In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from collections import Counter
```

In [2]:
```
def print_full(x):
    pd.set_option('display.max_rows', len(x))
    pd.set_option('display.max_columns', 500)
    pd.set_option('display.width', 2000)
    pd.set_option('display.float_format', '{:20,.2f}'.format
    pd.set_option('display.max_colwidth', -1)
    print(x)
    pd.reset_option('display.max_rows')
    pd.reset_option('display.max_columns')
    pd.reset_option('display.width')
    pd.reset_option('display.float_format')
    pd.reset_option('display.max_colwidth')
```

In [3]:
```
data = pd.read_csv('SMSSpamCollection', sep="    ", header=No
data.columns = ["Class", "Text"]
```

In [4]:
```
data
```

	Class	Text
0	ham	Go until jurong point, crazy.. Available only ...
1	ham	Ok lar... Joking wif u oni...
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...
3	ham	U dun say so early hor... U c already then say...
4	ham	Nah I don't think he goes to usf, he lives aro...
...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...
5568	ham	Will ü b going to esplanade fr home?
5569	ham	Pity, * was in mood for that. So...any other s...
5570	ham	The guy did some bitching but I acted like i'd...
5571	ham	Rofl. Its true to its name

5572 rows × 2 columns

In [5]:

```
proporcja = data['Class'].value_counts()
proporcja
```

```
ham     4825
spam     747
Name: Class, dtype: int64
```

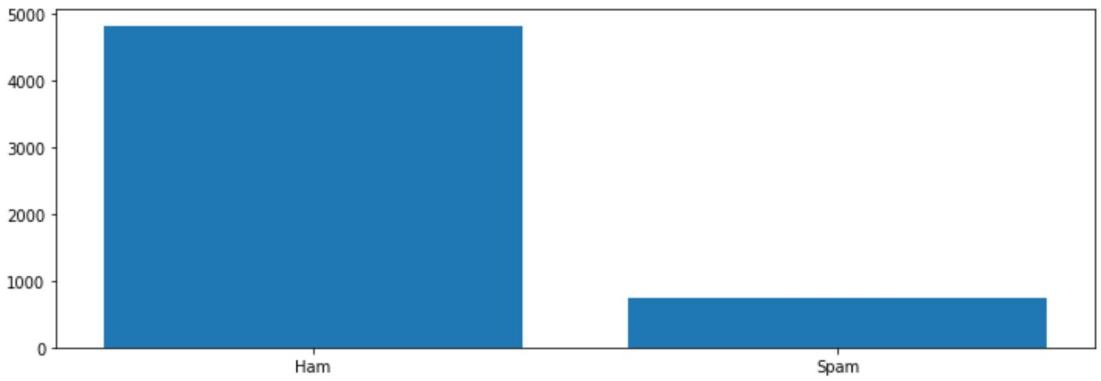
In [6]:

```
names = ['Ham', 'Spam']
values = [4825,747]

plt.figure(figsize=(12,4))
plt.bar(names, values)

#proporcje w zbiorze - występuje istotna dysproporcja, przew
```

```
<BarContainer object of 2 artists>
```



In [7]:

```
1 Duplicates = data[data.duplicated(keep=False)]
2 Duplicates
```

	Class	Text
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...
7	ham	As per your request 'Melle Melle (Oru Minnamin...
8	spam	WINNER!! As a valued network customer you have...
9	spam	Had your mobile 11 months or more? U R entitle...
11	spam	SIX chances to win CASH! From 100 to 20,000 po...
...	...	...
5524	spam	You are awarded a SiPix Digital Camera! call 0...
5535	ham	I know you are thinkin malaria. But relax, chi...
5539	ham	Just sleeping..and surfing
5553	ham	Hahaha..use your brain dear
5558	ham	Sorry, I'll call later

684 rows × 2 columns

In [8]:

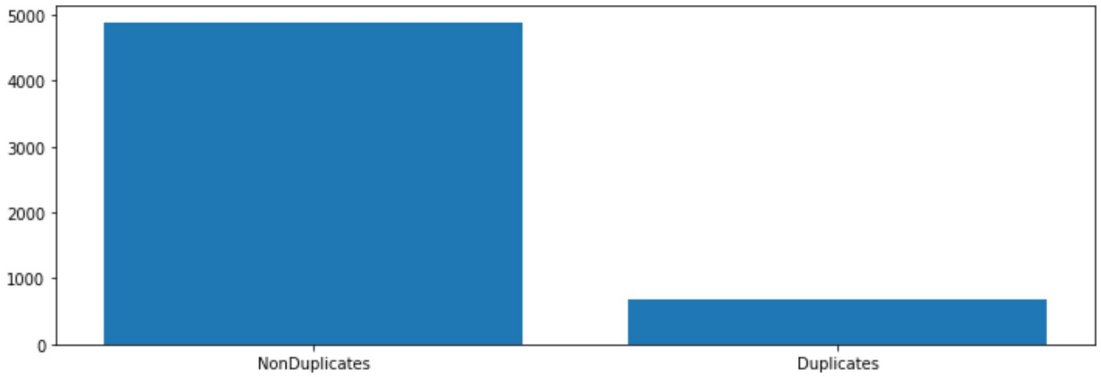
```
D = Duplicates.count()[0]
NonD = data.count()[0] - D
print(D,NonD)


names = ['NonDuplicates', 'Duplicates']
values = [NonD,D]

plt.figure(figsize=(12,4))
plt.bar(names, values)
```

```
684 4888
```

```
<BarContainer object of 2 artists>
```



In [9]:

```
#Najczestsze wiadomosci:

Ham = data[data['Class']=='ham']
Spam = data[data['Class']=='spam']

display(Ham.mode())
print("")
display(Spam.mode())
```

	Class	Text
0	ham	Sorry, I'll call later

	Class	Text
0	spam	Please call our customer service representativ...

In [10]:

```
Multiclass = pd.DataFrame(pd.merge(Ham,Spam,on = 'Text', how
Multiclass['_merge'].value_counts()
#brak elementow znajdujacych się w obu klasach jednoczesnie
```

```
left_only     4825
right_only     747
both             0
Name: _merge, dtype: int64
```

In [11]:

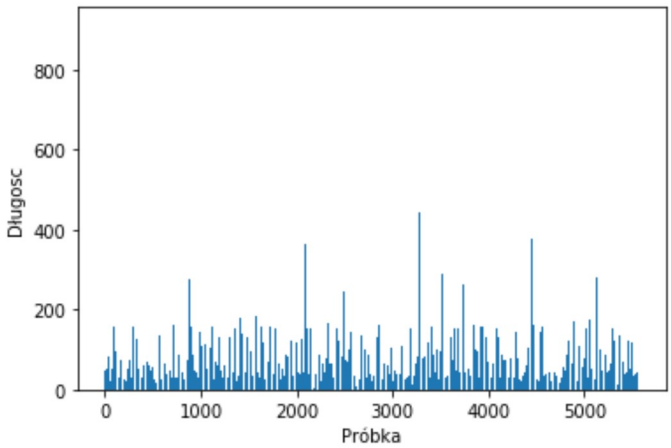
```
data['length'] = data['Text'].apply(len)
data.head()
```

	Class	Text	length
0	ham	Go until jurong point, crazy.. Available only ...	111
1	ham	Ok lar... Joking wif u oni...	29
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	155
3	ham	U dun say so early hor... U c already then say...	49
4	ham	Nah I don't think he goes to usf, he lives aro...	61

In [12]:

```
Wykres = {'a': data.index.tolist(),      #Wykres dlugosci wi
          "b" : data['length'].tolist()
         }

plt.bar('a', 'b', data=Wykres)
plt.xlabel('Próbka')
plt.ylabel('Długosc')
plt.show()
```



In [13]:

```
Most_pop = pd.DataFrame(Counter(" ".join(data["Text"]).split
Most_pop.columns = ["Slowa", "Wystapienia"]
Most_pop
```

	Slowa	Wystapienia
0	to	2145
1	you	1626
2	I	1469
3	a	1337
4	the	1207
5	and	858
6	in	800
7	is	788
8	i	748
9	u	698
10	for	650
11	my	630
12	of	592
13	me	561
14	your	561
15	on	488

In [14]:

```
Most_popSpam = pd.DataFrame(Counter(" ".join(Spam["Text"]).s
Most_popSpam.columns = ["Slowa", "Wystapienia"]
Most_popSpam
```

	Slowa	Wystapienia
0	to	607
1	a	360
2	your	187
3	call	185
4	or	185
5	the	178
6	2	169
7	for	169
8	you	164
9	is	143
10	Call	136
11	on	136
12	have	128
13	and	119
14	from	116
15	ur	107

In [15]:

```
Most_popHam = pd.DataFrame(Counter(" ".join(Ham["Text"]).spl
Most_popHam.columns = ["Slowa", "Wystapienia"]
Most_popHam
```

	Slowa	Wystapienia
0	to	1538
1	you	1462
2	I	1439
3	the	1029
4	a	977
5	i	742
6	and	739
7	in	736
8	u	651
9	is	645
10	my	621
11	me	541
12	of	499
13	for	481
14	that	399
15	it	376

W smsach nie spamowych duzo czesciej wystepuja slowa takie jak you, I oraz and.

Preprocessing danych

In [16]:

```
def preprocess1(test_string):

# initializing bad_chars_list
    bad_chars = [';', ':', '!', "*",",",".", "/","\ ","?", "

# using replace() to remove bad_chars
    for i in bad_chars :
        test_string = test_string.replace(i, '')
        test_string = test_string.lower()


    return test_string
```

In [17]:
```
lista = data['Text'].tolist()
wynik = []
wynik2 = []

for i in lista:
    a =  preprocess1(i)
    wynik.append(a)
for j in wynik:
    b = j.split()
    wynik2.append(b)
```

In [18]:
```
data['Processed'] = pd.Series(wynik2)
```

In [19]:
```
data #data z malymi literkami,podzielona na tokeny, bez znak
```

	Class	Text	length	Processed
0	ham	Go until jurong point, crazy.. Available only ...	111	[go, until, jurong, point, crazy, available, o...
1	ham	Ok lar... Joking wif u oni...	29	[ok, lar, joking, wif, u, oni]
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	155	[free, entry, in, 2, a, wkly, comp, to, win, f...
3	ham	U dun say so early hor... U c already then say...	49	[u, dun, say, so, early, hor, u, c, already, t...
4	ham	Nah I don't think he goes to usf, he lives aro...	61	[nah, i, don't, think, he, goes, to, usf, he, ...
...	...	...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...	160	[this, is, the, 2nd, time, we, have, tried, 2,...
5568	ham	Will ü b going to esplanade fr home?	36	[will, ü, b, going, to, esplanade, fr, home]
5569	ham	Pity, * was in mood for that. So...any other s...	57	[pity, was, in, mood, for, that, soany, other,...
5570	ham	The guy did some bitching but I acted like i'd...	125	[the, guy, did, some, bitching, but, i, acted,...
5571	ham	Rofl. Its true to its name	26	[rofl, its, true, to, its, name]

5572 rows × 4 columns

NLTK

In [20]:
```
from nltk.stem import WordNetLemmatizer
from nltk.stem import PorterStemmer
lemmatizer = WordNetLemmatizer()
stemmer = PorterStemmer()
```

In [21]:

```
lemmitWordNet = lambda message : [lemmatizer.lemmatize(word)
stemmitPS = lambda message : [stemmer.stem(word) for word in

data['stemmitPS'] = data['Processed'].apply(stemmitPS)
data['Lemm'] = data['Processed'].apply(lemmitWordNet)
```

In [22]:

```
1 data.tail(50)
```

	Class	Text	length	Processed	stemmitPS	Lemm
5522	ham	Thats cool. I want to please you...	35	[thats, cool, i, want, to, please, you]	[that, cool, i, want, to, pleas, you]	[thats, cool, i, want, to, please, you]
5523	ham	Going to join tomorrow.	23	[going, to, join, tomorrow]	[go, to, join, tomorrow]	[going, to, join, tomorrow]
5524	spam	You are awarded a SiPix Digital Camera! call 0...	152	[you, are, awarded, a, sipix, digital, camera,...	[you, are, award, a, sipix, digit, camera, cal...	[you, are, awarded, a, sipix, digital, camera,...
5525	ham	I want to tell you how bad I feel that basical...	103	[i, want, to, tell, you, how, bad, i, feel, th...	[i, want, to, tell, you, how, bad, i, feel, th...	[i, want, to, tell, you, how, bad, i, feel, th...
5526	spam	PRIVATE! Your 2003 Account Statement for shows...	134	[private, your, 2003, account, statement, for,...	[privat, your, 2003, account, statement, for, ...	[private, your, 2003, account, statement, for,...
5527	ham	Total disappointment, when I texted you was th...	68	[total, disappointment, when, i, texted, you, ...	[total, disappoint, when, i, text, you, wa, th...	[total, disappointment, when, i, texted, you, ...
5528	ham	Its just the effect of irritation. Just ignore it	49	[its, just, the, effect, of, irritation, just,...	[it, just, the, effect, of, irrit, just, ignor...	[it, just, the, effect, of, irritation, just, ...
5529	ham	What about this one then.	25	[what, about, this, one, then]	[what, about, thi, one, then]	[what, about, this, one, then]
5530	ham	I think that tantrum's finished so yeah I'll b...	64	[i, think, that, tantrum's, finished, so, yeah...	[i, think, that, tantrum', finish, so, yeah, i...	[i, think, that, tantrum's, finished, so, yeah...
5531	ham	Compliments to you. Was away from the system. ...	60	[compliments, to, you, was, away, from, the, s...	[compliment, to, you, wa, away, from, the, sys...	[compliment, to, you, wa, away, from, the, sys...
5532	ham	happened here while you were adventuring	40	[happened, here, while, you, were, adventuring]	[happen, here, while, you, were, adventur]	[happened, here, while, you, were, adventuring]
5533	ham	Hey chief, can you give me a bell when you get...	113	[hey, chief, can, you, give, me, a, bell, when...	[hey, chief, can, you, give, me, a, bell, when...	[hey, chief, can, you, give, me, a, bell, when...
5534	ham	Ok which your another number	28	[ok, which, your, another, number]	[ok, which, your, anoth, number]	[ok, which, your, another, number]
5535	ham	I know you are thinkin malaria. But relax, chi...	329	[i, know, you, are, thinkin, malaria, but, rel...	[i, know, you, are, thinkin, malaria, but, rel...	[i, know, you, are, thinkin, malaria, but, rel...
5536	ham	Aiyah ok wat as long as got improve can alread...	54	[aiyah, ok, wat, as, long, as, got, improve, c...	[aiyah, ok, wat, as, long, as, got, improv, ca...	[aiyah, ok, wat, a, long, a, got, improve, can...
5537	spam	Want explicit SEX in 30 secs? Ring 02073162414...	90	[want, explicit, sex, in, 30, secs, ring, 0207...	[want, explicit, sex, in, 30, sec, ring, 02073...	[want, explicit, sex, in, 30, sec, ring, 02073...
5538	ham	I can't believe how attached I am to seeing yo...	158	[i, can't, believe, how, attached, i, am, to, ...	[i, can't, believ, how, attach, i, am, to, see...	[i, can't, believe, how, attached, i, am, to, ...
5539	ham	Just sleeping..and surfing	26	[just, sleepingand, surfing]	[just, sleepingand, surf]	[just, sleepingand, surfing]
5540	spam	ASKED 3MOBILE IF 0870 CHATLINES INCLU IN FREE ...	158	[asked, 3mobile, if, 0870, chatlines, inclu, i...	[ask, 3mobil, if, 0870, chatlin, inclu, in, fr...	[asked, 3mobile, if, 0870, chatlines, inclu, i...

In [23]:
```
samples = data.sample(n=8)
print([sample for sample in samples['Lemm']])
print('')
print([sample for sample in samples['stemmitPS']])
```

```
[['haha', 'better', 'late', 'than', 'ever', 'any', 'way', 'i', 'could', 'swing', 'by'], ['hey',
'what', 'happened', 'u', 'switch', 'off', 'ur', 'cell', 'd', 'whole', 'day', 'this', 'isnt', 'go
od', 'now', 'if', 'u', 'do', 'care', 'give', 'me', 'a', 'call', 'tomorrow'], ['ü', 'got', 'wat',
'to', 'buy', 'tell', 'u', 'then', 'ü', 'no', 'need', 'to', 'come', 'in', 'again'], ['where', 'ar
e', 'youwhen', 'wil', 'you', 'reach', 'here'], ['i', 'cant', 'pick', 'the', 'phone', 'right', 'n
ow', 'pls', 'send', 'a', 'message'], ['you', 'do', 'what', 'all', 'you', 'like'], ["1's", 'reach
', 'home', 'call', 'me'], ['yep', 'i', 'do', 'like', 'the', 'pink', 'furniture', 'tho']]

[['haha', 'better', 'late', 'than', 'ever', 'ani', 'way', 'i', 'could', 'swing', 'by'], ['hey',
'what', 'happen', 'u', 'switch', 'off', 'ur', 'cell', 'd', 'whole', 'day', 'thi', 'isnt', 'good
', 'now', 'if', 'u', 'do', 'care', 'give', 'me', 'a', 'call', 'tomorrow'], ['ü', 'got', 'wat', '
to', 'buy', 'tell', 'us', 'then', 'ü', 'no', 'need', 'to', 'come', 'in', 'again'], ['where', 'ar
e', 'youwhen', 'wil', 'you', 'reach', 'here'], ['i', 'cant', 'pick', 'the', 'phone', 'right', 'n
ow', 'pl', 'send', 'a', 'messag'], ['you', 'do', 'what', 'all', 'you', 'like'], ["1'", 'reach',
'home', 'call', 'me'], ['yep', 'i', 'do', 'like', 'the', 'pink', 'furnitur', 'tho']]
```

In [24]:
```
# Zauwazalne sa roznice w działaniu algorytmu Portera takie
```

Usuwanie słów o małym znaczeniu

In [25]:
```
import nltk
nltk.download('stopwords')
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
nltk.download('punkt')
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\sticz\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\sticz\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!


True
```

In [26]:
```
print(stopwords.words('english'))
```

```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're", "you've", "you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves', 'he', 'him', 'his', 'himself', 'she', "she's", 'her', 'hers', 'herself', 'it', "it's", 'its', 'itself', 'they', 'them', 'their', 'theirs', 'themselves', 'what', 'which', 'who', 'whom', 'this', 'that', "that'll", 'these', 'those', 'am', 'is', 'are', 'was', 'were', 'be', 'been', 'being', 'have', 'has', 'had', 'having', 'do', 'does', 'did', 'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or', 'because', 'as', 'until', 'while', 'of', 'at', 'by', 'for', 'with', 'about', 'against', 'between', 'into', 'through', 'during', 'before', 'after', 'above', 'below', 'to', 'from', 'up', 'down', 'in', 'out', 'on', 'off', 'over', 'under', 'again', 'further', 'then', 'once', 'here', 'there', 'when', 'where', 'why', 'how', 'all', 'any', 'both', 'each', 'few', 'more', 'most', 'other', 'some', 'such', 'no', 'nor', 'not', 'only', 'own', 'same', 'so', 'than', 'too', 'very', 's', 't', 'can', 'will', 'just', 'don', "don't", 'should', "should've", 'now', 'd', 'll', 'm', 'o', 're', 've', 'y', 'ain', 'aren', "aren't", 'couldn', "couldn't", 'didn', "didn't", 'doesn', "doesn't", 'hadn', "hadn't", 'hasn', "hasn't", 'haven', "haven't", 'isn', "isn't", 'ma', 'mightn', "mightn't", 'mustn', "mustn't", 'needn', "needn't", 'shan', "shan't", 'shouldn', "shouldn't", 'wasn', "wasn't", 'weren', "weren't", 'won', "won't", 'wouldn', "wouldn't"]
```

In [27]:
```
def DelStopwords(string):
    STOPWORDS = stopwords.words('english') + ['u', 'ü', 'ur'
    return [word for word in string if word not in STOPWORDS
```

Konieczne jest uzupelnienie listy, chociazby z powodu wielu skrótów używanych w sms takich jak "u" zamiast "you" czy "2" zamiast "to"

In [28]:
```
data['DeletedStopfromLemm'] = data['Lemm'].apply(DelStopword
```

In [29]:

```
data
```

	Class	Text	length	Processed	stemmitPS	Lemm	DeletedStopfromLemm
0	ham	Go until jurong point, crazy.. Available only ...	111	[go, until, jurong, point, crazy, available, o...	[go, until, jurong, point, crazi, avail, onli,...	[go, until, jurong, point, crazy, available, o...	[go, jurong, point, crazy, available, bugis, n...
1	ham	Ok lar... Joking wif u oni...	29	[ok, lar, joking, wif, u, oni]	[ok, lar, joke, wif, u, oni]	[ok, lar, joking, wif, u, oni]	[ok, lar, joking, wif, oni]
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	155	[free, entry, in, 2, a, wkly, comp, to, win, f...	[free, entri, in, 2, a, wkli, comp, to, win, f...	[free, entry, in, 2, a, wkly, comp, to, win, f...	[free, entry, wkly, comp, win, fa, cup, final,...
3	ham	U dun say so early hor... U c already then say...	49	[u, dun, say, so, early, hor, u, c, already, t...	[u, dun, say, so, earli, hor, u, c, alreadi, t...	[u, dun, say, so, early, hor, u, c, already, t...	[dun, say, early, hor, c, already, say]
4	ham	Nah I don't think he goes to usf, he lives aro...	61	[nah, i, don't, think, he, goes, to, usf, he, ...	[nah, i, don't, think, he, goe, to, usf, he, l...	[nah, i, don't, think, he, go, to, usf, he, li...	[nah, think, go, usf, life, around, though]
...	...	...	...	...	...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...	160	[this, is, the, 2nd, time, we, have, tried, 2,...	[thi, is, the, 2nd, time, we, have, tri, 2, co...	[this, is, the, 2nd, time, we, have, tried, 2,...	[2nd, time, tried, contact, £750, pound, prize...
5568	ham	Will ü b going to esplanade fr home?	36	[will, ü, b, going, to, esplanade, fr, home]	[will, ü, b, go, to, esplanad, fr, home]	[will, ü, b, going, to, esplanade, fr, home]	[b, going, esplanade, fr, home]
5569	ham	Pity, * was in mood for that. So...any other s...	57	[pity, was, in, mood, for, that, soany, other,...	[piti, wa, in, mood, for, that, soani, other, ...	[pity, wa, in, mood, for, that, soany, other, ...	[pity, wa, mood, soany, suggestion]
5570	ham	The guy did some bitching but I acted like i'd...	125	[the, guy, did, some, bitching, but, i, acted,...	[the, guy, did, some, bitch, but, i, act, like...	[the, guy, did, some, bitching, but, i, acted,...	[guy, bitching, acted, like, i'd, interested, ...
5571	ham	Rofl. Its true to its name	26	[rofl, its, true, to, its, name]	[rofl, it, true, to, it, name]	[rofl, it, true, to, it, name]	[rofl, true, name]

5572 rows × 7 columns

In [30]:

```
Ham = data[data['Class']=='ham']
Spam = data[data['Class']=='spam']
```

In [31]:
```
1 Most_popHam
```

	Slowa	Wystapienia
0	to	1538
1	you	1462
2	I	1439
3	the	1029
4	a	977
5	i	742
6	and	739
7	in	736
8	u	651
9	is	645
10	my	621
11	me	541
12	of	499
13	for	481
14	that	399
15	it	376

In [32]:
```
1 Most_popSpam
```

	Slowa	Wystapienia
0	to	607
1	a	360
2	your	187
3	call	185
4	or	185
5	the	178
6	2	169
7	for	169
8	you	164
9	is	143
10	Call	136
11	on	136
12	have	128
13	and	119
14	from	116
15	ur	107

In [33]:
```
from collections import Counter
import itertools
```

In [34]:
```
Most_pop_stop = Counter(list(itertools.chain.from_iterable(d
Most_pop_stop = pd.DataFrame(Most_pop_stop.most_common(16),
```

In [35]:
```
Most_pop_stop
```

	Słowa	Wystąpienia
0	call	602
1	get	395
2	i'm	380
3	go	306
4	ltgt	276
5	free	275
6	ok	273
7	know	267
8	come	250
9	like	247
10	got	237
11	good	237
12	day	236
13	wa	234
14	time	232
15	text	214

In [36]:

```
Most_pop_stopSpam = Counter(list(itertools.chain.from_iterab
Most_pop_stopSpam = pd.DataFrame(Most_pop_stopSpam.most_comm
Most_pop_stopSpam
```

	word	count
0	call	359
1	free	216
2	txt	148
3	text	137
4	mobile	135
5	claim	115
6	stop	113
7	reply	102
8	prize	94
9	get	83
10	tone	73
11	service	72
12	new	69
13	send	68
14	nokia	65
15	urgent	63

In [37]:

```
Most_pop_stopHam = Counter(list(itertools.chain.from_iterabl
Most_pop_stopHam = pd.DataFrame(Most_pop_stopHam.most_common
Most_pop_stopHam
```

	word	count
0	i'm	372
1	get	312
2	go	276
3	ltgt	276
4	ok	268
5	come	245
6	call	243
7	know	241
8	like	234
9	got	230
10	wa	225
11	good	225
12	time	213
13	day	209
14	love	197
15	want	184

Tak, zmienily sie najpopularniejsze slowa z powodu usuniecia tych malo znaczcacych

Klasyfikator i wektoryzacja cech

In [38]:

```
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.naive_bayes import MultinomialNB
from sklearn import metrics

from sklearn.pipeline import Pipeline
from sklearn.model_selection import train_test_split
```

In [39]:
```
data
```

	Class	Text	length	Processed	stemmitPS	Lemm	DeletedStopfromLemm
0	ham	Go until jurong point, crazy.. Available only ...	111	[go, until, jurong, point, crazy, available, o...	[go, until, jurong, point, crazi, avail, onli,...	[go, until, jurong, point, crazy, available, o...	[go, jurong, point, crazy, available, bugis, n...
1	ham	Ok lar... Joking wif u oni...	29	[ok, lar, joking, wif, u, oni]	[ok, lar, joke, wif, u, oni]	[ok, lar, joking, wif, u, oni]	[ok, lar, joking, wif, oni]
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	155	[free, entry, in, 2, a, wkly, comp, to, win, f...	[free, entri, in, 2, a, wkli, comp, to, win, f...	[free, entry, in, 2, a, wkly, comp, to, win, f...	[free, entry, wkly, comp, win, fa, cup, final,...
3	ham	U dun say so early hor... U c already then say...	49	[u, dun, say, so, early, hor, u, c, already, t...	[u, dun, say, so, earli, hor, u, c, alreadi, t...	[u, dun, say, so, early, hor, u, c, already, t...	[dun, say, early, hor, c, already, say]
4	ham	Nah I don't think he goes to usf, he lives aro...	61	[nah, i, don't, think, he, goes, to, usf, he, ...	[nah, i, don't, think, he, goe, to, usf, he, l...	[nah, i, don't, think, he, go, to, usf, he, li...	[nah, think, go, usf, life, around, though]
...	...	...	...	...	...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...	160	[this, is, the, 2nd, time, we, have, tried, 2,...	[thi, is, the, 2nd, time, we, have, tri, 2, co...	[this, is, the, 2nd, time, we, have, tried, 2,...	[2nd, time, tried, contact, £750, pound, prize...
5568	ham	Will ü b going to esplanade fr home?	36	[will, ü, b, going, to, esplanade, fr, home]	[will, ü, b, go, to, esplanad, fr, home]	[will, ü, b, going, to, esplanade, fr, home]	[b, going, esplanade, fr, home]
5569	ham	Pity, * was in mood for that. So...any other s...	57	[pity, was, in, mood, for, that, soany, other,...	[piti, wa, in, mood, for, that, soani, other, ...	[pity, wa, in, mood, for, that, soany, other, ...	[pity, wa, mood, soany, suggestion]
5570	ham	The guy did some bitching but I acted like i'd...	125	[the, guy, did, some, bitching, but, i, acted,...	[the, guy, did, some, bitch, but, i, act, like...	[the, guy, did, some, bitching, but, i, acted,...	[guy, bitching, acted, like, i'd, interested, ...
5571	ham	Rofl. Its true to its name	26	[rofl, its, true, to, its, name]	[rofl, it, true, to, it, name]	[rofl, it, true, to, it, name]	[rofl, true, name]

5572 rows × 7 columns

In [40]:
```
data_pred = data['DeletedStopfromLemm'].tolist()
labels = data['Class']
```

In [41]:
```
X_train, X_test, y_train, y_test = train_test_split(data_pre
```

In [42]:
```
vectorizer = CountVectorizer()
```

In [43]:
```
%%time
def dummy(doc):
    return doc

pipe = Pipeline([('bow', CountVectorizer(tokenizer=dummy, pr
                 ('model', MultinomialNB(alpha=0.5))])
pipe.fit(X_train, y_train)
```

```
Wall time: 46.1 ms


Pipeline(memory=None,
         steps=[('bow',
                 CountVectorizer(analyzer='word', binary=False,
                                 decode_error='strict',
                                 dtype=<class 'numpy.int64'>, encoding='utf-8',
                                 input='content', lowercase=True, max_df=1.0,
                                 max_features=None, min_df=1,
                                 ngram_range=(1, 1),
                                 preprocessor=<function dummy at 0x000001D7AF22D5E8>,
                                 stop_words=None, strip_accents=None,
                                 token_pattern='(?u)\\b\\w\\w+\\b',
                                 tokenizer=<function dummy at 0x000001D7AF22D5E8>,
                                 vocabulary=None)),
                ('model',
                 MultinomialNB(alpha=0.5, class_prior=None, fit_prior=True))],
         verbose=False)
```

In [44]:
```
y_pred = pipe.predict(X_test)
```

In [45]:
```
metrics.accuracy_score(y_test, y_pred)
```

```
0.9849246231155779
```

In [46]:
```
cnf_matrix = metrics.confusion_matrix(y_test, y_pred)
```

In [47]:
```
cnf_matrix  #wyswietlenie confusion matrix TP FP FN TN
```

```
array([[1198,    8],
       [  13,  174]], dtype=int64)
```

In [48]:
```
cnf_matrix[0,1]
```

```
8
```

```
1 nalezy zminimalizowac błąd, odpowiadjący za wiadomosci
  uznane za spam, a spamem nie będące czyli false positive.
  Jest to błąd pierwszego rodzaju.Dlaczego akurat ten -
  lepiej żeby doszła do nas wiadomosc spamowa, niz zeby nie
  doszla do nas wazna wiadomosc od znajomego, bo została
  uznana za spam.
```

In [49]:

```
1 import scipy
2 from sklearn.dummy import DummyClassifier
```

In [50]:

```
1  def to_optimize(alpha):
2      global dummy
3      global X_train,y_train,y_test
4
5      pipe = Pipeline([('bow', CountVectorizer(tokenizer=dummy
6                   ('model', MultinomialNB(alpha=alpha))])
7      pipe.fit(X_train, y_train)
8      y_pred = pipe.predict(X_test)
9      cnf_matrix = metrics.confusion_matrix(y_test, y_pred)
10     metrics.accuracy_score(y_test, y_pred)
11     FP = cnf_matrix[0,1]
12     return FP
```

In [51]:

```
1 a = scipy.optimize.minimize_scalar(to_optimize, method = "bo
2 a
```

```
    fun: 0
message: 'Solution found.'
   nfev: 30
 status: 0
success: True
      x: 15.278645586830855
```

In [52]:

```
1 to_optimize(15.27)
```

```
0
```

In [53]:
```
pipe = Pipeline([('bow', CountVectorizer(tokenizer=dummy, pr
                 ('model', MultinomialNB(alpha=15))])
pipe.fit(X_train, y_train)
y_pred = pipe.predict(X_test)
cnf_matrix = metrics.confusion_matrix(y_test, y_pred)
metrics.accuracy_score(y_test, y_pred)
```

```
0.9662598707824839
```

In [54]:
```
cnf_matrix #confusion matrix, po zoptymalizowaniu parametru
```

```
array([[1206,    0],
       [  47,  140]], dtype=int64)
```

In [55]:
```
pipe_dummy = Pipeline([('bow', CountVectorizer(tokenizer=dum
                    ('model', DummyClassifier())])
pipe_dummy.fit(X_train, y_train)
```

```
F:\ProgramData\Anaconda3\lib\site-packages\sklearn\dummy.py:132: FutureWarning: The default valu
e of strategy will change from stratified to prior in 0.24.
  "stratified to prior in 0.24.", FutureWarning)


Pipeline(memory=None,
         steps=[('bow',
                 CountVectorizer(analyzer='word', binary=False,
                                 decode_error='strict',
                                 dtype=<class 'numpy.int64'>, encoding='utf-8',
                                 input='content', lowercase=True, max_df=1.0,
                                 max_features=None, min_df=1,
                                 ngram_range=(1, 1),
                                 preprocessor=<function dummy at 0x000001D7AF22D5E8>,
                                 stop_words=None, strip_accents=None,
                                 token_pattern='(?u)\\b\\w\\w+\\b',
                                 tokenizer=<function dummy at 0x000001D7AF22D5E8>,
                                 vocabulary=None)),
                ('model',
                 DummyClassifier(constant=None, random_state=None,
                                 strategy='warn'))],
         verbose=False)
```

In [56]:
```
y_pred_class = pipe_dummy.predict(X_test)
```

In [57]:
```
metrics.accuracy_score(y_test, y_pred_class)
```

```
0.7666905958363245
```

In [58]:
```
metrics.confusion_matrix(y_test, y_pred_class)
```

```
array([[1038,  168],
       [ 157,   30]], dtype=int64)
```

Biorac pod uwage nasz najwazniejszy blad, czyli usuniete wiadomosci, ktore usuniete byc nie powinny, nasz classifier ma błąd 10 wiadmości, na 1196 sklasyfikowanych poprawnie ,natomiast dummy classifier ma 149 błędow na 1057 poprawnie sklasyfikowanych iadomosci, czyniac z niego średnio użyteczne narzędzie do przeznaczonych celów.

Klasyfikacja maila

In [59]:
```
mail = """Dear Sir:
I have been requested by the Nigerian National Petroleum Com
You assistance is requested as a non-Nigerian citizen to ass
However, to be a legitimate transferee of these moneys accor
If it will be possible for you to assist us, we would be mos
Please call me at your earliest convenience at 18-467-4975.
Yours truly,
Prince Alyusi Islassis"""
```

In [60]:
```
d = {'Class': "spam", 'Text': mail}
mail_df = pd.DataFrame(data=d, index = [1],dtype=object)
```

In [61]:
```
mail_df
```

	Class	Text
1	spam	Dear Sir:\nI have been requested by the Nigeri...

In [62]:
```
lista = mail_df['Text'].tolist()
wynik = []
wynik2 = []

for i in lista:
    a =  preprocess1(i)
    wynik.append(a)
for j in wynik:
    b = j.split()
    wynik2.append(b)
```

In [63]:
```
wynik2
```

```
[['dear',
  'sir',
  'i',
  'have',
  'been',
  'requested',
  'by',
  'the',
  'nigerian',
  'national',
  'petroleum',
  'company',
  'to',
  'contact',
  'you',
  'for',
  'assistance',
  'in',
  'resolving',
  'a',
```

In [64]:
```
mail_df['Processed'] = wynik2
```

In [65]:
```
mail_df
```

	Class	Text	Processed
1	spam	Dear Sir:\nI have been requested by the Nigeri...	[dear, sir, i, have, been, requested, by, the,...

In [66]:
```
mail_df['stemmitPS'] = mail_df['Processed'].apply(stemmitPS)
mail_df['Lemm'] = mail_df['Processed'].apply(lemmitWordNet)
```

In [67]:
```
mail_df
```

	Class	Text	Processed	stemmitPS	Lemm
1	spam	Dear Sir:\nI have been requested by the Nigeri...	[dear, sir, i, have, been, requested, by, the,...	[dear, sir, i, have, been, request, by, the, n...	[dear, sir, i, have, been, requested, by, the,...

In [68]:
```
mail_df['DeletedStopfromLemm'] = mail_df['Lemm'].apply(DelSt
```

In [69]:
```
mail_df
```

	Class	Text	Processed	stemmitPS	Lemm	DeletedStopfromLemm
1	spam	Dear Sir:\nI have been requested by the Nigeri...	[dear, sir, i, have, been, requested, by, the,...	[dear, sir, i, have, been, request, by, the, n...	[dear, sir, i, have, been, requested, by, the,...	[dear, sir, requested, nigerian, national, pet...

In [70]:
```
mail_df['DeletedStopfromLemm']
```

```
1    [dear, sir, requested, nigerian, national, pet...
Name: DeletedStopfromLemm, dtype: object
```

In [71]:
```
pipe = Pipeline([('bow', CountVectorizer(tokenizer=dummy, pr
                 ('model', MultinomialNB(alpha=15))])
pipe.fit(X_train, y_train)
```

```
Pipeline(memory=None,
         steps=[('bow',
                 CountVectorizer(analyzer='word', binary=False,
                                 decode_error='strict',
                                 dtype=<class 'numpy.int64'>, encoding='utf-8',
                                 input='content', lowercase=True, max_df=1.0,
                                 max_features=None, min_df=1,
                                 ngram_range=(1, 1),
                                 preprocessor=<function dummy at 0x000001D7AF22D5E8>,
                                 stop_words=None, strip_accents=None,
                                 token_pattern='(?u)\\b\\w\\w+\\b',
                                 tokenizer=<function dummy at 0x000001D7AF22D5E8>,
                                 vocabulary=None)),
                ('model',
                 MultinomialNB(alpha=15, class_prior=None, fit_prior=True))],
         verbose=False)
```

In [72]:
```
X_test = mail_df['DeletedStopfromLemm']
y_pred = pipe.predict(X_test)
```

In [73]:
```
y_pred
```

```
array(['ham'], dtype='<U4')
```

Wiadomosc mimo, ze jest spamem została zakwalifikowana jako Ham, ponieważ zawierała bardzo duzo symboli, oraz miala inna budowe niz te na których system był uczony oraz posiadała duzy jak na wiadomosc typu spam zasób slow.

In [ ]:
```

```

In [ ]:
```

```