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

Read the .csv file using Pandas. Take a look at the top few records.

In [2]:
```
review_df=pd.read_csv(r'K8 Reviews v0.2.csv')
review_df.head(8)
```

Out[2]:

	sentiment	review
0	1	Good but need updates and improvements
1	0	Worst mobile i have bought ever, Battery is dr...
2	1	when I will get my 10% cash back.... its alrea...
3	1	Good
4	0	The worst phone everThey have changed the last...
5	0	Only I'm telling don't buyI'm totally disappoi...
6	1	Phone is awesome. But while charging, it heats...
7	0	The battery level has worn down

In [3]:
```
review_df.describe()
```

Out[3]:

	sentiment
count	14675.000000
mean	0.474480
std	0.499365
min	0.000000
25%	0.000000
50%	0.000000
75%	1.000000
max	1.000000

In [4]:
```
review_df[review_df.sentiment==1] #Positive reviews
```

Out[4]:

	sentiment	review
0	1	Good but need updates and improvements
2	1	when I will get my 10% cash back.... its alrea...
3	1	Good
6	1	Phone is awesome. But while charging, it heats...
11	1	Good phone but charger not working / damage wi...
...	...	...
14670	1	I really like the phone, Everything is working...
14671	1	The Lenovo K8 Note is awesome. It takes best p...
14672	1	Awesome Gaget.. @ this price
14673	1	This phone is nice processing will be successf...
14674	1	Good product but the pakeging was not enough.

6963 rows × 2 columns

In [5]:
```
review_df[review_df.sentiment==0] #Neg reviews
```

Out[5]:

	sentiment	review
1	0	Worst mobile i have bought ever, Battery is dr...
4	0	The worst phone everThey have changed the last...
5	0	Only I'm telling don't buyI'm totally disappoi...
7	0	The battery level has worn down
8	0	It's over hitting problems...and phone hanging...
...	...	...
14663	0	Waste of buying this mobileMobile getting over...
14664	0	Mobile is very worst and customer support very...
14666	0	I am facing problem with network connection.Wh...
14668	0	Not so good.
14669	0	Very poour battery parformance and prosecer

7712 rows × 2 columns

In [6]:
```
review_df.head(8)
```

Out[6]:

	sentiment	review
0	1	Good but need updates and improvements
1	0	Worst mobile i have bought ever, Battery is dr...
2	1	when I will get my 10% cash back.... its alrea...
3	1	Good
4	0	The worst phone everThey have changed the last...
5	0	Only I'm telling don't buyI'm totally disappoi...
6	1	Phone is awesome. But while charging, it heats...
7	0	The battery level has worn down

In [7]:
```
review_df['sentiment'].value_counts()
```

Out[7]:
```
0    7712
1    6963
Name: sentiment, dtype: int64
```

In [8]:
```
review_df['sentiment'].shape
```

Out[8]:
```
(14675,)
```

In [9]:
```
review_df.review.count()
```

Out[9]:
```
14675
```

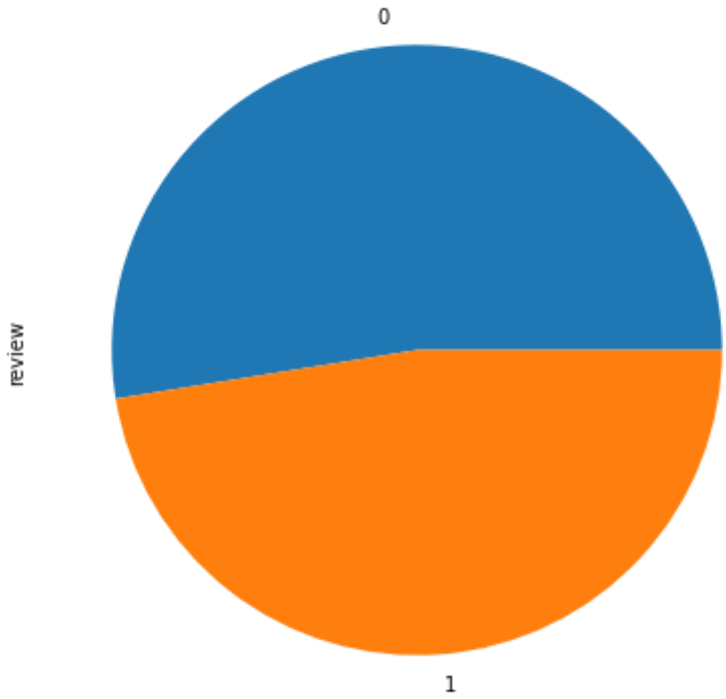
In [ ]:
```

```

In [10]:
```
# Figure Size
fig = plt.figure(figsize =(10, 7))

# Horizontal Bar Plot
review_df.groupby('sentiment').review.count().plot.pie()

# Show Plot
plt.show()
```



Normalize casings for the review text and extract the text into a list for easier manipulation.

Review to Lower Case

In [11]:
```
review_df['review']=review_df['review'].astype(str).str.lower()
review_df['review'][:10]
```

Out[11]:
```
0                 good but need updates and improvements
1    worst mobile i have bought ever, battery is dr...
2    when i will get my 10% cash back.... its alrea...
3                                                 good
4    the worst phone everthey have changed the last...
5    only i'm telling don't buyi'm totally disappoi...
6    phone is awesome. but while charging, it heats...
7                       the battery level has worn down
8    it's over hitting problems...and phone hanging...
9    a lot of glitches dont buy this thing better g...
Name: review, dtype: object
```

In [12]:
```
Review_List= review_df['review'].tolist()
```

In [13]:
```
Review_List[1],Review_List[5]
```

Out[13]:
```
("worst mobile i have bought ever, battery is draining like hell, backup is only 6
to 7 hours with internet uses, even if i put mobile idle its getting discharged.th
is is biggest lie from amazon & lenove which is not at all expected, they are maki
ng full by saying that battery is 4000mah & booster charger is fake, it takes at l
east 4 to 5 hours to be fully charged.don't know how lenovo will survive by making
full of us.please don;t go for this else you will regret like me.",
 "only i'm telling don't buyi'm totally disappointedpoor batterypoor camerawaste o
f money")
```

In [14]:
```
len(Review_List)
```

Out[14]:
```
14675
```

Tokenize the reviews using NLTKs word_tokenize function.

In [15]:
```
Tokenized_Review=[]
for text in Review_List:
    Tokenized_Review.append(nltk.tokenize.word_tokenize(text))
```

In [16]:
```
Tokenized_Review[0]
```

Out[16]:
```
['good', 'but', 'need', 'updates', 'and', 'improvements']
```

Perform parts-of-speech tagging on each sentence using the NLTK POS tagger.

In [17]:
```
nltk.pos_tag(Tokenized_Review[0])
```

Out[17]:
```
[('good', 'JJ'),
 ('but', 'CC'),
 ('need', 'VBP'),
 ('updates', 'NNS'),
 ('and', 'CC'),
 ('improvements', 'NNS')]
```

In [18]:
```
Review_POS=[]
for comments in Tokenized_Review:
    Review_POS.append(nltk.pos_tag(comments))
```

In [19]:
```
# nltk.download('averaged_perceptron_tagger')
```

In [20]:
```
Review_POS[0]
```

Out[20]:
```
[('good', 'JJ'),
 ('but', 'CC'),
 ('need', 'VBP'),
 ('updates', 'NNS'),
 ('and', 'CC'),
 ('improvements', 'NNS')]
```

Include only nouns

In [21]:
```
Review_NounNAdj=[]


for postaggedComment  in Review_POS:
    Review_NounNAdj.append([word for (word, PosTag) in postaggedComment  if  PosTag
```

In [22]:
```
Review_NounNAdj[0]
```

Out[22]:
```
['updates', 'improvements']
```

In [23]:
```
##Another way to get POS Tagging

%%time
from textblob import TextBlob
```

```
poslist = []
for text in Review_List:
   blob = TextBlob(text)
   poslist.append(blob.pos_tags)
```

```
UsageError: Line magic function `%%time` not found.
```

Lemmatize.

Different forms of the terms need to be treated as one.

In [24]:
```
from nltk.stem import WordNetLemmatizer
from nltk.corpus import stopwords

lemmatizer = WordNetLemmatizer()
```

In [25]:
```
Lemma_Review=[]


# for comment  in Review_NounNAdj:
#     temp=[]
#     for word in comment:
#         temp.append(lemmatizer.lemmatize(word))

#     Lemma_Review.append(temp)
for comment  in Review_NounNAdj:
    Lemma_Review.append([lemmatizer.lemmatize(word)  for word in comment])

Lemma_Review[:10] # top 5 items in List
```

Out[25]:
```
[['update', 'improvement'],
 ['hour', 'us', 'hour'],
 [],
 [],
 [],
 [],
 ['..', 'k8'],
 [],
 ['problem', 'problem', 'year'],
 ['glitch', 'option']]
```

Remove stopwords and punctuation (if there are any).

Combining the corpus to single list

In [26]:
```
from nltk.corpus import stopwords
from string import punctuation
```

In [27]:
```
# Removing Puncuation and Stop Words:
my_stopwords = stopwords.words('english')+list(punctuation) + ["..."] +[".."] +["."

Review_NoStop1=[ x for x in Lemma_Review if x not in my_stopwords]
```

In [28]:
```
Review_NoStop1[:10]
```

Out[28]:
```
[['update', 'improvement'],
 ['hour', 'us', 'hour'],
 [],
 [],
 [],
 [],
 ['..', 'k8'],
 [],
 ['problem', 'problem', 'year'],
 ['glitch', 'option']]
```

In [29]:
```
# def remove_stopword(x):
#     return [y for y in x if y not in stopwords.words('english')]
```

In [30]:
```
Review_NoStop=[ x for x in Review_NoStop1 if x !=[] ]
```

In [32]:
```
# Review_NoStop=[ x for x in Review_NoStop2 if x not in (stopwords.words('english')
```

In [33]:
```
Review_NoStop[:10]
```

Out[33]:
```
[['update', 'improvement'],
 ['hour', 'us', 'hour'],
 ['..', 'k8'],
 ['problem', 'problem', 'year'],
 ['glitch', 'option'],
 ['month'],
 ['i', 'month'],
 ['i', '..', '..'],
 ['..', 'solution'],
 ['option']]
```

Remove data such as '..','...','.','....','.....'

In [34]:
```
# XY=[]
# for ele in Review_NoStop:
#     for x in ele:
#         if x not in ('..','...','.','....','.....'):
#             XY.append(x)
```

In [35]:
```
Review_Clean= []
```

In [36]:
```
for ele  in Review_NoStop:
    Review_Clean.append([y for y in ele  if  y not in ('..','...','.','....','....
```

In [37]:
```
Review_Clean[:10]
```

Out[37]:
```
[['update', 'improvement'],
 ['hour', 'us', 'hour'],
 ['k8'],
 ['problem', 'problem', 'year'],
 ['glitch', 'option'],
 ['month'],
 ['i', 'month'],
 ['i'],
 ['solution'],
 ['option']]
```

In [38]:
```
# clean_vocab=vocab.apply(lambda x:remove_stopword(x))
# for item in Lemma_Review:
#     item.apply(lambda x:remove_stopword(x))
# print(item)


# for comment  in Lemma_Review:
#     temp=[]
#     for word in comment:
#         word=word.tolist()
#         temp.append(word.apply(lambda x:remove_stopword(x)))

#     # print(temp)
```

Word cloud

In [39]:
```
#all corpus made to single list using .extend()
vocab = []
for el in Review_Clean:
    vocab.extend(el)

vocab[:20],len(vocab)
```

Out[39]:
```
(['update',
  'improvement',
  'hour',
  'us',
  'hour',
  'k8',
  'problem',
  'problem',
  'year',
  'glitch',
  'option',
  'month',
  'i',
  'month',
  'i',
  'solution',
  'option',
  'specification',
  'function',
  'speekars'],
 10566)
```

In [122…
```
# Import the wordcloud library
from wordcloud import WordCloud
```

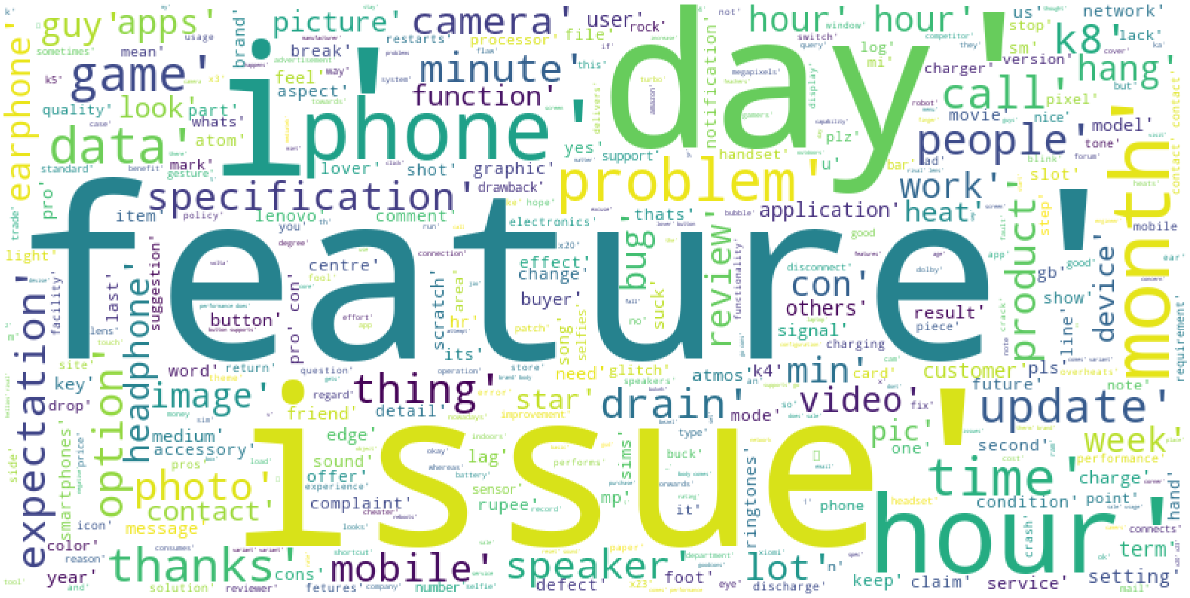
In [123…
```
# Join the different processed titles together.

# long_string = ','.join(list(papers['paper_text_processed'].values))
long_string=str(vocab)

# Create a WordCloud object
wordcloud = WordCloud(background_color="white", max_words=5000, contour_width=3, c
# Generate a word cloud
wordcloud.generate(long_string)

# Visualize the word cloud
wordcloud.to_image()
```

Out[123]:



In [ ]:

```

```

In [ ]:

```
# Lemma_Review
```

Create a topic model using LDA on the cleaned up data with 12 topics.

Print out the top terms for each topic anc checking the coherence of the model with the c_v metric?

In [40]:

```
import gensim.corpora as corpora


# Create Dictionary
id2word = corpora.Dictionary(Review_Clean)

# Create Corpus
texts = Review_Clean

# Term Document Frequency
corpus = [id2word.doc2bow(text) for text in texts]
# View
# print(corpus[:1][0])
print(corpus[:1])
```

```
[[(0, 1), (1, 1)]]
```

In [41]:

```
# print(id2word)
```

In [63]:

```
# Creating the term dictionary of our courpus, where every unique term is assigned
dictionary = corpora.Dictionary(Review_Clean)
print(dictionary)
```

```
Dictionary(1536 unique tokens: ['improvement', 'update', 'hour', 'us', 'k8']...)
```

In [64]:

```
# Converting list of documents (corpus) into Document Term Matrix using dictionary
doc_term_matrix = [dictionary.doc2bow(doc) for doc in Review_Clean]
```

In [65]:

```
doc_term_matrix[:3]
```

Out[65]:
```
[[(0, 1), (1, 1)], [(2, 2), (3, 1)], [(4, 1)]]
```

In [66]:
```
doc_term_matrix[:1][0]
```

Out[66]:
```
[(0, 1), (1, 1)]
```

In [67]:
```
# Build LDA model
import time
```

In [68]:
```
# gensim for LDA
import gensim
import gensim.corpora as corpora
from gensim.utils import simple_preprocess
from gensim.models import CoherenceModel
```

In [69]:
```
%%time
lda_model = gensim.models.ldamodel.LdaModel(corpus=doc_term_matrix,
                                            id2word=dictionary,
                                            num_topics=10,
                                            random_state=42,
                                            passes=10,
                                            per_word_topics=True)
```

```
CPU times: total: 3.98 s
Wall time: 3.99 s
```

In [70]:
```
for idx, topic in lda_model.print_topics(-1):
    print("Topic: {} \nWords: {}".format(idx, topic ))
    print("\n")
```

```
Topic: 0
Words: 0.153*"data" + 0.114*"call" + 0.094*"thing" + 0.060*"earphone" + 0.055*"hea
t" + 0.038*"user" + 0.037*"function" + 0.019*"second" + 0.015*"@" + 0.013*"gb"


Topic: 1
Words: 0.267*"day" + 0.230*"hour" + 0.077*"*" + 0.049*"k8" + 0.044*"camera" + 0.03
2*"headphone" + 0.015*"service" + 0.015*"edge" + 0.015*"result" + 0.007*"claim"


Topic: 2
Words: 0.304*"i" + 0.081*"speaker" + 0.042*"guy" + 0.034*"device" + 0.026*"feel" +
0.022*"atmos" + 0.019*"slot" + 0.017*"model" + 0.017*"word" + 0.015*"need"


Topic: 3
Words: 0.402*"issue" + 0.078*"drain" + 0.057*"con" + 0.036*"star" + 0.022*"game" +
0.020*"message" + 0.016*"friend" + 0.016*"detail" + 0.016*"graphic" + 0.013*"lag"


Topic: 4
Words: 0.250*"phone" + 0.086*"expectation" + 0.053*"contact" + 0.041*"apps" + 0.04
0*"look" + 0.033*"setting" + 0.024*"scratch" + 0.023*"pls" + 0.020*"charge" + 0.01
5*"buyer"


Topic: 5
Words: 0.202*"problem" + 0.076*"specification" + 0.073*"min" + 0.050*"image" + 0.0
39*"......" + 0.036*"video" + 0.022*"suck" + 0.021*"accessory" + 0.020*"u" + 0.018
*"sound"


Topic: 6
Words: 0.241*"month" + 0.093*"game" + 0.083*"option" + 0.075*"product" + 0.051*"ha
ng" + 0.050*"review" + 0.033*"pic" + 0.015*"medium" + 0.014*"comment" + 0.013*"hr"


Topic: 7
Words: 0.120*"thanks" + 0.109*"people" + 0.097*"minute" + 0.052*"picture" + 0.037
*"others" + 0.027*"button" + 0.021*"complaint" + 0.019*"centre" + 0.016*"keep" +
0.014*"movie"


Topic: 8
Words: 0.483*"feature" + 0.056*"photo" + 0.054*"mobile" + 0.024*"customer" + 0.016
*"signal" + 0.015*"rupee" + 0.015*"sims" + 0.013*"brand" + 0.012*"lenovo" + 0.010
*"sm"


Topic: 9
Words: 0.161*"time" + 0.114*"update" + 0.063*"lot" + 0.056*"bug" + 0.047*"work" +
0.044*"week" + 0.031*"application" + 0.026*"term" + 0.021*"key" + 0.021*"year"
```

In [77]:
```
import pyLDAvis.gensim
import pickle
import pyLDAvis
# from pyLDAvis import gensim
```

In [82]:
```
 #Visualize the topics
pyLDAvis.enable_notebook()
```

```
vis = pyLDAvis.gensim.prepare(lda_model, doc_term_matrix, dictionary)
vis
```

```
C:\Users\keert\anaconda3\lib\site-packages\pyLDAvis\_prepare.py:247: FutureWarnin
g: In a future version of pandas all arguments of DataFrame.drop except for the ar
gument 'labels' will be keyword-only.
  default_term_info = default_term_info.sort_values(
```

Out[82]:

In [78]:
```
pyLDAvis.__version__
```

Out[78]:
```
'3.2.1'
```

In [80]:

In [83]:
```
 #Compute Perplexity
print('Perplexity: ', lda_model.log_perplexity(doc_term_matrix)) # a measure of hou
```

```
Perplexity:  -6.360985931139761
```

In [84]:
```
# Compute Coherence Score
coherence_model_lda = CoherenceModel(model=lda_model, texts=Review_Clean, dictionar
 coherence='c_v')
coherence_lda = coherence_model_lda.get_coherence()
print('\nCoherence Score: ', coherence_lda)
```

```
Coherence Score:  0.5963680198476624
```

Changing number of topics to 8

In [91]:
```
%%time
lda_model = gensim.models.ldamodel.LdaModel(corpus=doc_term_matrix,
                                            id2word=dictionary,
                                            num_topics=8,
                                            random_state=42,
                                            passes=10,
                                            per_word_topics=True)
```

```
CPU times: total: 3.98 s
Wall time: 4 s
```

In [92]:
```
for idx, topic in lda_model.print_topics(-1):
    print("Topic: {} \nWords: {}".format(idx, topic ))
    print("\n")
```

```
Topic: 0
Words: 0.092*"drain" + 0.088*"thing" + 0.078*"k8" + 0.061*"lot" + 0.052*"heat" +
0.048*"image" + 0.033*"user" + 0.025*"button" + 0.024*"result" + 0.021*"edge"


Topic: 1
Words: 0.226*"day" + 0.196*"hour" + 0.117*"phone" + 0.065*"*" + 0.038*"photo" + 0.
037*"camera" + 0.027*"headphone" + 0.018*"function" + 0.014*"message" + 0.007*"vid
eo"


Topic: 2
Words: 0.254*"i" + 0.068*"speaker" + 0.040*"guy" + 0.026*"video" + 0.025*"device"
+ 0.020*"work" + 0.017*"brand" + 0.016*"slot" + 0.015*"accessory" + 0.015*"atmos"


Topic: 3
Words: 0.312*"feature" + 0.258*"issue" + 0.064*"game" + 0.031*"min" + 0.023*"star"
+ 0.010*"graphic" + 0.010*"lag" + 0.010*"rupee" + 0.009*"friend" + 0.009*"detail"


Topic: 4
Words: 0.132*"time" + 0.122*"data" + 0.073*"expectation" + 0.055*"mobile" + 0.045
*"contact" + 0.036*"week" + 0.036*"apps" + 0.025*"feel" + 0.019*"pls" + 0.018*"cha
rge"


Topic: 5
Words: 0.070*"specification" + 0.065*"con" + 0.054*"earphone" + 0.042*"pic" + 0.03
6*"......" + 0.034*"customer" + 0.032*"look" + 0.031*"term" + 0.031*"pro" + 0.021
*"suck"


Topic: 6
Words: 0.171*"month" + 0.130*"problem" + 0.073*"thanks" + 0.059*"option" + 0.053
*"product" + 0.036*"hang" + 0.034*"review" + 0.024*"bug" + 0.017*"service" + 0.016
*"scratch"


Topic: 7
Words: 0.101*"update" + 0.092*"call" + 0.075*"minute" + 0.067*"people" + 0.040*"pi
cture" + 0.029*"others" + 0.025*"sims" + 0.022*"key" + 0.021*"application" + 0.015
*"bug"
```

In [93]:
```
 #Visualize the topics
pyLDAvis.enable_notebook()
vis = pyLDAvis.gensim.prepare(lda_model, doc_term_matrix, dictionary)
vis
```

```
C:\Users\keert\anaconda3\lib\site-packages\pyLDAvis\_prepare.py:247: FutureWarnin
g: In a future version of pandas all arguments of DataFrame.drop except for the ar
gument 'labels' will be keyword-only.
  default_term_info = default_term_info.sort_values(
```

Out[93]:

In [94]:
```
 #Compute Perplexity
print('Perplexity: ', lda_model.log_perplexity(doc_term_matrix)) # a measure of hou
```

```
Perplexity:  -6.253023913459027
```

In [95]:
```
# Compute Coherence Score
```

```
coherence_model_lda = CoherenceModel(model=lda_model, texts=Review_Clean, dictionar
 coherence='c_v')
coherence_lda = coherence_model_lda.get_coherence()
print('\nCoherence Score: ', coherence_lda)
```

```
Coherence Score:  0.5833787750919727
```

In [ ]: