced | 56981.0 | 0 | 0 | 25-01-2014 | 91 | 908 | ... | 6 | 0 | 1 | 0 | 0 | 0 | |
| **2238** | 8235 | 1956 | Master | Together | 69245.0 | 0 | 1 | 24-01-2014 | 8 | 428 | ... | 3 | 0 | 0 | 0 | 0 | 0 | |
| **2239** | 9405 | 1954 | PhD | Married | 52869.0 | 1 | 1 | 15-10-2012 | 40 | 84 | ... | 7 | 0 | 0 | 0 | 0 | 0 | |

2240 rows × 29 columns

3. Проверка наличия NULL-данных. При их наличии вывести на экран

```
dataframe[dataframe.isnull().any(1)]
```

| | ID | Year_Birth | Education | Marital_Status | Income | Kidhome | Teenhome | Dt_Customer | Recency | MntWines | ... | NumWebVisitsMonth | AcceptedCmp3 | AcceptedCmp4 | AcceptedCmp5 | AcceptedCmp1 | AcceptedCmp2 | Comp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **10** | 1994 | 1983 | Graduation | Married | NaN | 1 | 0 | 15-11-2013 | 11 | 5 | ... | 7 | 0 | 0 | 0 | 0 | 0 | |
| **27** | 5255 | 1986 | Graduation | Single | NaN | 1 | 0 | 20-02-2013 | 19 | 5 | ... | 1 | 0 | 0 | 0 | 0 | 0 | |
| **43** | 7281 | 1959 | PhD | Single | NaN | 0 | 0 | 05-11-2013 | 80 | 81 | ... | 2 | 0 | 0 | 0 | 0 | 0 | |
| **48** | 7244 | 1951 | Graduation | Single | NaN | 2 | 1 | 01-01-2014 | 96 | 48 | ... | 6 | 0 | 0 | 0 | 0 | 0 | |
| **58** | 8557 | 1982 | Graduation | Single | NaN | 1 | 0 | 17-06-2013 | 57 | 11 | ... | 6 | 0 | 0 | 0 | 0 | 0 | |
| **71** | 10629 | 1973 | 2n Cycle | Married | NaN | 1 | 0 | 14-09-2012 | 25 | 25 | ... | 8 | 0 | 0 | 0 | 0 | 0 | |
| **90** | 8996 | 1957 | PhD | Married | NaN | 2 | 1 | 19-11-2012 | 4 | 230 | ... | 9 | 0 | 0 | 0 | 0 | 0 | |
| **91** | 9235 | 1957 | Graduation | Single | NaN | 1 | 1 | 27-05-2014 | 45 | 7 | ... | 7 | 0 | 0 | 0 | 0 | 0 | |
| **92** | 5798 | 1973 | Master | Together | NaN | 0 | 0 | 23-11-2013 | 87 | 445 | ... | 1 | 0 | 0 | 0 | 0 | 0 | |
| **128** | 8268 | 1961 | PhD | Married | NaN | 0 | 1 | 11-07-2013 | 23 | 352 | ... | 6 | 0 | 0 | 0 | 0 | 0 | |
| **133** | 1295 | 1963 | Graduation | Married | NaN | 0 | 1 | 11-08-2013 | 96 | 231 | ... | 4 | 0 | 0 | 0 | 0 | 0 | |
| **312** | 2437 | 1989 | Graduation | Married | NaN | 0 | 0 | 03-06-2013 | 69 | 861 | ... | 3 | 0 | 1 | 0 | 1 | 0 | |
| **319** | 2863 | 1970 | Graduation | Single | NaN | 1 | 2 | 23-08-2013 | 67 | 738 | ... | 7 | 0 | 1 | 0 | 1 | 0 | |
| **1379** | 10475 | 1970 | Master | Together | NaN | 0 | 1 | 01-04-2013 | 39 | 187 | ... | 5 | 0 | 0 | 0 | 0 | 0 | |
| **1382** | 2902 | 1958 | Graduation | Together | NaN | 1 | 1 | 03-09-2012 | 87 | 19 | ... | 5 | 0 | 0 | 0 | 0 | 0 | |
| **1383** | 4345 | 1964 | 2n Cycle | Single | NaN | 1 | 1 | 12-01-2014 | 49 | 5 | ... | 7 | 0 | 0 | 0 | 0 | 0 | |
| **1386** | 3769 | 1972 | PhD | Together | NaN | 1 | 0 | 02-03-2014 | 17 | 25 | ... | 7 | 0 | 0 | 0 | 0 | 0 | |
| **2059** | 7187 | 1969 | Master | Together | NaN | 1 | 1 | 18-05-2013 | 52 | 375 | ... | 3 | 0 | 0 | 0 | 0 | 0 | |
| **2061** | 1612 | 1981 | PhD | Single | NaN | 1 | 0 | 31-05-2013 | 82 | 23 | ... | 6 | 0 | 0 | 0 | 0 | 0 | |
| **2078** | 5079 | 1971 | Graduation | Married | NaN | 1 | 1 | 02-03-2013 | 82 | 71 | | 8 | 0 | 0 | 0 | 0 | 0 | |

4. Удалить колонки "Z_CostContact", "Z_Revenue"

```
print(f'Before: {dataframe.columns}')
dataframe = dataframe.drop('Z_CostContact', axis=1).drop('Z_Revenue', axis=1)
print(f'After: {dataframe.columns}')
```

```
Before: Index(['ID', 'Year_Birth', 'Education', 'Marital_Status', 'Income', 'Kidhome',
       'Teenhome', 'Dt_Customer', 'Recency', 'MntWines', 'MntFruits',
       'MntMeatProducts', 'MntFishProducts', 'MntSweetProducts',
       'MntGoldProds', 'NumDealsPurchases', 'NumWebPurchases',
       'NumCatalogPurchases', 'NumStorePurchases', 'NumWebVisitsMonth',
       'AcceptedCmp3', 'AcceptedCmp4', 'AcceptedCmp5', 'AcceptedCmp1',
       'AcceptedCmp2', 'Complain', 'Z_CostContact', 'Z_Revenue', 'Response'],
      dtype='object')
After: Index(['ID', 'Year_Birth', 'Education', 'Marital_Status', 'Income', 'Kidhome',
       'Teenhome', 'Dt_Customer', 'Recency', 'MntWines', 'MntFruits',
       'MntMeatProducts', 'MntFishProducts', 'MntSweetProducts',
       'MntGoldProds', 'NumDealsPurchases', 'NumWebPurchases',
       'NumCatalogPurchases', 'NumStorePurchases', 'NumWebVisitsMonth',
       'AcceptedCmp3', 'AcceptedCmp4', 'AcceptedCmp5', 'AcceptedCmp1',
       'AcceptedCmp2', 'Complain', 'Response'],
      dtype='object')
```

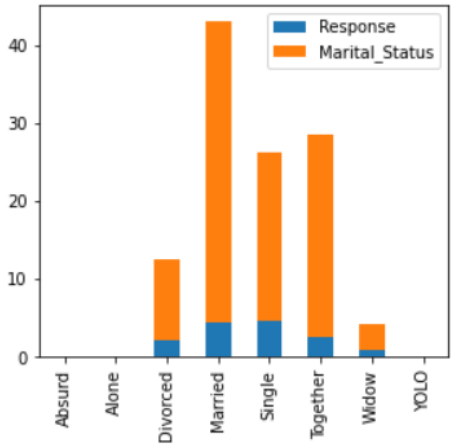
5. Переименовать колонку "Year_Birth" в "Age"

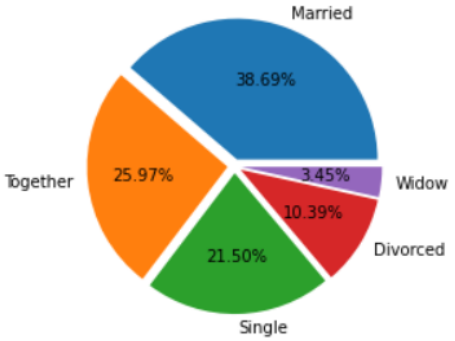
```
print(f'Before: {dataframe.columns}')
dataframe = dataframe.rename({'Year_Birth': 'Age'}, axis=1)
print(f'After: {dataframe.columns}')
```

```
Before: Index(['ID', 'Year_Birth', 'Education', 'Marital_Status', 'Income', 'Kidhome',
       'Teenhome', 'Dt_Customer', 'Recency', 'MntWines', 'MntFruits',
       'MntMeatProducts', 'MntFishProducts', 'MntSweetProducts',
       'MntGoldProds', 'NumDealsPurchases', 'NumWebPurchases',
       'NumCatalogPurchases', 'NumStorePurchases', 'NumWebVisitsMonth',
       'AcceptedCmp3', 'AcceptedCmp4', 'AcceptedCmp5', 'AcceptedCmp1',
       'AcceptedCmp2', 'Complain', 'Z_CostContact', 'Z_Revenue', 'Response'],
      dtype='object')
After: Index(['ID', 'Age', 'Education', 'Marital_Status', 'Income', 'Kidhome',
       'Teenhome', 'Dt_Customer', 'Recency', 'MntWines', 'MntFruits',
       'MntMeatProducts', 'MntFishProducts', 'MntSweetProducts',
       'MntGoldProds', 'NumDealsPurchases', 'NumWebPurchases',
       'NumCatalogPurchases', 'NumStorePurchases', 'NumWebVisitsMonth',
       'AcceptedCmp3', 'AcceptedCmp4', 'AcceptedCmp5', 'AcceptedCmp1',
       'AcceptedCmp2', 'Complain', 'Z_CostContact', 'Z_Revenue', 'Response'],
      dtype='object')
```

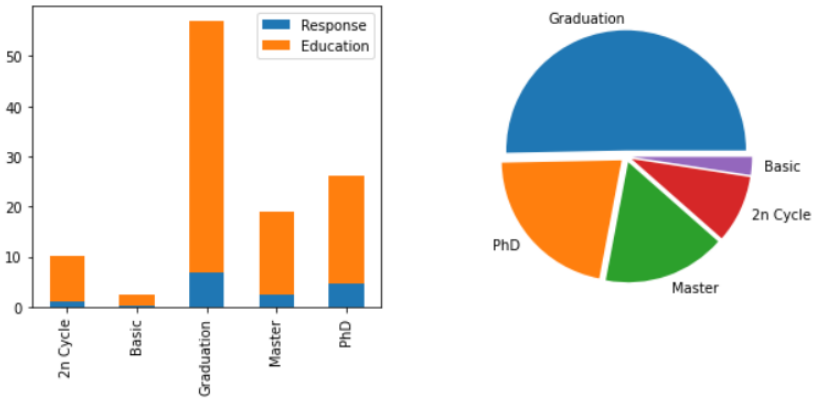
6. Оценить состояние колонок "Marital_Status", "Education". Построить информативные диаграммы и гистограммы для каждой.

```
fig, axs = plt.subplots(ncols=2, figsize=(10, 4))

marital_statuses_df = dataframe[['Marital_Status', 'Response']]

marital_status_series = dataframe['Marital_Status']
responces = marital_statuses_df.groupby('Marital_Status', as_index=True)['Response'].sum()

marital_statuses_precents = (marital_status_series.value_counts() / marital_status_series.size) * 100
responces_precents = (responces / marital_status_series.size) * 100

df = pd.DataFrame([responces_precents, marital_statuses_precents]).transpose()
df.plot.bar(stacked=True, ax=axs[0])

values = marital_statuses_precents.values[:-3]
indexes = marital_statuses_precents.index[:-3]
explode = [0.05] * len(values)

plt.pie(values, labels=indexes, explode=explode, autopct="%1.2f%%")
plt.show()
```



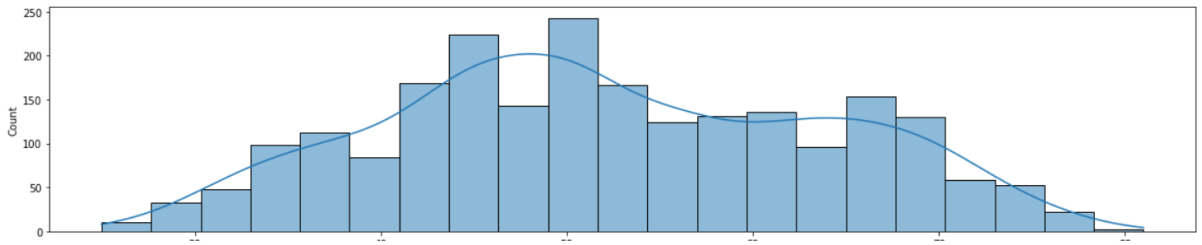



```
fig, axs = plt.subplots(ncols=2, figsize=(10, 4))

education_df = dataframe[['Education', 'Response']]

education_series = dataframe['Education']
responces = education_df.groupby('Education', as_index=True)['Response'].sum()

educations_precents = (education_series.value_counts() / education_series.size) * 100
responces_precents = (responces / education_series.size) * 100

df = pd.DataFrame([responces_precents, educations_precents]).transpose()
df.plot.bar(stacked=True, ax=axs[0])

plt.pie(educations_precents.values, labels=educations_precents.index, explode=[0.05] * len(educations_precents.values))
plt.show()
```




7. Создать гистаграмму по колонке "Age" и оценить на распределение по Гауссу.

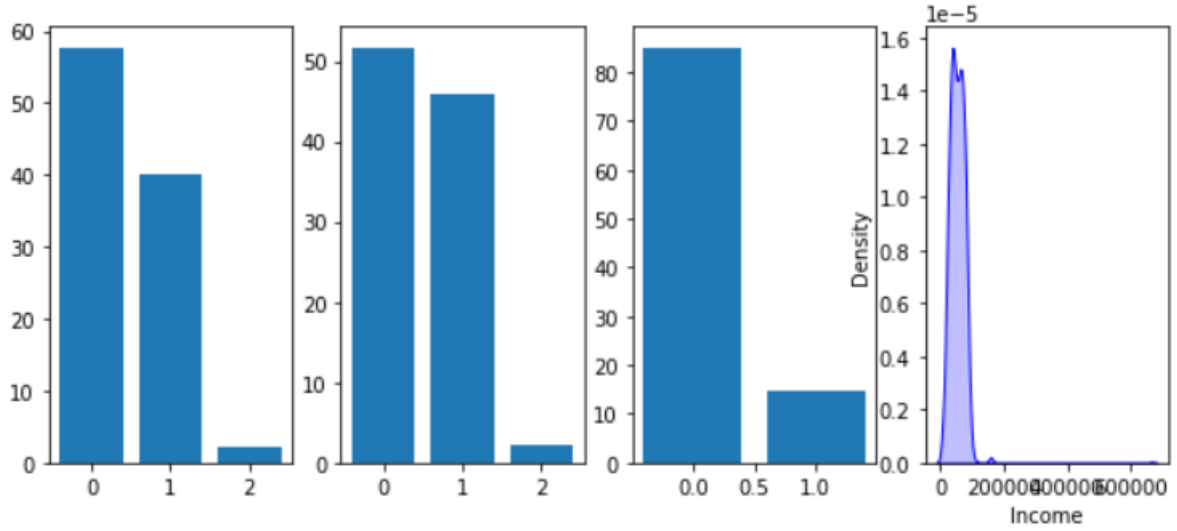
```
fig, axs = plt.subplots(ncols=1, figsize=(20, 4))

age = (2021- dataframe['Age'])
age = age[age < 90]

seaborn.histplot(x=age, kde=True)

plt.show()
```




8. Оценка полей "Kidhome" и "Teenhome", "Response" и "Income" (диаграммы и гистограммы)

```
fig, axs = plt.subplots(ncols=4, figsize=(10, 4))

kidhome = dataframe['Kidhome']
kidhome = (kidhome.value_counts() / kidhome.size) * 100
axs[0].bar(kidhome.index, kidhome.values)

teenhome = dataframe['Teenhome']
teenhome = (teenhome.value_counts() / teenhome.size) * 100
axs[1].bar(teenhome.index, teenhome.values)

response = dataframe['Response']
response = (response.value_counts() / response.size) * 100
axs[2].bar(response.index, response.values)

seaborn.kdeplot(dataframe['Income'], color='b', shade=True)
```

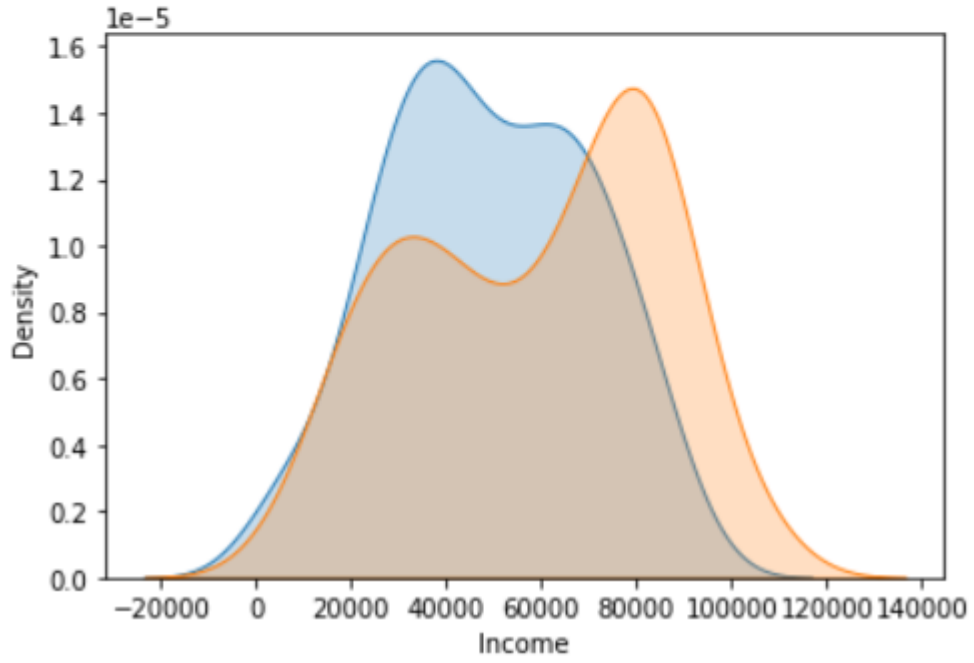
```
<AxesSubplot:xlabel='Income', ylabel='Density'>
```



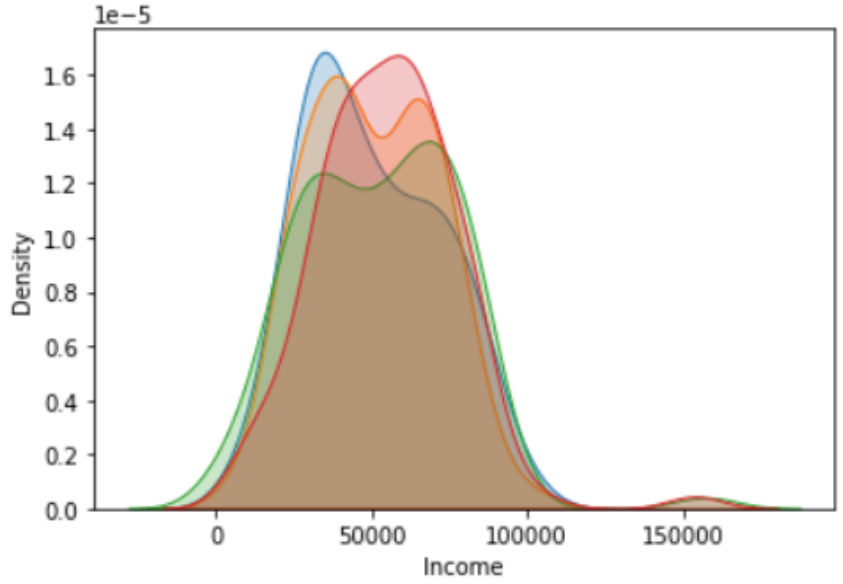

9. Построить графики "Response", "Marital_Status", "Education" и "Kidhome"

```
responses = dataframe[['Response', 'Income']]
zero = responses[responses['Response'] == 0][:100]
one = responses[responses['Response'] == 1][:100]

sns.kdeplot(zero['Income'], shade=True)
sns.kdeplot(one['Income'], shade=True)
```

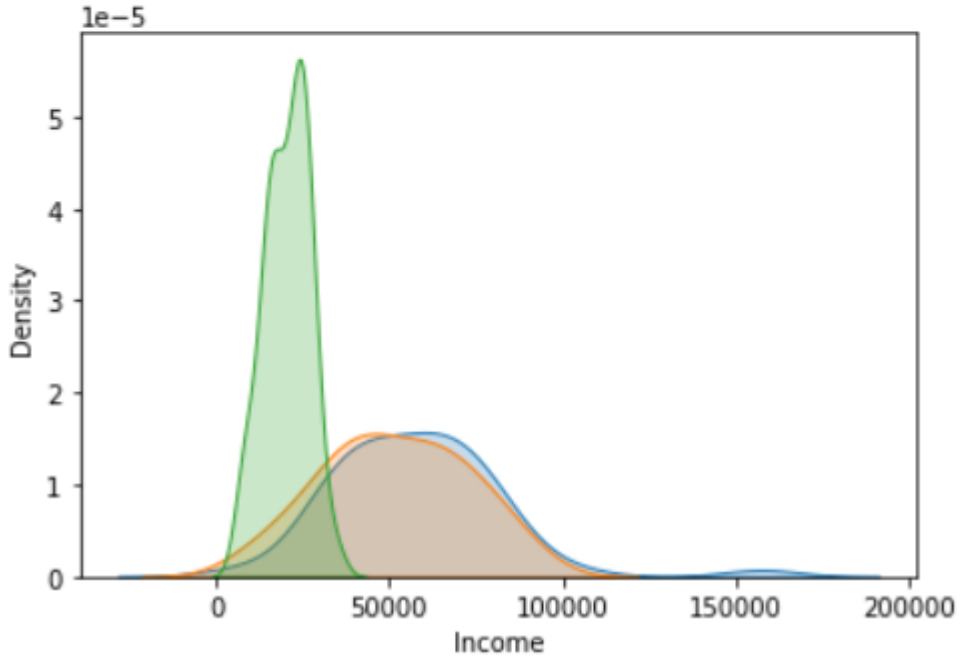
```
<AxesSubplot:xlabel='Income', ylabel='Density'>
```



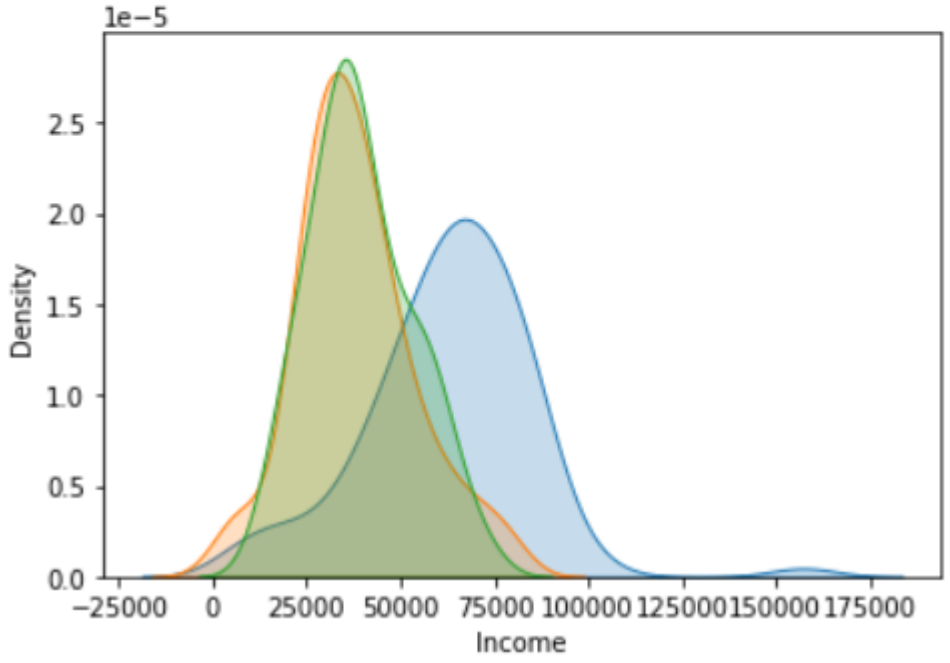
```
marital_status = dataframe[['Marital_Status', 'Income']]

for status in [
    marital_status[marital_status['Marital_Status'] == 'Single'][:100],
    marital_status[marital_status['Marital_Status'] == 'Together'][:100],
    marital_status[marital_status['Marital_Status'] == 'Married'][:100],
    marital_status[marital_status['Marital_Status'] == 'Divorced'][:100],
    marital_status[marital_status['Marital_Status'] == 'Wdow'][:100]
]:
    sns.kdeplot(status['Income'], shade=True)
```



```
educations = dataframe[['Education', 'Income']]

for education in [
    educations[educations['Education'] == 'Bachelor'][:50],
    educations[educations['Education'] == 'PhD'][:50],
    educations[educations['Education'] == 'Master'][:50],
    educations[educations['Education'] == 'Basic'][:50]
]:
    sns.kdeplot(education['Income'], shade=True)
```



```
kidhomes = dataframe[['Kidhome', 'Income']]

for kidhome in [
    kidhomes[kidhomes['Kidhome'] == 0][:100],
    kidhomes[kidhomes['Kidhome'] == 1][:100],
    kidhomes[kidhomes['Kidhome'] == 2][:100],
]:
    sns.kdeplot(kidhome['Income'], shade=True)
```




10. Построить heatmap для всех числовых колонок

```
columns = ['Income', 'Kidhome', 'Teenhome', 'Recency', 'MntWines',
                      'MntFruits', 'MntMeatProducts', 'MntFishProducts',
                     'MntSweetProducts', 'MntGoldProds', 'NumWebPurchases',
                     'NumCatalogPurchases', 'NumStorePurchases', 'NumWebVisitsMonth',
                     'AcceptedCmp3', 'AcceptedCmp4', 'AcceptedCmp5', 'AcceptedCmp1',
                     'AcceptedCmp2', 'Complain', 'Response', 'Age']
sns.heatmap(dataframe[columns].corr())
```

```
<AxesSubplot:>
```