lab1

May 18, 2023

1 - ładowanie biblioteki Pandas

[1]:
```
import pandas as pd
```

2 - tworzenie ramki danych ze słownika

[2]:
```
dict_city = {"City" : ["Warszawa", "Łódź", "Poznań", "Wrocław"],
             "Population" : [12678079,   5398064,  1625631, 2039421]}
df = pd.DataFrame(dict_city)
df
```

[2]:

	City	Population
0	Warszawa	12678079
1	Łódź	5398064
2	Poznań	1625631
3	Wrocław	2039421

3 - zachowanie ramki danych pobranych z pliku w formacie csv (xlsx)

[3]:
```
df.to_csv("city.csv")
```

4 - tworzenie ramki danych z listy list

[4]:
```
lists_city = [["Warszawa", "Łódź", "Poznań", "Wrocław"],
[12678079,   5398064,  1625631, 2039421]]

pd.DataFrame(lists_city)
```

[4]:

	0	1	2	3
0	Warszawa	Łódź	Poznań	Wrocław
1	12678079	5398064	1625631	2039421

5 - transponowanie (wymieniamy kolumny a wierszy)

[5]:
```
pd.DataFrame(lists_city).T
```

[5]:

	0	1
0	Warszawa	12678079
1	Łódź	5398064

```
2    Poznań   1625631
3   Wrocław   2039421
```

6 - wyświetlić pierwsze 10 wierszy ramki danych

[6]:
```
df = pd.read_csv("IHME_GBD_2019_SMOKING_TOB_1990_2019_NUM_SMOKERS_Y2021M05D27.
↪csv", encoding = "utf-8")
```

[7]:
```
df.head(10)
```

[7]:

	measure_name	location_id	location_name	sex_id	sex_name	age_group_id	age_group_name	year_id	val	upper	lower
0	Number of Smokers	1	Global	1	Male	29	15+ years	1990	8.031015e+08	8.096221e+08	7.959086e+08
1	Number of Smokers	1	Global	2	Female	29	15+ years	1990	1.891488e+08	1.930929e+08	1.855595e+08
2	Number of Smokers	1	Global	3	Both	29	15+ years	1990	9.922503e+08	1.000161e+09	9.847880e+08
3	Number of Smokers	1	Global	1	Male	29	15+ years	1991	8.138972e+08	8.200339e+08	8.069514e+08
4	Number of Smokers	1	Global	2	Female	29	15+ years	1991	1.905375e+08	1.944249e+08	1.869744e+08
5	Number of Smokers	1	Global	3	Both	29	15+ years	1991	1.004435e+09	1.011925e+09	9.969811e+08
6	Number of Smokers	1	Global	1	Male	29	15+ years	1992	8.233148e+08	8.292228e+08	8.167264e+08
7	Number of Smokers	1	Global	2	Female	29	15+ years	1992	1.919026e+08	1.957109e+08	1.884066e+08
8	Number of Smokers	1	Global	3	Both	29	15+ years	1992	1.015217e+09	1.022720e+09	1.007847e+09
9	Number of Smokers	1	Global	1	Male	29	15+ years	1993	8.313873e+08	8.372931e+08	8.249496e+08

7 - wyświetlić ostatnie 10 wierszy ramki danych

[8]:
```
df.tail(10)
```

[8]:

	measure_name	location_id	location_name	sex_id	sex_name	\
20960	Number of Smokers	522	Sudan	3	Both	
20961	Number of Smokers	522	Sudan	1	Male	
20962	Number of Smokers	522	Sudan	2	Female	
20963	Number of Smokers	522	Sudan	3	Both	
20964	Number of Smokers	522	Sudan	1	Male	
20965	Number of Smokers	522	Sudan	2	Female	
20966	Number of Smokers	522	Sudan	3	Both	
20967	Number of Smokers	522	Sudan	1	Male	
20968	Number of Smokers	522	Sudan	2	Female	
20969	Number of Smokers	522	Sudan	3	Both	

	age_group_id	age_group_name	year_id	val	upper	\
20960	29	15+ years	2016	2.454893e+06	2.665441e+06	
20961	29	15+ years	2017	2.297622e+06	2.490884e+06	
20962	29	15+ years	2017	2.373815e+05	3.217514e+05	
20963	29	15+ years	2017	2.535003e+06	2.743769e+06	
20964	29	15+ years	2018	2.367072e+06	2.575100e+06	
20965	29	15+ years	2018	2.435999e+05	3.286166e+05	
20966	29	15+ years	2018	2.610672e+06	2.833943e+06	
20967	29	15+ years	2019	2.439150e+06	2.656579e+06	
20968	29	15+ years	2019	2.500800e+05	3.345384e+05	
20969	29	15+ years	2019	2.689230e+06	2.918332e+06	

	lower
20960	2.267696e+06
20961	2.114574e+06
20962	1.729171e+05
20963	2.341329e+06
20964	2.173995e+06
20965	1.752508e+05
20966	2.409108e+06
20967	2.236450e+06
20968	1.816686e+05
20969	2.480656e+06

8 - wyświetlić informację o ramce danych

[9]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20970 entries, 0 to 20969
Data columns (total 11 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   measure_name    20970 non-null  object
```

```
 1   location_id     20970 non-null  int64
 2   location_name   20970 non-null  object
 3   sex_id          20970 non-null  int64
 4   sex_name        20970 non-null  object
 5   age_group_id    20970 non-null  int64
 6   age_group_name  20970 non-null  object
 7   year_id         20970 non-null  int64
 8   val             20970 non-null  float64
 9   upper           20970 non-null  float64
 10  lower           20970 non-null  float64
dtypes: float64(3), int64(4), object(4)
memory usage: 1.8+ MB
```

9 - wyświetlić, ile wierszy i kolumn znajduje się w ramce danych

[10]:
```
df.shape
```

[10]:
```
(20970, 11)
```

10 - wyświetlić informację statystyczną o kolumnach liczbowych (wartości niepowtarzalne, średnia, odchylenie standardowe, minimum, kwartyle, maksimum)

[11]:
```
df.describe()
```

[11]:

	location_id	sex_id	age_group_id	year_id	val	\
count	20970.000000	20970.000000	20970.0	20970.000000	2.097000e+04	
mean	131.111588	2.000000	29.0	2004.500000	1.242807e+07	
std	95.055111	0.816516	0.0	8.655648	6.489191e+07	
min	1.000000	1.000000	29.0	1990.000000	6.345717e+01	
25%	61.000000	1.000000	29.0	1997.000000	8.201065e+04	
50%	119.000000	2.000000	29.0	2004.500000	5.777123e+05	
75%	177.000000	3.000000	29.0	2012.000000	2.901197e+06	
max	522.000000	3.000000	29.0	2019.000000	1.144819e+09	

	upper	lower
count	2.097000e+04	2.097000e+04
mean	1.269088e+07	1.217241e+07
std	6.555971e+07	6.421446e+07
min	7.868296e+01	5.029157e+01
25%	9.576943e+04	6.875439e+04
50%	6.278332e+05	5.329521e+05
75%	3.070281e+06	2.742651e+06
max	1.157286e+09	1.131582e+09

11 - wyświetlić informację statystyczną o kolumnach kategoryzowanych (ile unikalnych wartości, top - jaka jest najpopularniejsza wartość, freq - jak często najpopularniejsza)

[12]:
```
df.describe(include = 'all')
```

[12]:

	measure_name	location_id	location_name	sex_id	sex_name
count	20970	20970.000000	20970	20970.000000	20970
unique	1	NaN	231	NaN	3
top	Number of Smokers	NaN	South Asia	NaN	Male
freq	20970	NaN	180	NaN	6990
mean	NaN	131.111588	NaN	2.000000	NaN
std	NaN	95.055111	NaN	0.816516	NaN
min	NaN	1.000000	NaN	1.000000	NaN
25%	NaN	61.000000	NaN	1.000000	NaN
50%	NaN	119.000000	NaN	2.000000	NaN
75%	NaN	177.000000	NaN	3.000000	NaN
max	NaN	522.000000	NaN	3.000000	NaN

	age_group_id	age_group_name	year_id	val	upper
count	20970.0	20970	20970.000000	2.097000e+04	2.097000e+04
unique	NaN	1	NaN	NaN	NaN
top	NaN	15+ years	NaN	NaN	NaN
freq	NaN	20970	NaN	NaN	NaN
mean	29.0	NaN	2004.500000	1.242807e+07	1.269088e+07
std	0.0	NaN	8.655648	6.489191e+07	6.555971e+07
min	29.0	NaN	1990.000000	6.345717e+01	7.868296e+01
25%	29.0	NaN	1997.000000	8.201065e+04	9.576943e+04
50%	29.0	NaN	2004.500000	5.777123e+05	6.278332e+05
75%	29.0	NaN	2012.000000	2.901197e+06	3.070281e+06
max	29.0	NaN	2019.000000	1.144819e+09	1.157286e+09

	lower
count	2.097000e+04
unique	NaN
top	NaN
freq	NaN
mean	1.217241e+07
std	6.421446e+07
min	5.029157e+01
25%	6.875439e+04
50%	5.329521e+05
75%	2.742651e+06
max	1.131582e+09

12 - usunąć brakujące wartości w ramce danych

[13]:
```
df.dropna(inplace=True)
df
```

[13]:

	measure_name	location_id	location_name	sex_id	sex_name
0	Number of Smokers	1	Global	1	Male
1	Number of Smokers	1	Global	2	Female

```
2      Number of Smokers            1        Global       3     Both
3      Number of Smokers            1        Global       1     Male
4      Number of Smokers            1        Global       2   Female
…                    …          …           …     …      …
20965  Number of Smokers          522         Sudan       2   Female
20966  Number of Smokers          522         Sudan       3     Both
20967  Number of Smokers          522         Sudan       1     Male
20968  Number of Smokers          522         Sudan       2   Female
20969  Number of Smokers          522         Sudan       3     Both

       age_group_id age_group_name  year_id           val         upper  \
0                29      15+ years     1990  8.031015e+08  8.096221e+08
1                29      15+ years     1990  1.891488e+08  1.930929e+08
2                29      15+ years     1990  9.922503e+08  1.000161e+09
3                29      15+ years     1991  8.138972e+08  8.200339e+08
4                29      15+ years     1991  1.905375e+08  1.944249e+08
…               …             …       …           …            …
20965            29      15+ years     2018  2.435999e+05  3.286166e+05
20966            29      15+ years     2018  2.610672e+06  2.833943e+06
20967            29      15+ years     2019  2.439150e+06  2.656579e+06
20968            29      15+ years     2019  2.500800e+05  3.345384e+05
20969            29      15+ years     2019  2.689230e+06  2.918332e+06

              lower
0      7.959086e+08
1      1.855595e+08
2      9.847880e+08
3      8.069514e+08
4      1.869744e+08
…             …
20965  1.752508e+05
20966  2.409108e+06
20967  2.236450e+06
20968  1.816686e+05
20969  2.480656e+06

[20970 rows x 11 columns]
```

13 - przedstawić wybór wierszy i kolumny używając nazw oraz indeksów na różne sposoby

[14]:
```
df["location_name"]
```

[14]:
```
0        Global
1        Global
2        Global
3        Global
4        Global
```

```
          …
20965     Sudan
20966     Sudan
20967     Sudan
20968     Sudan
20969     Sudan
Name: location_name, Length: 20970, dtype: object
```

[15]:
```
df.location_name
```

[15]:
```
0        Global
1        Global
2        Global
3        Global
4        Global
          …
20965     Sudan
20966     Sudan
20967     Sudan
20968     Sudan
20969     Sudan
Name: location_name, Length: 20970, dtype: object
```

[16]:
```
df[["location_name","sex_name","year_id"]]
```

[16]:
```
      location_name sex_name  year_id
0            Global     Male     1990
1            Global   Female     1990
2            Global     Both     1990
3            Global     Male     1991
4            Global   Female     1991
…             …       …       …
20965         Sudan   Female     2018
20966         Sudan     Both     2018
20967         Sudan     Male     2019
20968         Sudan   Female     2019
20969         Sudan     Both     2019

[20970 rows x 3 columns]
```

[17]:
```
df.loc[100:110, "location_name":"year_id"]
```

[17]:
```
                              location_name  sex_id sex_name  age_group_id  \
100  Southeast Asia, East Asia, and Oceania       2   Female            29
101  Southeast Asia, East Asia, and Oceania       3     Both            29
102  Southeast Asia, East Asia, and Oceania       1     Male            29
103  Southeast Asia, East Asia, and Oceania       2   Female            29
```

```
104  Southeast Asia, East Asia, and Oceania       3     Both            29
105  Southeast Asia, East Asia, and Oceania       1     Male            29
106  Southeast Asia, East Asia, and Oceania       2   Female            29
107  Southeast Asia, East Asia, and Oceania       3     Both            29
108  Southeast Asia, East Asia, and Oceania       1     Male            29
109  Southeast Asia, East Asia, and Oceania       2   Female            29
110  Southeast Asia, East Asia, and Oceania       3     Both            29

    age_group_name  year_id
100      15+ years     1993
101      15+ years     1993
102      15+ years     1994
103      15+ years     1994
104      15+ years     1994
105      15+ years     1995
106      15+ years     1995
107      15+ years     1995
108      15+ years     1996
109      15+ years     1996
110      15+ years     1996
```

[18]:
```
df.iloc[105:115, 0:3]
```

[18]:
```
          measure_name  location_id                          location_name
105  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
106  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
107  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
108  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
109  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
110  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
111  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
112  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
113  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
114  Number of Smokers            4  Southeast Asia, East Asia, and Oceania
```

14 - przedstawić wybór wierszy z ramki danych pod warunkiem odnośnie określonej wartości kolumny

[19]:
```
df[df["sex_name"] == "Both"]
```

[19]:
```
            measure_name  location_id location_name  sex_id sex_name  \
2      Number of Smokers            1        Global       3     Both
5      Number of Smokers            1        Global       3     Both
8      Number of Smokers            1        Global       3     Both
11     Number of Smokers            1        Global       3     Both
14     Number of Smokers            1        Global       3     Both
…                    …            …             …      …       …
```

```
20957  Number of Smokers          522         Sudan       3     Both
20960  Number of Smokers          522         Sudan       3     Both
20963  Number of Smokers          522         Sudan       3     Both
20966  Number of Smokers          522         Sudan       3     Both
20969  Number of Smokers          522         Sudan       3     Both

       age_group_id age_group_name  year_id           val         upper  \
2                29      15+ years     1990  9.922503e+08  1.000161e+09
5                29      15+ years     1991  1.004435e+09  1.011925e+09
8                29      15+ years     1992  1.015217e+09  1.022720e+09
11               29      15+ years     1993  1.024669e+09  1.031965e+09
14               29      15+ years     1994  1.032567e+09  1.039842e+09
…               …            …        …           …            …
20957            29      15+ years     2015  2.388216e+06  2.587005e+06
20960            29      15+ years     2016  2.454893e+06  2.665441e+06
20963            29      15+ years     2017  2.535003e+06  2.743769e+06
20966            29      15+ years     2018  2.610672e+06  2.833943e+06
20969            29      15+ years     2019  2.689230e+06  2.918332e+06

              lower
2      9.847880e+08
5      9.969811e+08
8      1.007847e+09
11     1.017551e+09
14     1.025631e+09
…             …
20957  2.211144e+06
20960  2.267696e+06
20963  2.341329e+06
20966  2.409108e+06
20969  2.480656e+06

[6990 rows x 11 columns]
```

15 - przedstawić wybór wierszy z ramki danych pod warunkiem spełnienia kilku warunkow jednocześnie

[20]:
```
df[(df["sex_name"] == "Both") & (df["year_id"] == 2016) & (df["location_name"]␣
 ↪== "Sudan")]
```

[20]:
```
            measure_name  location_id location_name  sex_id sex_name  \
20960  Number of Smokers          522         Sudan       3     Both

       age_group_id age_group_name  year_id          val        upper  \
20960            29      15+ years     2016  2454892.625  2665440.938

             lower
```

```
20960  2267696.034
```

16 - wybrać wiersze które zawierają w kolumnie kategoryzowanej określone słowo

[21]:
```
df[df["location_name"].str.contains("States")]
```

[21]:
```
            measure_name  location_id                    location_name  \
1980   Number of Smokers           25  Micronesia (Federated States of)
1981   Number of Smokers           25  Micronesia (Federated States of)
1982   Number of Smokers           25  Micronesia (Federated States of)
1983   Number of Smokers           25  Micronesia (Federated States of)
1984   Number of Smokers           25  Micronesia (Federated States of)
…                    …          …                                   …
20785  Number of Smokers          422      United States Virgin Islands
20786  Number of Smokers          422      United States Virgin Islands
20787  Number of Smokers          422      United States Virgin Islands
20788  Number of Smokers          422      United States Virgin Islands
20789  Number of Smokers          422      United States Virgin Islands

       sex_id sex_name  age_group_id age_group_name  year_id           val  \
1980        1     Male            29      15+ years     1990  18134.775290
1981        2   Female            29      15+ years     1990   9470.305481
1982        3     Both            29      15+ years     1990  27605.080770
1983        1     Male            29      15+ years     1991  18395.672830
1984        2   Female            29      15+ years     1991   9658.519070
…       …       …             …             …       …           …
20785       2   Female            29      15+ years     2018   2308.376511
20786       3     Both            29      15+ years     2018   5633.535832
20787       1     Male            29      15+ years     2019   3280.527338
20788       2   Female            29      15+ years     2019   2282.281664
20789       3     Both            29      15+ years     2019   5562.809002

              upper         lower
1980   19169.248820  17155.196930
1981   11156.303110   7825.944174
1982   29580.226920  25829.741340
1983   19459.617700  17385.018410
1984   11404.994170   7961.453848
…               …             …
20785   2820.434508   1871.029388
20786   6212.418101   5090.184376
20787   3649.862482   2939.996840
20788   2813.914814   1831.778372
20789   6146.429254   4990.914042

[270 rows x 11 columns]
```

17 - wybrać wiersze które nie zawierają w kolumnie kategoryzowanej określone słowo

[22]:
```
df[~df["location_name"].str.contains("States")]
```

[22]:

	measure_name	location_id	location_name	sex_id	sex_name	\
0	Number of Smokers	1	Global	1	Male	
1	Number of Smokers	1	Global	2	Female	
2	Number of Smokers	1	Global	3	Both	
3	Number of Smokers	1	Global	1	Male	
4	Number of Smokers	1	Global	2	Female	
…	…	…	…	…	…	
20965	Number of Smokers	522	Sudan	2	Female	
20966	Number of Smokers	522	Sudan	3	Both	
20967	Number of Smokers	522	Sudan	1	Male	
20968	Number of Smokers	522	Sudan	2	Female	
20969	Number of Smokers	522	Sudan	3	Both	

	age_group_id	age_group_name	year_id	val	upper	\
0	29	15+ years	1990	8.031015e+08	8.096221e+08	
1	29	15+ years	1990	1.891488e+08	1.930929e+08	
2	29	15+ years	1990	9.922503e+08	1.000161e+09	
3	29	15+ years	1991	8.138972e+08	8.200339e+08	
4	29	15+ years	1991	1.905375e+08	1.944249e+08	
…	…	…	…	…	…	
20965	29	15+ years	2018	2.435999e+05	3.286166e+05	
20966	29	15+ years	2018	2.610672e+06	2.833943e+06	
20967	29	15+ years	2019	2.439150e+06	2.656579e+06	
20968	29	15+ years	2019	2.500800e+05	3.345384e+05	
20969	29	15+ years	2019	2.689230e+06	2.918332e+06	

	lower
0	7.959086e+08
1	1.855595e+08
2	9.847880e+08
3	8.069514e+08
4	1.869744e+08
…	…
20965	1.752508e+05
20966	2.409108e+06
20967	2.236450e+06
20968	1.816686e+05
20969	2.480656e+06

[20700 rows x 11 columns]

18 - utwórz kolumnę na podstawie istniejącyn

[23]:
```
df["new_location_name"] = df["location_name"]
df
```

[23]:

	measure_name	location_id	location_name	sex_id	sex_name	\
0	Number of Smokers	1	Global	1	Male	
1	Number of Smokers	1	Global	2	Female	
2	Number of Smokers	1	Global	3	Both	
3	Number of Smokers	1	Global	1	Male	
4	Number of Smokers	1	Global	2	Female	
…	…	…	…	…	…	
20965	Number of Smokers	522	Sudan	2	Female	
20966	Number of Smokers	522	Sudan	3	Both	
20967	Number of Smokers	522	Sudan	1	Male	
20968	Number of Smokers	522	Sudan	2	Female	
20969	Number of Smokers	522	Sudan	3	Both	

	age_group_id	age_group_name	year_id	val	upper	\
0	29	15+ years	1990	8.031015e+08	8.096221e+08	
1	29	15+ years	1990	1.891488e+08	1.930929e+08	
2	29	15+ years	1990	9.922503e+08	1.000161e+09	
3	29	15+ years	1991	8.138972e+08	8.200339e+08	
4	29	15+ years	1991	1.905375e+08	1.944249e+08	
…	…	…	…	…	…	
20965	29	15+ years	2018	2.435999e+05	3.286166e+05	
20966	29	15+ years	2018	2.610672e+06	2.833943e+06	
20967	29	15+ years	2019	2.439150e+06	2.656579e+06	
20968	29	15+ years	2019	2.500800e+05	3.345384e+05	
20969	29	15+ years	2019	2.689230e+06	2.918332e+06	

	lower	new_location_name
0	7.959086e+08	Global
1	1.855595e+08	Global
2	9.847880e+08	Global
3	8.069514e+08	Global
4	1.869744e+08	Global
…	…	…
20965	1.752508e+05	Sudan
20966	2.409108e+06	Sudan
20967	2.236450e+06	Sudan
20968	1.816686e+05	Sudan
20969	2.480656e+06	Sudan

[20970 rows x 12 columns]

19 - usuń kolumnę

[24]:
```
df.drop("new_location_name", axis=1, inplace = True)
df
```

[24]:
```
             measure_name  location_id location_name  sex_id sex_name  \
0      Number of Smokers            1        Global       1     Male
1      Number of Smokers            1        Global       2   Female
2      Number of Smokers            1        Global       3     Both
3      Number of Smokers            1        Global       1     Male
4      Number of Smokers            1        Global       2   Female
…                    …          …           …      …      …
20965  Number of Smokers          522         Sudan       2   Female
20966  Number of Smokers          522         Sudan       3     Both
20967  Number of Smokers          522         Sudan       1     Male
20968  Number of Smokers          522         Sudan       2   Female
20969  Number of Smokers          522         Sudan       3     Both

       age_group_id age_group_name  year_id           val          upper  \
0                29      15+ years     1990  8.031015e+08  8.096221e+08
1                29      15+ years     1990  1.891488e+08  1.930929e+08
2                29      15+ years     1990  9.922503e+08  1.000161e+09
3                29      15+ years     1991  8.138972e+08  8.200339e+08
4                29      15+ years     1991  1.905375e+08  1.944249e+08
…               …            …       …           …           …
20965            29      15+ years     2018  2.435999e+05  3.286166e+05
20966            29      15+ years     2018  2.610672e+06  2.833943e+06
20967            29      15+ years     2019  2.439150e+06  2.656579e+06
20968            29      15+ years     2019  2.500800e+05  3.345384e+05
20969            29      15+ years     2019  2.689230e+06  2.918332e+06

              lower
0      7.959086e+08
1      1.855595e+08
2      9.847880e+08
3      8.069514e+08
4      1.869744e+08
…               …
20965  1.752508e+05
20966  2.409108e+06
20967  2.236450e+06
20968  1.816686e+05
20969  2.480656e+06

[20970 rows x 11 columns]
```

20 - zmień nazwę kolumny

[25]:
```
df.rename(columns = {"year_id": "year"}, inplace = True)
df
```

[25]:
```
            measure_name  location_id location_name  sex_id sex_name  \
0      Number of Smokers            1        Global       1     Male
1      Number of Smokers            1        Global       2   Female
2      Number of Smokers            1        Global       3     Both
3      Number of Smokers            1        Global       1     Male
4      Number of Smokers            1        Global       2   Female
…                    …          …           …     …      …
20965  Number of Smokers          522         Sudan       2   Female
20966  Number of Smokers          522         Sudan       3     Both
20967  Number of Smokers          522         Sudan       1     Male
20968  Number of Smokers          522         Sudan       2   Female
20969  Number of Smokers          522         Sudan       3     Both

       age_group_id age_group_name  year           val         upper  \
0                29      15+ years  1990  8.031015e+08  8.096221e+08
1                29      15+ years  1990  1.891488e+08  1.930929e+08
2                29      15+ years  1990  9.922503e+08  1.000161e+09
3                29      15+ years  1991  8.138972e+08  8.200339e+08
4                29      15+ years  1991  1.905375e+08  1.944249e+08
…               …            …   …           …          …
20965            29      15+ years  2018  2.435999e+05  3.286166e+05
20966            29      15+ years  2018  2.610672e+06  2.833943e+06
20967            29      15+ years  2019  2.439150e+06  2.656579e+06
20968            29      15+ years  2019  2.500800e+05  3.345384e+05
20969            29      15+ years  2019  2.689230e+06  2.918332e+06

              lower
0      7.959086e+08
1      1.855595e+08
2      9.847880e+08
3      8.069514e+08
4      1.869744e+08
…              …
20965  1.752508e+05
20966  2.409108e+06
20967  2.236450e+06
20968  1.816686e+05
20969  2.480656e+06

[20970 rows x 11 columns]
```

21 - zachowaj ramkę danych jako plik csv na komputerze

[26]:
```
df.to_csv("Lab1_eiwd_Justyna_Kowal.csv")
```

22 - wyświetlić średnia (maksymalną, minimalną) wartość z jednej kolumny

[27]:
```
df["val"].mean() #średnia
```

[27]:
```
12428071.383604305
```

[28]:
```
df['val'].max() #maksymalna
```

[28]:
```
1144818597.0
```

[29]:
```
df['val'].min() #minimalna
```

[29]:
```
63.45716608
```

23 - wyświetlić liczbę wierszy

[30]:
```
df['measure_name'].count()
```

[30]:
```
20970
```

24 - wyświetlić wartości unikatowe w kolumnie

[31]:
```
df['sex_name'].unique()
```

[31]:
```
array(['Male', 'Female', 'Both'], dtype=object)
```

25 - wyświetlić liczby rekordów odpowiadających do wartości

[32]:
```
df['sex_name'].value_counts()
```

[32]:
```
Male      6990
Female    6990
Both      6990
Name: sex_name, dtype: int64
```

26 - sortowanie wierszy ramki danych według wartości określonej kolumny (malejąco, rosnąo)

[33]:
```
df.sort_values(['sex_id'], ascending = False)
```

[33]:

	measure_name	location_id	location_name	sex_id	\
20969	Number of Smokers	522	Sudan	3	
8456	Number of Smokers	96	Southern Latin America	3	
18149	Number of Smokers	205	Côte d'Ivoire	3	
8462	Number of Smokers	97	Argentina	3	
8465	Number of Smokers	97	Argentina	3	
…	…	…	…	…	
10488	Number of Smokers	119	Trinidad and Tobago	1	
10491	Number of Smokers	119	Trinidad and Tobago	1	
10494	Number of Smokers	119	Trinidad and Tobago	1	
10497	Number of Smokers	119	Trinidad and Tobago	1	
10485	Number of Smokers	119	Trinidad and Tobago	1	

```
      sex_name  age_group_id age_group_name  year           val         upper  \
20969     Both            29      15+ years  2019  2.689230e+06  2.918332e+06
8456      Both            29      15+ years  2018  1.375418e+07  1.433091e+07
18149     Both            29      15+ years  2009  1.851309e+06  1.958859e+06
8462      Both            29      15+ years  1990  6.940515e+06  7.626183e+06
8465      Both            29      15+ years  1991  6.966965e+06  7.650883e+06
…          …             …             …    …           …             …
10488     Male            29      15+ years  2006  1.543484e+05  1.663233e+05
10491     Male            29      15+ years  2007  1.567341e+05  1.686857e+05
10494     Male            29      15+ years  2008  1.588890e+05  1.709821e+05
10497     Male            29      15+ years  2009  1.603883e+05  1.724855e+05
10485     Male            29      15+ years  2005  1.516994e+05  1.639840e+05

              lower
20969  2.480656e+06
8456   1.317504e+07
18149  1.740542e+06
8462   6.336184e+06
8465   6.364471e+06
…               …
10488  1.431156e+05
10491  1.452546e+05
10494  1.474781e+05
10497  1.481193e+05
10485  1.401675e+05

[20970 rows x 11 columns]
```

[34]:
```
df.sort_values(['sex_id'], ascending = True)
```

[34]:
```
            measure_name  location_id        location_name  sex_id sex_name  \
0      Number of Smokers            1               Global       1     Male
18147  Number of Smokers          205        Côte d'Ivoire       1     Male
8463   Number of Smokers           97            Argentina       1     Male
8466   Number of Smokers           97            Argentina       1     Male
8469   Number of Smokers           97            Argentina       1     Male
…                    …          …                    …     …       …
10490  Number of Smokers          119  Trinidad and Tobago       3     Both
10493  Number of Smokers          119  Trinidad and Tobago       3     Both
10496  Number of Smokers          119  Trinidad and Tobago       3     Both
10439  Number of Smokers          118             Suriname       3     Both
20969  Number of Smokers          522                Sudan       3     Both

       age_group_id age_group_name  year           val         upper  \
0                29      15+ years  1990  8.031015e+08  8.096221e+08
18147            29      15+ years  2009  1.610315e+06  1.701718e+06
8463             29      15+ years  1991  3.962138e+06  4.302021e+06
```

```
8466              29      15+ years  1992  3.971895e+06  4.312380e+06
8469              29      15+ years  1993  3.985485e+06  4.306737e+06
…                 …         …        …          …             …
10490             29      15+ years  2006  1.964041e+05  2.110698e+05
10493             29      15+ years  2007  1.993844e+05  2.138476e+05
10496             29      15+ years  2008  2.020567e+05  2.162465e+05
10439             29      15+ years  2019  9.249139e+04  9.954819e+04
20969             29      15+ years  2019  2.689230e+06  2.918332e+06

              lower
0      7.959086e+08
18147  1.518489e+06
8463   3.640765e+06
8466   3.661012e+06
8469   3.673090e+06
…               …
10490  1.829523e+05
10493  1.858097e+05
10496  1.881899e+05
10439  8.606268e+04
20969  2.480656e+06

[20970 rows x 11 columns]
```

27 - wyświetlić wierszy dla 10 największych (najmniejszych) wartości określonej kolumny

[35]:
```
df.nlargest(10,'location_id')
```

[35]:
```
            measure_name  location_id location_name  sex_id sex_name  \
20880  Number of Smokers          522         Sudan       1     Male
20881  Number of Smokers          522         Sudan       2   Female
20882  Number of Smokers          522         Sudan       3     Both
20883  Number of Smokers          522         Sudan       1     Male
20884  Number of Smokers          522         Sudan       2   Female
20885  Number of Smokers          522         Sudan       3     Both
20886  Number of Smokers          522         Sudan       1     Male
20887  Number of Smokers          522         Sudan       2   Female
20888  Number of Smokers          522         Sudan       3     Both
20889  Number of Smokers          522         Sudan       1     Male

       age_group_id age_group_name  year           val         upper  \
20880            29      15+ years  1990  1.210513e+06  1.343292e+06
20881            29      15+ years  1990  1.295362e+05  1.719868e+05
20882            29      15+ years  1990  1.340050e+06  1.481698e+06
20883            29      15+ years  1991  1.260431e+06  1.394211e+06
20884            29      15+ years  1991  1.341847e+05  1.777673e+05
20885            29      15+ years  1991  1.394615e+06  1.538089e+06
```

```
20886            29      15+ years  1992  1.309607e+06  1.446107e+06
20887            29      15+ years  1992  1.388423e+05  1.850937e+05
20888            29      15+ years  1992  1.448449e+06  1.588898e+06
20889            29      15+ years  1993  1.357387e+06  1.498584e+06

              lower
20880  1.085168e+06
20881  9.532772e+04
20882  1.204444e+06
20883  1.132721e+06
20884  9.848629e+04
20885  1.254003e+06
20886  1.180870e+06
20887  1.019466e+05
20888  1.304217e+06
20889  1.225640e+06
```

[36]:
```
df.nsmallest(10,'location_id')
```

[36]:
```
         measure_name  location_id location_name  sex_id sex_name  \
0  Number of Smokers             1        Global       1     Male
1  Number of Smokers             1        Global       2   Female
2  Number of Smokers             1        Global       3     Both
3  Number of Smokers             1        Global       1     Male
4  Number of Smokers             1        Global       2   Female
5  Number of Smokers             1        Global       3     Both
6  Number of Smokers             1        Global       1     Male
7  Number of Smokers             1        Global       2   Female
8  Number of Smokers             1        Global       3     Both
9  Number of Smokers             1        Global       1     Male

   age_group_id age_group_name  year           val         upper         lower
0            29      15+ years  1990  8.031015e+08  8.096221e+08  7.959086e+08
1            29      15+ years  1990  1.891488e+08  1.930929e+08  1.855595e+08
2            29      15+ years  1990  9.922503e+08  1.000161e+09  9.847880e+08
3            29      15+ years  1991  8.138972e+08  8.200339e+08  8.069514e+08
4            29      15+ years  1991  1.905375e+08  1.944249e+08  1.869744e+08
5            29      15+ years  1991  1.004435e+09  1.011925e+09  9.969811e+08
6            29      15+ years  1992  8.233148e+08  8.292228e+08  8.167264e+08
7            29      15+ years  1992  1.919026e+08  1.957109e+08  1.884066e+08
8            29      15+ years  1992  1.015217e+09  1.022720e+09  1.007847e+09
9            29      15+ years  1993  8.313873e+08  8.372931e+08  8.249496e+08
```

28 - wyświetlić wierszy dla 10 największych wartości określonej kolumny pod warunkiem określonych wartości innej kolumny

[37]:
```
df[df['year'] == 2015].nlargest(10,'location_id')
```

[37]:

	measure_name	location_id	location_name	sex_id	\
20955	Number of Smokers	522	Sudan	1	
20956	Number of Smokers	522	Sudan	2	
20957	Number of Smokers	522	Sudan	3	
20865	Number of Smokers	435	South Sudan	1	
20866	Number of Smokers	435	South Sudan	2	
20867	Number of Smokers	435	South Sudan	3	
20775	Number of Smokers	422	United States Virgin Islands	1	
20776	Number of Smokers	422	United States Virgin Islands	2	
20777	Number of Smokers	422	United States Virgin Islands	3	
20685	Number of Smokers	416	Tuvalu	1	

	sex_name	age_group_id	age_group_name	year	val	upper	\
20955	Male	29	15+ years	2015	2.159385e+06	2.329364e+06	
20956	Female	29	15+ years	2015	2.288306e+05	3.056884e+05	
20957	Both	29	15+ years	2015	2.388216e+06	2.587005e+06	
20865	Male	29	15+ years	2015	4.716963e+05	5.254786e+05	
20866	Female	29	15+ years	2015	5.970915e+04	7.713253e+04	
20867	Both	29	15+ years	2015	5.314055e+05	5.866896e+05	
20775	Male	29	15+ years	2015	3.466521e+03	3.821509e+03	
20776	Female	29	15+ years	2015	2.390917e+03	2.845169e+03	
20777	Both	29	15+ years	2015	5.857438e+03	6.406057e+03	
20685	Male	29	15+ years	2015	1.854994e+03	1.955782e+03	

	lower
20955	1.990166e+06
20956	1.694027e+05
20957	2.211144e+06
20865	4.222599e+05
20866	4.480880e+04
20867	4.787462e+05
20775	3.149973e+03
20776	1.981502e+03
20777	5.368333e+03
20685	1.751382e+03

29 - grupowanie wierszy wedlug wartości kolumny kategoryzowanej, potem - uśrednienie wartości wszystkich kolumn w grupie - MultiIndex

[38]:
```
df.groupby('sex_name').agg({'age_group_id': ['count'],'val': ['mean']})
```

[38]:

	age_group_id	val
	count	mean
sex_name		
Both	6990	1.864211e+07
Female	6990	3.441201e+06
Male	6990	1.520091e+07

30 - grupowanie wierszy wedlug wartości kolumny kategoryzowanej, potem - uśrednienie wartości dla pewnych kolumn, liczba wartości i mediana dla pozostałych kolumn w grupach

[39]:
```
df.groupby('sex_name').agg({'age_group_id': ['count'],'val': ['mean',␣
↪'median']})
```

[39]:
```
          age_group_id           val
                 count          mean       median
sex_name
Both              6990  1.864211e+07  968560.4033
Female            6990  3.441201e+06  177406.7973
Male              6990  1.520091e+07  721673.5286
```

31 - wyświetlić nazwy kolumn indeksu złożonego

[40]:
```
df.index
```

[40]:
```
RangeIndex(start=0, stop=20970, step=1)
```

[41]:
```
df_sexname = df.groupby('sex_name').agg({'age_group_id': ['count'],'val':␣
↪['mean', 'median']})
df_sexname.columns
```

[41]:
```
MultiIndex([('age_group_id',  'count'),
            (         'val',   'mean'),
            (         'val', 'median')],
           )
```

32 - sortować kolumnę indeksu złożonego

[42]:
```
df_sexname['val']['mean'].sort_values(ascending = False)
```

[42]:
```
sex_name
Both      1.864211e+07
Male      1.520091e+07
Female    3.441201e+06
Name: mean, dtype: float64
```

33 - stworzyć tabelę przystawną (pivot table) na podstawie ramki danych

[43]:
```
df_pivot = df.pivot_table(values='sex_id', index='location_name',␣
↪columns='sex_name',
                          margins=False, dropna=True, fill_value=None)
df_pivot
```

[43]:
```
sex_name                    Both  Female  Male
location_name
Afghanistan                    3       2     1
```

```
Albania                          3       2     1
Algeria                          3       2     1
American Samoa                   3       2     1
Andean Latin America             3       2     1
…                              …       …     …
Western Europe                   3       2     1
Western Sub-Saharan Africa       3       2     1
Yemen                            3       2     1
Zambia                           3       2     1
Zimbabwe                         3       2     1

[231 rows x 3 columns]
```

34 - wyświetlić indeksy i kolumny tabeli przystawnej

[44]:
```
df_pivot.index
```

[44]:
```
Index(['Afghanistan', 'Albania', 'Algeria', 'American Samoa',
       'Andean Latin America', 'Andorra', 'Angola', 'Antigua and Barbuda',
       'Argentina', 'Armenia',
       …
       'Uruguay', 'Uzbekistan', 'Vanuatu',
       'Venezuela (Bolivarian Republic of)', 'Viet Nam', 'Western Europe',
       'Western Sub-Saharan Africa', 'Yemen', 'Zambia', 'Zimbabwe'],
      dtype='object', name='location_name', length=231)
```

[45]:
```
df_pivot.columns
```

[45]:
```
Index(['Both', 'Female', 'Male'], dtype='object', name='sex_name')
```

35 - utwórz indeks złożony tabeli przystawnej i wyświetl go

[46]:
```
df_pivot = df.pivot_table(values='sex_id', index=['location_name',␣
 ↪'location_id'], columns='sex_name',
                          margins=False, dropna=True, fill_value=None)
df_pivot
```

[46]:
```
sex_name                                Both  Female  Male
location_name              location_id
Afghanistan                160             3       2     1
Albania                    43              3       2     1
Algeria                    139             3       2     1
American Samoa             298             3       2     1
Andean Latin America       120             3       2     1
…                                        …       …     …
Western Europe             73              3       2     1
Western Sub-Saharan Africa 199             3       2     1
Yemen                      157             3       2     1
```

```
Zambia                    191             3       2     1
Zimbabwe                  198             3       2     1

[233 rows x 3 columns]
```

[47]:
```
df_pivot.index
```

[47]:
```
MultiIndex([(                       'Afghanistan', 160),
            (                           'Albania',  43),
            (                           'Algeria', 139),
            (                      'American Samoa', 298),
            (                'Andean Latin America', 120),
            (                           'Andorra',  74),
            (                            'Angola', 168),
            (                 'Antigua and Barbuda', 105),
            (                         'Argentina',  97),
            (                           'Armenia',  33),
            …
            (                           'Uruguay',  99),
            (                        'Uzbekistan',  41),
            (                           'Vanuatu',  30),
            ('Venezuela (Bolivarian Republic of)', 133),
            (                          'Viet Nam',  20),
            (                    'Western Europe',  73),
            (         'Western Sub-Saharan Africa', 199),
            (                             'Yemen', 157),
            (                            'Zambia', 191),
            (                          'Zimbabwe', 198)],
           names=['location_name', 'location_id'], length=233)
```

36 - zaimportuj moduł pyplot z biblioteki matplotlib

[48]:
```
import matplotlib.pyplot as plt
```

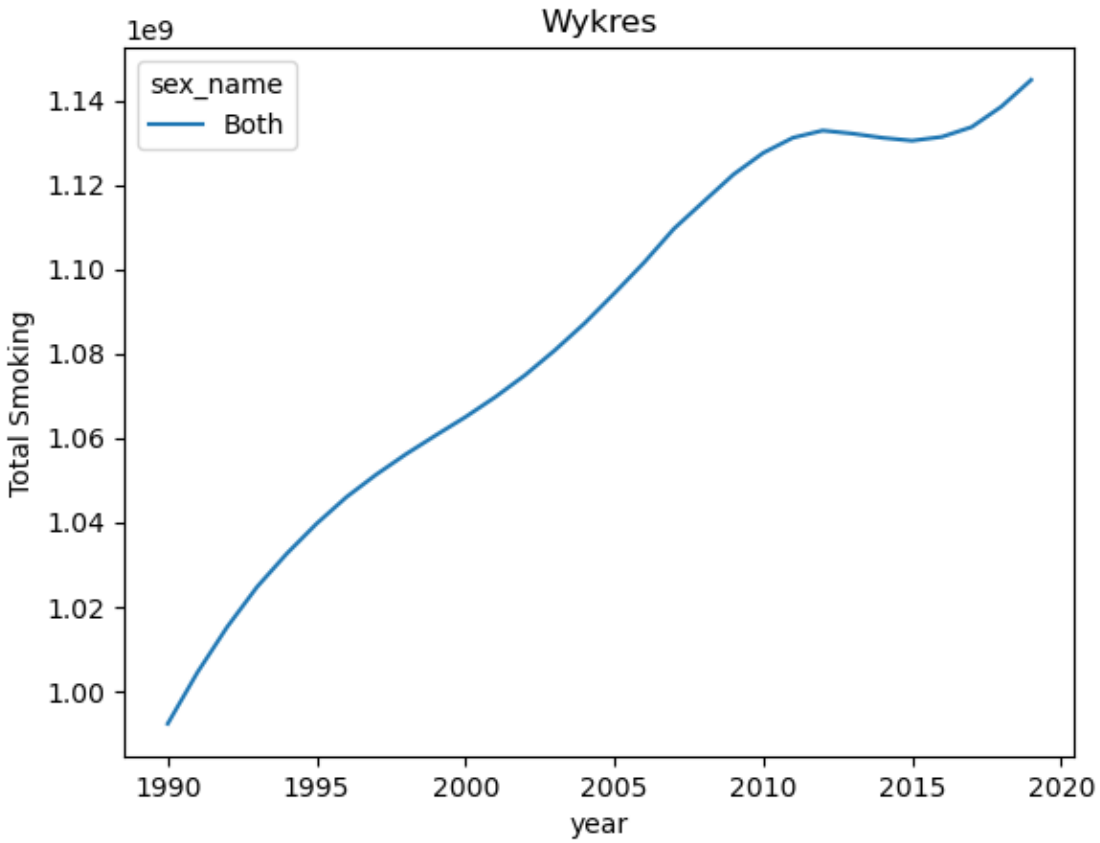
37 - wskazać, że wykresy należy rysować bezpośrednio w zeszycie, a nie w osobnej zakładce

[49]:
```
%matplotlib inline
```

38 - wyświetlić wykres na podstawie tabeli przystawnej

[50]:
```
df[(df['location_name'] == 'Global') & (df['age_group_name'] == '15+ years') &
  (df['sex_name'] == 'Both')].pivot_table(values='val', index='year',␣
 ↪columns='sex_name', aggfunc='mean',
                                         fill_value=None, margins=False,␣
 ↪dropna=True).plot(kind = 'line')
plt.ylabel('Total Smoking')
plt.title('Wykres')
```

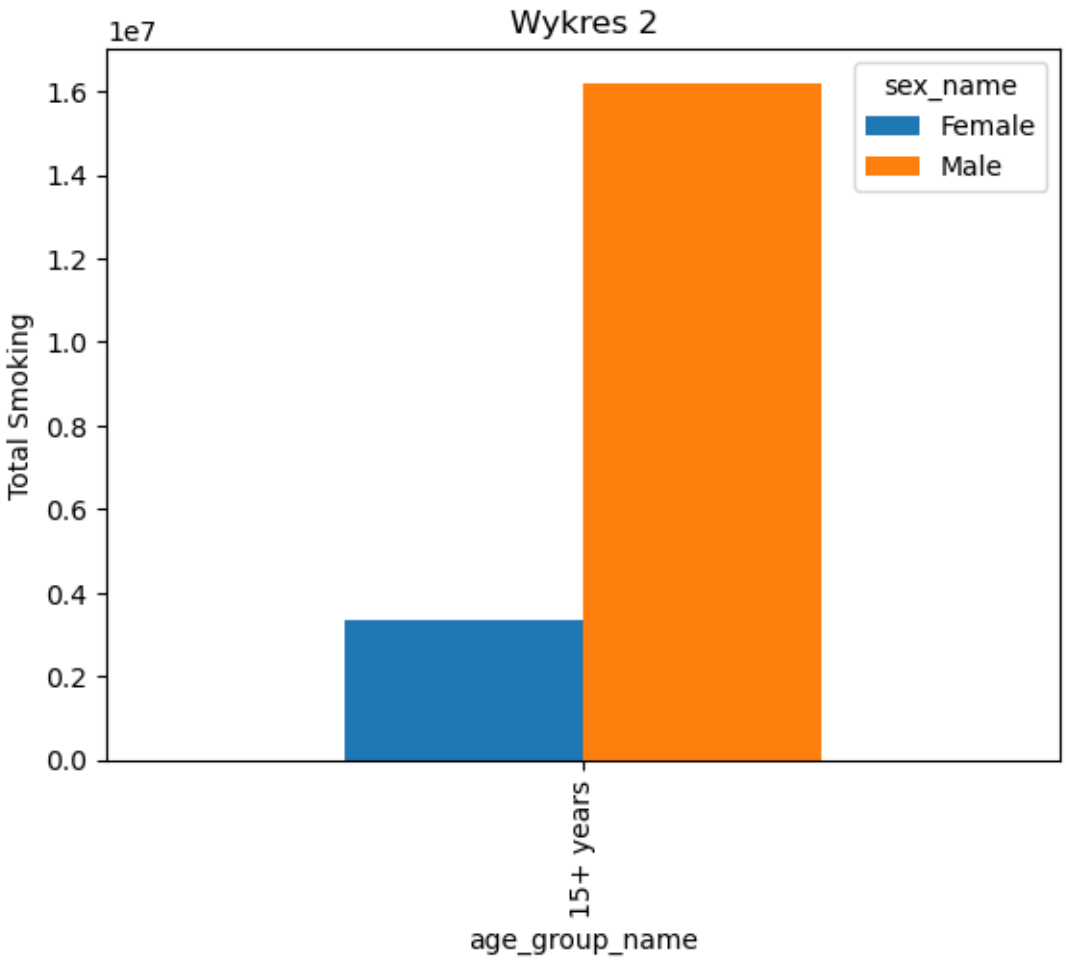
[50]: Text(0.5, 1.0, 'Wykres')



39 - narysować histogram na podstawie wartości kolumny

[51]:
```
df_bar = df[(df['sex_name'].isin(['Male','Female'])) & (df['year'] == 2018)].
 ↪pivot_table(values='val',
                index='age_group_name', columns='sex_name', aggfunc='mean',
                      fill_value=None, margins=False, dropna=True)
df_bar.plot(kind = 'bar')
plt.ylabel('Total Smoking')
plt.title('Wykres 2')
```

[51]: Text(0.5, 1.0, 'Wykres 2')



40 - przedstawić sposoby łączenia ramek danych za pomocą metod merge i concat

[52]:
```
df1 = pd.read_csv("IHME_GBD_2019_SMOKING_TOB_1990_2019_NUM_SMOKERS_Y2021M05D27.
↪csv", encoding = "utf-8")
df2 = pd.read_csv("Lab1_eiwd_Justyna_Kowal.csv", encoding = "utf-8")
```

[53]:
```
df1.rename(columns = {'val': 'val_1', 'upper':'upper_1', 'lower':'lower_1'},␣
↪inplace = True)
df2.rename(columns = {'val': 'val_2', 'upper': 'upper_2', 'lower':'lower_2'},␣
↪inplace = True)
```

[54]:
```
df1
```

[54]:

	measure_name	location_id	location_name	sex_id	sex_name
0	Number of Smokers	1	Global	1	Male
1	Number of Smokers	1	Global	2	Female
2	Number of Smokers	1	Global	3	Both

```
3      Number of Smokers             1        Global       1     Male
4      Number of Smokers             1        Global       2   Female
…                    …           …           …      …      …
20965  Number of Smokers           522         Sudan       2   Female
20966  Number of Smokers           522         Sudan       3     Both
20967  Number of Smokers           522         Sudan       1     Male
20968  Number of Smokers           522         Sudan       2   Female
20969  Number of Smokers           522         Sudan       3     Both

       age_group_id age_group_name  year_id         val_1       upper_1  \
0                29      15+ years     1990  8.031015e+08  8.096221e+08
1                29      15+ years     1990  1.891488e+08  1.930929e+08
2                29      15+ years     1990  9.922503e+08  1.000161e+09
3                29      15+ years     1991  8.138972e+08  8.200339e+08
4                29      15+ years     1991  1.905375e+08  1.944249e+08
…               …             …       …           …           …
20965            29      15+ years     2018  2.435999e+05  3.286166e+05
20966            29      15+ years     2018  2.610672e+06  2.833943e+06
20967            29      15+ years     2019  2.439150e+06  2.656579e+06
20968            29      15+ years     2019  2.500800e+05  3.345384e+05
20969            29      15+ years     2019  2.689230e+06  2.918332e+06

           lower_1
0      7.959086e+08
1      1.855595e+08
2      9.847880e+08
3      8.069514e+08
4      1.869744e+08
…              …
20965  1.752508e+05
20966  2.409108e+06
20967  2.236450e+06
20968  1.816686e+05
20969  2.480656e+06

[20970 rows x 11 columns]
```

[55]:
```
df_all = pd.merge(df1, df2, on = ['location_name', 'sex_name',␣
 ↪'age_group_name'], how = 'inner')
df_all.head()
```

[55]:
```
      measure_name_x  location_id_x location_name  sex_id_x sex_name  \
0  Number of Smokers              1        Global         1     Male
1  Number of Smokers              1        Global         1     Male
2  Number of Smokers              1        Global         1     Male
3  Number of Smokers              1        Global         1     Male
4  Number of Smokers              1        Global         1     Male
```

```
   age_group_id_x age_group_name  year_id        val_1      upper_1  \
0              29      15+ years     1990  803101467.1  809622101.0
1              29      15+ years     1990  803101467.1  809622101.0
2              29      15+ years     1990  803101467.1  809622101.0
3              29      15+ years     1990  803101467.1  809622101.0
4              29      15+ years     1990  803101467.1  809622101.0

       lower_1  Unnamed: 0     measure_name_y  location_id_y  sex_id_y  \
0  795908635.8           0  Number of Smokers              1         1
1  795908635.8           3  Number of Smokers              1         1
2  795908635.8           6  Number of Smokers              1         1
3  795908635.8           9  Number of Smokers              1         1
4  795908635.8          12  Number of Smokers              1         1

   age_group_id_y  year        val_2      upper_2      lower_2
0              29  1990  803101467.1  809622101.0  795908635.8
1              29  1991  813897216.4  820033926.0  806951447.9
2              29  1992  823314827.8  829222821.2  816726365.2
3              29  1993  831387254.4  837293112.8  824949648.0
4              29  1994  837820449.8  843723308.3  831634003.9
```

[56]:
```
df_all_1 = df_all.iloc[:50000,:]
df_all_2 = df_all.iloc[50000:,:]

df_all_new = pd.concat([df_all_1, df_all_2], axis = 0)
df_all_new.head()
```

[56]:
```
      measure_name_x  location_id_x location_name  sex_id_x sex_name  \
0  Number of Smokers              1        Global         1     Male
1  Number of Smokers              1        Global         1     Male
2  Number of Smokers              1        Global         1     Male
3  Number of Smokers              1        Global         1     Male
4  Number of Smokers              1        Global         1     Male

   age_group_id_x age_group_name  year_id        val_1      upper_1  \
0              29      15+ years     1990  803101467.1  809622101.0
1              29      15+ years     1990  803101467.1  809622101.0
2              29      15+ years     1990  803101467.1  809622101.0
3              29      15+ years     1990  803101467.1  809622101.0
4              29      15+ years     1990  803101467.1  809622101.0

       lower_1  Unnamed: 0     measure_name_y  location_id_y  sex_id_y  \
0  795908635.8           0  Number of Smokers              1         1
1  795908635.8           3  Number of Smokers              1         1
2  795908635.8           6  Number of Smokers              1         1
3  795908635.8           9  Number of Smokers              1         1
```

```
4  795908635.8          12  Number of Smokers              1         1

   age_group_id_y  year        val_2      upper_2      lower_2
0              29  1990  803101467.1  809622101.0  795908635.8
1              29  1991  813897216.4  820033926.0  806951447.9
2              29  1992  823314827.8  829222821.2  816726365.2
3              29  1993  831387254.4  837293112.8  824949648.0
4              29  1994  837820449.8  843723308.3  831634003.9
```

41 - pokazać dodawanie nowych kolumn za pomocą operacji matematycznych

[57]:
```
df_all["val1_round"] = df_all["val_1"].round(decimals = 1)
df_all.head()
```

[57]:
```
      measure_name_x  location_id_x location_name  sex_id_x sex_name  \
0  Number of Smokers              1        Global         1     Male
1  Number of Smokers              1        Global         1     Male
2  Number of Smokers              1        Global         1     Male
3  Number of Smokers              1        Global         1     Male
4  Number of Smokers              1        Global         1     Male

   age_group_id_x age_group_name  year_id        val_1      upper_1  …  \
0              29      15+ years     1990  803101467.1  809622101.0  …
1              29      15+ years     1990  803101467.1  809622101.0  …
2              29      15+ years     1990  803101467.1  809622101.0  …
3              29      15+ years     1990  803101467.1  809622101.0  …
4              29      15+ years     1990  803101467.1  809622101.0  …

   Unnamed: 0     measure_name_y location_id_y  sex_id_y  age_group_id_y  \
0           0  Number of Smokers             1         1              29
1           3  Number of Smokers             1         1              29
2           6  Number of Smokers             1         1              29
3           9  Number of Smokers             1         1              29
4          12  Number of Smokers             1         1              29

   year        val_2      upper_2      lower_2   val1_round
0  1990  803101467.1  809622101.0  795908635.8  803101467.1
1  1991  813897216.4  820033926.0  806951447.9  803101467.1
2  1992  823314827.8  829222821.2  816726365.2  803101467.1
3  1993  831387254.4  837293112.8  824949648.0  803101467.1
4  1994  837820449.8  843723308.3  831634003.9  803101467.1

[5 rows x 21 columns]
```

[58]:
```
df_all["total"] = df_all["val_1"] + df_all["upper_1"] + df_all["lower_1"]
df_all
```

[58]:

	measure_name_x	location_id_x	location_name	sex_id_x	sex_name	\
0	Number of Smokers	1	Global	1	Male	
1	Number of Smokers	1	Global	1	Male	
2	Number of Smokers	1	Global	1	Male	
3	Number of Smokers	1	Global	1	Male	
4	Number of Smokers	1	Global	1	Male	
…	…	…	…	…	…	
639895	Number of Smokers	522	Sudan	3	Both	
639896	Number of Smokers	522	Sudan	3	Both	
639897	Number of Smokers	522	Sudan	3	Both	
639898	Number of Smokers	522	Sudan	3	Both	
639899	Number of Smokers	522	Sudan	3	Both	

	age_group_id_x	age_group_name	year_id	val_1	upper_1	\
0	29	15+ years	1990	8.031015e+08	8.096221e+08	
1	29	15+ years	1990	8.031015e+08	8.096221e+08	
2	29	15+ years	1990	8.031015e+08	8.096221e+08	
3	29	15+ years	1990	8.031015e+08	8.096221e+08	
4	29	15+ years	1990	8.031015e+08	8.096221e+08	
…	…	…	…	…	…	
639895	29	15+ years	2019	2.689230e+06	2.918332e+06	
639896	29	15+ years	2019	2.689230e+06	2.918332e+06	
639897	29	15+ years	2019	2.689230e+06	2.918332e+06	
639898	29	15+ years	2019	2.689230e+06	2.918332e+06	
639899	29	15+ years	2019	2.689230e+06	2.918332e+06	

	…	measure_name_y	location_id_y	sex_id_y	age_group_id_y	year	\
0	…	Number of Smokers	1	1	29	1990	
1	…	Number of Smokers	1	1	29	1991	
2	…	Number of Smokers	1	1	29	1992	
3	…	Number of Smokers	1	1	29	1993	
4	…	Number of Smokers	1	1	29	1994	
…	…	…	…	…	…	…	
639895	…	Number of Smokers	522	3	29	2015	
639896	…	Number of Smokers	522	3	29	2016	
639897	…	Number of Smokers	522	3	29	2017	
639898	…	Number of Smokers	522	3	29	2018	
639899	…	Number of Smokers	522	3	29	2019	

	val_2	upper_2	lower_2	val1_round	total
0	8.031015e+08	8.096221e+08	7.959086e+08	803101467.1	2.408632e+09
1	8.138972e+08	8.200339e+08	8.069514e+08	803101467.1	2.408632e+09
2	8.233148e+08	8.292228e+08	8.167264e+08	803101467.1	2.408632e+09
3	8.313873e+08	8.372931e+08	8.249496e+08	803101467.1	2.408632e+09
4	8.378204e+08	8.437233e+08	8.316340e+08	803101467.1	2.408632e+09
…	…	…	…	…	…
639895	2.388216e+06	2.587005e+06	2.211144e+06	2689229.6	8.088217e+06

```
639896  2.454893e+06  2.665441e+06  2.267696e+06    2689229.6  8.088217e+06
639897  2.535003e+06  2.743769e+06  2.341329e+06    2689229.6  8.088217e+06
639898  2.610672e+06  2.833943e+06  2.409108e+06    2689229.6  8.088217e+06
639899  2.689230e+06  2.918332e+06  2.480656e+06    2689229.6  8.088217e+06

[639900 rows x 22 columns]
```

42 - przedstawić na przykładzie dodawanie nowych kolumn z pomocą funkcji lambda

[59]:
```
CIS_2020 = ['Poland', 'Hungary', 'Italia', 'Germany', 'France',
            'Spain', 'Romania']
```

[60]:
```
df_all['CIS_2020'] = df_all['location_name'].apply(lambda x: True if x in␣
 ↪CIS_2020 else False )
df_all[df_all['CIS_2020'] == True]
```

[60]:
```
           measure_name_x  location_id_x location_name  sex_id_x sex_name  \
121500  Number of Smokers             48       Hungary         1     Male
121501  Number of Smokers             48       Hungary         1     Male
121502  Number of Smokers             48       Hungary         1     Male
121503  Number of Smokers             48       Hungary         1     Male
121504  Number of Smokers             48       Hungary         1     Male
…                     …             …           …       …      …
242995  Number of Smokers             92         Spain         3     Both
242996  Number of Smokers             92         Spain         3     Both
242997  Number of Smokers             92         Spain         3     Both
242998  Number of Smokers             92         Spain         3     Both
242999  Number of Smokers             92         Spain         3     Both

        age_group_id_x age_group_name  year_id        val_1       upper_1  \
121500              29      15+ years     1990  1691795.129  1.764520e+06
121501              29      15+ years     1990  1691795.129  1.764520e+06
121502              29      15+ years     1990  1691795.129  1.764520e+06
121503              29      15+ years     1990  1691795.129  1.764520e+06
121504              29      15+ years     1990  1691795.129  1.764520e+06
…                  …            …       …           …           …
242995              29      15+ years     2019  9748202.722  1.023282e+07
242996              29      15+ years     2019  9748202.722  1.023282e+07
242997              29      15+ years     2019  9748202.722  1.023282e+07
242998              29      15+ years     2019  9748202.722  1.023282e+07
242999              29      15+ years     2019  9748202.722  1.023282e+07

        …  location_id_y  sex_id_y age_group_id_y  year         val_2  \
121500  …             48         1             29  1990  1.691795e+06
121501  …             48         1             29  1991  1.683045e+06
121502  …             48         1             29  1992  1.674390e+06
121503  …             48         1             29  1993  1.665224e+06
```

```
121504  …             48         1             29  1994  1.658081e+06
…     …             …          …             …   …           …
242995  …             92         3             29  2015  1.117824e+07
242996  …             92         3             29  2016  1.070556e+07
242997  …             92         3             29  2017  1.031479e+07
242998  …             92         3             29  2018  1.001427e+07
242999  …             92         3             29  2019  9.748203e+06

              upper_2       lower_2  val1_round         total  CIS_2020
121500  1.764520e+06  1.619503e+06   1691795.1  5.075818e+06      True
121501  1.753812e+06  1.611946e+06   1691795.1  5.075818e+06      True
121502  1.742527e+06  1.607019e+06   1691795.1  5.075818e+06      True
121503  1.730905e+06  1.601383e+06   1691795.1  5.075818e+06      True
121504  1.722809e+06  1.596858e+06   1691795.1  5.075818e+06      True
…                …             …           …             …       …
242995  1.152098e+07  1.086683e+07   9748202.7  2.928604e+07      True
242996  1.107828e+07  1.037339e+07   9748202.7  2.928604e+07      True
242997  1.071837e+07  9.948682e+06   9748202.7  2.928604e+07      True
242998  1.046173e+07  9.610001e+06   9748202.7  2.928604e+07      True
242999  1.023282e+07  9.305015e+06   9748202.7  2.928604e+07      True

[16200 rows x 23 columns]
```

43 - przedstawić możliwości pracy z dużymi plikami przy użyciu argumentu chunksize

[61]:
```
df.to_csv('df_all.csv')

for chunk_df in pd.read_csv('df_all.csv',
                      chunksize = 50000):
    print("CHUNK DF")
    print(chunk_df.head())
```

```
CHUNK DF
   Unnamed: 0       measure_name  location_id location_name  sex_id sex_name  \
0           0  Number of Smokers            1        Global       1     Male
1           1  Number of Smokers            1        Global       2   Female
2           2  Number of Smokers            1        Global       3     Both
3           3  Number of Smokers            1        Global       1     Male
4           4  Number of Smokers            1        Global       2   Female

   age_group_id age_group_name  year          val         upper        lower
0            29      15+ years  1990  803101467.1  8.096221e+08  795908635.8
1            29      15+ years  1990  189148834.0  1.930929e+08  185559469.9
2            29      15+ years  1990  992250301.2  1.000161e+09  984788043.8
3            29      15+ years  1991  813897216.4  8.200339e+08  806951447.9
4            29      15+ years  1991  190537545.1  1.944249e+08  186974424.5
```

[62]:
```
new_df = pd.DataFrame()
for chunk_df in pd.read_csv('df_all.csv',
                      chunksize = 50000):
    result = chunk_df.groupby(['location_name', 'sex_name']).agg({'upper':␣
 ↪'mean',
                                                          'lower': 'mean'})
    new_df = pd.concat([new_df,result])
```

[63]:
```
new_df
```

[63]:

location_name	sex_name	upper	lower
Afghanistan	Both	1.184427e+06	9.776876e+05
	Female	1.867379e+05	1.060589e+05
	Male	1.037830e+06	8.447279e+05
Albania	Both	6.302436e+05	5.752316e+05
	Female	1.248055e+05	8.917709e+04
…		…	…
Zambia	Female	2.766568e+05	1.879562e+05
	Male	8.156664e+05	7.266267e+05
Zimbabwe	Both	1.132936e+06	1.018202e+06
	Female	1.442346e+05	9.511072e+04
	Male	1.010215e+06	9.072602e+05

[693 rows x 2 columns]

[ ]:
```

```