```
!pip install nltk spacy wordcloud
```

```
Requirement already satisfied: nltk in /usr/local/lib/python3.12/dist-packages (3.9.1)
Requirement already satisfied: spacy in /usr/local/lib/python3.12/dist-packages (3.8.11)
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Requirement already satisfied: spacy-legacy<3.1.0,>=3.0.11 in /usr/local/lib/python3.12/dist-packages (from spacy) (3.0.12)
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Requirement already satisfied: catalogue<2.1.0,>=2.0.6 in /usr/local/lib/python3.12/dist-packages (from spacy) (2.0.10)
Requirement already satisfied: weasel<0.5.0,>=0.4.2 in /usr/local/lib/python3.12/dist-packages (from spacy) (0.4.3)
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Requirement already satisfied: requests<3.0.0,>=2.13.0 in /usr/local/lib/python3.12/dist-packages (from spacy) (2.32.4)
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Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.12/dist-packages (from requests<3.0.0,>=2.13.0->
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Requirement already satisfied: blis<1.4.0,>=1.3.0 in /usr/local/lib/python3.12/dist-packages (from thinc<8.4.0,>=8.3.4->spac
Requirement already satisfied: confection<1.0.0,>=0.0.1 in /usr/local/lib/python3.12/dist-packages (from thinc<8.4.0,>=8.3.4
Requirement already satisfied: cloudpathlib<1.0.0,>=0.7.0 in /usr/local/lib/python3.12/dist-packages (from weasel<0.5.0,>=0.
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Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.12/dist-packages (from jinja2->spacy) (3.0.3)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib->wordcloud) (1.3
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Requirement already satisfied: wrapt in /usr/local/lib/python3.12/dist-packages (from smart-open<8.0.0,>=5.2.1->weasel<0.5.0
```

```
import pandas as pd
import numpy as np
import re
import nltk
import matplotlib.pyplot as plt

from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
from sklearn.feature_extraction.text import TfidfVectorizer
from wordcloud import WordCloud
```

```
nltk.download('punkt')
nltk.download('stopwords')
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Unzipping tokenizers/punkt.zip.
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
True
```

```
import pandas as pd

data = {
    "text": [
        "Flight delayed again very frustrating experience",
        "Worst airline service ever never booking again",
        "Seats were uncomfortable and staff was rude",
        "Customer support did not respond for hours",
        "Flight got cancelled without proper notice",
        "The airline experience was amazing and smooth",
        "Staff were friendly and helpful",
        "Average flight nothing special",
        "Food quality was okay"
    ],
    "airline_sentiment": [
        "negative",
        "negative",
        "negative",
        "negative",
        "negative",
        "positive",
        "positive",
        "neutral",
        "neutral"
    ]
}

df = pd.DataFrame(data)
df
```

```
                                       text  airline_sentiment
0  Flight delayed again very frustrating experience          negative
1      Worst airline service ever never booking again          negative
2       Seats were uncomfortable and staff was rude          negative
3           Customer support did not respond for hours          negative
4              Flight got cancelled without proper notice          negative
5  The airline experience was amazing and smooth          positive
6                         Staff were friendly and helpful          positive
7                         Average flight nothing special           neutral
8                                  Food quality was okay           neutral
```

Next steps: Generate code with df New interactive sheet

```
df.head()
```

```
                                       text  airline_sentiment
0  Flight delayed again very frustrating experience          negative
1      Worst airline service ever never booking again          negative
2       Seats were uncomfortable and staff was rude          negative
3           Customer support did not respond for hours          negative
4              Flight got cancelled without proper notice          negative
```

Next steps: Generate code with df New interactive sheet

```
df = df[['text', 'airline_sentiment']]
df.head()
```

```
                                       text  airline_sentiment
0  Flight delayed again very frustrating experience          negative
1      Worst airline service ever never booking again          negative
2       Seats were uncomfortable and staff was rude          negative
3           Customer support did not respond for hours          negative
4              Flight got cancelled without proper notice          negative
```

Next steps: Generate code with df New interactive sheet

```
def clean_text(text):
    text = re.sub(r"http\S+", "", text)
    text = re.sub(r"@\w+", "", text)
    text = re.sub(r"#\w+", "", text)
    text = re.sub(r"[^a-zA-Z]", " ", text)
    text = text.lower()
    return text
```

```
df['clean_text'] = df['text'].apply(clean_text)
df.head()
```

```
                                         text  airline_sentiment                                    clean_text
0  Flight delayed again very frustrating experience           negative  flight delayed again very frustrating experience
1      Worst airline service ever never booking again           negative      worst airline service ever never booking again
2         Seats were uncomfortable and staff was rude           negative         seats were uncomfortable and staff was rude
3           Customer support did not respond for hours           negative           customer support did not respond for hours
4              Flight got cancelled without proper notice           negative              flight got cancelled without proper notice
```

Next steps: Generate code with df New interactive sheet

```
stop_words = set(stopwords.words('english'))

def tokenize_remove_stopwords(text):
    tokens = word_tokenize(text)
    tokens = [word for word in tokens if word not in stop_words]
    return " ".join(tokens)
```

```
!pip install -q nltk
```

```
import nltk
nltk.download('punkt')
nltk.download('stopwords')
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
True
```

```
import pandas as pd
import re

from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
```

```
data = {
    "text": [
        "Flight delayed again very frustrating experience",
        "Worst airline service ever never booking again",
        "Seats were uncomfortable and staff was rude",
        "Customer support did not respond for hours",
        "Flight got cancelled without proper notice",
        "The airline experience was amazing and smooth",
        "Staff were friendly and helpful",
        "Average flight nothing special",
        "Food quality was okay"
    ],
    "airline_sentiment": [
        "negative","negative","negative","negative","negative",
        "positive","positive","neutral","neutral"
    ]
}

df = pd.DataFrame(data)
df
```

	text	airline_sentiment
0	Flight delayed again very frustrating experience	negative
1	Worst airline service ever never booking again	negative
2	Seats were uncomfortable and staff was rude	negative
3	Customer support did not respond for hours	negative
4	Flight got cancelled without proper notice	negative
5	The airline experience was amazing and smooth	positive
6	Staff were friendly and helpful	positive
7	Average flight nothing special	neutral
8	Food quality was okay	neutral

Next steps: Generate code with df New interactive sheet

```
def clean_text(text):
    text = str(text)
    text = re.sub(r'[^a-zA-Z ]', '', text)
    return text.lower()

df['clean_text'] = df['text'].apply(clean_text)
df[['text', 'clean_text']]
```

	text	clean_text
0	Flight delayed again very frustrating experience	flight delayed again very frustrating experience
1	Worst airline service ever never booking again	worst airline service ever never booking again
2	Seats were uncomfortable and staff was rude	seats were uncomfortable and staff was rude
3	Customer support did not respond for hours	customer support did not respond for hours
4	Flight got cancelled without proper notice	flight got cancelled without proper notice
5	The airline experience was amazing and smooth	the airline experience was amazing and smooth
6	Staff were friendly and helpful	staff were friendly and helpful
7	Average flight nothing special	average flight nothing special
8	Food quality was okay	food quality was okay

```
stop_words = set(stopwords.words('english'))

def tokenize_remove_stopwords(text):
    text = str(text)
    tokens = text.split()      # ✅ NO NLTK tokenizer (avoids errors)
    tokens = [word for word in tokens if word not in stop_words]
    return " ".join(tokens)
```

```
df['processed_text'] = df['clean_text'].apply(tokenize_remove_stopwords)
df
```

	text	airline_sentiment	clean_text	processed_text
0	Flight delayed again very frustrating experience	negative	flight delayed again very frustrating experience	flight delayed frustrating experience
1	Worst airline service ever never booking again	negative	worst airline service ever never booking again	worst airline service ever never booking
2	Seats were uncomfortable and staff was rude	negative	seats were uncomfortable and staff was rude	seats uncomfortable staff rude
3	Customer support did not respond for hours	negative	customer support did not respond for hours	customer support respond hours
4	Flight got cancelled without proper notice	negative	flight got cancelled without proper notice	flight got cancelled without proper notice
5	The airline experience was amazing and smooth	positive	the airline experience was amazing and smooth	airline experience amazing smooth

Next steps: Generate code with df New interactive sheet

```
negative_df = df[df['airline_sentiment'] == 'negative']
negative_df.head()
```

	text	airline_sentiment	clean_text	processed_text
0	Flight delayed again very frustrating experience	negative	flight delayed again very frustrating experience	flight delayed frustrating experience
1	Worst airline service ever never booking again	negative	worst airline service ever never booking again	worst airline service ever never booking
2	Seats were uncomfortable and staff was rude	negative	seats were uncomfortable and staff was rude	seats uncomfortable staff rude
	Customer support did not respond for		customer support did not respond for	

Next steps: Generate code with negative_df New interactive sheet

```
vectorizer = TfidfVectorizer(max_features=20)
tfidf_matrix = vectorizer.fit_transform(negative_df['processed_text'])

tfidf_df = pd.DataFrame(
    tfidf_matrix.toarray(),
    columns=vectorizer.get_feature_names_out()
)

tfidf_df.head()
```

	airline	booking	cancelled	customer	delayed	ever	experience	flight	frustrating	got	hours	never	
0	0.000000	0.000000	0.000000	0.0	0.523358	0.000000	0.523358	0.422242	0.523358	0.000000	0.0	0.000000	0.0
1	0.447214	0.447214	0.000000	0.0	0.000000	0.447214	0.000000	0.000000	0.000000	0.000000	0.0	0.447214	0.0
2	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.0
3	0.000000	0.000000	0.000000	0.5	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.5	0.000000	0.0
4	0.000000	0.000000	0.463693	0.0	0.000000	0.000000	0.000000	0.374105	0.000000	0.463693	0.0	0.000000	0.4

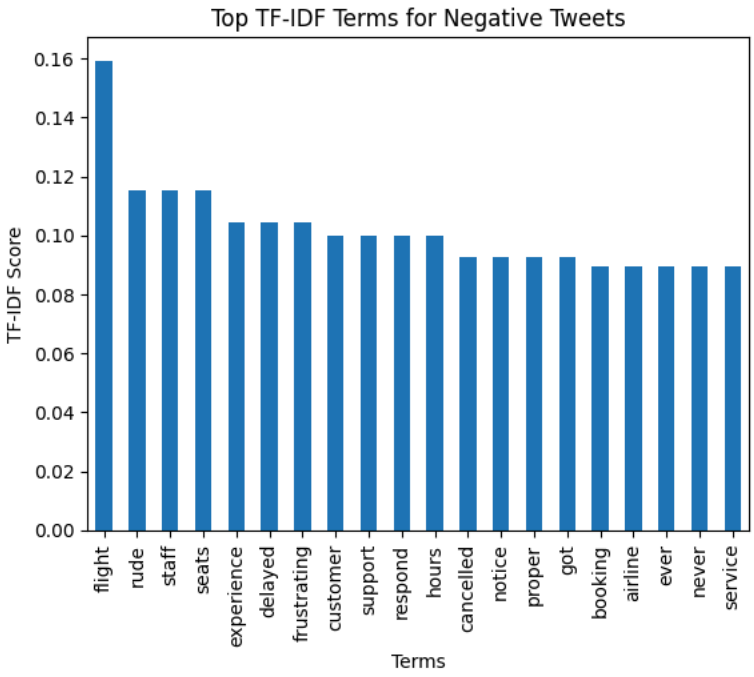
Next steps: Generate code with tfidf_df New interactive sheet

```
tfidf_scores = tfidf_df.mean().sort_values(ascending=False)
tfidf_scores
```

```
                   0
flight      0.159269
rude        0.115470
staff       0.115470
seats       0.115470
experience  0.104672
delayed     0.104672
frustrating 0.104672
customer    0.100000
support     0.100000
respond     0.100000
hours       0.100000
cancelled   0.092739
notice      0.092739
proper      0.092739
got         0.092739
booking     0.089443
airline     0.089443
ever        0.089443
never       0.089443
service     0.089443

dtype: float64
```

```
plt.figure()
tfidf_scores.plot(kind='bar')
plt.title("Top TF-IDF Terms for Negative Tweets")
plt.xlabel("Terms")
plt.ylabel("TF-IDF Score")
plt.show()
```



```
import matplotlib.pyplot as plt

# Convert TF-IDF scores to sorted values
tfidf_scores = tfidf_scores.sort_values(ascending=False)

# Plot BAR GRAPH
plt.figure(figsize=(10,5))
plt.bar(tfidf_scores.index, tfidf_scores.values)
plt.xlabel("Terms")
plt.ylabel("TF-IDF Score")
plt.title("Top TF-IDF Terms for Negative Sentiment")
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```