Regular expressions (aka regexps)

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Nessesary imports:

In [177…
```
import re
import os
import functools
!pip install matplotlib
import matplotlib.pyplot as plt
import numpy as np
```

```
Requirement already satisfied: matplotlib in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (3.6.1)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from matplotlib) (4.37.4)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from matplotlib) (2.8.2)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from matplotlib) (1.4.4)
Requirement already satisfied: packaging>=20.0 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from matplotlib) (21.3)
Requirement already satisfied: numpy>=1.19 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from matplotlib) (1.23.4)
Requirement already satisfied: cycler>=0.10 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from matplotlib) (0.11.0)
Requirement already satisfied: pillow>=6.2.0 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from matplotlib) (9.2.0)
Requirement already satisfied: pyparsing>=2.2.1 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from matplotlib) (3.0.9)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from matplotlib) (1.0.5)
Requirement already satisfied: six>=1.5 in c:\users\kpr\appdata\local\programs\python\python310\lib\site-packages (from python-dateutil>=2.7->matplotlib) (1.16.0)
[notice] A new release of pip available: 22.2.2 -> 22.3
[notice] To update, run: python.exe -m pip install --upgrade pip
```

Load data:

In [178…
```
data=[]
data_dict={}
for file in os.listdir('../ustawy'):
    with open("../ustawy/"+file, "r", encoding="utf8") as f:
        text = functools.reduce(lambda a,b: a + b, f.readlines())
        year = int(file[0:4])
        data.append([year,text])

for [year,text] in data:
    if year not in data_dict.keys():
        data_dict[year]=[text]
    else:
        data_dict[year].append(text)


data_dict.keys()
```

Out[178]:
```
dict_keys([1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004])
```

Utility functions

In [179…
```
#count pattern matches by year
def count_per_year(pattern,data):
    result={}
    for key in data.keys():
        count=0
        for text in data[key]:
            count+=len(re.findall(pattern,text.lower()))
        result[key]=count
    return result

def count_all(pattern,data):
    result=0
    for key in data.keys():
        for text in data[key]:
            result+=len(re.findall(pattern,text))
    return result
```

Basic data analysis:

according to 'zasady techniki prawodawczej' we can distinguish following types of units in bills:

- artykuł
- paragraf
- ustęp
- punkt
- litera

Knowing this we can prepare a regex as such:
(art\.|§|ust\.|pkt|lit\.)\s+\d+[a-z]?

Counting bill amendments

A manual review of a sample of data was conducted and a following construction matching given criteria and not given as an example in the task was found:

- pkt 3 i 4 otrzymują brzmienie

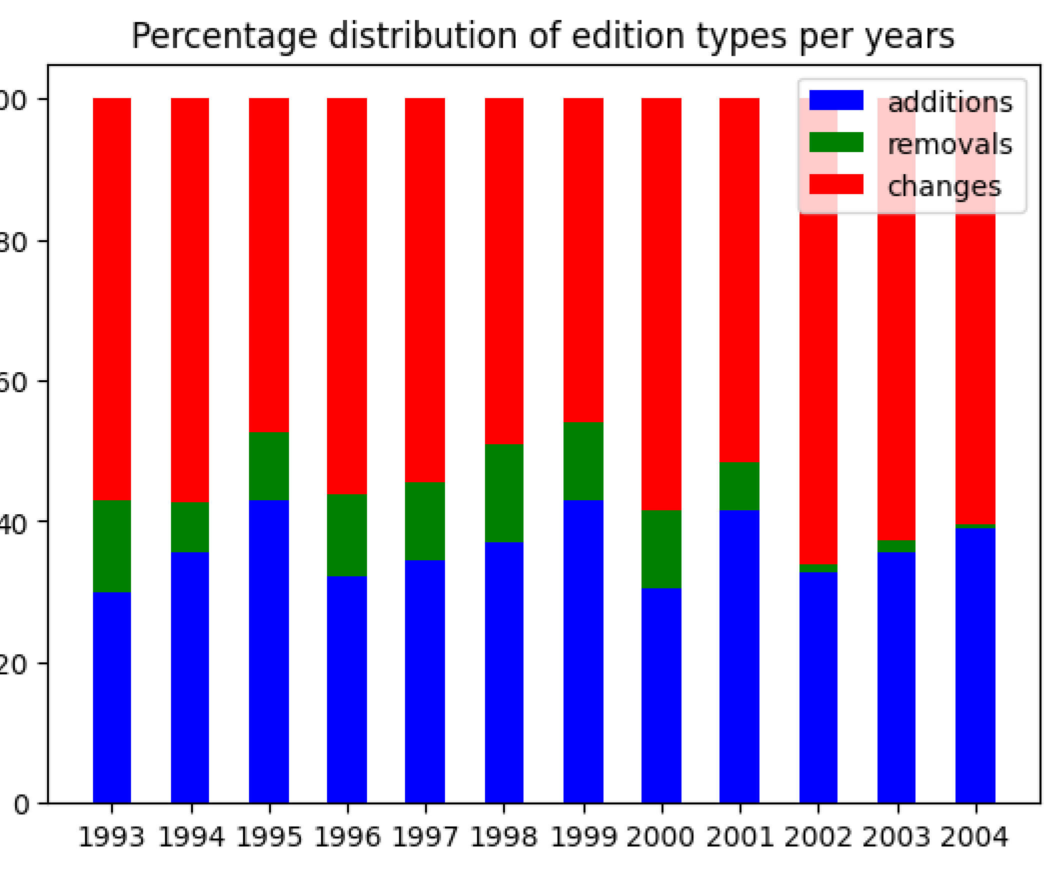
This construction has been classified as a change of unit. Other examples have not been found during the text reviews.

In [180…
```
#Addition of unit
add_regex='dodaje\s+się\s+(art\.|§|ust\.|pkt|lit\.)\s+\d+[a-z]?'
add_result = count_per_year(add_regex,data_dict)


#Removal of unit
rm_regex='(art\.|§|ust\.|pkt|lit\.)\s+\d+[a-z]?\s+skreśla\s+się\s+'
rm_result = count_per_year(rm_regex,data_dict)


#Change of unit
change1_regex='(art\.|§|ust\.|pkt|lit\.)\s+\d+[a-z]?\s+otrzymuje\s+brzmienie'
change1_result = count_per_year(change1_regex,data_dict)

change2_regex='(art\.|§|ust\.|pkt|lit\.)\s+\d+[a-z]?\s+i\s+\d+\s+otrzymują\s+brzmienie'
change2_result = count_per_year(change3_regex,data_dict)


change_result={}
sum_result={}
for year in data_dict.keys():
    change_result[year] = change1_result[year]+change2_result[year]
    sum_result[year] = change_result[year]+add_result[year]+rm_result[year]

print('Additions:')
print(add_result)
print('Removals:')
print(rm_result)
print('Changes:')
print(change_result)
add_percentage=[list(add_result.values())[i]*100/list(sum_result.values())[i] for i in range(12)]
rm_percentage=[list(rm_result.values())[i]*100/list(sum_result.values())[i] for i in range(12)]
change_percentage=[list(change_result.values())[i]*100/list(sum_result.values())[i] for i in range(12)]
histogram_tmp_bottom=[sum(x) for x in zip(rm_percentage, add_percentage)]
```

```
Additions:
{1993: 32, 1994: 105, 1995: 326, 1996: 498, 1997: 665, 1998: 217, 1999: 153, 2000: 759, 2001: 1096, 2002: 91, 2003: 1025, 2004: 1029}
Removals:
{1993: 14, 1994: 21, 1995: 74, 1996: 179, 1997: 210, 1998: 82, 1999: 39, 2000: 283, 2001: 186, 2002: 3, 2003: 51, 2004: 17}
Changes:
{1993: 61, 1994: 170, 1995: 361, 1996: 866, 1997: 1050, 1998: 288, 1999: 163, 2000: 1460, 2001: 1361, 2002: 183, 2003: 1807, 2004: 1591}
```

Chart of percentage distribution of amendment types per years

In [181…
```
X = np.arange(12)
plt.title("Percentage distribution of edition types per years")
plt.bar(X , add_percentage, color = 'b',  label='additions', width=0.5)
plt.bar(X , rm_percentage, color = 'g', bottom=add_percentage, label='removals', width=0.5)
plt.bar(X , change_percentage, color = 'r', bottom=histogram_tmp_bottom , label='changes', width=0.5)
plt.xticks([r  for r in range(12)], [year for year in range(1993, 2005)])
plt.legend(loc='best')
plt.show()
```



Counting of "ustawa" occurences

We notice that all possible versions of the given word are constructed using base "ustaw" and adding postfixes such as "a" "ie" etc. Knowing this we can construct a regex looking for all inflections known to us, such as this one:
\b(ustaw(a|ie|y|ę|ą|e|om|ach|ami))\b

then in order to make it case insensitive:
\b((u|U)(s|S)(t|T)(a|A)(w|W)((a|A)|(i|I)(e|E)|(y|Y)|(ę|Ę)|(ą|Ą)|(e|E)|(o|O)(m|M)|(a|A)(c|C)(h|H)|(a|A)(m|M)(i|I)))\b

In [182…
```
ustawa_regex='\\b((u|U)(s|S)(t|T)(a|A)(w|W)((a|A)|(i|I)(e|E)|(y|Y)|(ę|Ę)|(ą|Ą)|(e|E)|(o|O)(m|M)|(a|A)(c|C)(h|H)|(a|A)(m|M)
count = count_all(ustawa_regex,data_dict)
count
```

Out[182]: 24025

In [183…
```
ustawa_regex_followed='(\\b((u|U)(s|S)(t|T)(a|A)(w|W)((a|A)|(i|I)(e|E)|(y|Y)|(ę|Ę)|(ą|Ą)|(e|E)|(o|O)(m|M)|(a|A)(c|C)(h|H)|
count_followed = count_all(ustawa_regex_followed,data_dict)
count_followed
```

Out[183]: 8101

In [184…
```
ustawa_regex_not_followed='(\\b((u|U)(s|S)(t|T)(a|A)(w|W)((a|A)|(i|I)(e|E)|(y|Y)|(ę|Ę)|(ą|Ą)|(e|E)|(o|O)(m|M)|(a|A)(c|C)(h
count_not_followed = count_all(ustawa_regex_not_followed,data_dict)
count_not_followed
```

Out[184]: 15924

In [185…
```
count_followed+count_not_followed
```

Out[185]: 24025

Number of occurences found in total: 24025

Number of occurences followed by 'z dnia': 8101

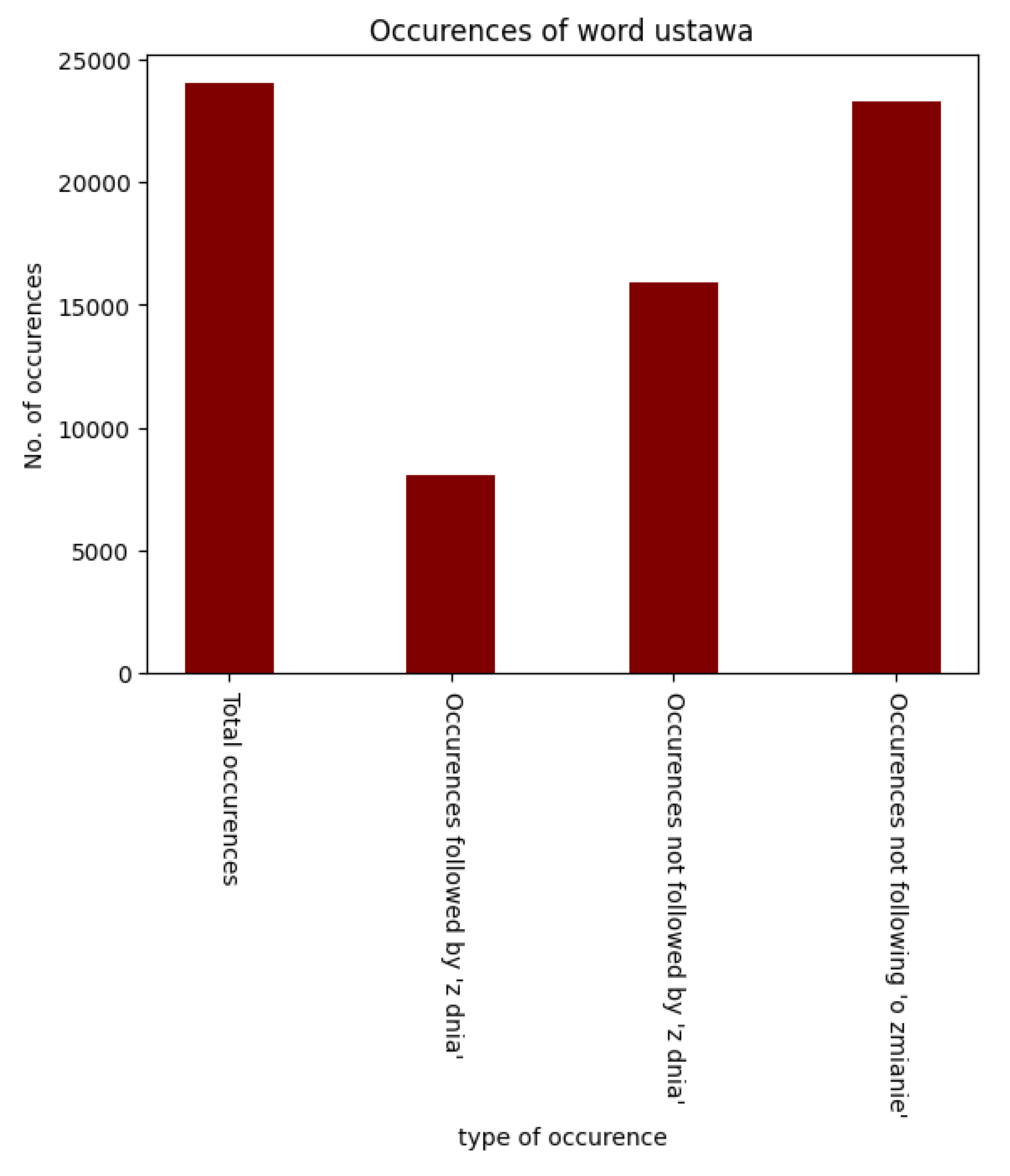
Number of occurences not followed by 'z dnia': 15924

Total number of occurences adds up

In [186…
```
ustawa_regex_change='(?<!o zmianie )(\\b((u|U)(s|S)(t|T)(a|A)(w|W)((a|A)|(i|I)(e|E)|(y|Y)|(ę|Ę)|(ą|Ą)|(e|E)|(o|O)(m|M)|(a|
count_change = count_all(ustawa_regex_change,data_dict)
count_change
```

Out[186]: 23275

In [187…
```
plt.bar(['Total occurences','Occurences followed by \'z dnia\'','Occurences not followed by \'z dnia\'','Occurences not fo
        width = 0.4)
plt.xticks(rotation = -90)
plt.xlabel("type of occurence")
plt.ylabel("No. of occurences")
plt.title("Occurences of word ustawa")
plt.show()
```



In [ ]: