Ben Earnest

Andrew Kim

Grigor Tashchyan

A Text Analysis of MLB Performance

ADS-509 Final Project Team 11

*Github link: https://github.com/ApkimCA/AppliedTextMining_Team11

Libraries

In [1]:
```
#Install reqired libraries
!pip install beautifulsoup4 requests
!pip install tqdm
```

```
Requirement already satisfied: beautifulsoup4 in c:\users\andre\downloads\new folder\envs\r\lib\site-packages
(4.12.2)
Requirement already satisfied: requests in c:\users\andre\downloads\new folder\envs\r\lib\site-packages (2.27.
1)
Requirement already satisfied: soupsieve>1.2 in c:\users\andre\downloads\new folder\envs\r\lib\site-packages (f
rom beautifulsoup4) (2.4.1)
Requirement already satisfied: idna<4,>=2.5 in c:\users\andre\downloads\new folder\envs\r\lib\site-packages (fr
om requests) (3.3)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\andre\downloads\new folder\envs\r\lib\site-packag
es (from requests) (2021.10.8)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\andre\downloads\new folder\envs\r\lib\site-pac
kages (from requests) (1.26.8)
Requirement already satisfied: charset-normalizer~=2.0.0 in c:\users\andre\downloads\new folder\envs\r\lib\site
-packages (from requests) (2.0.4)
Requirement already satisfied: tqdm in c:\users\andre\downloads\new folder\envs\r\lib\site-packages (4.65.0)
Requirement already satisfied: colorama in c:\users\andre\downloads\new folder\envs\r\lib\site-packages (from t
qdm) (0.4.6)
```

In [2]:
```
#Import required libraries
import requests
from bs4 import BeautifulSoup
import pandas as pd
import matplotlib.pyplot as plt
from nltk.corpus import stopwords
import string
from string import punctuation
from wordcloud import WordCloud
import re
from collections import Counter
from tqdm import tqdm
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import re
import string
from nltk.tokenize import word_tokenize
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer
from sklearn.feature_extraction.text import TfidfVectorizer
from spacy.lang.en.stop_words import STOP_WORDS as stopwords
```

The goal of our project is to conduct a text/event analysis of articles and blog posts of certain Major League Baseball (MLB) teams to predict the association of blog posts with winning or losing teams. This will involve considering whether the text in a specific blog post is generally associated with a winning or losing MLB team.

The first step in our effort is to scrape blog post text from the mlbtraderumors.com website. This posts include text, dates posted, and the authors name. We will scrape this information and store it in a dataframe that we can use to start our text analysis.

Functions to Acquire Text Data

In [3]:
```
def scrape_website(url, file_path):
    #Send a GET request to the website
    response = requests.get(url)

    #Parse the HTML content using BeautifulSoup
    soup = BeautifulSoup(response.content, "html.parser")

    #Find all the news article elements
    articles = soup.find_all("article")

    #Create lists to store the extracted values
    titles = []
    authors = []
    dates = []
    contents = []

    #Iterate over the articles and extract the text
    with open(file_path, "w", encoding="utf-8") as file:
        for article in articles:
            #Extract the article title
            title_element = article.find("h2")
            title = title_element.text.strip() if title_element else ""
            titles.append(title)

            #Extract the article author
            author_element = article.find("span", class_="entry-author")
            author = author_element.text.strip() if author_element else ""
            authors.append(author)

            #Extract the article date
            date_element = article.find("time", class_="entry-time")
            date = date_element.text.strip() if date_element else ""
            dates.append(date)

            #Extract the article content
            content_element = article.find("div", class_="entry-content")
            content = content_element.text.strip() if content_element else ""
            contents.append(content)

            #Write the title and content to the file
            file.write("Title: " + title + "\n")
            file.write("Author: " + author + "\n")
            file.write("Date: " + date + "\n")
            file.write("Content: " + content + "\n")
            file.write("---\n")

    #Create a DataFrame from the extracted values
    data = {
        "Title": titles,
        "Author": authors,
        "Date": dates,
        "Content": contents
    }

    df = pd.DataFrame(data)

    #Drop rows without content
    df.dropna()

    return df
```

Washington Nationals Data Collection and Cleaning

In [4]:
```
#URL of the website to scrape
url = "https://www.mlbtraderumors.com/washington-nationals?show=all"
file_path = "C:/Users/andre/OneDrive/Project/mlbtraderumors_washington_nationals_articles1.txt"

#Scrape the website, write the scraped text to a file, and get the head of the DataFrame
wsh_df = scrape_website(url, file_path)
wsh_df.head()
```

Out[4]:

	Title	Author	Date	Content
0	Nationals Designate Chad Kuhl For Assignment	Nick Deeds	June 24, 2023	The Nationals announced this evening that the ...
1	Nationals Select Derek Hill, Place Victor Robl...	Steve Adams	June 21, 2023	The Nationals have selected the contract of ou...
2	Nationals, Orioles Reach Settlement On 2012-16...	Anthony Franco	June 20, 2023	The Nationals and Orioles have settled their d...
3	Sean Doolittle Completes Rehab Assignment, Hea...	Steve Adams	June 15, 2023	Veteran lefty Sean Doolittle was transferred f...
4	Nationals Release Erasmo Ramírez	Darragh McDonald	June 9, 2023	The Nationals have released right-hander Erasm...

In [5]:
```
#Change the Data column to a datetime object:
wsh_df['Date'] = pd.to_datetime(wsh_df['Date'], format="%B %d, %Y", errors= 'coerce')
```

In [6]:
```
wsh_df.dtypes
```

Out[6]:
```
Title              object
Author             object
Date       datetime64[ns]
Content            object
dtype: object
```

In [7]:
```
#Check for missing values
wsh_df.isna().sum()
```

Out[7]:
```
Title       0
Author      0
Date       30
Content     0
dtype: int64
```

In [8]:
```
len(wsh_df)
```

Out[8]:
```
1030
```

In [9]:
```
wsh_df = wsh_df.dropna()
wsh_df
```

Out[9]:

	Title	Author	Date	Content
0	Nationals Designate Chad Kuhl For Assignment	Nick Deeds	2023-06-24	The Nationals announced this evening that the ...
1	Nationals Select Derek Hill, Place Victor Robl...	Steve Adams	2023-06-21	The Nationals have selected the contract of ou...
2	Nationals, Orioles Reach Settlement On 2012-16...	Anthony Franco	2023-06-20	The Nationals and Orioles have settled their d...
3	Sean Doolittle Completes Rehab Assignment, Hea...	Steve Adams	2023-06-15	Veteran lefty Sean Doolittle was transferred f...
4	Nationals Release Erasmo Ramírez	Darragh McDonald	2023-06-09	The Nationals have released right-hander Erasm...
...	...	...	...	...
995	Nationals, Anthony Rendon Not Progressing Towa...	Connor Byrne	2019-07-01	The underrating of Nationals third baseman Ant...
996	Tigers Sign Trevor Rosenthal	TC Zencka	2019-06-29	The Tigers agreed to terms with Trevor Rosenth...
997	Nationals Option Michael A. Taylor, Activate R...	Steve Adams	2019-06-28	1:55pm: The Nationals have announced the moves...
998	Nationals Notes: Deadline, Scherzer, Zimmerman	Steve Adams	2019-06-28	The resurgent Nationals have won eight of thei...
999	Alex Meyer Retires	Connor Byrne	2019-06-25	Right-hander Alex Meyer has announced his reti...

1000 rows × 4 columns

In [10]:
```
len(wsh_df)
```

Out[10]:
```
1000
```

Blog posts included content that featured textual information, rumors, analysis, and news related to MLB teams and player trades. The timestamp of data was when the blog post was published. Despite the blog posts spanning as far back as 2005, the data for our project could only be accessible as far back as 2019 (1000 total articles per team).

Import data on the Washington Nationals from baseball-reference.com

https://www.baseball-reference.com/teams/WSN/attend.shtml

In [11]:
```
#URL of the webpage to scrape
url = "https://www.baseball-reference.com/teams/WSN/attend.shtml"

#Read the HTML table into a list of DataFrames
tables = pd.read_html(url)

#Select the table of interest (index 0 in this case)
table = tables[0]

#Save the DataFrame as a CSV file
file_path = "C:/Users/andre/OneDrive/Project/MLB_data/nationals_statistics.csv"
table.to_csv(file_path, index=False, header=True)

print("Data saved to", file_path)
```

```
Data saved to C:/Users/andre/OneDrive/Project/MLB_data/nationals_statistics.csv
```

In [12]:
```
path = "C:/Users/andre/OneDrive/Project/MLB_data/"

nationals_df = pd.DataFrame(pd.read_csv(path + 'nationals_statistics.csv'))
nationals_df.head()
```

Out[12]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Washington Nationals	NL East	29	47	5	NaN	861885.0	21547.0	11th of 15	$98,376,067	96	94	Nationals Park
1	2022	Washington Nationals	NL East	55	107	5	NaN	2026401.0	25017.0	11th of 15	$125,051,666	96	94	Nationals Park
2	2021	Washington Nationals	NL East	65	97	5	NaN	1465543.0	18093.0	12th of 15	$172,370,147	96	95	Nationals Park
3	2020	Washington Nationals	NL East	26	34	5	NaN	NaN	NaN	15th of 15	$172,237,283	99	99	Nationals Park
4	2019	Washington Nationals	NL East	93	69	2	Won WS (4-3)	2259781.0	27899.0	11th of 15	$203,016,595	102	102	Nationals Park

Team performance data included historical team records, attendance, and total player payroll.

In [13]:
```
nationals_df= nationals_df[nationals_df['Year'] > 2004]
nationals_df
```

Out[13]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Washington Nationals	NL East	29	47	5	NaN	861885.0	21547.0	11th of 15	$98,376,067	96	94	Nationals Park
1	2022	Washington Nationals	NL East	55	107	5	NaN	2026401.0	25017.0	11th of 15	$125,051,666	96	94	Nationals Park
2	2021	Washington Nationals	NL East	65	97	5	NaN	1465543.0	18093.0	12th of 15	$172,370,147	96	95	Nationals Park
3	2020	Washington Nationals	NL East	26	34	5	NaN	NaN	NaN	15th of 15	$172,237,283	99	99	Nationals Park
4	2019	Washington Nationals	NL East	93	69	2	Won WS (4-3)	2259781.0	27899.0	11th of 15	$203,016,595	102	102	Nationals Park
5	2018	Washington Nationals	NL East	82	80	2	NaN	2529604.0	31230.0	8th of 15	$188,886,699	105	106	Nationals Park
6	2017	Washington Nationals	NL East	97	65	1	Lost NLDS (3-2)	2524980.0	31173.0	7th of 15	$175,587,301	103	104	Nationals Park
7	2016	Washington Nationals	NL East	95	67	1	Lost NLDS (3-2)	2481938.0	30641.0	7th of 15	$152,967,400	102	103	Nationals Park
8	2015	Washington Nationals	NL East	83	79	2	NaN	2619843.0	32344.0	5th of 15	$176,496,372	101	102	Nationals Park
9	2014	Washington Nationals	NL East	96	66	1	Lost NLDS (3-1)	2579389.0	31844.0	7th of 15	$137,235,080	102	104	Nationals Park
10	2013	Washington Nationals	NL East	86	76	2	NaN	2652422.0	32746.0	6th of 15	$112,493,250	101	103	Nationals Park
11	2012	Washington Nationals	NL East	98	64	1	Lost NLDS (3-2)	2370794.0	29269.0	9th of 16	$92,386,000	101	101	Nationals Park
12	2011	Washington Nationals	NL East	80	81	3	NaN	1940478.0	24256.0	14th of 16	$68,492,928	100	100	Nationals Park
13	2010	Washington Nationals	NL East	69	93	5	NaN	1828066.0	22569.0	14th of 16	$67,701,000	100	99	Nationals Park
14	2009	Washington Nationals	NL East	59	103	5	NaN	1817226.0	22435.0	13th of 16	$64,384,000	101	99	Nationals Park
15	2008	Washington Nationals	NL East	59	102	5	NaN	2320400.0	29005.0	13th of 16	$54,961,000	100	98	Nationals Park
16	2007	Washington Nationals	NL East	73	89	4	NaN	1943812.0	23998.0	14th of 16	$36,947,500	95	94	Robert F. Kennedy Stadium
17	2006	Washington Nationals	NL East	71	91	5	NaN	2153056.0	26581.0	11th of 16	$63,143,000	95	94	Robert F. Kennedy Stadium
18	2005	Washington Nationals	NL East	81	81	5	NaN	2731993.0	33728.0	8th of 16	$48,581,500	96	95	Robert F. Kennedy Stadium

In [14]:
```
#Remove the dollar and comma signs from the 'Estimated Payroll' column:
nationals_df['Est. Payroll'] = nationals_df['Est. Payroll'].replace({'\$':''}, regex = True)
nationals_df['Est. Payroll'] = nationals_df['Est. Payroll'].replace({'\,':''}, regex = True)
nationals_df.head()
```

Out[14]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Washington Nationals	NL East	29	47	5	NaN	861885.0	21547.0	11th of 15	98376067	96	94	Nationals Park
1	2022	Washington Nationals	NL East	55	107	5	NaN	2026401.0	25017.0	11th of 15	125051666	96	94	Nationals Park
2	2021	Washington Nationals	NL East	65	97	5	NaN	1465543.0	18093.0	12th of 15	172370147	96	95	Nationals Park
3	2020	Washington Nationals	NL East	26	34	5	NaN	NaN	NaN	15th of 15	172237283	99	99	Nationals Park
4	2019	Washington Nationals	NL East	93	69	2	Won WS (4-3)	2259781.0	27899.0	11th of 15	203016595	102	102	Nationals Park

In [15]:
```
nationals_df['Est. Payroll'] = nationals_df['Est. Payroll'].astype(float)
nationals_df.dtypes
```

Out[15]:
```
Year              int64
Tm               object
Lg               object
W                 int64
L                 int64
Finish            int64
Playoffs         object
Attendance      float64
Attend/G        float64
Rank             object
Est. Payroll    float64
PPF               int64
BPF               int64
Stadium          object
dtype: object
```

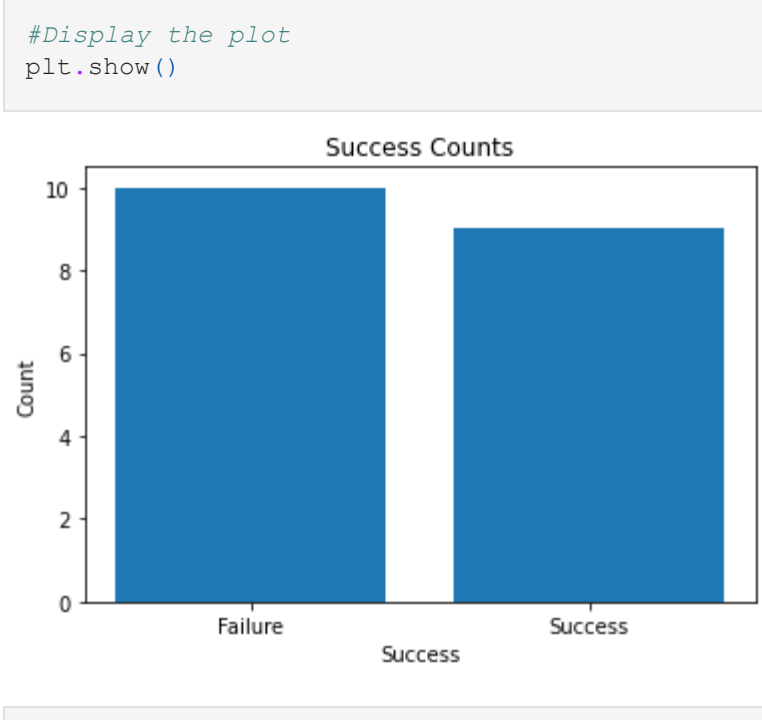
Create Binary feature that defines a successful year as wins greater than or equal to 50% of total games played

In [16]:
```
#Add a column to define a binary output that has a 1 if the team has a winning record for the year, and 0 if th
nationals_df['success'] = (nationals_df['W'] / (nationals_df['W'] + nationals_df['L']) >= 0.5).astype(int)
nationals_df.head()
```

Out[16]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium	success
0	2023	Washington Nationals	NL East	29	47	5	NaN	861885.0	21547.0	11th of 15	98376067.0	96	94	Nationals Park	0
1	2022	Washington Nationals	NL East	55	107	5	NaN	2026401.0	25017.0	11th of 15	125051666.0	96	94	Nationals Park	0
2	2021	Washington Nationals	NL East	65	97	5	NaN	1465543.0	18093.0	12th of 15	172370147.0	96	95	Nationals Park	0
3	2020	Washington Nationals	NL East	26	34	5	NaN	NaN	NaN	15th of 15	172237283.0	99	99	Nationals Park	0
4	2019	Washington Nationals	NL East	93	69	2	Won WS (4-3)	2259781.0	27899.0	11th of 15	203016595.0	102	102	Nationals Park	1

In [17]:
```
#Count the number of successes and failures
success_counts = nationals_df['success'].value_counts()

#Create a bar plot
plt.bar(success_counts.index, success_counts.values)
plt.xticks(success_counts.index, ['Failure', 'Success'])
plt.xlabel('Success')
plt.ylabel('Count')
plt.title('Success Counts')

#Display the plot
plt.show()
```

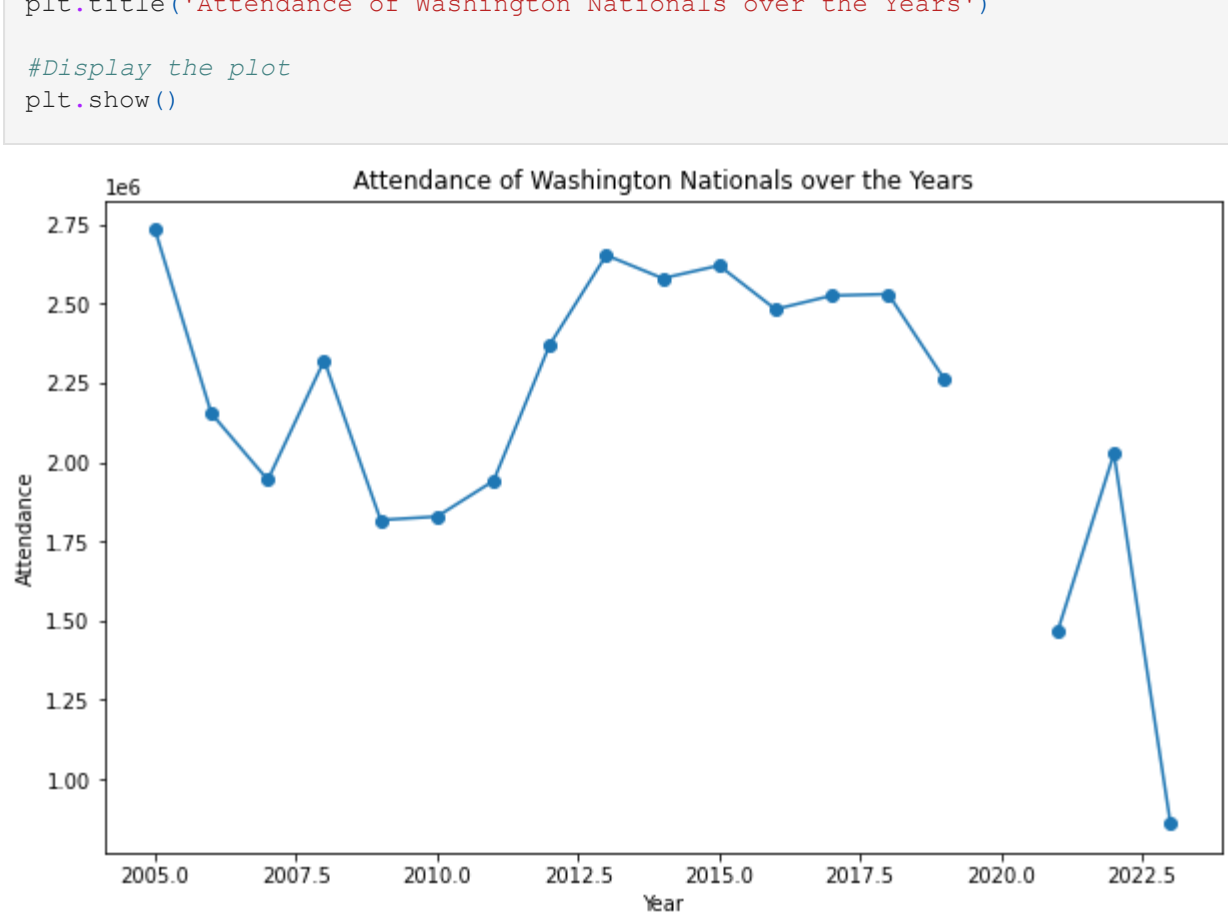


In [18]:
```
nationals_df.describe()
```

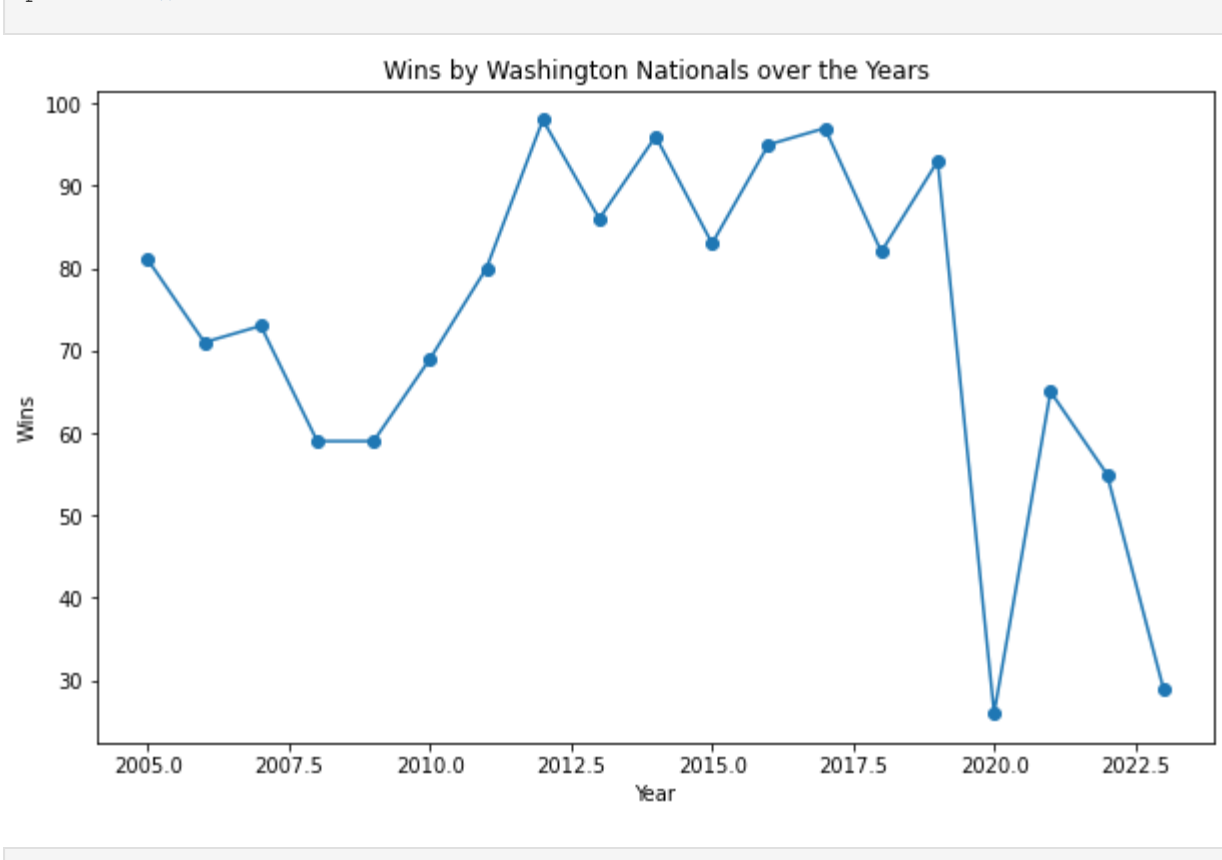
Out[18]:

	Year	W	L	Finish	Attendance	Attend/G	Est. Payroll	PPF	BPF	success
count	19.000000	19.000000	19.000000	19.000000	1.800000e+01	18.000000	1.900000e+01	19.000000	19.000000	19.000000
mean	2014.000000	73.526316	78.473684	3.368421	2.172645e+06	27465.277778	1.163850e+08	99.526316	99.263158	0.473684
std	5.627314	21.103892	19.074032	1.738790	4.799247e+05	4570.628748	5.466072e+07	2.988281	3.983886	0.512989
min	2005.000000	26.000000	34.000000	1.000000	8.618850e+05	18093.000000	3.694750e+07	95.000000	94.000000	0.000000
25%	2009.500000	62.000000	66.500000	2.000000	1.941312e+06	24062.500000	6.604250e+07	96.000000	95.000000	0.000000
50%	2014.000000	80.000000	80.000000	4.000000	2.290090e+06	28452.000000	1.124932e+08	100.000000	99.000000	0.000000
75%	2018.500000	89.500000	92.000000	5.000000	2.528448e+06	31215.750000	1.723037e+08	101.500000	102.500000	1.000000
max	2023.000000	98.000000	107.000000	5.000000	2.731993e+06	33728.000000	2.030166e+08	105.000000	106.000000	1.000000

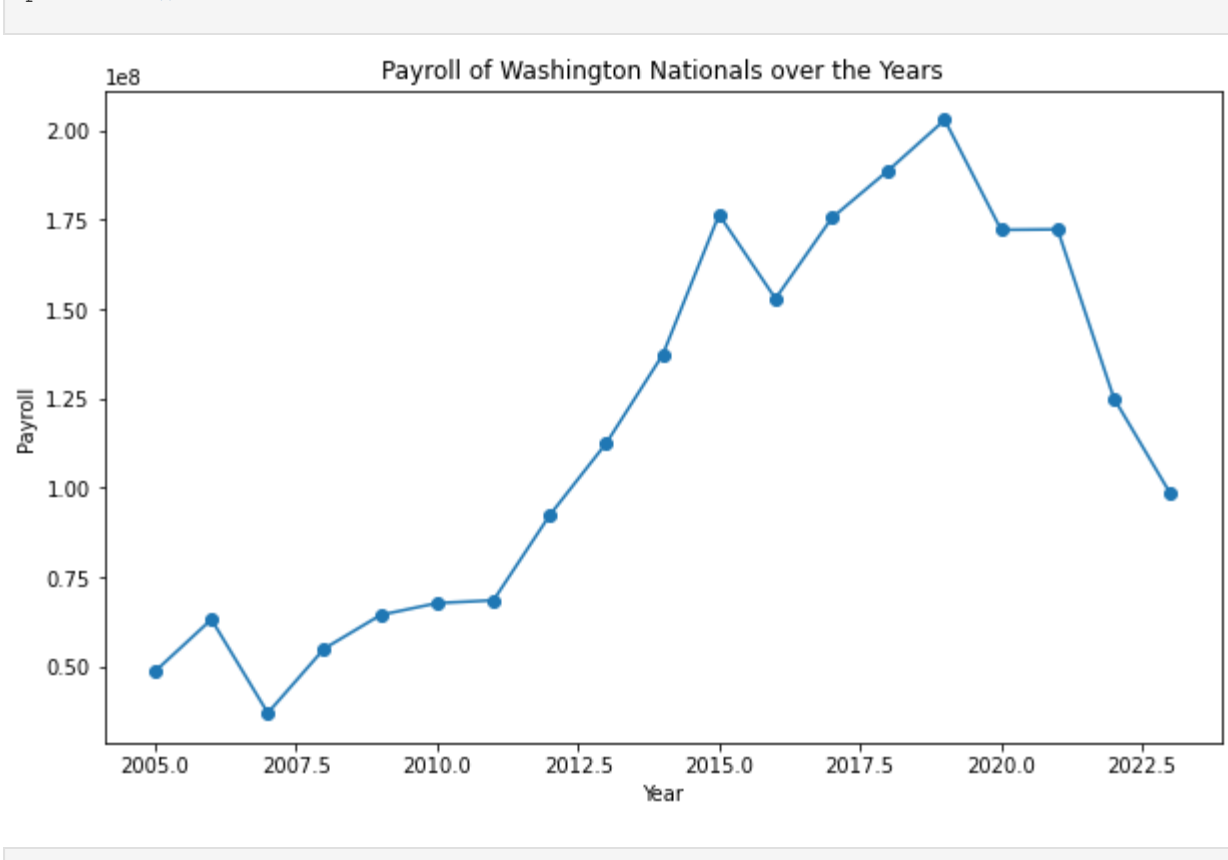
In [19]:
```
#Plotting the data
#Convert columns to numpy arrays
year = np.array(nationals_df['Year'])
attendance = np.array(nationals_df['Attendance'])

plt.figure(figsize=(10, 6))

#Plotting Attendance over the years
plt.plot(year, attendance, marker='o')
plt.xlabel('Year')
plt.ylabel('Attendance')
plt.title('Attendance of Washington Nationals over the Years')

#Display the plot
plt.show()
```



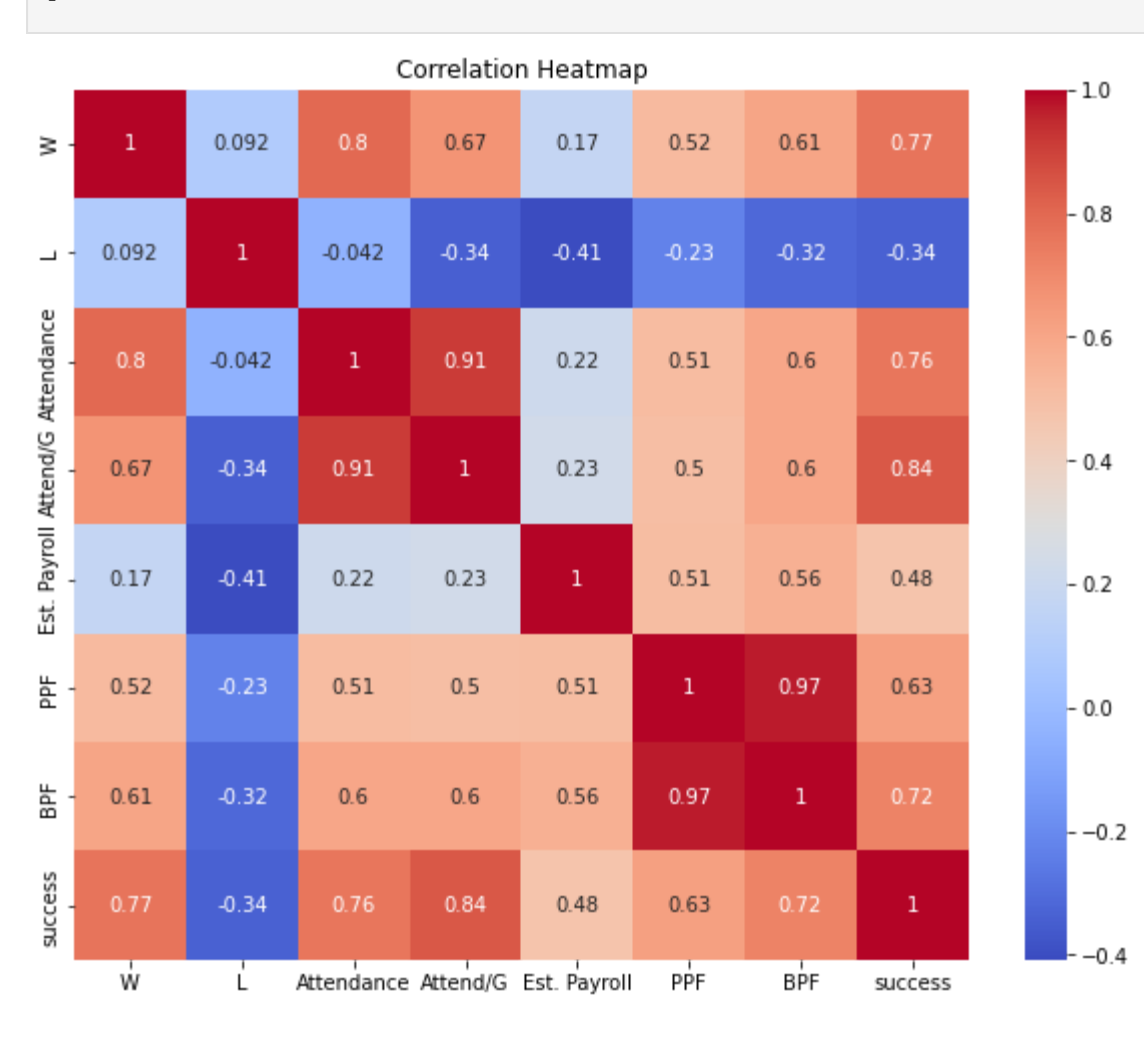
In [20]:
```
#Plotting Wins over the years
year = np.array(nationals_df['Year'])
wins = np.array(nationals_df['W'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, wins, marker='o')
plt.xlabel('Year')
plt.ylabel('Wins')
plt.title('Wins by Washington Nationals over the Years')

#Display the plot
plt.show()
```



In [21]:
```
#Plotting Payroll over the years
#Convert columns to numpy arrays
year = np.array(nationals_df['Year'])
payroll = np.array(nationals_df['Est. Payroll'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, payroll, marker='o')
plt.xlabel('Year')
plt.ylabel('Payroll')
plt.title('Payroll of Washington Nationals over the Years')

#Display the plot
plt.show()
```



In [22]:
```
#Select numeric columns for correlation analysis
numeric_cols = ['W', 'L', 'Attendance', 'Attend/G', 'Est. Payroll', 'PPF', 'BPF', 'success']
numeric_df = nationals_df[numeric_cols]

#Correlation matrix
correlation = numeric_df.corr()

#Plotting the correlation heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(correlation, annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap')

#Display the plot
plt.show()
```



Add column to for whether blog post occurred in a successful year or not.

In [23]:
```
#Extract the year from the "Date" column in df DataFrame
wsh_df['Year'] = pd.to_datetime(wsh_df['Date']).dt.year

#Merge df and athletics_df DataFrames on the "Year" column
merged_wsh_df = pd.merge(wsh_df, nationals_df[['Year', 'success']], on='Year', how='left')

#Add a new column 'Year_Successful' based on 'success' column
merged_wsh_df['Year_Successful'] = merged_wsh_df['success'].fillna(0).astype(int)

merged_wsh_df.head()
```

Out[23]:

	Title	Author	Date	Content	Year	success	Year_Successful
0	Nationals Designate Chad Kuhl For Assignment	Nick Deeds	2023-06-24	The Nationals announced this evening that the ...	2023	0	0
1	Nationals Select Derek Hill, Place Victor Robl...	Steve Adams	2023-06-21	The Nationals have selected the contract of ou...	2023	0	0
2	Nationals, Orioles Reach Settlement On 2012-16...	Anthony Franco	2023-06-20	The Nationals and Orioles have settled their d...	2023	0	0
3	Sean Doolittle Completes Rehab Assignment, Hea...	Steve Adams	2023-06-15	Veteran lefty Sean Doolittle was transferred f...	2023	0	0
4	Nationals Release Erasmo Ramírez	Darragh McDonald	2023-06-09	The Nationals have released right-hander Erasm...	2023	0	0

In [24]:
```
len(merged_wsh_df)
```

Out[24]:
```
1000
```

Cleaning the Nationals' Data

*Here, we will look for any noise in the data, and also calculate the impurity:

In [25]:
```
#Identify any noise in the data
RE_SUSPICIOUS = re.compile(r'[&#<>{}\[\]\\]')

def impurity(text, min_len=10):
    """returns the share of suspicious characters in a text"""
    if text == None or len(text) < min_len:
        return 0
    else:
        return len(RE_SUSPICIOUS.findall(text))/len(text)
```

In [26]:
```
merged_wsh_df['Content'].apply
```

Out[26]:
```
<bound method Series.apply of 0      The Nationals announced this evening that the ...
1      The Nationals have selected the contract of ou...
2      The Nationals and Orioles have settled their d...
3      Veteran lefty Sean Doolittle was transferred f...
4      The Nationals have released right-hander Erasm...
                             ...
995    The underrating of Nationals third baseman Ant...
996    The Tigers agreed to terms with Trevor Rosenth...
997    1:55pm: The Nationals have announced the moves...
998    The resurgent Nationals have won eight of thei...
999    Right-hander Alex Meyer has announced his reti...
Name: Content, Length: 1000, dtype: object>
```

In [27]:
```
pd.options.display.max_colwidth = 100 ###
#Add new column to data frame
merged_wsh_df['impurity'] = merged_wsh_df['Content'].apply(impurity, min_len=10)

#Get the top 3 records
merged_wsh_df[['Content', 'impurity']].sort_values(by='impurity', ascending=False).head(3)
```

Out[27]:

	Content	impurity
604	The Nationals announced they've selected the contract of right-hander Steven Fuentes. The 23-yea...	0.003333
562	Kyle Schwarber is now a member of the Washington Nationals, in no small part because of Nats man...	0.003155
568	The Nationals accomplished a big part of their winter to-do list when they acquired Josh Bell fr...	0.002786

The above shows the highest impurity levels for the Nationals' data set. Note, these are extremely low...well below 1% of all characters in each blog post are suspicious.

Implement Character Normalization and Tokenization on Nationals' Data

In [28]:
```
#Example function to normalize the text in the "Contents" column
def normalize_text(text):
    #Lowercase the text
    text = text.lower()

    #Remove punctuation
    text = text.translate(str.maketrans("", "", string.punctuation))

    #Remove special characters and digits
    text = re.sub(r"[^a-zA-Z]", " ", text)

    #Tokenize the text
    tokens = word_tokenize(text)

    #Remove stopwords
    stop_words = set(stopwords.words("english"))
    tokens = [token for token in tokens if token not in stop_words]

    #Perform stemming
    stemmer = PorterStemmer()
    tokens = [stemmer.stem(token) for token in tokens]

    return tokens

#Apply normalization to the "Contents" column
merged_wsh_df["Contents_Normalized"] = merged_wsh_df["Content"].apply(normalize_text)

#Print the head of the DataFrame with the normalized contents
merged_wsh_df[["Content", "Contents_Normalized"]].head()
```

Out[28]:

	Content	Contents_Normalized
0	The Nationals announced this evening that the club has designated right-hander Chad Kuhl for ass...	[nation, announc, even, club, design, righthand, chad, kuhl, assign, correspond, move, washingto...
1	The Nationals have selected the contract of outfielder Derek Hill from Triple-A Rochester, per a...	[nation, select, contract, outfield, derek, hill, triplea, rochest, per, team, announc, correspo...
2	The Nationals and Orioles have settled their dispute regarding MASN rights fees between 2012-16,...	[nation, oriol, settl, disput, regard, masn, right, fee, first, report, chelsea, jane, ben, stra...
3	Veteran lefty Sean Doolittle was transferred from the Nationals' Double-A affiliate to their Tri...	[veteran, lefti, sean, doolittl, transfer, nation, doublea, affili, triplea, club, thursday, sig...
4	The Nationals have released right-hander Erasmo Ramírez, according to his transactions tracker a...	[nation, releas, righthand, erasmo, ram, rez, accord, transact, tracker, mlbcom, design, assign,...

The characters were tokenized by lowercasing text and removing punctuation, stop words, and special characters.

In [29]:
```
merged_wsh_df['length'] = merged_wsh_df['Contents_Normalized'].str.len()
merged_wsh_df.head()
```

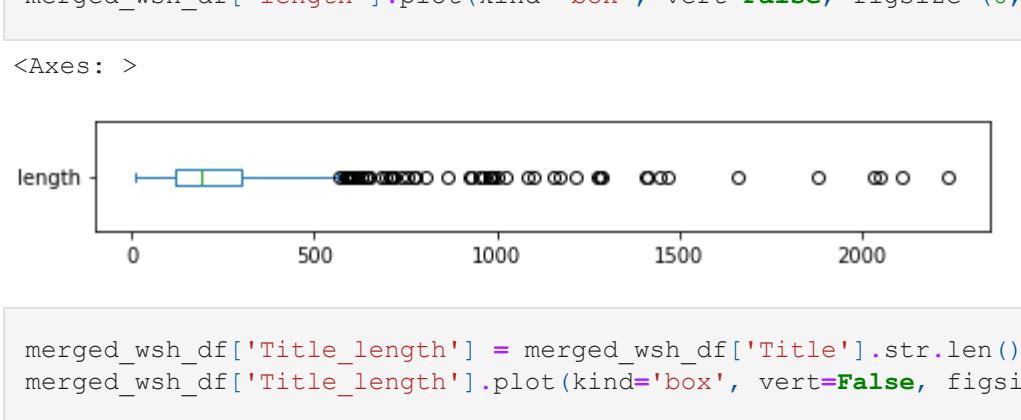
Out[29]:

	Title	Author	Date	Content	Year	success	Year_Successful	impurity	Contents_Normalized	length
0	Nationals Designate Chad Kuhl For Assignment	Nick Deeds	2023-06-24	The Nationals announced this evening that the club has designated right-hander Chad Kuhl for ass...	2023	0	0	0.0	[nation, announc, even, club, design, righthand, chad, kuhl, assign, correspond, move, washingto...	240
1	Nationals Select Derek Hill, Place Victor Robles On Injured List	Steve Adams	2023-06-21	The Nationals have selected the contract of outfielder Derek Hill from Triple-A Rochester, per a...	2023	0	0	0.0	[nation, select, contract, outfield, derek, hill, triplea, rochest, per, team, announc, correspo...	239
2	Nationals, Orioles Reach Settlement On 2012-16 MASN Rights Fees	Anthony Franco	2023-06-20	The Nationals and Orioles have settled their dispute regarding MASN rights fees between 2012-16,...	2023	0	0	0.0	[nation, oriol, settl, disput, regard, masn, right, fee, first, report, chelsea, jane, ben, stra...	274
3	Sean Doolittle Completes Rehab Assignment, Heads To Triple-A Rochester	Steve Adams	2023-06-15	Veteran lefty Sean Doolittle was transferred from the Nationals' Double-A affiliate to their Tri...	2023	0	0	0.0	[veteran, lefti, sean, doolittl, transfer, nation, doublea, affili, triplea, club, thursday, sig...	60
4	Nationals Release Erasmo Ramírez	Darragh McDonald	2023-06-09	The Nationals have released right-hander Erasmo Ramírez, according to his transactions tracker a...	2023	0	0	0.0	[nation, releas, righthand, erasmo, ram, rez, accord, transact, tracker, mlbcom, design, assign,...	130

Analyze descriptive statistics for text in dataframe

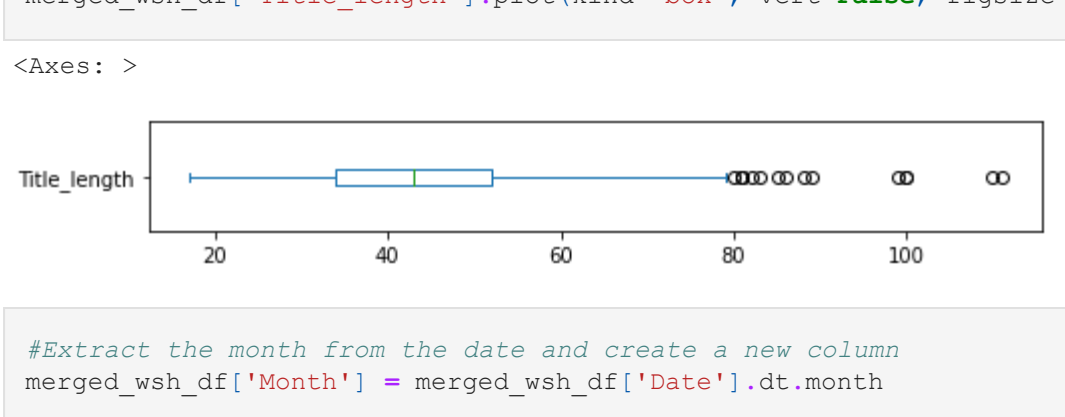
In [30]:
```
merged_wsh_df['length'].plot(kind='box', vert=False, figsize=(8, 1))
```

Out[30]:
```
<Axes: >
```



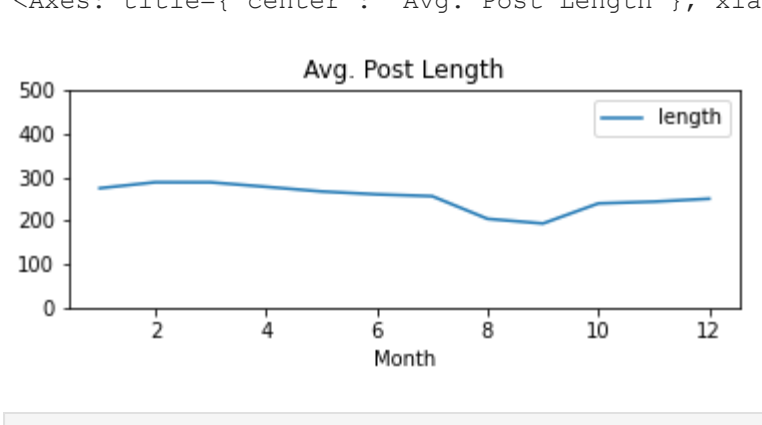
In [31]:
```
merged_wsh_df['Title_length'] = merged_wsh_df['Title'].str.len()
merged_wsh_df['Title_length'].plot(kind='box', vert=False, figsize=(8, 1))
```

Out[31]:
```
<Axes: >
```



In [32]:
```
#Extract the month from the date and create a new column
merged_wsh_df['Month'] = merged_wsh_df['Date'].dt.month

#Plot the average post length
merged_wsh_df.groupby('Month').agg({'length': 'mean'}) \
  .plot(title="Avg. Post Length", ylim=(0,500), figsize=(6,2))
```

Out[32]:
```
<Axes: title={'center': 'Avg. Post Length'}, xlabel='Month'>
```



In [33]:
```
def count_words(df, column='Contents_Normalized', preprocess=None, min_freq=2):

    #Process tokens and update counter
    def update(doc):
        tokens = doc if preprocess is None else preprocess(doc)
        counter.update(tokens)

    #Create counter and run through all data
    counter = Counter()
    tqdm.pandas() #initialize tqdm for progress bar
    df[column].apply(update)

    #Transform counter into data frame
    freq_df = pd.DataFrame.from_dict(counter, orient='index', columns=['freq'])
    freq_df = freq_df.query('freq >= @min_freq')
    freq_df.index.name = 'token'

    return freq_df.sort_values('freq', ascending=False)
```

In [34]:
```
freq_df = count_words(merged_wsh_df)
freq_df.head(5)
```

Out[34]:

token	freq
season	3106
nation	2760
year	2407
leagu	1807
nat	1609

In [35]:
```
#How many tokens are in the df?
len(freq_df)
```
Out[35]:
```
6442
```

In [36]:
```
#Top words with 10+ characters
count_words(merged_wsh_df, column='Content',
            preprocess=lambda Content: re.findall(r"\w{10,}", Content)).head(5)
```
Out[36]:

token	freq
Washington	1261
appearances	622
organization	386
outfielder	259
arbitration	257

In [37]:
```
ax = freq_df.head(15).plot(kind='barh', width=0.95, figsize=(8,3))
ax.invert_yaxis()
ax.set(xlabel='Frequency', ylabel='Token', title='Top Words')
```
Out[37]:
```
[Text(0.5, 0, 'Frequency'), Text(0, 0.5, 'Token'), Text(0.5, 1.0, 'Top Words')]
```

San Diego Padres Data Collection and Cleaning

In [38]:
```
#URL of the website to scrape
url = "https://www.mlbtraderumors.com/san-diego-padres?show=all"
file_path = "C:/Users/andre/OneDrive/Project/mlbtraderumors_san_diego_padres_articles1.txt"

#Scrape the website, write the scraped text to a file, and get the head of the DataFrame
sd_df = scrape_website(url, file_path)
sd_df.head()
```
Out[38]:

	Title	Author	Date	Content
0	Padres Select Matt Waldron	Anthony Franco	June 24, 2023	TODAY: The Padres have officially announced their selection of Waldron's contract. To make room ...
1	Michael Wacha To Skip Start Due To Shoulder Fatigue	Mark Polishuk	June 24, 2023	Knuckleballer Matt Waldron will start today's game for the Padres, as Michael Wacha (the origina...
2	A's Claim Angel Felipe	Steve Adams	June 21, 2023	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...
3	Padres Designate Nabil Crismatt For Assignment	Darragh McDonald	June 20, 2023	The Padres announced that right-hander Seth Lugo has been reinstated from the injured list, with...
4	Jose Iglesias Opts Out Of Contract With Padres	Anthony Franco	June 19, 2023	Veteran infielder José Iglesias has opted out of his minor league deal with the Padres, reports ...

In [39]:
```
#Change the Data column to a datetime object:
sd_df['Date'] = pd.to_datetime(sd_df['Date'], format="%B %d, %Y", errors= 'coerce')
```

In [40]:
```
sd_df.dtypes
```
Out[40]:
```
Title              object
Author             object
Date       datetime64[ns]
Content            object
dtype: object
```

In [41]:
```
#Check for missing values
sd_df.isna().sum()
```
Out[41]:
```
Title       0
Author      0
Date       30
Content     0
dtype: int64
```

In [42]:
```
len(sd_df)
```
Out[42]:
```
1030
```

In [43]:
```
sd_df = sd_df.dropna()
sd_df
```
Out[43]:

	Title	Author	Date	Content
0	Padres Select Matt Waldron	Anthony Franco	2023-06-24	TODAY: The Padres have officially announced their selection of Waldron's contract. To make room ...
1	Michael Wacha To Skip Start Due To Shoulder Fatigue	Mark Polishuk	2023-06-24	Knuckleballer Matt Waldron will start today's game for the Padres, as Michael Wacha (the origina...
2	A's Claim Angel Felipe	Steve Adams	2023-06-21	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...
3	Padres Designate Nabil Crismatt For Assignment	Darragh McDonald	2023-06-20	The Padres announced that right-hander Seth Lugo has been reinstated from the injured list, with...
4	Jose Iglesias Opts Out Of Contract With Padres	Anthony Franco	2023-06-19	Veteran infielder José Iglesias has opted out of his minor league deal with the Padres, reports ...
...	...	...	...	...
995	Latest On Garrett Richards	Connor Byrne	2019-09-11	Having scored a 10-year, $300MM contract, Manny Machado was easily the Padres' biggest free-agen...
996	Padres Unsure If Hunter Renfroe Will Play Again This Year	Connor Byrne	2019-09-10	Padres manager Andy Green isn't willing to guarantee that banged up outfielder Hunter Renfroe wi...
997	Hunter Renfroe's Second-Half Decline	Connor Byrne	2019-09-10	Just a couple months ago, Padres outfielder Hunter Renfroe looked like a legitimate breakout pla...
998	Padres Face Outfield Uncertainty	Jeff Todd	2019-09-10	The Padres continue to feature numerous possibilities and numerous questions in their outfield m...
999	Latest On Cordero, Richards, Nix	Mark Polishuk	2019-09-07	Franchy Cordero has suffered another setback while rehabbing a quad injury, Jeff Sanders of the ...

1000 rows × 4 columns

In [44]:
```
len(sd_df)
```
Out[44]:
```
1000
```

Import data on the San Diego Padres from baseball-reference.com.

https://www.baseball-reference.com/teams/SDP/attend.shtml

In [45]:
```
#URL of the webpage to scrape
url = "https://www.baseball-reference.com/teams/SDP/attend.shtml"

#Read the HTML table into a list of DataFrames
tables = pd.read_html(url)

#Select the table of interest (index 0 in this case)
table = tables[0]

#Save the DataFrame as a CSV file
file_path = "C:/Users/andre/OneDrive/Project/MLB_data/padres_statistics.csv"
table.to_csv(file_path, index=False, header=True)

print("Data saved to", file_path)
```
```
Data saved to C:/Users/andre/OneDrive/Project/MLB_data/padres_statistics.csv
```

In [46]:
```
path = "C:/Users/andre/OneDrive/Project/MLB_data/"

padres_df = pd.DataFrame(pd.read_csv(path + 'padres_statistics.csv'))
padres_df.head()
```
Out[46]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	San Diego Padres	NL West	37	40	4	NaN	1635354.0	39887.0	2nd of 15	$234,100,139	93	93	Petco Park
1	2022	San Diego Padres	NL West	89	73	2	Lost NLCS (4-1)	2987470.0	36882.0	4th of 15	$173,600,824	93	93	Petco Park
2	2021	San Diego Padres	NL West	79	83	3	NaN	2191950.0	27061.0	3rd of 15	$151,984,286	92	92	Petco Park
3	2020	San Diego Padres	NL West	37	23	2	Lost NLDS (3-0)	NaN	NaN	12th of 15	$141,953,667	93	93	Petco Park
4	2019	San Diego Padres	NL West	70	92	5	NaN	2396399.0	29585.0	10th of 15	$90,260,767	95	94	Petco Park

In [47]:
```
padres_df= padres_df[padres_df['Year'] > 2004]
padres_df
```
Out[47]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	San Diego Padres	NL West	37	40	4	NaN	1635354.0	39887.0	2nd of 15	$234,100,139	93	93	Petco Park
1	2022	San Diego Padres	NL West	89	73	2	Lost NLCS (4-1)	2987470.0	36882.0	4th of 15	$173,600,824	93	93	Petco Park
2	2021	San Diego Padres	NL West	79	83	3	NaN	2191950.0	27061.0	3rd of 15	$151,984,286	92	92	Petco Park
3	2020	San Diego Padres	NL West	37	23	2	Lost NLDS (3-0)	NaN	NaN	12th of 15	$141,953,667	93	93	Petco Park
4	2019	San Diego Padres	NL West	70	92	5	NaN	2396399.0	29585.0	10th of 15	$90,260,767	95	94	Petco Park
5	2018	San Diego Padres	NL West	66	96	5	NaN	2168536.0	26772.0	11th of 15	$93,821,067	95	93	Petco Park
6	2017	San Diego Padres	NL West	71	91	4	NaN	2138491.0	26401.0	10th of 15	$49,248,767	97	95	Petco Park
7	2016	San Diego Padres	NL West	68	94	5	NaN	2351422.0	29030.0	8th of 15	$50,656,166	95	95	Petco Park
8	2015	San Diego Padres	NL West	74	88	4	NaN	2459752.0	30367.0	10th of 15	$125,203,700	95	95	Petco Park
9	2014	San Diego Padres	NL West	77	85	3	NaN	2195373.0	27103.0	12th of 15	$76,662,100	92	92	Petco Park
10	2013	San Diego Padres	NL West	76	86	3	NaN	2166691.0	26749.0	12th of 15	$65,988,600	91	91	Petco Park
11	2012	San Diego Padres	NL West	76	86	4	NaN	2123721.0	26219.0	14th of 16	$55,494,700	91	91	Petco Park
12	2011	San Diego Padres	NL West	71	91	5	NaN	2143018.0	26457.0	11th of 16	$45,869,140	93	93	Petco Park
13	2010	San Diego Padres	NL West	90	72	2	NaN	2131774.0	26318.0	11th of 16	$37,799,300	91	91	Petco Park
14	2009	San Diego Padres	NL West	75	87	4	NaN	1919603.0	23699.0	12th of 16	$50,954,200	90	90	Petco Park
15	2008	San Diego Padres	NL West	63	99	5	NaN	2427535.0	29970.0	12th of 16	$73,677,616	88	87	Petco Park
16	2007	San Diego Padres	NL West	89	74	3	NaN	2790074.0	34445.0	9th of 16	$58,110,567	90	90	Petco Park
17	2006	San Diego Padres	NL West	88	74	1	Lost NLDS (3-1)	2659757.0	32837.0	8th of 16	$69,896,141	90	91	Petco Park
18	2005	San Diego Padres	NL West	82	80	1	Lost NLDS (3-0)	2869787.0	35429.0	5th of 16	$63,290,833	91	91	Petco Park

In [48]:
```
#Remove the dollar and comma signs from the 'Estimated Payroll' column:
padres_df['Est. Payroll'] = padres_df['Est. Payroll'].replace({'\$':''}, regex = True)
padres_df['Est. Payroll'] = padres_df['Est. Payroll'].replace({'\,':''}, regex = True)
padres_df.head()
```
Out[48]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	San Diego Padres	NL West	37	40	4	NaN	1635354.0	39887.0	2nd of 15	234100139	93	93	Petco Park
1	2022	San Diego Padres	NL West	89	73	2	Lost NLCS (4-1)	2987470.0	36882.0	4th of 15	173600824	93	93	Petco Park
2	2021	San Diego Padres	NL West	79	83	3	NaN	2191950.0	27061.0	3rd of 15	151984286	92	92	Petco Park
3	2020	San Diego Padres	NL West	37	23	2	Lost NLDS (3-0)	NaN	NaN	12th of 15	141953667	93	93	Petco Park
4	2019	San Diego Padres	NL West	70	92	5	NaN	2396399.0	29585.0	10th of 15	90260767	95	94	Petco Park

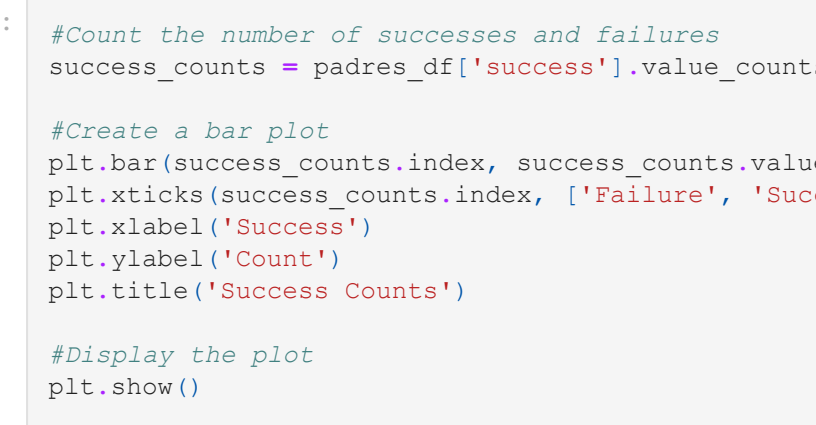
In [49]:
```
padres_df['Est. Payroll'] = padres_df['Est. Payroll'].astype(float)
padres_df.dtypes
```
Out[49]:
```
Year              int64
Tm               object
Lg               object
W                 int64
L                 int64
Finish            int64
Playoffs         object
Attendance      float64
Attend/G        float64
Rank             object
Est. Payroll    float64
PPF               int64
BPF               int64
Stadium          object
dtype: object
```

Create Binary feature that defines a successful year as wins greater than or equal to 50% of total games played

In [50]:
```
#Add a column to define a binary output that has a 1 if the team has a winning record for the year, and 0 if th
padres_df['success'] = (padres_df['W'] / (padres_df['W'] + padres_df['L']) >= 0.5).astype(int)
padres_df.head()
```
Out[50]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium	success
0	2023	San Diego Padres	NL West	37	40	4	NaN	1635354.0	39887.0	2nd of 15	234100139.0	93	93	Petco Park	0
1	2022	San Diego Padres	NL West	89	73	2	Lost NLCS (4-1)	2987470.0	36882.0	4th of 15	173600824.0	93	93	Petco Park	1
2	2021	San Diego Padres	NL West	79	83	3	NaN	2191950.0	27061.0	3rd of 15	151984286.0	92	92	Petco Park	0
3	2020	San Diego Padres	NL West	37	23	2	Lost NLDS (3-0)	NaN	NaN	12th of 15	141953667.0	93	93	Petco Park	1
4	2019	San Diego Padres	NL West	70	92	5	NaN	2396399.0	29585.0	10th of 15	90260767.0	95	94	Petco Park	0

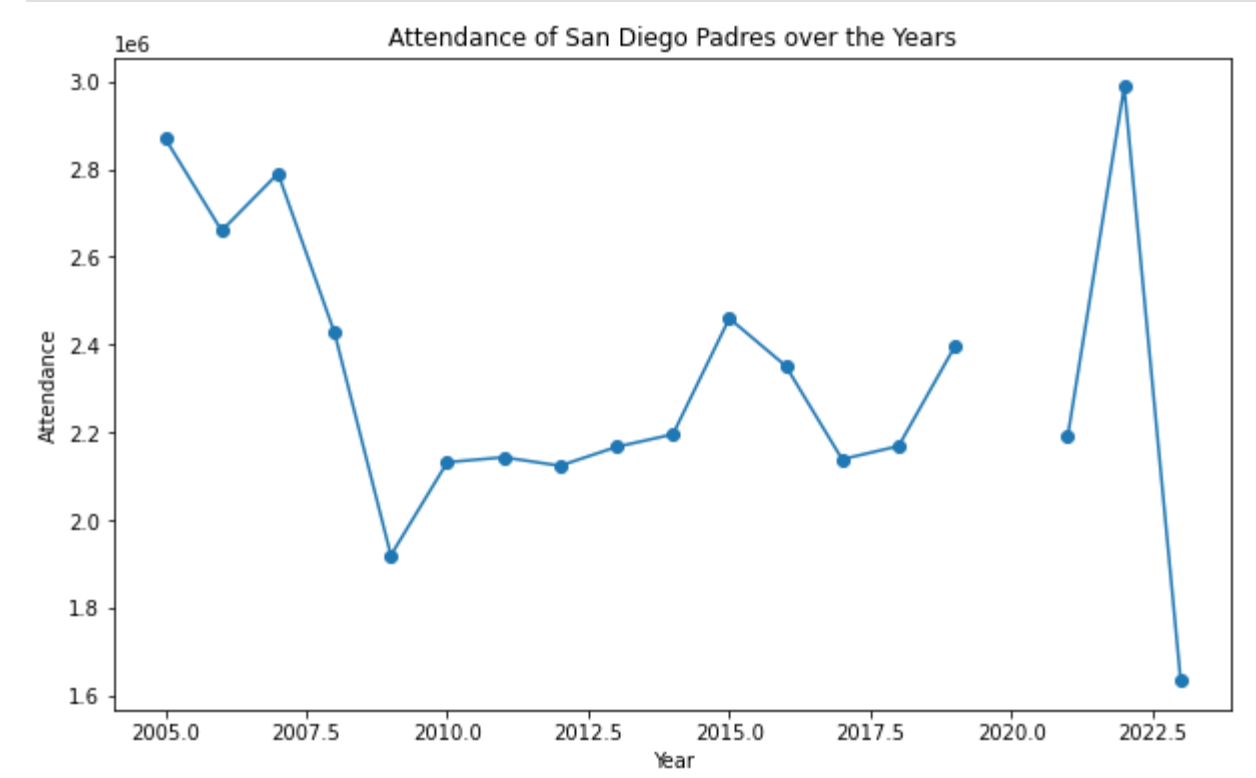
In [51]:
```
#Count the number of successes and failures
success_counts = padres_df['success'].value_counts()

#Create a bar plot
plt.bar(success_counts.index, success_counts.values)
plt.xticks(success_counts.index, ['Failure', 'Success'])
plt.xlabel('Success')
plt.ylabel('Count')
plt.title('Success Counts')

#Display the plot
plt.show()
```



In [52]:
```
padres_df.describe()
```
Out[52]:

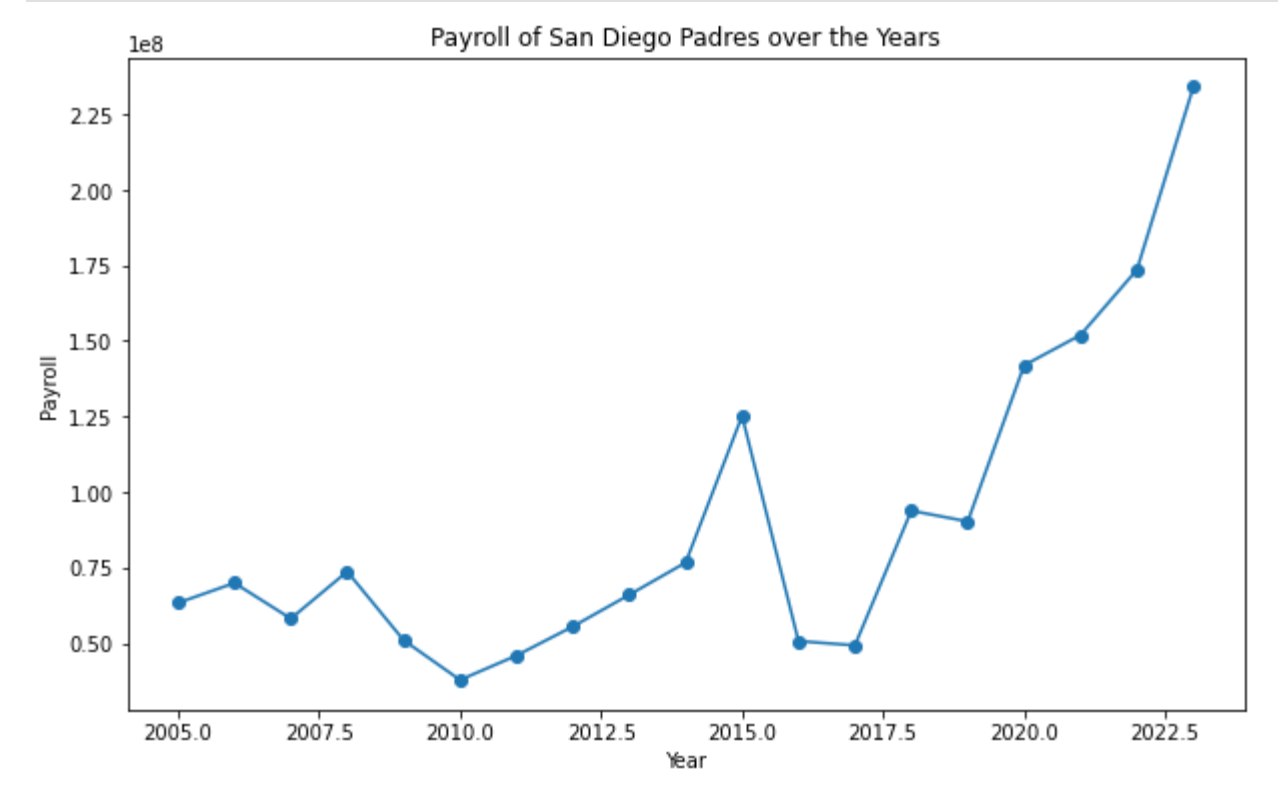
	Year	W	L	Finish	Attendance	Attend/G	Est. Payroll	PPF	BPF	success
count	19.000000	19.000000	19.000000	19.000000	1.800000e+01	18.000000	1.900000e+01	19.000000	19.000000	19.000000
mean	2014.000000	72.526316	79.684211	3.421053	2.319817e+06	29733.944444	8.992487e+07	92.368421	92.105263	0.315789
std	5.627314	14.833777	18.929849	1.346427	3.402212e+05	4428.852945	5.233473e+07	2.290331	2.024701	0.477567
min	2005.000000	37.000000	23.000000	1.000000	1.635354e+06	23699.000000	3.779930e+07	88.000000	87.000000	0.000000
25%	2009.500000	69.000000	74.000000	2.500000	2.139623e+06	26530.000000	5.322445e+07	91.000000	91.000000	0.000000
50%	2014.000000	75.000000	86.000000	4.000000	2.193662e+06	28066.500000	6.989614e+07	92.000000	92.000000	0.000000
75%	2018.500000	80.500000	91.000000	4.500000	2.451698e+06	32219.500000	1.095124e+08	94.000000	93.000000	1.000000
max	2023.000000	90.000000	99.000000	5.000000	2.987470e+06	39887.000000	2.341001e+08	97.000000	95.000000	1.000000

In [53]:
```
#Plotting the data
#Convert columns to numpy arrays
year = np.array(padres_df['Year'])
attendance = np.array(padres_df['Attendance'])

plt.figure(figsize=(10, 6))

#Plotting Attendance over the years
plt.plot(year, attendance, marker='o')
plt.xlabel('Year')
plt.ylabel('Attendance')
plt.title('Attendance of San Diego Padres over the Years')

#Display the plot
plt.show()
```

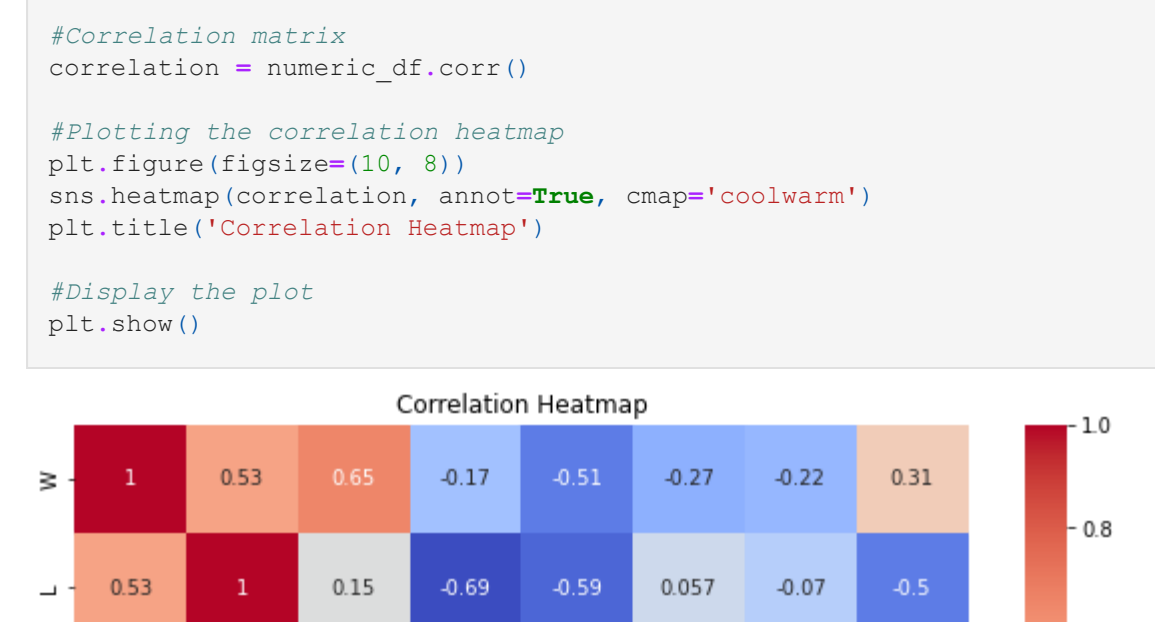


In [54]:
```
#Plotting Wins over the years
year = np.array(padres_df['Year'])
wins = np.array(padres_df['W'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, wins, marker='o')
plt.xlabel('Year')
plt.ylabel('Wins')
plt.title('Wins by San Diego Padres over the Years')

#Display the plot
plt.show()
```

In [55]:
```
#Plotting Payroll over the years
#Convert columns to numpy arrays
year = np.array(padres_df['Year'])
payroll = np.array(padres_df['Est. Payroll'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, payroll, marker='o')
plt.xlabel('Year')
plt.ylabel('Payroll')
plt.title('Payroll of San Diego Padres over the Years')

#Display the plot
plt.show()
```



In [56]:
```
#Select numeric columns for correlation analysis
numeric_cols = ['W', 'L', 'Attendance', 'Attend/G', 'Est. Payroll', 'PPF', 'BPF', 'success']
numeric_df = padres_df[numeric_cols]

#Correlation matrix
correlation = numeric_df.corr()

#Plotting the correlation heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(correlation, annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap')

#Display the plot
plt.show()
```



Add column to analyze whether blog post occurred in a successful year or not.

In [57]:
```
#Extract the year from the "Date" column in df DataFrame
sd_df['Year'] = pd.to_datetime(sd_df['Date']).dt.year

#Merge df and athletics_df DataFrames on the "Year" column
merged_sd_df = pd.merge(sd_df, padres_df[['Year', 'success']], on='Year', how='left')

#Add a new column 'Year_Successful' based on 'success' column
merged_sd_df['Year_Successful'] = merged_sd_df['success'].fillna(0).astype(int)

merged_sd_df.head()
```
Out[57]:

	Title	Author	Date	Content	Year	success	Year_Successful
0	Padres Select Matt Waldron	Anthony Franco	2023-06-24	TODAY: The Padres have officially announced their selection of Waldron's contract. To make room ...	2023	0	0
1	Michael Wacha To Skip Start Due To Shoulder Fatigue	Mark Polishuk	2023-06-24	Knuckleballer Matt Waldron will start today's game for the Padres, as Michael Wacha (the origina...	2023	0	0
2	A's Claim Angel Felipe	Steve Adams	2023-06-21	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...	2023	0	0
3	Padres Designate Nabil Crismatt For Assignment	Darragh McDonald	2023-06-20	The Padres announced that right-hander Seth Lugo has been reinstated from the injured list, with...	2023	0	0
4	Jose Iglesias Opts Out Of Contract With Padres	Anthony Franco	2023-06-19	Veteran infielder José Iglesias has opted out of his minor league deal with the Padres, reports ...	2023	0	0

In [58]:
```
len(merged_sd_df)
```
Out[58]:
```
1000
```

Cleaning the Padres' Data

In [59]:
```
#Identify any noise in the data
RE_SUSPICIOUS = re.compile(r'[&#<>{}\[\]\\]')

def impurity(text, min_len=10):
    """returns the share of suspicious characters in a text"""
    if text == None or len(text) < min_len:
        return 0
    else:
        return len(RE_SUSPICIOUS.findall(text))/len(text)
```

In [60]:
```
merged_sd_df['Content'].apply
```
Out[60]:
```
<bound method Series.apply of 0      TODAY: The Padres have officially announced their selection of Waldron's c
ontract. To make room ...
1      Knuckleballer Matt Waldron will start today's game for the Padres, as Michael Wacha (the origina...
2      The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...
3      The Padres announced that right-hander Seth Lugo has been reinstated from the injured list, with...
4      Veteran infielder José Iglesias has opted out of his minor league deal with the Padres, reports ...
                                              ...
995    Having scored a 10-year, $300MM contract, Manny Machado was easily the Padres' biggest free-agen...
996    Padres manager Andy Green isn't willing to guarantee that banged up outfielder Hunter Renfroe wi...
997    Just a couple months ago, Padres outfielder Hunter Renfroe looked like a legitimate breakout pla...
998    The Padres continue to feature numerous possibilities and numerous questions in their outfield m...
999    Franchy Cordero has suffered another setback while rehabbing a quad injury, Jeff Sanders of the ...
Name: Content, Length: 1000, dtype: object>
```

In [61]:
```
pd.options.display.max_colwidth = 100 ###
#Add new column to data frame
merged_sd_df['impurity'] = merged_sd_df['Content'].apply(impurity, min_len=10)

#Get the top 3 records
merged_sd_df[['Content', 'impurity']].sort_values(by='impurity', ascending=False).head(3)
```
Out[61]:

	Content	impurity
61	Jake Cronenworth signed a seven-year, $80MM extension with the Padres, so what does that mean fo...	0.009479
131	Major League Baseball's international signing period for 2023 has officially opened up today, wi...	0.005563
842	What is the role of the Players' Union in the Astros' sign-stealing scandal? Why are the Padres ...	0.003484

The above shows the highest impurity levels for the Padres' data set. Note, these are extremely low...well below 1% of all characters in each blog post are suspicious.

Character Normalization and Tokenization

In [62]:
```
#Example function to normalize the text in the "Contents" column
def normalize_text(text):
    #Lowercase the text
    text = text.lower()

    #Remove punctuation
    text = text.translate(str.maketrans("", "", string.punctuation))

    #Remove special characters and digits
    text = re.sub(r"[^a-zA-Z]", " ", text)

    #Tokenize the text
    tokens = word_tokenize(text)

    #Remove stopwords
    stop_words = set(stopwords.words("english"))
    tokens = [token for token in tokens if token not in stop_words]

    #Perform stemming
    stemmer = PorterStemmer()
    tokens = [stemmer.stem(token) for token in tokens]

    return tokens

#Apply normalization to the "Contents" column
merged_sd_df["Contents_Normalized"] = merged_sd_df["Content"].apply(normalize_text)

#Print the head of the DataFrame with the normalized contents
merged_sd_df[["Content", "Contents_Normalized"]].head()
```
Out[62]:

	Content	Contents_Normalized
0	TODAY: The Padres have officially announced their selection of Waldron's contract. To make room ...	[today, padr, offici, announc, select, waldron, contract, make, room, waldron, activ, roster, le...
1	Knuckleballer Matt Waldron will start today's game for the Padres, as Michael Wacha (the origina...	[knucklebal, matt, waldron, start, today, game, padr, michael, wacha, origin, schedul, starter, ...
2	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...	[athlet, claim, righthand, angel, felip, waiver, padr, per, team, announc, felip, option, triple...
3	The Padres announced that right-hander Seth Lugo has been reinstated from the injured list, with...	[padr, announc, righthand, seth, lugo, reinstat, injur, list, fellow, righti, nabil, crismatt, d...
4	Veteran infielder José Iglesias has opted out of his minor league deal with the Padres, reports ...	[veteran, infield, jo, iglesia, opt, minor, leagu, deal, padr, report, mark, feinsand, mlbcom, t...

In [63]:
```
merged_sd_df['length'] = merged_sd_df['Contents_Normalized'].str.len()
merged_sd_df.head()
```
Out[63]:

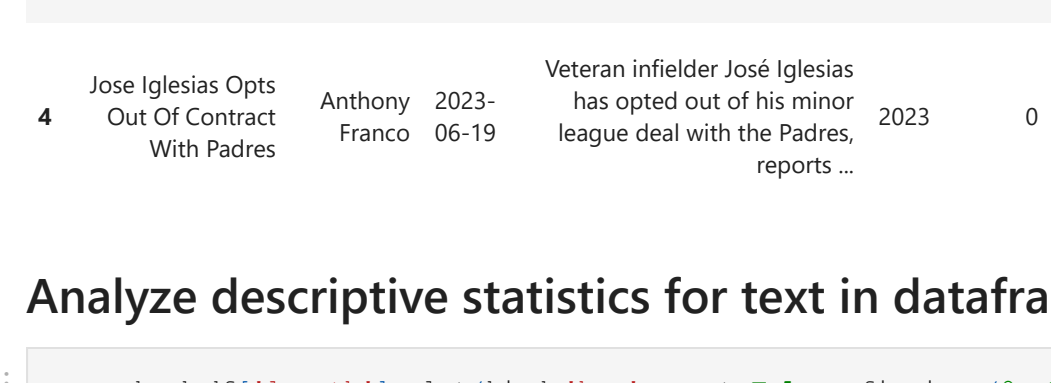
	Title	Author	Date	Content	Year	success	Year_Successful	impurity	Contents_Normalized	length
0	Padres Select Matt Waldron	Anthony Franco	2023-06-24	TODAY: The Padres have officially announced their selection of Waldron's contract. To make room ...	2023	0	0	0.0	[today, padr, offici, announc, select, waldron, contract, make, room, waldron, activ, roster, le...	222
1	Michael Wacha To Skip Start Due To Shoulder Fatigue	Mark Polishuk	2023-06-24	Knuckleballer Matt Waldron will start today's game for the Padres, as Michael Wacha (the origina...	2023	0	0	0.0	[knucklebal, matt, waldron, start, today, game, padr, michael, wacha, origin, schedul, starter, ...	91
2	A's Claim Angel Felipe	Steve Adams	2023-06-21	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...	2023	0	0	0.0	[athlet, claim, righthand, angel, felip, waiver, padr, per, team, announc, felip, option, triple...	182
3	Padres Designate Nabil Crismatt For Assignment	Darragh McDonald	2023-06-20	The Padres announced that right-hander Seth Lugo has been reinstated from the injured list, with...	2023	0	0	0.0	[padr, announc, righthand, seth, lugo, reinstat, injur, list, fellow, righti, nabil, crismatt, d...	147
4	Jose Iglesias Opts Out Of Contract With Padres	Anthony Franco	2023-06-19	Veteran infielder José Iglesias has opted out of his minor league deal with the Padres, reports ...	2023	0	0	0.0	[veteran, infield, jo, iglesia, opt, minor, leagu, deal, padr, report, mark, feinsand, mlbcom, t...	181

Analyze descriptive statistics for text in dataframe.

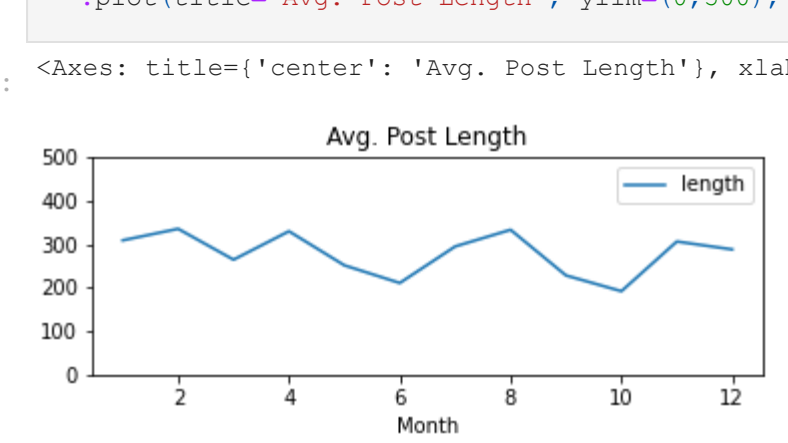
In [64]:
```
merged_sd_df['length'].plot(kind='box', vert=False, figsize=(8, 1))
```
Out[64]:
```
<Axes: >
```

In [65]:
```
merged_sd_df['Title_length'] = merged_sd_df['Title'].str.len()
merged_sd_df['Title_length'].plot(kind='box', vert=False, figsize=(8, 1))
```
Out[65]:
```
<Axes: >
```


In [66]:
```
merged_sd_df['length'].plot(kind='hist', bins=30, figsize=(8,2))
```
Out[66]:
```
<Axes: ylabel='Frequency'>
```



In [67]:
```
#Extract the month from the date and create a new column
merged_sd_df['Month'] = merged_sd_df['Date'].dt.month

#Plot the average post length
merged_sd_df.groupby('Month').agg({'length': 'mean'}) \
  .plot(title="Avg. Post Length", ylim=(0,500), figsize=(6,2))
```
Out[67]:
```
<Axes: title={'center': 'Avg. Post Length'}, xlabel='Month'>
```



In [68]:
```
def count_words(df, column='Contents_Normalized', preprocess=None, min_freq=2):

    #Process tokens and update counter
    def update(doc):
        tokens = doc if preprocess is None else preprocess(doc)
        counter.update(tokens)

    #Create counter and run through all data
    counter = Counter()
    tqdm.pandas() #initialize tqdm for progress bar
    df[column].apply(update)

    #Transform counter into data frame
    freq_df = pd.DataFrame.from_dict(counter, orient='index', columns=['freq'])
    freq_df = freq_df.query('freq >= @min_freq')
    freq_df.index.name = 'token'

    return freq_df.sort_values('freq', ascending=False)
```

In [69]:
```
freq_df = count_words(merged_sd_df)
freq_df.head(5)
```
Out[69]:

token	freq
padr	3770
season	3483
year	2701
mm	2362
leagu	1831

In [70]:
```
#How many tokens are in the df?
len(freq_df)
```
Out[70]:
```
6520
```

In [71]:
```
#Top words with 10+ characters
count_words(merged_sd_df, column='Content',
            preprocess=lambda Content: re.findall(r"\w{10,}", Content)).head(5)
```
Out[71]:

token	freq
appearances	645
outfielder	379
organization	319
arbitration	258
assignment	195

In [72]:
```
ax = freq_df.head(15).plot(kind='barh', width=0.95, figsize=(8,3))
ax.invert_yaxis()
ax.set(xlabel='Frequency', ylabel='Token', title='Top Words')
```
Out[72]:
```
[Text(0.5, 0, 'Frequency'), Text(0, 0.5, 'Token'), Text(0.5, 1.0, 'Top Words')]
```

Oakland Athletics Data Collection and Cleaning

In [73]:
```
#URL of the website to scrape
url = "https://www.mlbtraderumors.com/oakland-athletics?show=all"
file_path = "C:/Users/andre/OneDrive/Project/mlbtraderumors_oakland_athletics_articles1.txt"

#Scrape the website, write the scraped text to a file, and get the head of the DataFrame
oa_df = scrape_website(url, file_path)
oa_df.head()
```
Out[73]:

	Title	Author	Date	Content
0	Athletics Place Ramón Laureano On IL With Hand Fracture	Darragh McDonald	June 23, 2023	2:55pm: Martin Gallegos of MLB.com relays word from the A's training staff that this injury is t...
1	A's Preparing Application To MLB For Relocation	Anthony Franco	June 21, 2023	The Athletics have begun the process to officially apply to Major League Baseball for relocation...
2	A's Claim Angel Felipe	Steve Adams	June 21, 2023	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...
3	Athletics Select Yacksel Rios	Darragh McDonald	June 20, 2023	The Athletics announced that they have selected the contract of right-hander Yacksel Ríos. Fello...
4	Dick Hall Passes Away	Darragh McDonald	June 19, 2023	The Orioles have announced that former major leaguer Dick Hall has passed away. He was 92 years ...

In [74]:
```
#Change the Data column to a datetime object:
oa_df['Date'] = pd.to_datetime(oa_df['Date'], format="%B %d, %Y", errors= 'coerce')
```

In [75]:
```
oa_df.dtypes
```
Out[75]:
```
Title              object
Author             object
Date       datetime64[ns]
Content            object
dtype: object
```

In [76]:
```python
#Check for missing values
oa_df.isna().sum()
```
Out[76]:
```
Title       0
Author      0
Date       30
Content     0
dtype: int64
```

In [77]:
```python
len(oa_df)
```
Out[77]:
```
1030
```

In [78]:
```python
oa_df = oa_df.dropna()
oa_df
```
Out[78]:

	Title	Author	Date	Content
0	Athletics Place Ramón Laureano On IL With Hand Fracture	Darragh McDonald	2023-06-23	2:55pm: Martin Gallegos of MLB.com relays word from the A's training staff that this injury is t...
1	A's Preparing Application To MLB For Relocation	Anthony Franco	2023-06-21	The Athletics have begun the process to officially apply to Major League Baseball for relocation...
2	A's Claim Angel Felipe	Steve Adams	2023-06-21	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...
3	Athletics Select Yacksel Ríos	Darragh McDonald	2023-06-20	The Athletics announced that they have selected the contract of right-hander Yacksel Ríos. Fello...
4	Dick Hall Passes Away	Darragh McDonald	2023-06-19	The Orioles have announced that former major leaguer Dick Hall has passed away. He was 92 years ...
...	...	...	...	...
995	Athletics Outright Hatcher, Smolinski, Kiekhefer	Steve Adams	2018-10-15	5:29pm: Kiekhefer has indeed elected free agency, MLBTR has learned.\n2:37pm: The A's have now a...
996	Players Electing Free Agency	Jeff Todd	2018-10-08	Quite a few players will hit the open market this fall, and they'll do so by way of varying mech...
997	Forst: A's Expect Luzardo To Be "A Factor" Next Year	Steve Adams	2018-10-08	While some Athletics fans were hoping for a look at top pitching prospect Jesus Luardo late in t...
998	A's Notes: Davis, Melvin, Lucroy, Lowrie, Kelley	Mark Polishuk	2018-10-05	After falling short in the AL wild card game, the Athletics are looking ahead to what they hope ...
999	How Jonathan Lucroy Has Helped The A's	Mark Polishuk	2018-10-03	Jonathan Lucroy didn't contribute much at the plate for the Athletics this season, but the signi...

1000 rows × 4 columns

In [79]:
```python
len(oa_df)
```
Out[79]:
```
1000
```

Import data on the Oakland Athletics from baseball-reference.com

https://www.baseball-reference.com/teams/OAK/attend.shtml

In [80]:
```python
#URL of the webpage to scrape
url = "https://www.baseball-reference.com/teams/OAK/attend.shtml"

#Read the HTML table into a list of DataFrames
tables = pd.read_html(url)

#Select the table of interest (index 0 in this case)
table = tables[0]

#Save the DataFrame as a CSV file
file_path = "C:/Users/andre/OneDrive/Project/MLB_data/athletics_statistics.csv"
table.to_csv(file_path, index=False, header=True)

print("Data saved to", file_path)
```
```
Data saved to C:/Users/andre/OneDrive/Project/MLB_data/athletics_statistics.csv
```

In [81]:
```python
path = "C:/Users/andre/OneDrive/Project/MLB_data/"

athletics_df = pd.DataFrame(pd.read_csv(path + 'athletics_statistics.csv'))
athletics_df.head()
```
Out[81]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Oakland Athletics	AL West	20	59	5	NaN	368146.0	9688.0	15th of 15	$51,230,000	95	93	Oakland Coliseum
1	2022	Oakland Athletics	AL West	60	102	5	NaN	787902.0	9849.0	15th of 15	$50,248,334	95	93	RingCentral Coliseum
2	2021	Oakland Athletics	AL West	86	76	3	NaN	701430.0	8660.0	15th of 15	$94,555,834	95	95	RingCentral Coliseum
3	2020	Oakland Athletics	AL West	36	24	1	Lost ALDS (3-1)	NaN	NaN	11th of 15	$85,683,333	94	96	Oakland-Alameda County Coliseum
4	2019	Oakland Athletics	AL West	97	65	2	Lost ALWC (1-0)	1670734.0	20626.0	10th of 15	$102,935,833	93	94	Oakland-Alameda County Coliseum

In [82]:
```python
athletics_df= athletics_df[athletics_df['Year'] > 2004]
athletics_df
```
Out[82]:

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Oakland Athletics	AL West	20	59	5	NaN	368146.0	9688.0	15th of 15	$51,230,000	95	93	Oakland Coliseum
1	2022	Oakland Athletics	AL West	60	102	5	NaN	787902.0	9849.0	15th of 15	$50,248,334	95	93	RingCentral Coliseum
2	2021	Oakland Athletics	AL West	86	76	3	NaN	701430.0	8660.0	15th of 15	$94,555,834	95	95	RingCentral Coliseum
3	2020	Oakland Athletics	AL West	36	24	1	Lost ALDS (3-1)	NaN	NaN	11th of 15	$85,683,333	94	96	Oakland-Alameda County Coliseum
4	2019	Oakland Athletics	AL West	97	65	2	Lost ALWC (1-0)	1670734.0	20626.0	10th of 15	$102,935,833	93	94	Oakland-Alameda County Coliseum
5	2018	Oakland Athletics	AL West	97	65	2	Lost ALWC (1-0)	1573616.0	19427.0	13th of 15	$69,883,333	97	97	Oakland-Alameda County Coliseum
6	2017	Oakland Athletics	AL West	75	87	5	NaN	1475721.0	18219.0	14th of 15	$51,560,000	95	95	Oakland-Alameda County Coliseum
7	2016	Oakland Athletics	AL West	69	93	5	NaN	1521506.0	18784.0	14th of 15	$54,969,067	97	96	Oakland-Alameda County Coliseum
8	2015	Oakland Athletics	AL West	68	94	5	NaN	1768175.0	21829.0	12th of 15	$64,016,001	97	97	O.co Coliseum
9	2014	Oakland Athletics	AL West	88	74	2	Lost ALWC (1-0)	2003628.0	24736.0	10th of 15	$89,160,900	97	98	O.co Coliseum
10	2013	Oakland Athletics	AL West	96	66	1	Lost ALDS (3-2)	1809302.0	22337.0	9th of 15	$69,440,000	97	98	O.co Coliseum
11	2012	Oakland Athletics	AL West	94	68	1	Lost ALDS (3-2)	1679013.0	20729.0	12th of 14	$61,202,500	95	95	O.co Coliseum
12	2011	Oakland Athletics	AL West	74	88	3	NaN	1476791.0	18232.0	14th of 14	$67,094,000	98	98	O.co Coliseum
13	2010	Oakland Athletics	AL West	81	81	2	NaN	1418391.0	17511.0	13th of 14	$57,904,900	99	99	Oakland-Alameda County Coliseum
14	2009	Oakland Athletics	AL West	75	87	4	NaN	1408783.0	17392.0	14th of 14	$65,945,000	98	98	Oakland-Alameda County Coliseum
15	2008	Oakland Athletics	AL West	75	86	3	NaN	1665256.0	20559.0	13th of 14	$47,967,126	94	94	McAfee Coliseum, Tokyo Dome
16	2007	Oakland Athletics	AL West	76	86	3	NaN	1921844.0	23726.0	12th of 14	$79,366,940	94	94	McAfee Coliseum
17	2006	Oakland Athletics	AL West	93	69	1	Lost ALCS (4-0)	1976625.0	24403.0	12th of 14	$64,843,079	97	97	McAfee Coliseum
18	2005	Oakland Athletics	AL West	88	74	2	NaN	2109118.0	26038.0	8th of 14	$55,425,762	100	100	McAfee Coliseum

In [83]:
```python
#Remove the dollar and comma signs from the 'Estimated Payroll' column:
athletics_df['Est. Payroll'] = athletics_df['Est. Payroll'].replace({'\$':''}, regex = True)
athletics_df['Est. Payroll'] = athletics_df['Est. Payroll'].replace({'\,':''}, regex = True)
athletics_df.head()
```
Out[83]:

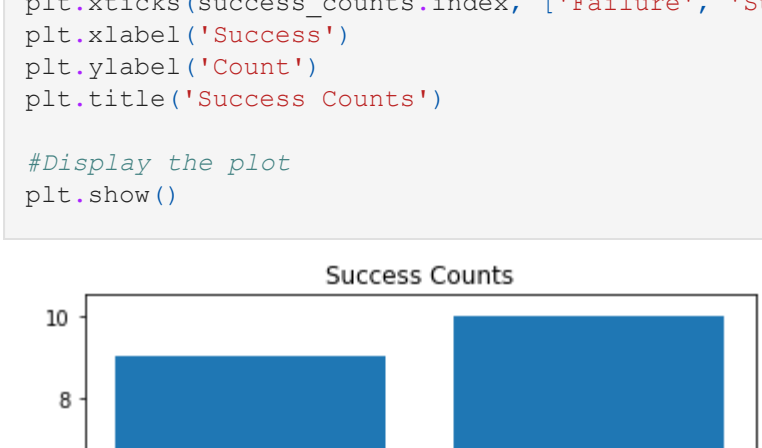
	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Oakland Athletics	AL West	20	59	5	NaN	368146.0	9688.0	15th of 15	51230000	95	93	Oakland Coliseum
1	2022	Oakland Athletics	AL West	60	102	5	NaN	787902.0	9849.0	15th of 15	50248334	95	93	RingCentral Coliseum
2	2021	Oakland Athletics	AL West	86	76	3	NaN	701430.0	8660.0	15th of 15	94555834	95	95	RingCentral Coliseum
3	2020	Oakland Athletics	AL West	36	24	1	Lost ALDS (3-1)	NaN	NaN	11th of 15	85683333	94	96	Oakland-Alameda County Coliseum
4	2019	Oakland Athletics	AL West	97	65	2	Lost ALWC (1-0)	1670734.0	20626.0	10th of 15	102935833	93	94	Oakland-Alameda County Coliseum

In [84]:
```python
athletics_df['Est. Payroll'] = athletics_df['Est. Payroll'].astype(float)
athletics_df.dtypes
```
Out[84]:
```
Year              int64
Tm               object
Lg               object
W                 int64
L                 int64
Finish            int64
Playoffs         object
Attendance      float64
Attend/G        float64
Rank             object
Est. Payroll    float64
PPF               int64
BPF               int64
Stadium          object
dtype: object
```

Create Binary feature that defines a successful year as wins greater than or equal to 50% of total games played

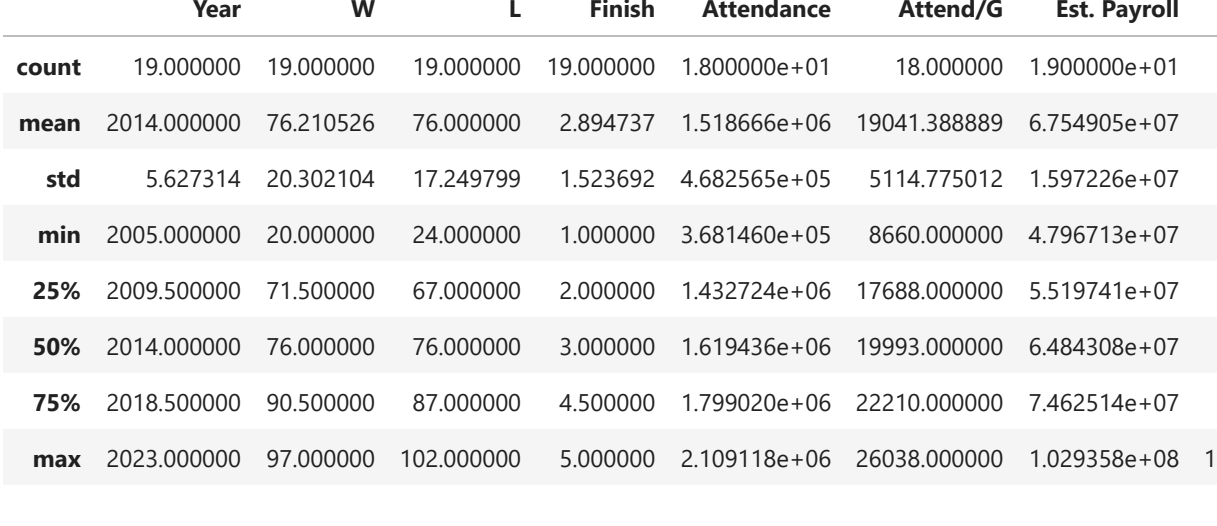
In [85]:
```python
#Add a column to define a binary output that has a 1 if the team has a winning record for the year, and 0 if th
athletics_df['success'] = (athletics_df['W'] / (athletics_df['W'] + athletics_df['L']) >= 0.5).astype(int)
athletics_df.head()
```
Out[85]:

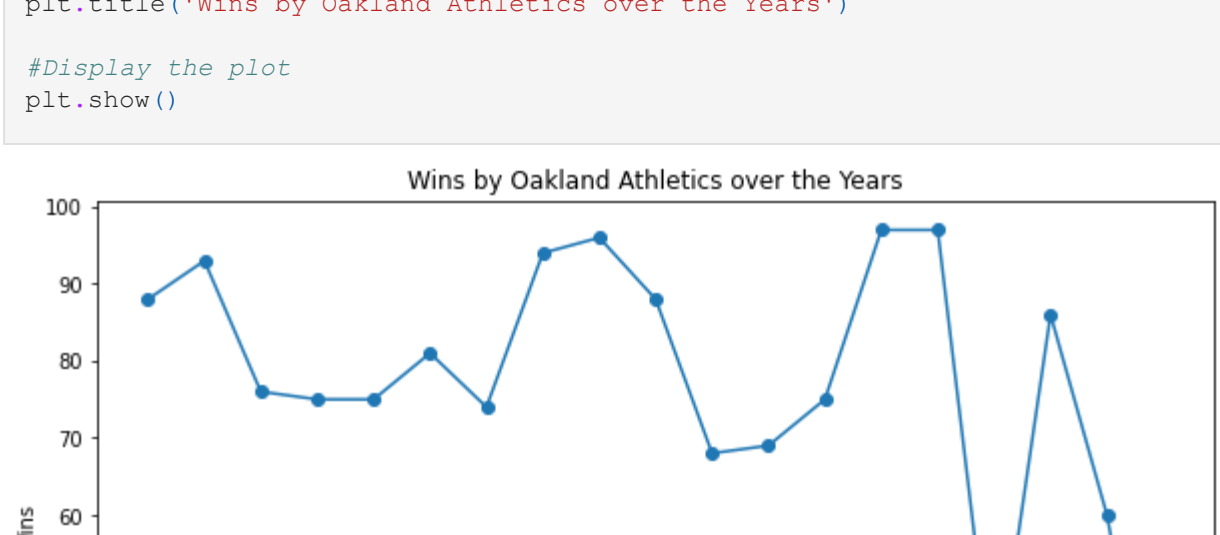
	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium	success
0	2023	Oakland Athletics	AL West	20	59	5	NaN	368146.0	9688.0	15th of 15	51230000.0	95	93	Oakland Coliseum	0
1	2022	Oakland Athletics	AL West	60	102	5	NaN	787902.0	9849.0	15th of 15	50248334.0	95	93	RingCentral Coliseum	0
2	2021	Oakland Athletics	AL West	86	76	3	NaN	701430.0	8660.0	15th of 15	94555834.0	95	95	RingCentral Coliseum	1
3	2020	Oakland Athletics	AL West	36	24	1	Lost ALDS (3-1)	NaN	NaN	11th of 15	85683333.0	94	96	Oakland-Alameda County Coliseum	1
4	2019	Oakland Athletics	AL West	97	65	2	Lost ALWC (1-0)	1670734.0	20626.0	10th of 15	102935833.0	93	94	Oakland-Alameda County Coliseum	1

In [86]:
```python
#Count the number of successes and failures
success_counts = athletics_df['success'].value_counts()

#Create a bar plot
plt.bar(success_counts.index, success_counts.values)
plt.xticks(success_counts.index, ['Failure', 'Success'])
plt.xlabel('Success')
plt.ylabel('Count')
plt.title('Success Counts')

#Display the plot
plt.show()
```


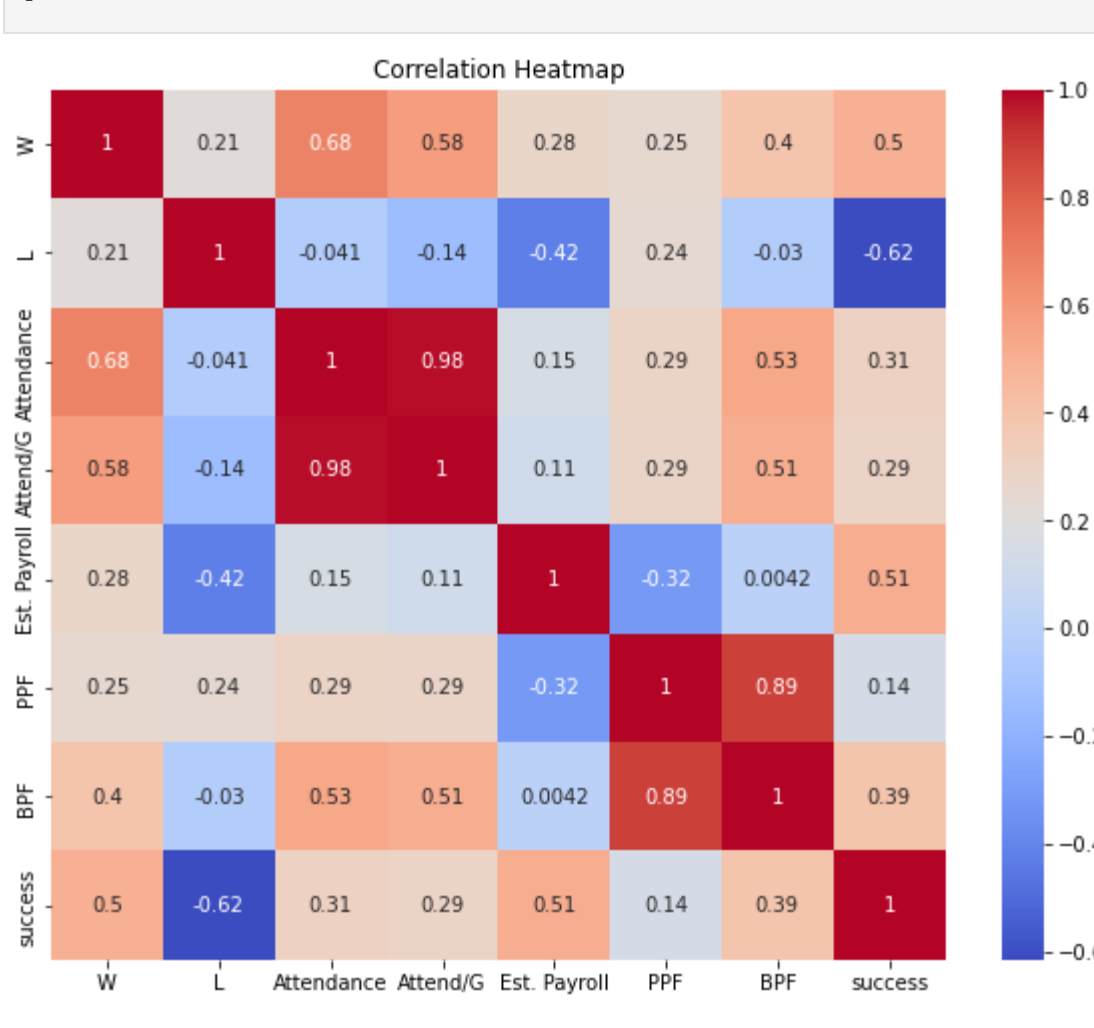
In [87]:
```python
athletics_df.describe()
```
Out[87]:

	Year	W	L	Finish	Attendance	Attend/G	Est. Payroll	PPF	BPF	success
count	19.000000	19.000000	19.000000	19.000000	1.800000e+01	18.000000	1.900000e+01	19.000000	19.000000	19.000000
mean	2014.000000	76.210526	76.000000	2.894737	1.518666e+06	19041.388889	6.754905e+07	96.157895	96.157895	0.526316
std	5.627314	20.302104	17.249799	1.523692	4.682565e+05	5114.775012	1.597226e+07	1.893356	2.061907	0.512989
min	2005.000000	20.000000	24.000000	1.000000	3.681460e+05	8660.000000	4.796713e+07	93.000000	93.000000	0.000000
25%	2009.500000	71.500000	67.000000	2.000000	1.432724e+06	17688.000000	5.519741e+07	95.000000	94.500000	0.000000
50%	2014.000000	76.000000	76.000000	3.000000	1.619436e+06	19993.000000	6.484308e+07	97.000000	96.000000	1.000000
75%	2018.500000	90.500000	87.000000	4.500000	1.799020e+06	22210.000000	7.462514e+07	97.000000	98.000000	1.000000
max	2023.000000	97.000000	102.000000	5.000000	2.109118e+06	26038.000000	1.029358e+08	100.000000	100.000000	1.000000

In [88]:
```python
#Plotting the data
#Convert columns to numpy arrays
year = np.array(athletics_df['Year'])
attendance = np.array(athletics_df['Attendance'])

plt.figure(figsize=(10, 6))

#Plotting Attendance over the years
plt.plot(year, attendance, marker='o')
plt.xlabel('Year')
plt.ylabel('Attendance')
plt.title('Attendance of Oakland Athletics over the Years')

#Display the plot
plt.show()
```


In [89]:
```python
#Plotting Wins over the years
year = np.array(athletics_df['Year'])
wins = np.array(athletics_df['W'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, wins, marker='o')
plt.xlabel('Year')
plt.ylabel('Wins')
plt.title('Wins by Oakland Athletics over the Years')

#Display the plot
plt.show()
```


In [90]:
```python
#Plotting Payroll over the years
#Convert columns to numpy arrays
year = np.array(athletics_df['Year'])
payroll = np.array(athletics_df['Est. Payroll'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, payroll, marker='o')
plt.xlabel('Year')
plt.ylabel('Payroll')
plt.title('Payroll of Oakland Athletics over the Years')

#Display the plot
plt.show()
```


In [91]:
```python
#Select numeric columns for correlation analysis
numeric_cols = ['W', 'L', 'Attendance', 'Attend/G', 'Est. Payroll', 'PPF', 'BPF', 'success']
numeric_df = athletics_df[numeric_cols]

#Correlation matrix
correlation = numeric_df.corr()

#Plotting the correlation heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(correlation, annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap')

#Display the plot
plt.show()
```


Add column to analyze whether blog post occurred in a successful year or not.

In [92]:
```python
#Extract the year from the "Date" column in df DataFrame
oa_df['Year'] = pd.to_datetime(oa_df['Date']).dt.year

#Merge df and athletics_df DataFrames on the "Year" column
merged_oa_df = pd.merge(oa_df, athletics_df[['Year', 'success']], on='Year', how='left')

#Add a new column 'Year_Successful' based on 'success' column
merged_oa_df['Year_Successful'] = merged_oa_df['success'].fillna(0).astype(int)

merged_oa_df.head()
```
Out[92]:

	Title	Author	Date	Content	Year	success	Year_Successful
0	Athletics Place Ramón Laureano On IL With Hand Fracture	Darragh McDonald	2023-06-23	2:55pm: Martin Gallegos of MLB.com relays word from the A's training staff that this injury is t...	2023	0	0
1	A's Preparing Application To MLB For Relocation	Anthony Franco	2023-06-21	The Athletics have begun the process to officially apply to Major League Baseball for relocation...	2023	0	0
2	A's Claim Angel Felipe	Steve Adams	2023-06-21	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...	2023	0	0
3	Athletics Select Yacksel Rios	Darragh McDonald	2023-06-20	The Athletics announced that they have selected the contract of right-hander Yacksel Rios. Fello...	2023	0	0
4	Dick Hall Passes Away	Darragh McDonald	2023-06-19	The Orioles have announced that former major leaguer Dick Hall has passed away. He was 92 years ...	2023	0	0

In [93]:
```python
len(merged_oa_df)
```
Out[93]:
```
1000
```

Cleaning the Athletics' Data

In [94]:
```python
#Identify any noise in the data
RE_SUSPICIOUS = re.compile(r'[&#<>{}\[\]\\]')

def impurity(text, min_len=10):
    """returns the share of suspicious characters in a text"""
    if text == None or len(text) < min_len:
        return 0
    else:
        return len(RE_SUSPICIOUS.findall(text))/len(text)
```

In [95]:
```python
merged_oa_df['Content'].apply
```
Out[95]:
```
<bound method Series.apply of 0      2:55pm: Martin Gallegos of MLB.com relays word from the A's training staff
that this injury is t...
1      The Athletics have begun the process to officially apply to Major League Baseball for relocation...
2      The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...
3      The Athletics announced that they have selected the contract of right-hander Yacksel Rios. Fello...
4      The Orioles have announced that former major leaguer Dick Hall has passed away. He was 92 years ...
                                                      ...
995    5:29pm: Kiekhefer has indeed elected free agency, MLBTR has learned.\n2:37pm: The A's have now a...
996    Quite a few players will hit the open market this fall, and they'll do so by way of varying mech...
997    While some Athletics fans were hoping for a look at top pitching prospect Jesus Luardo late in t...
998    After falling short in the AL wild card game, the Athletics are looking ahead to what they hope ...
999    Jonathan Lucroy didn't contribute much at the plate for the Athletics this season, but the signi...
Name: Content, Length: 1000, dtype: object>
```

In [96]:
```python
pd.options.display.max_colwidth = 100 ###
#Add new column to data frame
merged_oa_df['impurity'] = merged_oa_df['Content'].apply(impurity, min_len=10)

#Get the top 3 records
merged_oa_df[['Content', 'impurity']].sort_values(by='impurity', ascending=False).head(3)
```
Out[96]:

	Content	impurity
115	Major League Baseball's international signing period for 2023 has officially opened up today, wi...	0.005563
948	Left-handed pitching prospect Jesus Luzardo is drawing raves from both inside and outside the At...	0.004474
535	Kingston fit the mold of many of the Angels' candidates — well-regarded younger executives who w...	0.003306

The above shows the highest impurity levels for the Athletics' data set. Note, these are extremely low...well below 1% of all characters in each blog post are suspicious.

Character Normalization and Tokenization

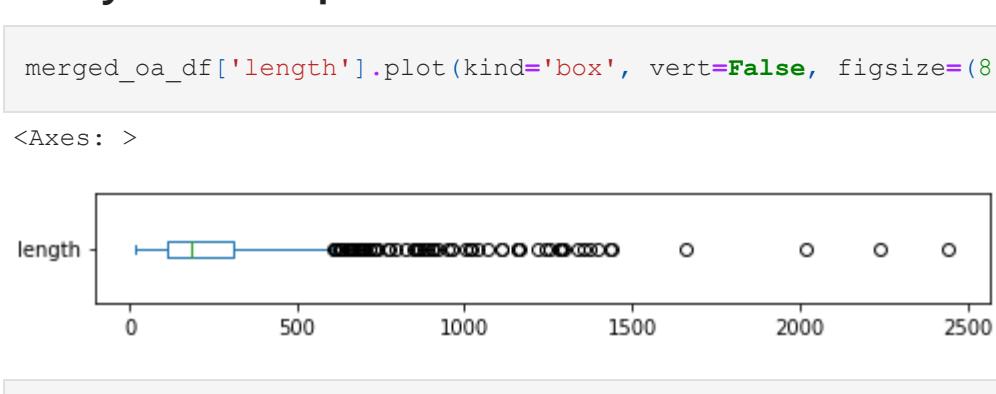
In [97]:
```python
#Example function to normalize the text in the "Contents" column
def normalize_text(text):
    #Lowercase the text
    text = text.lower()

    #Remove punctuation
    text = text.translate(str.maketrans("", "", string.punctuation))

    #Remove special characters and digits
    text = re.sub(r"[^a-zA-Z]", " ", text)

    #Tokenize the text
    tokens = word_tokenize(text)

    #Remove stopwords
    stop_words = set(stopwords.words("english"))
    tokens = [token for token in tokens if token not in stop_words]

    #Perform stemming
    stemmer = PorterStemmer()
    tokens = [stemmer.stem(token) for token in tokens]

    return tokens

#Apply normalization to the "Contents" column
merged_oa_df["Contents_Normalized"] = merged_oa_df["Content"].apply(normalize_text)

#Print the head of the DataFrame with the normalized contents
merged_oa_df[["Content", "Contents_Normalized"]].head()
```
Out[97]:

	Content	Contents_Normalized
0	2:55pm: Martin Gallegos of MLB.com relays word from the A's training staff that this injury is t...	[pm, martin, gallego, mlbcom, relay, word, train, staff, injuri, result, laureano, get, hit, pit...
1	The Athletics have begun the process to officially apply to Major League Baseball for relocation...	[athlet, begun, process, offici, appli, major, leagu, basebal, reloc, write, mick, aker, la, veg...
2	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...	[athlet, claim, righthand, angel, felip, waiver, padr, per, team, announc, felip, option, triple...
3	The Athletics announced that they have selected the contract of right-hander Yacksel Rios. Fello...	[athlet, announc, select, contract, righthand, yacksel, r, os, fellow, righti, chad, smith, opti...
4	The Orioles have announced that former major leaguer Dick Hall has passed away. He was 92 years ...	[oriol, announc, former, major, leaguer, dick, hall, pass, away, year, old, hall, underw, mani, ...

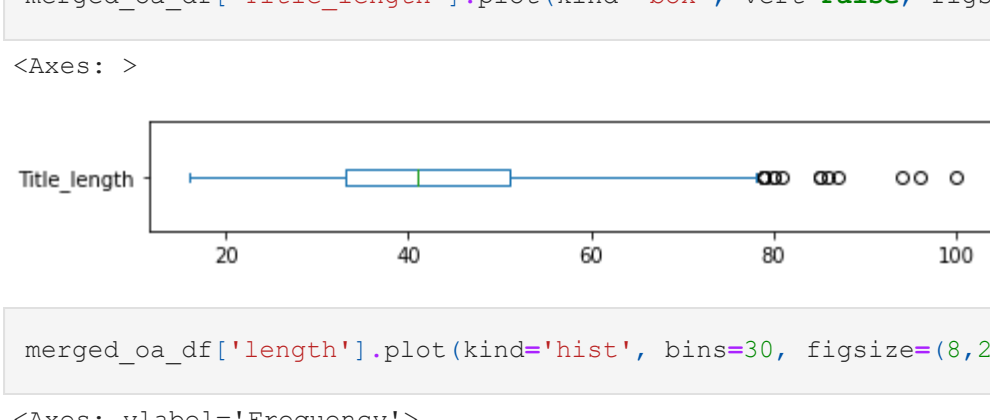
In [98]:
```python
merged_oa_df['length'] = merged_oa_df['Contents_Normalized'].str.len()
merged_oa_df.head()
```
Out[98]:

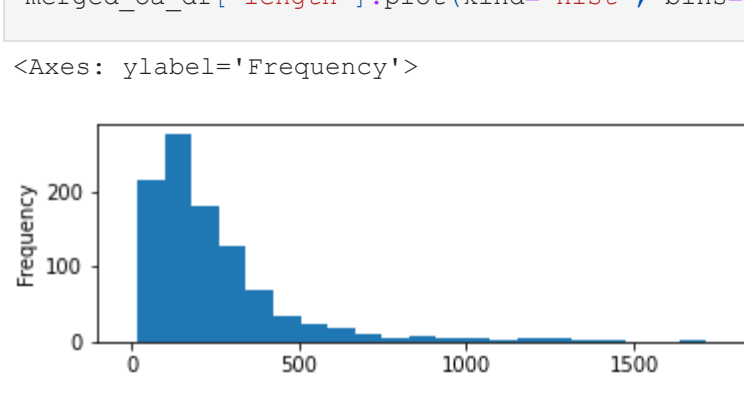
	Title	Author	Date	Content	Year	success	Year_Successful	impurity	Contents_Normalized	length
0	Athletics Place Ramón Laureano On IL With Hand Fracture	Darragh McDonald	2023-06-23	2:55pm: Martin Gallegos of MLB.com relays word from the A's training staff that this injury is t...	2023	0	0	0.0	[pm, martin, gallego, mlbcom, relay, word, train, staff, injuri, result, laureano, get, hit, pit...	253
1	A's Preparing Application To MLB For Relocation	Anthony Franco	2023-06-21	The Athletics have begun the process to officially apply to Major League Baseball for relocation...	2023	0	0	0.0	[athlet, begun, process, offici, appli, major, leagu, basebal, reloc, write, mick, aker, la, veg...	134
2	A's Claim Angel Felipe	Steve Adams	2023-06-21	The Athletics have claimed right-hander Angel Felipe off waivers from the Padres, per a team ann...	2023	0	0	0.0	[athlet, claim, righthand, angel, felip, waiver, padr, per, team, announc, felip, option, triple...	182
3	Athletics Select Yacksel Rios	Darragh McDonald	2023-06-20	The Athletics announced that they have selected the contract of right-hander Yacksel Rios. Fello...	2023	0	0	0.0	[athlet, announc, select, contract, righthand, yacksel, r, os, fellow, righti, chad, smith, opti...	179
4	Dick Hall Passes Away	Darragh McDonald	2023-06-19	The Orioles have announced that former major leaguer Dick Hall has passed away. He was 92 years ...	2023	0	0	0.0	[oriol, announc, former, major, leaguer, dick, hall, pass, away, year, old, hall, underw, mani, ...	173

Analyze descriptive statistics for text in dataframe.

In [99]:
```python
merged_oa_df['length'].plot(kind='box', vert=False, figsize=(8, 1))
```
Out[99]:
```
<Axes: >
```


In [100…
```python
merged_oa_df['Title_length'] = merged_oa_df['Title'].str.len()
merged_oa_df['Title_length'].plot(kind='box', vert=False, figsize=(8, 1))
```
Out[100…
```
<Axes: >
```


In [101…
```python
merged_oa_df['length'].plot(kind='hist', bins=30, figsize=(8,2))
```
Out[101…
```
<Axes: ylabel='Frequency'>
```


In [102…
```python
#Extract the month from the date and create a new column
merged_oa_df['Month'] = merged_oa_df['Date'].dt.month

#Plot the average post length
merged_oa_df.groupby('Month').agg({'length': 'mean'}) \
  .plot(title="Avg. Post Length", ylim=(0,500), figsize=(6,2))
```
Out[102…
```
<Axes: title={'center': 'Avg. Post Length'}, xlabel='Month'>
```


In [103…
```python
def count_words(df, column='Contents_Normalized', preprocess=None, min_freq=2):

    #Process tokens and update counter
    def update(doc):
        tokens = doc if preprocess is None else preprocess(doc)
        counter.update(tokens)

    #Create counter and run through all data
    counter = Counter()
    tqdm.pandas() #initialize tqdm for progress bar
    df[column].apply(update)

    #Transform counter into data frame
    freq_df = pd.DataFrame.from_dict(counter, orient='index', columns=['freq'])
    freq_df = freq_df.query('freq >= @min_freq')
    freq_df.index.name = 'token'

    return freq_df.sort_values('freq', ascending=False)
```

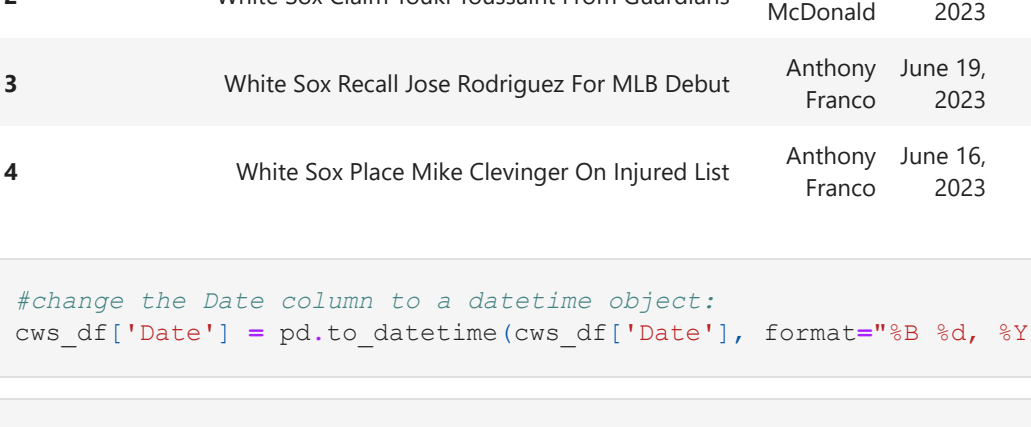
In [104…
```python
freq_df = count_words(merged_oa_df)
freq_df.head(5)
```
Out[104…

token	freq
season	3187
year	2294
leagu	1839
mm	1596
oakland	1572

In [105…
```python
#How many tokens are in the df?
len(freq_df)
```
Out[105…
```
6653
```

In [106…
```python
#Top words with 10+ characters
count_words(merged_oa_df, column='Content',
            preprocess=lambda Content: re.findall(r"\w{10,}", Content)).head(5)
```
Out[106…

token	freq
appearances	733
organization	374
arbitration	369
outfielder	318
assignment	272

In [107…
```python
ax = freq_df.head(15).plot(kind='barh', width=0.95, figsize=(8,3))
ax.invert_yaxis()
ax.set(xlabel='Frequency', ylabel='Token', title='Top Words')
```
Out[107…
```
[Text(0.5, 0, 'Frequency'), Text(0, 0.5, 'Token'), Text(0.5, 1.0, 'Top Words')]
```


Chicago White Sox Data Collection and Cleaning

In [108…
```python
#URL of the website to scrape
url = "https://www.mlbtraderumors.com/chicago-white-sox?show=all"
file_path = "C:/Users/andre/OneDrive/Project/mlbtraderumors_chicago_white_sox_articles1.txt"

#Scrape the website, write the scraped text to a file, and get the head of the DataFrame
cws_df = scrape_website(url, file_path)
cws_df.head()
```
Out[108…

	Title	Author	Date	Content
0	MLBTR Trade Rumors Podcast: Exciting Youth Movements in Cincinnati and Pittsburgh, Bad Central D...	Darragh McDonald	June 21, 2023	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...
1	AL Central Notes: Buxton, Crochet, Tigers	Darragh McDonald	June 21, 2023	Twins outfielder Byron Buxton has dealt with many injuries throughout his career, which has led ...
2	White Sox Claim Touki Toussaint From Guardians	Darragh McDonald	June 20, 2023	The White Sox have claimed right-hander Touki Toussaint off waivers from the Guardians, per anno...
3	White Sox Recall Jose Rodriguez For MLB Debut	Anthony Franco	June 19, 2023	The White Sox announced a handful of transactions before tonight's series opener with the Ranger...
4	White Sox Place Mike Clevinger On Injured List	Anthony Franco	June 16, 2023	The White Sox placed starter Mike Clevinger on the 15-day injured list, retroactive to June 15, ...

In [109…
```python
#change the Date column to a datetime object:
cws_df['Date'] = pd.to_datetime(cws_df['Date'], format="%B %d, %Y", errors= 'coerce')
```

In [110…
```python
cws_df.dtypes
```
Out[110…
```
Title              object
Author             object
Date       datetime64[ns]
Content            object
dtype: object
```

In [111…
```python
cws_df.isna().sum()
```
Out[111…
```
Title       0
Author      0
Date       30
Content     0
dtype: int64
```

In [112…
```python
len(cws_df)
```
Out[112…
```
1030
```

In [113…
```python
cws_df = cws_df.dropna()
cws_df
```
Out[113…

	Title	Author	Date	Content
0	MLBTR Trade Rumors Podcast: Exciting Youth Movements in Cincinnati and Pittsburgh, Bad Central D...	Darragh McDonald	2023-06-21	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...
1	AL Central Notes: Buxton, Crochet, Tigers	Darragh McDonald	2023-06-21	Twins outfielder Byron Buxton has dealt with many injuries throughout his career, which has led ...
2	White Sox Claim Touki Toussaint From Guardians	Darragh McDonald	2023-06-20	The White Sox have claimed right-hander Touki Toussaint off waivers from the Guardians, per anno...
3	White Sox Recall Jose Rodriguez For MLB Debut	Anthony Franco	2023-06-19	The White Sox announced a handful of transactions before tonight's series opener with the Ranger...
4	White Sox Place Mike Clevinger On Injured List	Anthony Franco	2023-06-16	The White Sox placed starter Mike Clevinger on the 15-day injured list, retroactive to June 15, ...
...	...	...	...	...
995	White Sox Outright Dustin Garneau	Connor Byrne	2018-10-02	The White Sox have outrighted catcher Dustin Garneau to Triple-A Charlotte, Daryl Van Schouwen o...
996	Rick Hahn On White Sox' Offseason Plans	Jeff Todd	2018-09-27	White Sox GM Rick Hahn addressed the media yesterday regarding the state of his organization's r...
997	Avisail Garcia To Undergo Knee Surgery	Jeff Todd	2018-09-25	White Sox outfielder Avisail Garcia is set to undergo right knee surgery, he told reporters incl...
998	Past, Present & Future: American League Closer Turnover	Jason Martinez	2018-09-25	By the end of the 2017 season, the list of pitchers closing out games for their respective teams...
999	Silver Linings: American League Central	Jeff Todd	2018-09-19	It's often difficult to feel positive about a team when it is finishing out a season that won't ...

1000 rows × 4 columns

In [114…
```python
len(cws_df)
```
Out[114…
```
1000
```

Import data on the Chicago White Sox from baseball-reference.com.

https://www.baseball-reference.com/teams/CHW/attend.shtml

In [115...
```python
#URL of the webpage to scrape
url = "https://www.baseball-reference.com/teams/CHW/attend.shtml"

#Read the HTML table into a list of DataFrames
tables = pd.read_html(url)

#Select the table of interest (index 0 in this case)
table = tables[0]

#Save the DataFrame as a CSV file
file_path = "C:/Users/andre/OneDrive/Project/MLB_data/white_sox_statistics.csv"
table.to_csv(file_path, index=False, header=True)

print("Data saved to", file_path)
```

```
Data saved to C:/Users/andre/OneDrive/Project/MLB_data/white_sox_statistics.csv
```

In [116...
```python
path = "C:/Users/andre/OneDrive/Project/MLB_data/"

white_sox_df = pd.DataFrame(pd.read_csv(path + 'white_sox_statistics.csv'))
white_sox_df.head()
```

Out[116...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Chicago White Sox	AL Central	33	45	4	NaN	758109.0	19439.0	11th of 15	$157,571,666	104	104	Guaranteed Rate Field
1	2022	Chicago White Sox	AL Central	81	81	2	NaN	2009359.0	24807.0	8th of 15	$163,958,334	103	103	Guaranteed Rate Field
2	2021	Chicago White Sox	AL Central	93	69	1	Lost ALDS (3-1)	1596385.0	19708.0	5th of 15	$115,546,333	101	102	Guaranteed Rate Field
3	2020	Chicago White Sox	AL Central	35	25	3	Lost ALWC (2-1)	NaN	NaN	3rd of 15	$119,066,333	100	100	Guaranteed Rate Field
4	2019	Chicago White Sox	AL Central	72	89	3	NaN	1649775.0	20622.0	11th of 15	$80,846,333	99	98	Guaranteed Rate Field

In [117...
```python
white_sox_df= white_sox_df[white_sox_df['Year'] > 2004]
white_sox_df
```

Out[117...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Chicago White Sox	AL Central	33	45	4	NaN	758109.0	19439.0	11th of 15	$157,571,666	104	104	Guaranteed Rate Field
1	2022	Chicago White Sox	AL Central	81	81	2	NaN	2009359.0	24807.0	8th of 15	$163,958,334	103	103	Guaranteed Rate Field
2	2021	Chicago White Sox	AL Central	93	69	1	Lost ALDS (3-1)	1596385.0	19708.0	5th of 15	$115,546,333	101	102	Guaranteed Rate Field
3	2020	Chicago White Sox	AL Central	35	25	3	Lost ALWC (2-1)	NaN	NaN	3rd of 15	$119,066,333	100	100	Guaranteed Rate Field
4	2019	Chicago White Sox	AL Central	72	89	3	NaN	1649775.0	20622.0	11th of 15	$80,846,333	99	98	Guaranteed Rate Field
5	2018	Chicago White Sox	AL Central	62	100	4	NaN	1608817.0	19862.0	12th of 15	$75,092,000	99	98	Guaranteed Rate Field
6	2017	Chicago White Sox	AL Central	67	95	4	NaN	1629470.0	20117.0	13th of 15	$97,842,000	98	97	Guaranteed Rate Field
7	2016	Chicago White Sox	AL Central	78	84	4	NaN	1746293.0	21559.0	12th of 15	$113,416,000	96	96	U.S. Cellular Field
8	2015	Chicago White Sox	AL Central	76	86	4	NaN	1755810.0	21677.0	13th of 15	$112,889,700	97	96	U.S. Cellular Field
9	2014	Chicago White Sox	AL Central	73	89	4	NaN	1650821.0	20381.0	13th of 15	$87,475,500	98	97	U.S. Cellular Field
10	2013	Chicago White Sox	AL Central	63	99	5	NaN	1768413.0	21832.0	10th of 15	$81,401,900	105	104	U.S. Cellular Field
11	2012	Chicago White Sox	AL Central	85	77	2	NaN	1965955.0	24271.0	9th of 14	$118,208,000	104	104	U.S. Cellular Field
12	2011	Chicago White Sox	AL Central	79	83	3	NaN	2001117.0	24705.0	7th of 14	$127,789,000	106	106	U.S. Cellular Field
13	2010	Chicago White Sox	AL Central	88	74	2	NaN	2194378.0	27091.0	7th of 14	$107,195,000	103	103	U.S. Cellular Field
14	2009	Chicago White Sox	AL Central	79	83	3	NaN	2284163.0	28200.0	6th of 14	$101,081,000	105	105	U.S. Cellular Field
15	2008	Chicago White Sox	AL Central	89	74	1	Lost ALDS (3-1)	2500648.0	30496.0	5th of 14	$121,189,332	105	104	U.S. Cellular Field
16	2007	Chicago White Sox	AL Central	72	90	4	NaN	2684395.0	33141.0	5th of 14	$108,671,833	104	104	U.S. Cellular Field
17	2006	Chicago White Sox	AL Central	90	72	3	NaN	2957414.0	36511.0	3rd of 14	$102,750,667	104	104	U.S. Cellular Field
18	2005	Chicago White Sox	AL Central	99	63	1	Won WS (4-0)	2342833.0	28924.0	7th of 14	$75,178,000	103	103	U.S. Cellular Field

In [118...
```python
#Remove the dollar sign from the 'Estimated Payroll' column:
white_sox_df['Est. Payroll'] = white_sox_df['Est. Payroll'].replace({'\$':''}, regex = True)
white_sox_df['Est. Payroll'] = white_sox_df['Est. Payroll'].replace({'\,':''}, regex = True)
white_sox_df.head()
```

Out[118...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Chicago White Sox	AL Central	33	45	4	NaN	758109.0	19439.0	11th of 15	157571666	104	104	Guaranteed Rate Field
1	2022	Chicago White Sox	AL Central	81	81	2	NaN	2009359.0	24807.0	8th of 15	163958334	103	103	Guaranteed Rate Field
2	2021	Chicago White Sox	AL Central	93	69	1	Lost ALDS (3-1)	1596385.0	19708.0	5th of 15	115546333	101	102	Guaranteed Rate Field
3	2020	Chicago White Sox	AL Central	35	25	3	Lost ALWC (2-1)	NaN	NaN	3rd of 15	119066333	100	100	Guaranteed Rate Field
4	2019	Chicago White Sox	AL Central	72	89	3	NaN	1649775.0	20622.0	11th of 15	80846333	99	98	Guaranteed Rate Field

In [119...
```python
white_sox_df['Est. Payroll'] = white_sox_df['Est. Payroll'].astype(float)
white_sox_df.dtypes
```

Out[119...
```
Year              int64
Tm               object
Lg               object
W                 int64
L                 int64
Finish            int64
Playoffs         object
Attendance      float64
Attend/G        float64
Rank             object
Est. Payroll    float64
PPF               int64
BPF               int64
Stadium          object
dtype: object
```

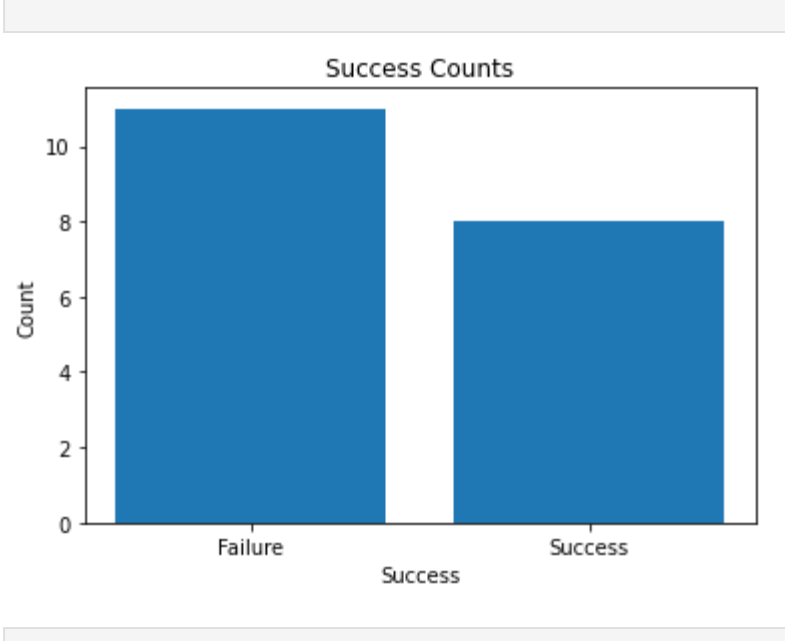
Create Binary feature that defines a successful year as wins greater than or equal to 50% of total games played

In [120...
```python
#Add a column to define a binary output that has a 1 if the team has a winning record for the year, and 0 if th
white_sox_df['success'] = (white_sox_df['W'] / (white_sox_df['W'] + white_sox_df['L']) >= 0.5).astype(int)
white_sox_df.head()
```

Out[120...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium	success
0	2023	Chicago White Sox	AL Central	33	45	4	NaN	758109.0	19439.0	11th of 15	157571666.0	104	104	Guaranteed Rate Field	0
1	2022	Chicago White Sox	AL Central	81	81	2	NaN	2009359.0	24807.0	8th of 15	163958334.0	103	103	Guaranteed Rate Field	1
2	2021	Chicago White Sox	AL Central	93	69	1	Lost ALDS (3-1)	1596385.0	19708.0	5th of 15	115546333.0	101	102	Guaranteed Rate Field	1
3	2020	Chicago White Sox	AL Central	35	25	3	Lost ALWC (2-1)	NaN	NaN	3rd of 15	119066333.0	100	100	Guaranteed Rate Field	1
4	2019	Chicago White Sox	AL Central	72	89	3	NaN	1649775.0	20622.0	11th of 15	80846333.0	99	98	Guaranteed Rate Field	0

In [121...
```python
#Count the number of successes and failures
success_counts = white_sox_df['success'].value_counts()

#Create a bar plot
plt.bar(success_counts.index, success_counts.values)
plt.xticks(success_counts.index, ['Failure', 'Success'])
plt.xlabel('Success')
plt.ylabel('Count')
plt.title('Success Counts')

#Display the plot
plt.show()
```

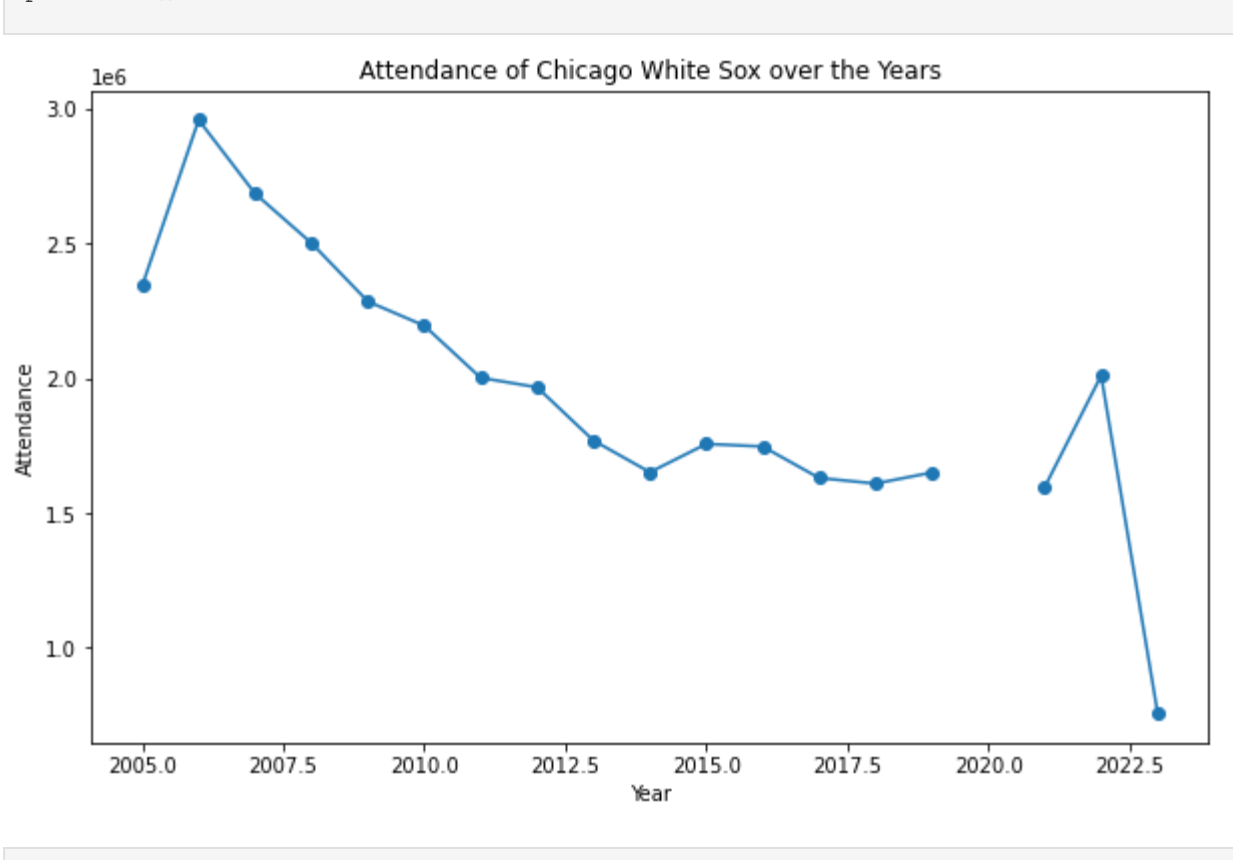


In [122...
```python
white_sox_df.describe()
```

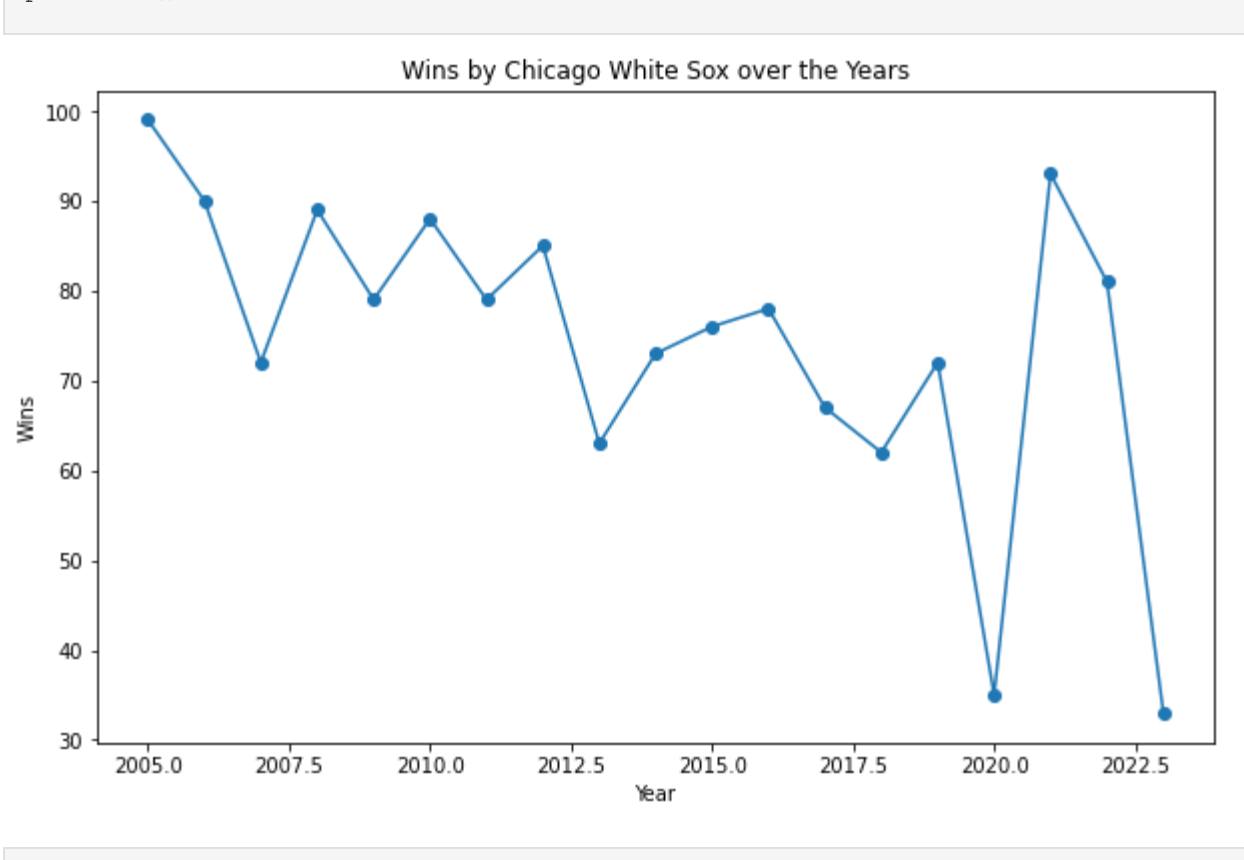
Out[122...

	Year	W	L	Finish	Attendance	Attend/G	Est. Payroll	PPF	BPF	success
count	19.000000	19.000000	19.000000	19.00000	1.800000e+01	18.000000	1.900000e+01	19.000000	19.000000	19.000000
mean	2014.000000	74.421053	77.789474	3.00000	1.950231e+06	24630.166667	1.087984e+08	101.789474	101.473684	0.421053
std	5.627314	17.359966	18.304762	1.20185	4.997730e+05	5086.213237	2.436409e+07	3.137213	3.372576	0.507257
min	2005.000000	33.000000	25.000000	1.00000	7.581090e+05	19439.000000	7.509200e+07	96.000000	96.000000	0.000000
25%	2009.500000	69.500000	73.000000	2.00000	1.650036e+06	20441.250000	9.265875e+07	99.000000	98.000000	0.000000
50%	2014.000000	78.000000	83.000000	3.00000	1.867184e+06	23051.500000	1.086718e+08	103.000000	103.000000	0.000000
75%	2018.500000	86.500000	89.000000	4.00000	2.261717e+06	27922.750000	1.186372e+08	104.000000	104.000000	1.000000
max	2023.000000	99.000000	100.000000	5.00000	2.957414e+06	36511.000000	1.639583e+08	106.000000	106.000000	1.000000

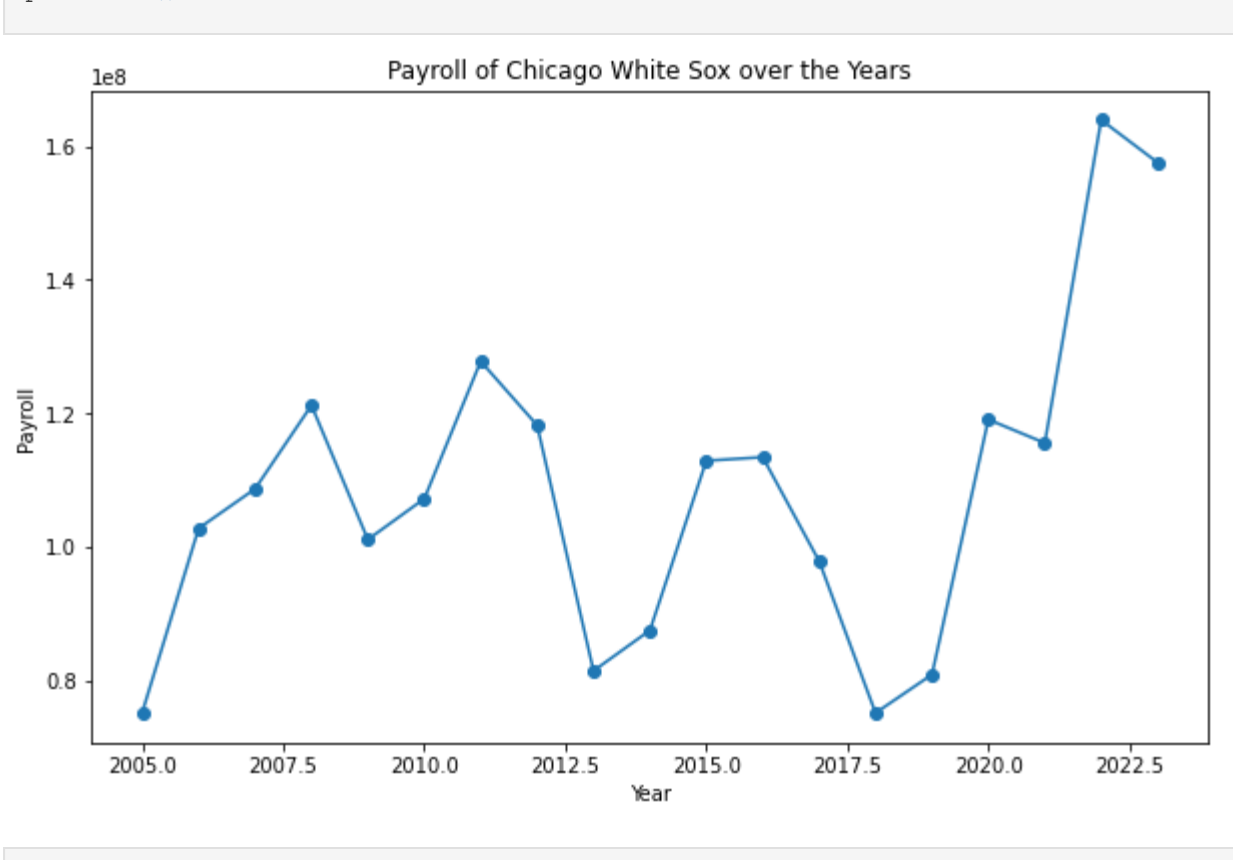
In [123...
```python
#Plotting
#Convert columns to numpy arrays
year = np.array(white_sox_df['Year'])
attendance = np.array(white_sox_df['Attendance'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, attendance, marker='o')
plt.xlabel('Year')
plt.ylabel('Attendance')
plt.title('Attendance of Chicago White Sox over the Years')

#Display the plot
plt.show()
```



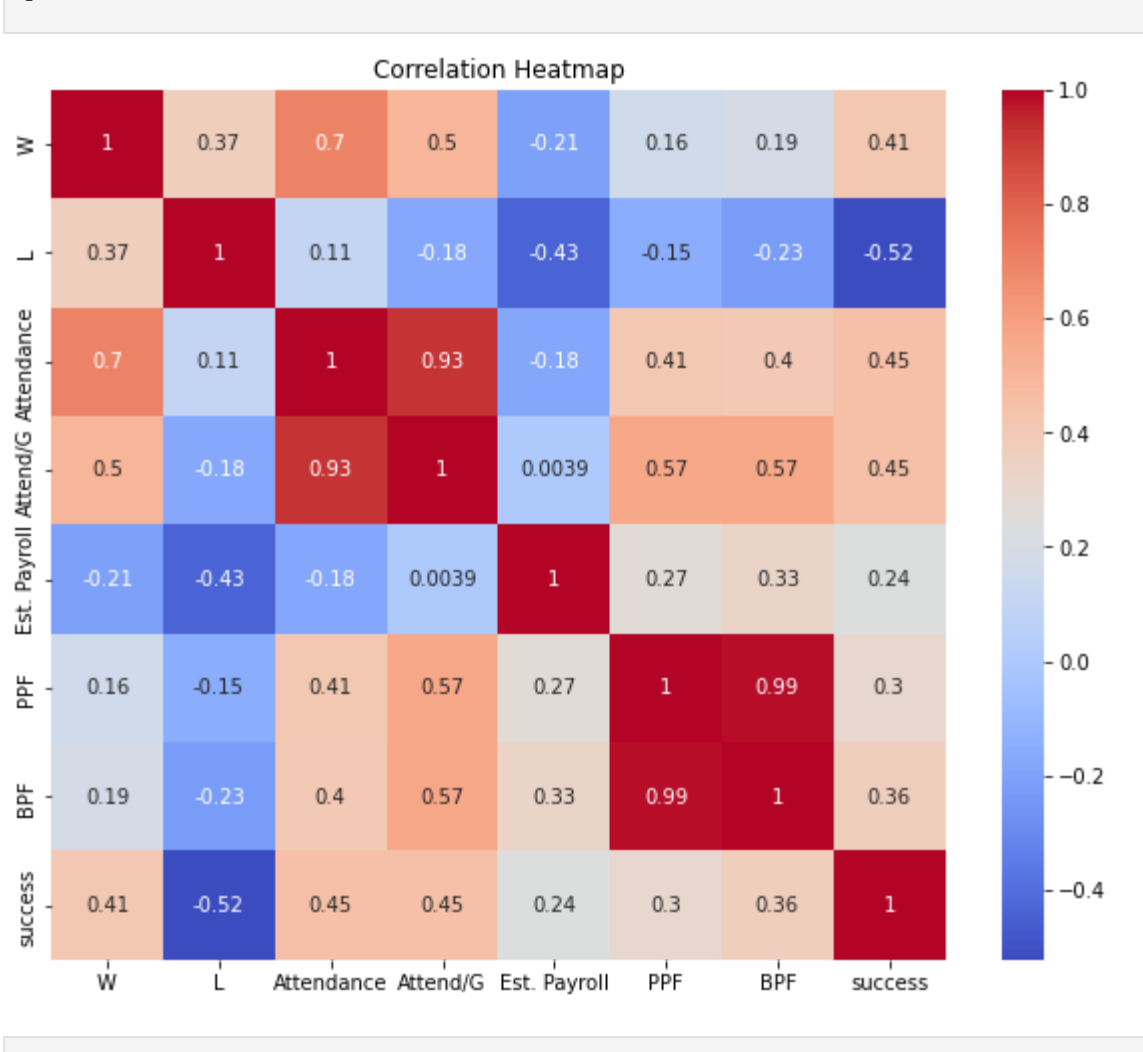
In [124...
```python
#Plotting Wins over the years
#Convert columns to numpy arrays
year = np.array(white_sox_df['Year'])
wins = np.array(white_sox_df['W'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, wins, marker='o')
plt.xlabel('Year')
plt.ylabel('Wins')
plt.title('Wins by Chicago White Sox over the Years')

#Display the plot
plt.show()
```



In [125...
```python
#Plotting Payroll over the years
#Convert columns to numpy arrays
year = np.array(white_sox_df['Year'])
payroll = np.array(white_sox_df['Est. Payroll'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, payroll, marker='o')
plt.xlabel('Year')
plt.ylabel('Payroll')
plt.title('Payroll of Chicago White Sox over the Years')

#Display the plot
plt.show()
```



In [126...
```python
# Select numeric columns for correlation analysis
numeric_cols = ['W', 'L', 'Attendance', 'Attend/G', 'Est. Payroll', 'PPF', 'BPF', 'success']
numeric_df = white_sox_df[numeric_cols]

# Correlation matrix
correlation = numeric_df.corr()

# Plotting the correlation heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(correlation, annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap')

# Display the plot
plt.show()
```



In [127...
```python
#Extract the year from the "Date" column in df DataFrame
cws_df['Year'] = pd.to_datetime(cws_df['Date']).dt.year

#Merge df and white_sox_df DataFrames on the "Year" column
merged_cws_df = pd.merge(cws_df, white_sox_df[['Year', 'success']], on='Year', how='left')

#Add a new column 'Year_Successful' based on 'success' column
merged_cws_df['Year_Successful'] = merged_cws_df['success'].fillna(0).astype(int)

merged_cws_df.head()
```

Out[127...

	Title	Author	Date	Content	Year	success	Year_Successful
0	MLBTR Trade Rumors Podcast: Exciting Youth Movements in Cincinnati and Pittsburgh, Bad Central D...	Darragh McDonald	2023-06-21	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...	2023	0	0
1	AL Central Notes: Buxton, Crochet, Tigers	Darragh McDonald	2023-06-21	Twins outfielder Byron Buxton has dealt with many injuries throughout his career, which has led ...	2023	0	0
2	White Sox Claim Touki Toussaint From Guardians	Darragh McDonald	2023-06-20	The White Sox have claimed right-hander Touki Toussaint off waivers from the Guardians, per anno...	2023	0	0
3	White Sox Recall Jose Rodriguez For MLB Debut	Anthony Franco	2023-06-19	The White Sox announced a handful of transactions before tonight's series opener with the Ranger...	2023	0	0
4	White Sox Place Mike Clevinger On Injured List	Anthony Franco	2023-06-16	The White Sox placed starter Mike Clevinger on the 15-day injured list, retroactive to June 15, ...	2023	0	0

In [128...
```python
len(merged_cws_df)
```

Out[128...
```
1000
```

Cleaning the Data

In [129...
```python
#Identify any noise in the data
RE_SUSPICIOUS = re.compile(r'[&#<>{}\[\]\\]')

def impurity(text, min_len=10):
    """returns the share of suspicious characters in a text"""
    if text == None or len(text) < min_len:
        return 0
    else:
        return len(RE_SUSPICIOUS.findall(text))/len(text)
```

In [130...
```python
merged_cws_df['Content'].apply
```

Out[130...
```
<bound method Series.apply of 0      The latest episode of the MLB Trade Rumors Podcast is now live on Spotif
y, Apple Podcasts, and w...
1      Twins outfielder Byron Buxton has dealt with many injuries throughout his career, which has led ...
2      The White Sox have claimed right-hander Touki Toussaint off waivers from the Guardians, per anno...
3      The White Sox announced a handful of transactions before tonight's series opener with the Ranger...
4      The White Sox placed starter Mike Clevinger on the 15-day injured list, retroactive to June 15, ...
                                                    ...
995    The White Sox have outrighted catcher Dustin Garneau to Triple-A Charlotte, Daryl Van Schouwen o...
996    White Sox GM Rick Hahn addressed the media yesterday regarding the state of his organization's r...
997    White Sox outfielder Avisail Garcia is set to undergo right knee surgery, he told reporters incl...
998    By the end of the 2017 season, the list of pitchers closing out games for their respective teams...
999    It's often difficult to feel positive about a team when it is finishing out a season that won't ...
Name: Content, Length: 1000, dtype: object>
```

In [131...
```python
pd.options.display.max_colwidth = 100 ###
#Add new column to data frame
merged_cws_df['impurity'] = merged_cws_df['Content'].apply(impurity, min_len=10)

#Get the top 3 records
merged_cws_df[['Content', 'impurity']].sort_values(by='impurity', ascending=False).head(3)
```

Out[131...

	Content	impurity
333	The White Sox aren't planning to make any coaching changes, manager Tony La Russa told Daryl Van...	0.003578
875	Eloy Jimenez's career-opening extension with the White Sox included "an understanding" that Jime...	0.002797
450	Adam Engel will begin the season the injured list, as White Sox manager Tony La Russa told repor...	0.002782

The above shows the highest impurity levels for the White Sox's data set. Note, these are extremely low...well below 1% of all characters in each blog post are suspicious.

Character Normalization and Tokenization

In [132...
```python
#Example function to normalize the text in the "Contents" column
def normalize_text(text):
    #Lowercase the text
    text = text.lower()

    #Remove punctuation
    text = text.translate(str.maketrans("", "", string.punctuation))

    #Remove special characters and digits
    text = re.sub(r"[^a-zA-Z]", " ", text)

    #Tokenize the text
    tokens = word_tokenize(text)

    #Remove stopwords
    stop_words = set(stopwords.words("english"))
    tokens = [token for token in tokens if token not in stop_words]

    #Perform stemming
    stemmer = PorterStemmer()
    tokens = [stemmer.stem(token) for token in tokens]

    return tokens
```

In [133...
```python
#Apply normalization to the "Contents" column
merged_cws_df["Contents_Normalized"] = merged_cws_df["Content"].apply(normalize_text)

#Print the head of the DataFrame with the normalized contents
merged_cws_df[["Content", "Contents_Normalized"]].head()
```

Out[133...

	Content	Contents_Normalized
0	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...	[latest, episod, mlb, trade, rumor, podcast, live, spotifi, appl, podcast, wherev, get, podcast,...
1	Twins outfielder Byron Buxton has dealt with many injuries throughout his career, which has led ...	[twin, outfield, byron, buxton, dealt, mani, injuri, throughout, career, led, twin, use, exclus,...
2	The White Sox have claimed right-hander Touki Toussaint off waivers from the Guardians, per anno...	[white, sox, claim, righthand, touki, toussaint, waiver, guardian, per, announc, club, design, a...
3	The White Sox announced a handful of transactions before tonight's series opener with the Ranger...	[white, sox, announc, hand, transact, tonight, seri, open, ranger, notabl, recal, infield, prosp...
4	The White Sox placed starter Mike Clevinger on the 15-day injured list, retroactive to June 15, ...	[white, sox, place, starter, mike, cleving, day, injur, list, retroact, june, due, bicep, inflam...

In [134...
```python
merged_cws_df['length'] = merged_cws_df['Contents_Normalized'].str.len()
merged_cws_df.head()
```

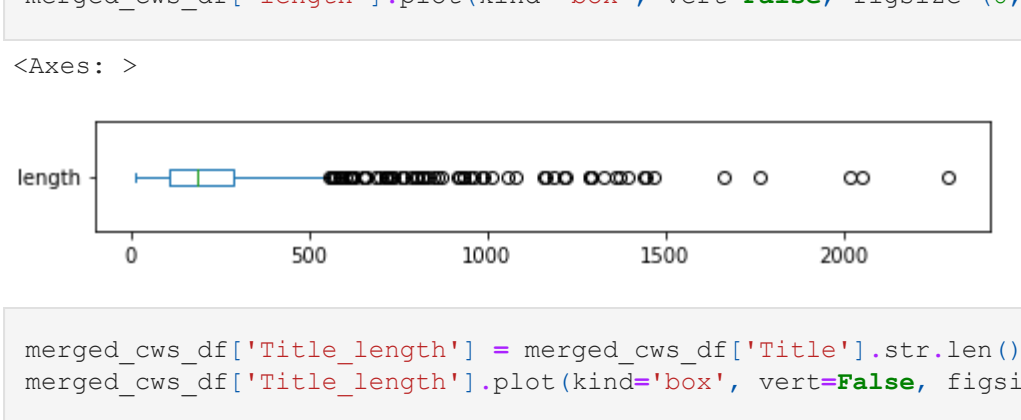
Out[134...

	Title	Author	Date	Content	Year	success	Year_Successful	impurity	Contents_Normalized	length
0	MLBTR Trade Rumors Podcast: Exciting Youth Movements in Cincinnati and Pittsburgh, Bad Central D...	Darragh McDonald	2023-06-21	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...	2023	0	0	0.0	[latest, episod, mlb, trade, rumor, podcast, live, spotifi, appl, podcast, wherev, get, podcast,...	124
1	AL Central Notes: Buxton, Crochet, Tigers	Darragh McDonald	2023-06-21	Twins outfielder Byron Buxton has dealt with many injuries throughout his career, which has led ...	2023	0	0	0.0	[twin, outfield, byron, buxton, dealt, mani, injuri, throughout, career, led, twin, use, exclus,...	377
2	White Sox Claim Touki Toussaint From Guardians	Darragh McDonald	2023-06-20	The White Sox have claimed right-hander Touki Toussaint off waivers from the Guardians, per anno...	2023	0	0	0.0	[white, sox, claim, righthand, touki, toussaint, waiver, guardian, per, announc, club, design, a...	143
3	White Sox Recall Jose Rodriguez For MLB Debut	Anthony Franco	2023-06-19	The White Sox announced a handful of transactions before tonight's series opener with the Ranger...	2023	0	0	0.0	[white, sox, announc, hand, transact, tonight, seri, open, ranger, notabl, recal, infield, prosp...	165
4	White Sox Place Mike Clevinger On Injured List	Anthony Franco	2023-06-16	The White Sox placed starter Mike Clevinger on the 15-day injured list, retroactive to June 15, ...	2023	0	0	0.0	[white, sox, place, starter, mike, cleving, day, injur, list, retroact, june, due, bicep, inflam...	229

Analyze descriptive statistics for text in dataframe.

In [135...
```python
merged_cws_df['length'].plot(kind='box', vert=False, figsize=(8, 1))
```

Out[135...
```
<Axes: >
```

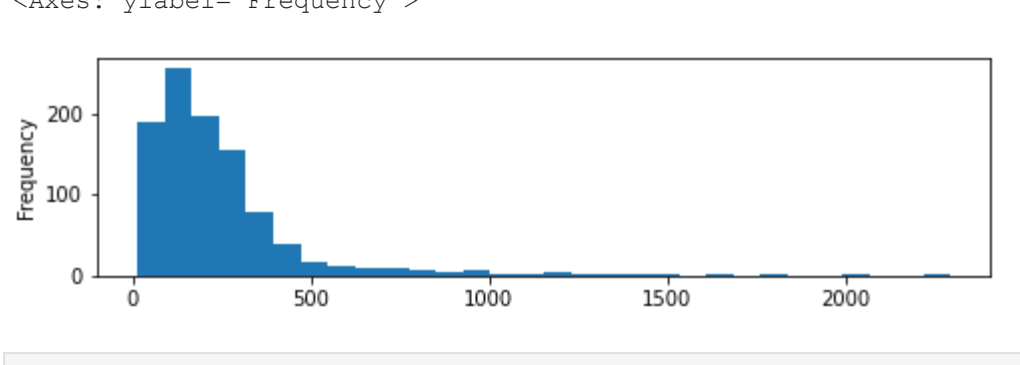


In [136...
```python
merged_cws_df['Title_length'] = merged_cws_df['Title'].str.len()
merged_cws_df['Title_length'].plot(kind='box', vert=False, figsize=(8, 1))
```

Out[136...
```
<Axes: >
```

In [137...
```python
merged_cws_df['length'].plot(kind='hist', bins=30, figsize=(8,2))
```

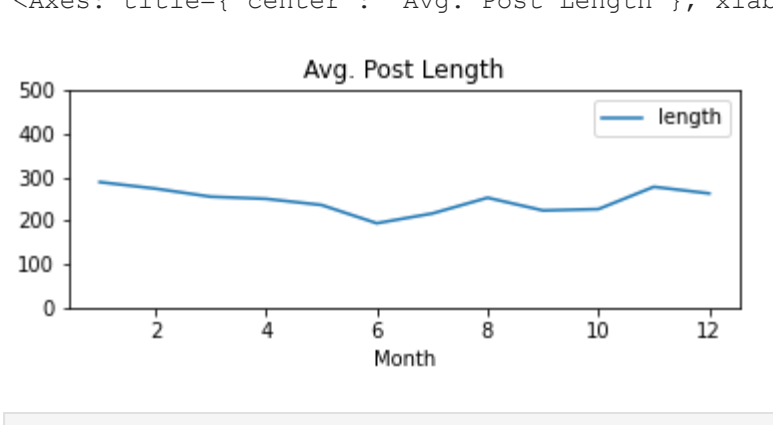
Out[137...
```
<Axes: ylabel='Frequency'>
```



In [138...
```python
# Extract the month from the date and create a new column
merged_cws_df['Month'] = merged_cws_df['Date'].dt.month
```

In [139...
```python
# Plot the average post length
merged_cws_df.groupby('Month').agg({'length': 'mean'}) \
  .plot(title="Avg. Post Length", ylim=(0,500), figsize=(6,2))
```

Out[139...
```
<Axes: title={'center': 'Avg. Post Length'}, xlabel='Month'>
```



In [140...
```python
def count_words(df, column='Contents_Normalized', preprocess=None, min_freq=2):

    # process tokens and update counter
    def update(doc):
        tokens = doc if preprocess is None else preprocess(doc)
        counter.update(tokens)

    # create counter and run through all data
    counter = Counter()
    tqdm.pandas() #initialize tqdm for progress bar
    df[column].apply(update)

    # transform counter into data frame
    freq_df = pd.DataFrame.from_dict(counter, orient='index', columns=['freq'])
    freq_df = freq_df.query('freq >= @min_freq')
    freq_df.index.name = 'token'

    return freq_df.sort_values('freq', ascending=False)
```

In [141...
```python
freq_df = count_words(merged_cws_df)
freq_df.head(5)
```

Out[141...

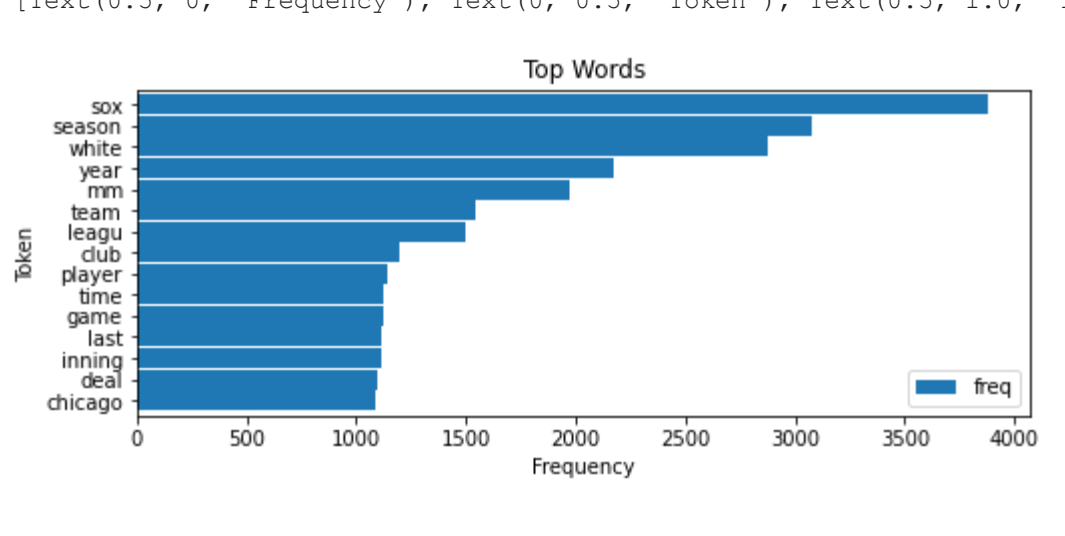
token	freq
sox	3881
season	3077
white	2872
year	2174
mm	1970

In [142...
```python
#How many tokens are in the df?
len(freq_df)
```

Out[142...
```
6278
```

In [143...
```python
# top words with 10+ characters
count_words(merged_cws_df, column='Content',
            preprocess=lambda Content: re.findall(r"\w{10,}", Content)).head(5)


ax = freq_df.head(15).plot(kind='barh', width=0.95, figsize=(8,3))
ax.invert_yaxis()
ax.set(xlabel='Frequency', ylabel='Token', title='Top Words')
```

Out[143...
```
[Text(0.5, 0, 'Frequency'), Text(0, 0.5, 'Token'), Text(0.5, 1.0, 'Top Words')]
```



Los Angeles Angels Data Collection and Cleaning

In [144...
```python
#URL of the website to scrape
url = "https://www.mlbtraderumors.com/los-angeles-angels?show=all"
file_path = "C:/Users/andre/OneDrive/Project/mlbtraderumors_los_angeles_angels_articles1.txt"

#Scrape the website, write the scraped text to a file, and get the head of the DataFrame
laa_df = scrape_website(url, file_path)
laa_df.head()
```

Out[144...

	Title	Author	Date	Content
0	Angels Acquire Mike Moustakas	Tim Dierkes	June 24, 2023	The Angels acquired infielder Mike Moustakas tonight, sending minor league righty Connor Van Sco...
1	Latest On Matt Moore	Nick Deeds	June 24, 2023	Angels lefty Matt Moore is making progress in his rehab from an oblique injury that has left his...
2	Angels Designate Chris Okey For Assignment	Nick Deeds	June 24, 2023	The Angels have designated catcher Chris Okey for assignment, according to Sam Blum of The Athle...
3	Angels To Promote David Fletcher	Mark Polishuk	June 24, 2023	12:04PM: Walsh and infielder Michael Stefanic have been optioned to Triple-A to make room for Fl...
4	Angels Acquire Eduardo Escobar	Anthony Franco	June 23, 2023	The Mets and Angels pulled off an unexpected swap Friday night. New York dealt veteran infielder...

In [145...
```python
#Change the Data column to a datetime object:
laa_df['Date'] = pd.to_datetime(laa_df['Date'], format="%B %d, %Y", errors= 'coerce')
```

In [146...
```python
laa_df.dtypes
```

Out[146...
```
Title              object
Author             object
Date       datetime64[ns]
Content            object
dtype: object
```

In [147...
```python
#Check for missing values
laa_df.isna().sum()
```

Out[147...
```
Title       0
Author      0
Date       30
Content     0
dtype: int64
```

In [148...
```python
len(laa_df)
```

Out[148...
```
1030
```

In [149...
```python
laa_df = laa_df.dropna()
laa_df
```

Out[149...

	Title	Author	Date	Content
0	Angels Acquire Mike Moustakas	Tim Dierkes	2023-06-24	The Angels acquired infielder Mike Moustakas tonight, sending minor league righty Connor Van Sco...
1	Latest On Matt Moore	Nick Deeds	2023-06-24	Angels lefty Matt Moore is making progress in his rehab from an oblique injury that has left his...
2	Angels Designate Chris Okey For Assignment	Nick Deeds	2023-06-24	The Angels have designated catcher Chris Okey for assignment, according to Sam Blum of The Athle...
3	Angels To Promote David Fletcher	Mark Polishuk	2023-06-24	12:04PM: Walsh and infielder Michael Stefanic have been optioned to Triple-A to make room for Fl...
4	Angels Acquire Eduardo Escobar	Anthony Franco	2023-06-23	The Mets and Angels pulled off an unexpected swap Friday night. New York dealt veteran infielder...
...	...	...	...	...
995	Angels Focused On Acquiring Players Controlled Beyond 2019	Steve Adams	2019-07-19	At 50-48 and 11 games back in the American League West, the Angels don't have much hope of conte...
996	Albert Pujols Leaves Game With Hamstring Tightness	Connor Byrne	2019-07-19	Angels first baseman Albert Pujols exited the team's game Thursday with left hamstring tightness...
997	Outrighted: Mac Williamson, Jarrett Parker	Jeff Todd	2019-07-17	We'll use this post to cover the day's minor moves, both involving a pair of former Giants outfi...
998	Hector Neris, Noe Ramirez Receive 3-Game Suspensions	Jeff Todd	2019-07-17	5:03pm: Angels righty Noe Ramirez has also been suspended for a trio of contests after also bein...
999	Mike Trout Suffers Minor Calf Strain	Mark Polishuk	2019-07-15	MONDAY: An MRI revealed a "small" calf strain, Hoornstra was among those to tweet. Trout's day-t...

1000 rows × 4 columns

In [150...
```python
len(laa_df)
```

Out[150...
```
1000
```

Import data on the Los Angeles Angels from baseball-reference.com.

https://www.baseball-reference.com/teams/ANA/attend.shtml

In [151...
```python
#URL of the webpage to scrape
url = "https://www.baseball-reference.com/teams/ANA/attend.shtml"

#Read the HTML table into a list of DataFrames
tables = pd.read_html(url)

#Select the table of interest (index 0 in this case)
table = tables[0]

#Save the DataFrame as a CSV file
file_path = "C:/Users/andre/OneDrive/Project/MLB_data/angels_statistics.csv"
table.to_csv(file_path, index=False, header=True)

print("Data saved to", file_path)
```

```
Data saved to C:/Users/andre/OneDrive/Project/MLB_data/angels_statistics.csv
```

In [152...
```python
path = "C:/Users/andre/OneDrive/Project/MLB_data/"

angels_df = pd.DataFrame(pd.read_csv(path + 'angels_statistics.csv'))
angels_df.head()
```

Out[152...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Los Angeles Angels	AL West	42	36	2	NaN	1181985.0	32833.0	5th of 15	$224,228,095	103	103	Angel Stadium of Anaheim
1	2022	Los Angeles Angels	AL West	73	89	3	NaN	2457461.0	30339.0	5th of 15	$177,063,095	103	103	Angel Stadium of Anaheim
2	2021	Los Angeles Angels	AL West	77	85	4	NaN	1515689.0	18484.0	6th of 15	$188,408,595	103	103	Angel Stadium of Anaheim
3	2020	Los Angeles Angels	AL West	26	34	4	NaN	NaN	NaN	8th of 15	$181,254,762	102	101	Angel Stadium of Anaheim
4	2019	Los Angeles Angels	AL West	72	90	4	NaN	3023012.0	37321.0	2nd of 15	$158,078,584	100	100	Angel Stadium of Anaheim

In [153...
```python
angels_df= angels_df[angels_df['Year'] > 2004]
angels_df
```

Out[153...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Los Angeles Angels	AL West	42	36	2	NaN	1181985.0	32833.0	5th of 15	$224,228,095	103	103	Angel Stadium of Anaheim
1	2022	Los Angeles Angels	AL West	73	89	3	NaN	2457461.0	30339.0	5th of 15	$177,063,095	103	103	Angel Stadium of Anaheim
2	2021	Los Angeles Angels	AL West	77	85	4	NaN	1515689.0	18484.0	6th of 15	$188,408,595	103	103	Angel Stadium of Anaheim
3	2020	Los Angeles Angels	AL West	26	34	4	NaN	NaN	NaN	8th of 15	$181,254,762	102	101	Angel Stadium of Anaheim
4	2019	Los Angeles Angels	AL West	72	90	4	NaN	3023012.0	37321.0	2nd of 15	$158,078,584	100	100	Angel Stadium of Anaheim
5	2018	Los Angeles Angels	AL West	80	82	4	NaN	3020216.0	37287.0	2nd of 15	$166,849,666	98	98	Angel Stadium of Anaheim
6	2017	Los Angeles Angels	AL West	80	82	2	NaN	3019585.0	37279.0	3rd of 15	$181,125,500	97	97	Angel Stadium of Anaheim
7	2016	Los Angeles Angels	AL West	74	88	4	NaN	3016142.0	37236.0	3rd of 15	$139,712,000	95	95	Angel Stadium of Anaheim
8	2015	Los Angeles Angels of Anaheim	AL West	85	77	3	NaN	3012765.0	37195.0	2nd of 15	$131,522,500	94	94	Angel Stadium of Anaheim
9	2014	Los Angeles Angels of Anaheim	AL West	98	64	1	Lost ALDS (3-0)	3095935.0	38221.0	2nd of 15	$128,667,000	94	95	Angel Stadium of Anaheim
10	2013	Los Angeles Angels of Anaheim	AL West	78	84	3	NaN	3019505.0	37278.0	4th of 15	$116,532,500	94	94	Angel Stadium of Anaheim
11	2012	Los Angeles Angels of Anaheim	AL West	89	73	3	NaN	3061770.0	37800.0	3rd of 14	$141,073,500	93	94	Angel Stadium of Anaheim
12	2011	Los Angeles Angels of Anaheim	AL West	86	76	2	NaN	3166321.0	39090.0	3rd of 14	$138,543,166	92	92	Angel Stadium of Anaheim
13	2010	Los Angeles Angels of Anaheim	AL West	80	82	3	NaN	3250814.0	40134.0	2nd of 14	$104,963,866	96	96	Angel Stadium of Anaheim
14	2009	Los Angeles Angels of Anaheim	AL West	97	65	1	Lost ALCS (4-2)	3240386.0	40005.0	2nd of 14	$118,169,000	98	99	Angel Stadium of Anaheim
15	2008	Los Angeles Angels of Anaheim	AL West	100	62	1	Lost ALDS (3-1)	3336747.0	41194.0	2nd of 14	$119,216,333	102	102	Angel Stadium of Anaheim
16	2007	Los Angeles Angels of Anaheim	AL West	94	68	1	Lost ALDS (3-0)	3365632.0	41551.0	2nd of 14	$109,251,333	100	101	Angel Stadium of Anaheim
17	2006	Los Angeles Angels of Anaheim	AL West	89	73	2	NaN	3406790.0	42059.0	2nd of 14	$103,472,000	99	100	Angel Stadium of Anaheim
18	2005	Los Angeles Angels of Anaheim	AL West	95	67	1	Lost ALCS (4-1)	3404686.0	42033.0	2nd of 14	$94,867,822	97	98	Angel Stadium of Anaheim

In [154...

```
#Remove the dollar and comma signs from the 'Estimated Payroll' column:
angels_df['Est. Payroll'] = angels_df['Est. Payroll'].replace({'\$':''}, regex = True)
angels_df['Est. Payroll'] = angels_df['Est. Payroll'].replace({'\,':''}, regex = True)
angels_df.head()
```

Out[154...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Los Angeles Angels	AL West	42	36	2	NaN	1181985.0	32833.0	5th of 15	224228095	103	103	Angel Stadium of Anaheim
1	2022	Los Angeles Angels	AL West	73	89	3	NaN	2457461.0	30339.0	5th of 15	177063095	103	103	Angel Stadium of Anaheim
2	2021	Los Angeles Angels	AL West	77	85	4	NaN	1515689.0	18484.0	6th of 15	188408595	103	103	Angel Stadium of Anaheim
3	2020	Los Angeles Angels	AL West	26	34	4	NaN	NaN	NaN	8th of 15	181254762	102	101	Angel Stadium of Anaheim
4	2019	Los Angeles Angels	AL West	72	90	4	NaN	3023012.0	37321.0	2nd of 15	158078584	100	100	Angel Stadium of Anaheim

In [155...

```
angels_df['Est. Payroll'] = angels_df['Est. Payroll'].astype(float)
angels_df.dtypes
```

Out[155...

```
Year              int64
Tm               object
Lg               object
W                 int64
L                 int64
Finish            int64
Playoffs         object
Attendance      float64
Attend/G        float64
Rank             object
Est. Payroll    float64
PPF               int64
BPF               int64
Stadium          object
dtype: object
```

Create Binary feature that defines a successful year as wins greater than or equal to 50% of total games played

In [156...

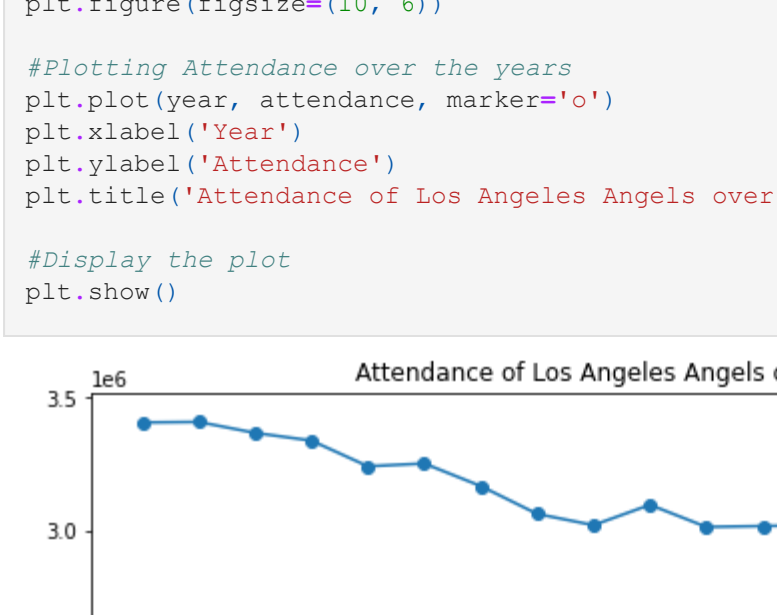
```
#Add a column to define a binary output that has a 1 if the team has a winning record for the year, and 0 if th
angels_df['success'] = (angels_df['W'] / (angels_df['W'] + angels_df['L']) >= 0.5).astype(int)
angels_df.head()
```

Out[156...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium	success
0	2023	Los Angeles Angels	AL West	42	36	2	NaN	1181985.0	32833.0	5th of 15	224228095.0	103	103	Angel Stadium of Anaheim	1
1	2022	Los Angeles Angels	AL West	73	89	3	NaN	2457461.0	30339.0	5th of 15	177063095.0	103	103	Angel Stadium of Anaheim	0
2	2021	Los Angeles Angels	AL West	77	85	4	NaN	1515689.0	18484.0	6th of 15	188408595.0	103	103	Angel Stadium of Anaheim	0
3	2020	Los Angeles Angels	AL West	26	34	4	NaN	NaN	NaN	8th of 15	181254762.0	102	101	Angel Stadium of Anaheim	0
4	2019	Los Angeles Angels	AL West	72	90	4	NaN	3023012.0	37321.0	2nd of 15	158078584.0	100	100	Angel Stadium of Anaheim	0

In [157...

```
#Count the number of successes and failures
success_counts = angels_df['success'].value_counts()

#Create a bar plot
plt.bar(success_counts.index, success_counts.values)
plt.xticks(success_counts.index, ['Failure', 'Success'])
plt.xlabel('Success')
plt.ylabel('Count')
plt.title('Success Counts')

#Display the plot
plt.show()
```



In [158...

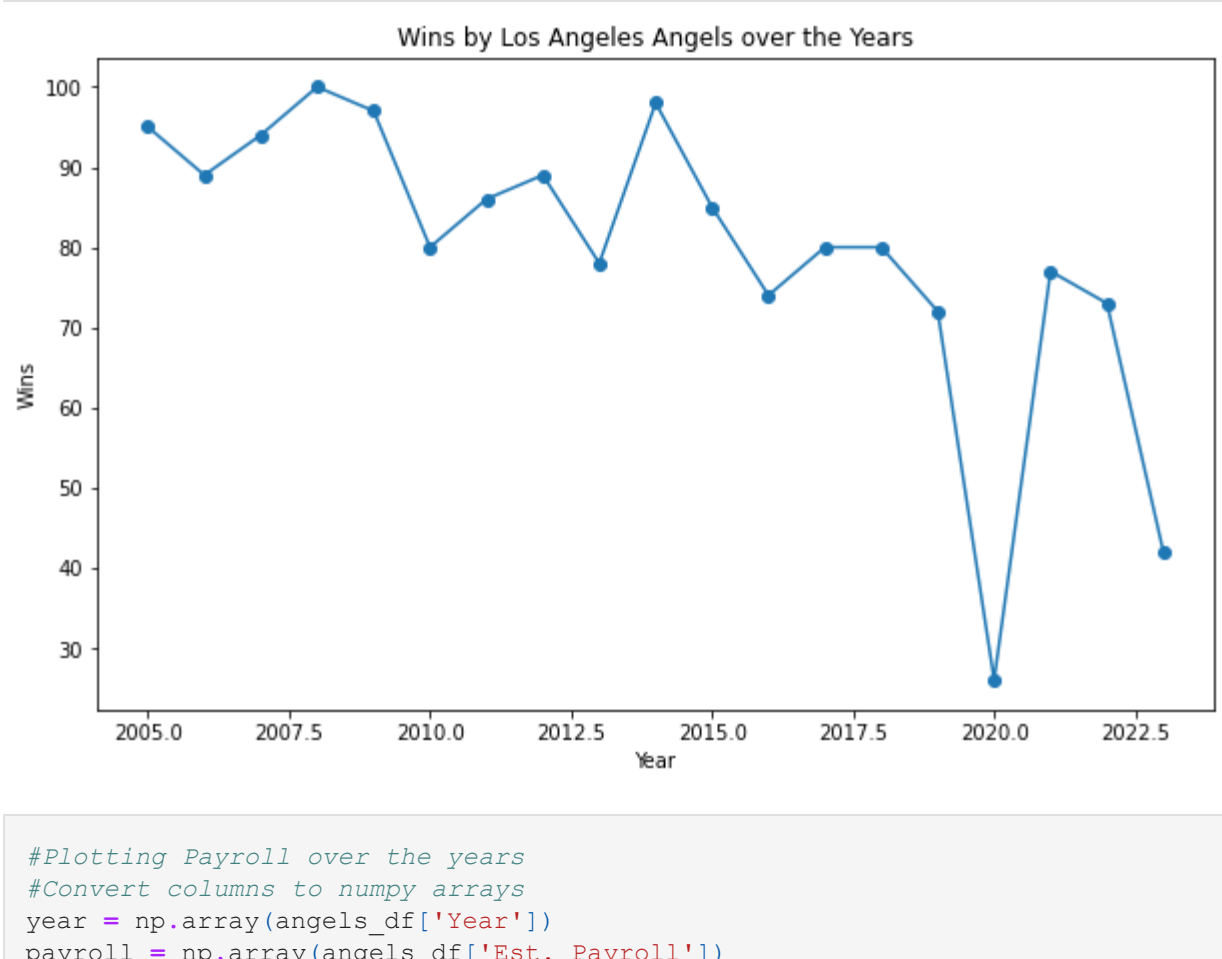
```
angels_df.describe()
```

Out[158...

	Year	W	L	Finish	Attendance	Attend/G	Est. Payroll	PPF	BPF	success
count	19.000000	19.000000	19.000000	19.000000	1.800000e+01	18.000000	1.900000e+01	19.000000	19.000000	19.000000
mean	2014.000000	79.736842	72.473684	2.526316	2.921969e+06	37074.388889	1.433158e+08	97.894737	98.157895	0.526316
std	5.627314	18.525784	15.837257	1.172292	6.151490e+05	5527.931452	3.515893e+07	3.649882	3.531810	0.512989
min	2005.000000	26.000000	34.000000	1.000000	1.181985e+06	18484.000000	9.486782e+07	92.000000	92.000000	0.000000
25%	2009.500000	75.500000	66.000000	1.500000	3.016983e+06	37246.500000	1.173508e+08	94.500000	95.000000	0.000000
50%	2014.000000	80.000000	76.000000	3.000000	3.042391e+06	37560.500000	1.385432e+08	98.000000	98.000000	1.000000
75%	2018.500000	91.500000	83.000000	3.500000	3.248207e+06	40101.750000	1.719564e+08	101.000000	101.000000	1.000000
max	2023.000000	100.000000	90.000000	4.000000	3.406790e+06	42059.000000	2.242281e+08	103.000000	103.000000	1.000000

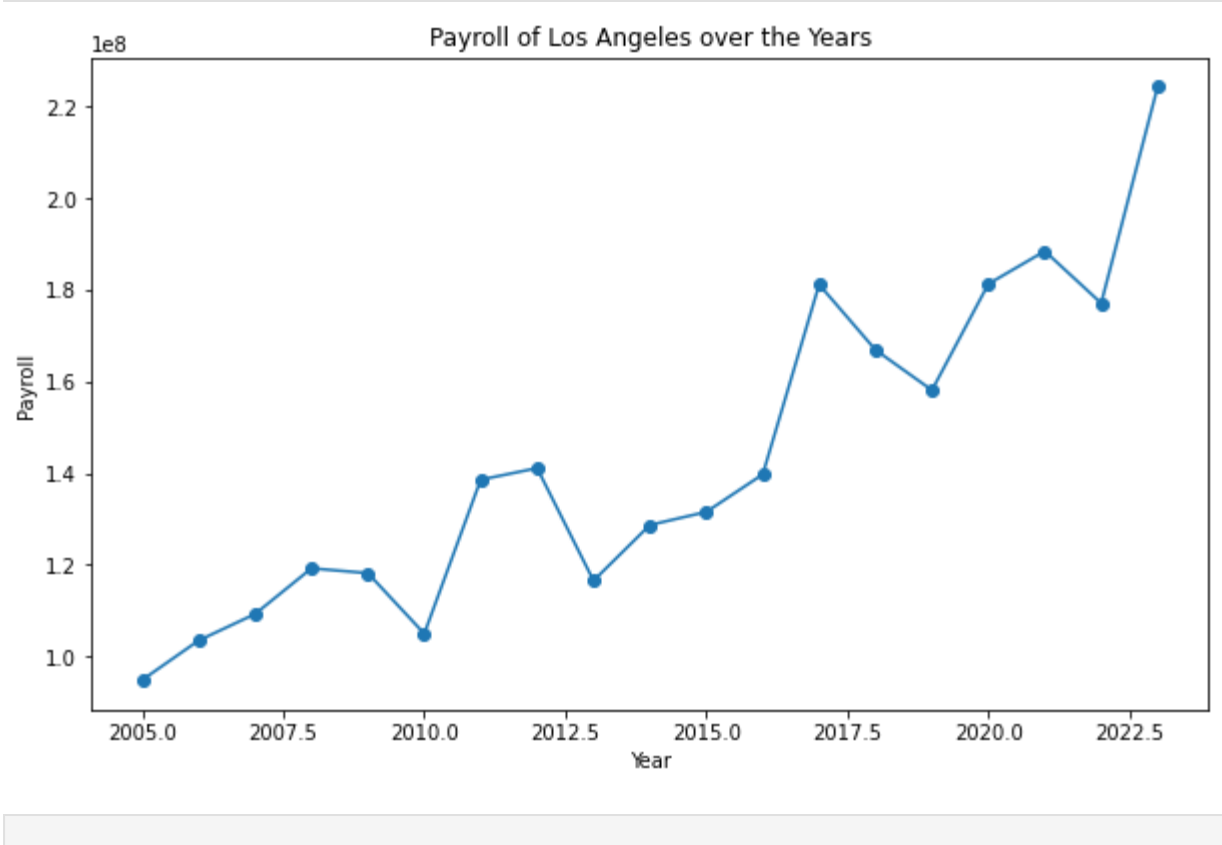
In [159...

```
#Plotting the data
#Convert columns to numpy arrays
year = np.array(angels_df['Year'])
attendance = np.array(angels_df['Attendance'])

plt.figure(figsize=(10, 6))

#Plotting Attendance over the years
plt.plot(year, attendance, marker='o')
plt.xlabel('Year')
plt.ylabel('Attendance')
plt.title('Attendance of Los Angeles Angels over the Years')

#Display the plot
plt.show()
```



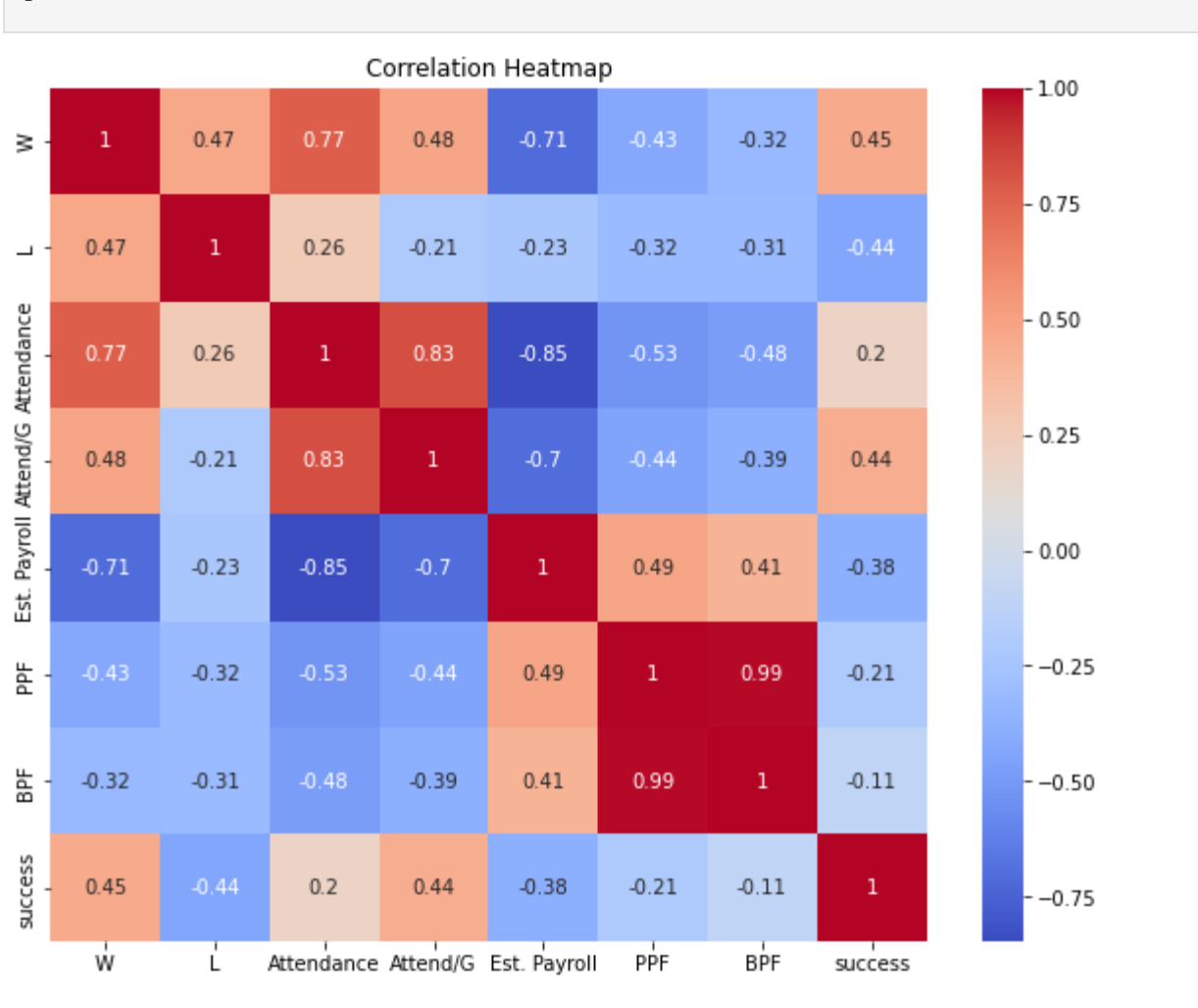
In [160...

```
#Plotting Wins over the years
year = np.array(angels_df['Year'])
wins = np.array(angels_df['W'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, wins, marker='o')
plt.xlabel('Year')
plt.ylabel('Wins')
plt.title('Wins by Los Angeles Angels over the Years')

#Display the plot
plt.show()
```



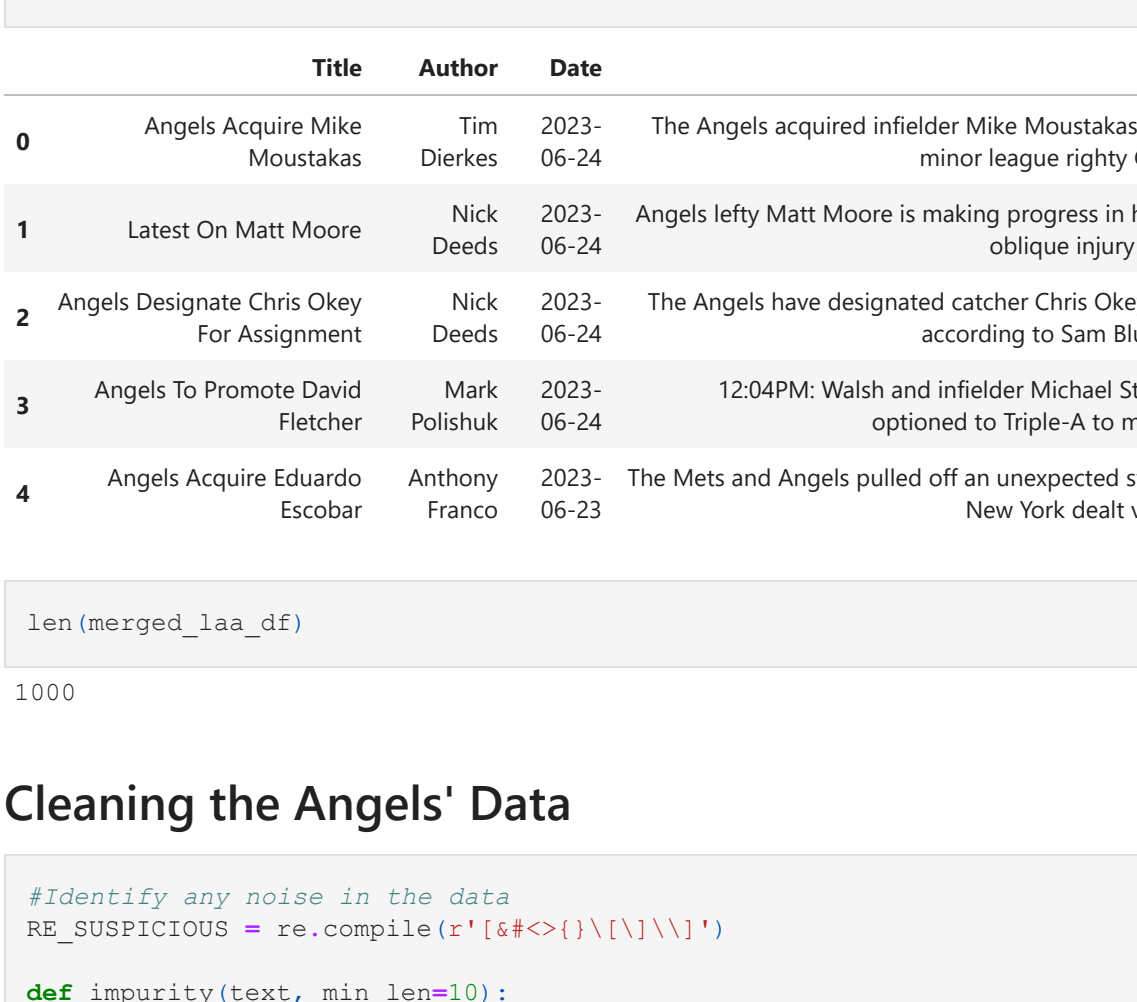
In [161...

```
#Plotting Payroll over the years
#Convert columns to numpy arrays
year = np.array(angels_df['Year'])
payroll = np.array(angels_df['Est. Payroll'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, payroll, marker='o')
plt.xlabel('Year')
plt.ylabel('Payroll')
plt.title('Payroll of Los Angeles over the Years')

#Display the plot
plt.show()
```



In [162...

```
#Select numeric columns for correlation analysis
numeric_cols = ['W', 'L', 'Attendance', 'Attend/G', 'Est. Payroll', 'PPF', 'BPF', 'success']
numeric_df = angels_df[numeric_cols]

#Correlation matrix
correlation = numeric_df.corr()

#Plotting the correlation heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(correlation, annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap')

#Display the plot
plt.show()
```



Add column to analyze whether blog post occurred in a successful year or not.

In [163...

```
#Extract the year from the "Date" column in df DataFrame
laa_df['Year'] = pd.to_datetime(laa_df['Date']).dt.year

#Merge df and athletics_df DataFrames on the "Year" column
merged_laa_df = pd.merge(laa_df, angels_df[['Year', 'success']], on='Year', how='left')

#Add a new column 'Year_Successful' based on 'success' column
merged_laa_df['Year_Successful'] = merged_laa_df['success'].fillna(0).astype(int)

merged_laa_df.head()
```

Out[163...

	Title	Author	Date	Content	Year	success	Year_Successful
0	Angels Acquire Mike Moustakas	Tim Dierkes	2023-06-24	The Angels acquired infielder Mike Moustakas tonight, sending minor league righty Connor Van Sco...	2023	1	1
1	Latest On Matt Moore	Nick Deeds	2023-06-24	Angels lefty Matt Moore is making progress in his rehab from an oblique injury that has left his...	2023	1	1
2	Angels Designate Chris Okey For Assignment	Nick Deeds	2023-06-24	The Angels have designated catcher Chris Okey for assignment, according to Sam Blum of The Athle...	2023	1	1
3	Angels To Promote David Fletcher	Mark Polishuk	2023-06-24	12:04PM: Walsh and infielder Michael Stefanic have been optioned to Triple-A to make room for Fl...	2023	1	1
4	Angels Acquire Eduardo Escobar	Anthony Franco	2023-06-23	The Mets and Angels pulled off an unexpected swap Friday night. New York dealt veteran infielder...	2023	1	1

In [164...

```
len(merged_laa_df)
```

Out[164...

```
1000
```

Cleaning the Angels' Data

In [165...

```
#Identify any noise in the data
RE_SUSPICIOUS = re.compile(r'[&#<>{}\[\]\\]')

def impurity(text, min_len=10):
    """returns the share of suspicious characters in a text"""
    if text == None or len(text) < min_len:
        return 0
    else:
        return len(RE_SUSPICIOUS.findall(text))/len(text)
```

In [166...

```
merged_laa_df['Content'].apply
```

Out[166...

```
<bound method Series.apply of 0      The Angels acquired infielder Mike Moustakas tonight, sending minor league
righty Connor Van Sco...
1      Angels lefty Matt Moore is making progress in his rehab from an oblique injury that has left his...
2      The Angels have designated catcher Chris Okey for assignment, according to Sam Blum of The Athle...
3      12:04PM: Walsh and infielder Michael Stefanic have been optioned to Triple-A to make room for Fl...
4      The Mets and Angels pulled off an unexpected swap Friday night. New York dealt veteran infielder...
                                                     ...
995    At 50-48 and 11 games back in the American League West, the Angels don't have much hope of conte...
996    Angels first baseman Albert Pujols exited the team's game Thursday with left hamstring tightness...
997    We'll use this post to cover the day's minor moves, both involving a pair of former Giants outfi...
998    5:03pm: Angels righty Noe Ramirez has also been suspended for a trio of contests after also bein...
999    MONDAY: An MRI revealed a "small" calf strain, Hoornstra was among those to tweet. Trout's day-t...
Name: Content, Length: 1000, dtype: object>
```

In [167...

```
pd.options.display.max_colwidth = 100 ###
#Add new column to data frame
merged_laa_df['impurity'] = merged_laa_df['Content'].apply(impurity, min_len=10)

#Get the top 3 records
merged_laa_df[['Content', 'impurity']].sort_values(by='impurity', ascending=False).head(3)
```

Out[167...

	Content	impurity
62	An early look at the trade deadline possibilities, particularly focusing on Shohei Ohtani and wh...	0.010753
737	According to the Centers for Disease Control and Prevention, people over the age of 65 and cance...	0.004571
237	A pair of top ten picks, Gavin Cross and Elijah Green, agreed to terms with their teams today. A...	0.003884

The above shows the highest impurity levels for the Angels' data set. Note, these are extremely low...well below 1% of all characters in each blog post are suspicious.

Character Normalization and Tokenization

In [168...

```
#Example function to normalize the text in the "Contents" column
def normalize_text(text):
    #Lowercase the text
    text = text.lower()

    #Remove punctuation
    text = text.translate(str.maketrans("", "", string.punctuation))

    #Remove special characters and digits
    text = re.sub(r"[^a-zA-Z]", " ", text)

    #Tokenize the text
    tokens = word_tokenize(text)

    #Remove stopwords
    stop_words = set(stopwords.words("english"))
    tokens = [token for token in tokens if token not in stop_words]

    #Perform stemming
    stemmer = PorterStemmer()
    tokens = [stemmer.stem(token) for token in tokens]

    return tokens

#Apply normalization to the "Contents" column
merged_laa_df["Contents_Normalized"] = merged_laa_df["Content"].apply(normalize_text)

#Print the head of the DataFrame with the normalized contents
merged_laa_df[["Content", "Contents_Normalized"]].head()
```

Out[168...

	Content	Contents_Normalized
0	The Angels acquired infielder Mike Moustakas tonight, sending minor league righty Connor Van Sco...	[angel, acquir, infield, mike, moustaka, tonight, send, minor, leagu, righti, connor, van, scoyo...
1	Angels lefty Matt Moore is making progress in his rehab from an oblique injury that has left his...	[angel, lefti, matt, moor, make, progress, rehab, obliqu, injuri, left, sidelin, nearli, month, ...
2	The Angels have designated catcher Chris Okey for assignment, according to Sam Blum of The Athle...	[angel, design, catcher, chri, okey, assign, accord, sam, blum, athlet, move, complet, seri, ros...
3	12:04PM: Walsh and infielder Michael Stefanic have been optioned to Triple-A to make room for Fl...	[pm, walsh, infield, michael, stefan, option, triplea, make, room, fletcher, escobar, sam, blum,...
4	The Mets and Angels pulled off an unexpected swap Friday night. New York dealt veteran infielder...	[met, angel, pull, unexpect, swap, friday, night, new, york, dealt, veteran, infield, eduardo, e...

In [169...

```
merged_laa_df['length'] = merged_laa_df['Contents_Normalized'].str.len()
merged_laa_df.head()
```

Out[169...

	Title	Author	Date	Content	Year	success	Year_Successful	impurity	Contents_Normalized	length
0	Angels Acquire Mike Moustakas	Tim Dierkes	2023-06-24	The Angels acquired infielder Mike Moustakas tonight, sending minor league righty Connor Van Sco...	2023	1	1	0.0	[angel, acquir, infield, mike, moustaka, tonight, send, minor, leagu, righti, connor, van, scoyo...	438
1	Latest On Matt Moore	Nick Deeds	2023-06-24	Angels lefty Matt Moore is making progress in his rehab from an oblique injury that has left his...	2023	1	1	0.0	[angel, lefti, matt, moor, make, progress, rehab, obliqu, injuri, left, sidelin, nearli, month, ...	69
2	Angels Designate Chris Okey For Assignment	Nick Deeds	2023-06-24	The Angels have designated catcher Chris Okey for assignment, according to Sam Blum of The Athle...	2023	1	1	0.0	[angel, design, catcher, chri, okey, assign, accord, sam, blum, athlet, move, complet, seri, ros...	171
3	Angels To Promote David Fletcher	Mark Polishuk	2023-06-24	12:04PM: Walsh and infielder Michael Stefanic have been optioned to Triple-A to make room for Fl...	2023	1	1	0.0	[pm, walsh, infield, michael, stefan, option, triplea, make, room, fletcher, escobar, sam, blum,...	265
4	Angels Acquire Eduardo Escobar	Anthony Franco	2023-06-23	The Mets and Angels pulled off an unexpected swap Friday night. New York dealt veteran infielder...	2023	1	1	0.0	[met, angel, pull, unexpect, swap, friday, night, new, york, dealt, veteran, infield, eduardo, e...	720

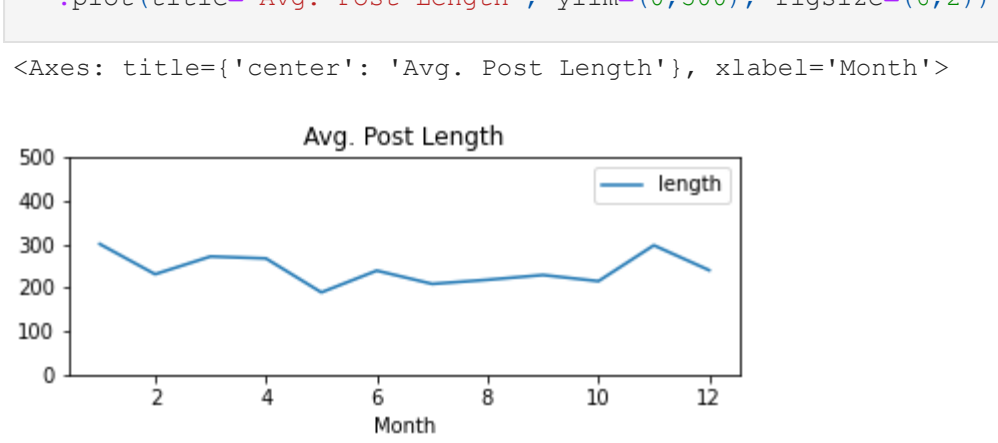
Analyze descriptive statistics for text in dataframe.

In [170...

```
merged_laa_df['length'].plot(kind='box', vert=False, figsize=(8, 1))
```

Out[170...

```
<Axes: >
```

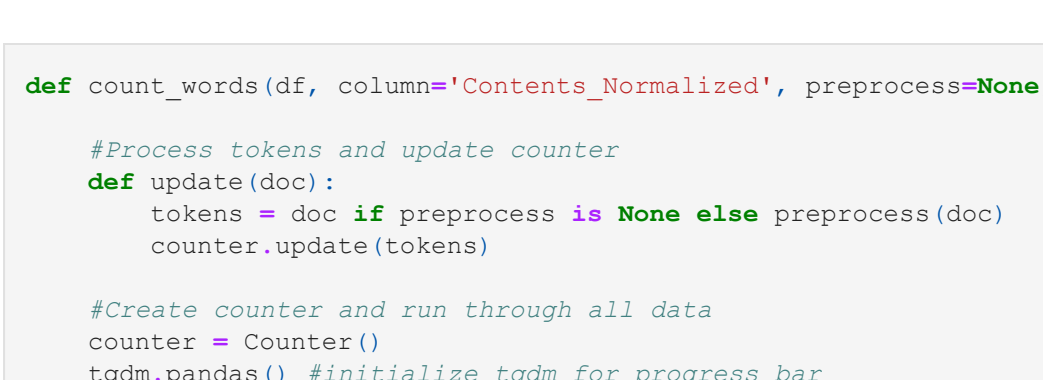


In [171...

```
merged_laa_df['Title_length'] = merged_laa_df['Title'].str.len()
merged_laa_df['Title_length'].plot(kind='box', vert=False, figsize=(8, 1))
```

Out[171...

```
<Axes: >
```



In [172...

```
merged_laa_df['length'].plot(kind='hist', bins=30, figsize=(8,2))
```

Out[172...

```
<Axes: ylabel='Frequency'>
```

In [173...

```
#Extract the month from the date and create a new column
merged_laa_df['Month'] = merged_laa_df['Date'].dt.month

#Plot the average post length
merged_laa_df.groupby('Month').agg({'length': 'mean'}) \
  .plot(title="Avg. Post Length", ylim=(0,500), figsize=(6,2))
```

Out[173...

```
<Axes: title={'center': 'Avg. Post Length'}, xlabel='Month'>
```

In [174...

```
def count_words(df, column='Contents_Normalized', preprocess=None, min_freq=2):

    #Process tokens and update counter
    def update(doc):
        tokens = doc if preprocess is None else preprocess(doc)
        counter.update(tokens)

    #Create counter and run through all data
    counter = Counter()
    tqdm.pandas() #initialize tqdm for progress bar
    df[column].apply(update)

    #Transform counter into data frame
    freq_df = pd.DataFrame.from_dict(counter, orient='index', columns=['freq'])
    freq_df = freq_df.query('freq >= @min_freq')
    freq_df.index.name = 'token'

    return freq_df.sort_values('freq', ascending=False)
```

In [175...

```
freq_df = count_words(merged_laa_df)
freq_df.head(5)
```

Out[175...

token	freq
angel	3991
season	3123
year	2390
leagu	1725
team	1503

In [176...

```
#How many tokens are in the df?
len(freq_df)
```

Out[176...

```
6268
```

In [177...

```
#Top words with 10+ characters
count_words(merged_laa_df, column='Content',
            preprocess=lambda Content: re.findall(r"\w{10,}", Content)).head(5)
```

Out[177...

token	freq
appearances	604
organization	325
assignment	317
outfielder	289
designated	262

In [178...

```
ax = freq_df.head(15).plot(kind='barh', width=0.95, figsize=(8,3))
ax.invert_yaxis()
ax.set(xlabel='Frequency', ylabel='Token', title='Top Words')
```

Out[178...

```
[Text(0.5, 0, 'Frequency'), Text(0, 0.5, 'Token'), Text(0.5, 1.0, 'Top Words')]
```

Los Angeles Dodgers Data Collection and Cleaning

In [179...

```
#URL of the website to scrape
url = "https://www.mlbtraderumors.com/los-angeles-dodgers?show=all"
file_path = "C:/Users/andre/OneDrive/Project/mlbtraderumors_los_angeles_dodgers_articles1.txt"

#Scrape the website, write the scraped text to a file, and get the head of the DataFrame
lad_df = scrape_website(url, file_path)
lad_df.head()
```

Out[179...

	Title	Author	Date	Content
0	Dodgers Notes: Muncy, Rotation, Thor	Nick Deeds	June 24, 2023	Dodgers manager Dave Roberts told reporters today (including Mike DiGiovanna of the Los Angeles ...
1	Dodgers To Stick With Emmet Sheehan In Rotation Next Week	Mark Polishuk	June 24, 2023	Emmet Sheehan's MLB career is off to a tremendous start, as the Dodgers prospect has a 1.50 ERA ...
2	Red Sox Acquire Tayler Scott From Dodgers	Darragh McDonald	June 22, 2023	The Red Sox announced that they have acquired right-hander Tayler Scott from the Dodgers in exch...
3	MLBTR Trade Rumors Podcast: Exciting Youth Movements in Cincinnati and Pittsburgh, Bad Central D...	Darragh McDonald	June 21, 2023	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...
4	Dodgers Sign David Dahl To Minor League Contract	Anthony Franco	June 20, 2023	Veteran outfielder David Dahl has signed a minor league deal with the Dodgers, according to Trip...

In [180...

```
#Change the Data column to a datetime object:
lad_df['Date'] = pd.to_datetime(lad_df['Date'], format="%B %d, %Y", errors= 'coerce')
```

In [181...

```
lad_df.dtypes
```

Out[181...

```
Title              object
Author             object
Date       datetime64[ns]
Content            object
dtype: object
```

In [182...

```
#Check for missing values
lad_df.isna().sum()
```

Out[182...

```
Title       0
Author      0
Date       30
Content     0
dtype: int64
```

In [183...

```
len(lad_df)
```

Out[183...

```
1030
```

In [184...

```
lad_df = lad_df.dropna()
lad_df
```

Out[184...

	Title	Author	Date	Content
0	Dodgers Notes: Muncy, Rotation, Thor	Nick Deeds	2023-06-24	Dodgers manager Dave Roberts told reporters today (including Mike DiGiovanna of the Los Angeles ...
1	Dodgers To Stick With Emmet Sheehan In Rotation Next Week	Mark Polishuk	2023-06-24	Emmet Sheehan's MLB career is off to a tremendous start, as the Dodgers prospect has a 1.50 ERA ...
2	Red Sox Acquire Tayler Scott From Dodgers	Darragh McDonald	2023-06-22	The Red Sox announced that they have acquired right-hander Tayler Scott from the Dodgers in exch...
3	MLBTR Trade Rumors Podcast: Exciting Youth Movements in Cincinnati and Pittsburgh, Bad Central D...	Darragh McDonald	2023-06-21	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...
4	Dodgers Sign David Dahl To Minor League Contract	Anthony Franco	2023-06-20	Veteran outfielder David Dahl has signed a minor league deal with the Dodgers, according to Trip...
...	...	...	...	...
995	Morosi: 50/50 Chance Of Nolan Arenado Trade	Jeff Todd	2020-01-02	With the market showing a big appetite for star third basemen, the Rockies now appear to be incr...
996	Remaining Needs: NL West	Jeff Todd	2019-12-30	With the offseason almost two months old, MLBTR is going through all 30 teams' remaining needs b...
997	Dodgers Release JT Chargois	George Miller	2019-12-29	Sunday: Chargois, as it turns out, has been acquired by the Rakuten Golden Eagles of NPB's Pacif...
998	Examining The Dodgers' Slow Offseason	Anthony Franco	2019-12-25	The Dodgers have had a quiet start to the offseason, observes Andy McCullough of the Athletic. G...
999	Mike Clevinger Drawing Trade Interest	Steve Adams	2019-12-22	TODAY: The Dodgers continue to be "very aggressive in pursuit of" Clevinger and Lindor, USA Toda...

1000 rows × 4 columns

In [185...

```
len(lad_df)
```

Out[185...

```
1000
```

Import data on the Los Angeles Dodgers from baseball-reference.com.

https://www.baseball-reference.com/teams/LAD/attend.shtml

In [186...

```
#URL of the webpage to scrape
url = "https://www.baseball-reference.com/teams/LAD/attend.shtml"

#Read the HTML table into a list of DataFrames
tables = pd.read_html(url)

#Select the table of interest (index 0 in this case)
table = tables[0]

#Save the DataFrame as a CSV file
file_path = "C:/Users/andre/OneDrive/Project/MLB_data/dodgers_statistics.csv"
table.to_csv(file_path, index=False, header=True)

print("Data saved to", file_path)
```

```
Data saved to C:/Users/andre/OneDrive/Project/MLB_data/dodgers_statistics.csv
```

In [187...

```
path = "C:/Users/andre/OneDrive/Project/MLB_data/"

dodgers_df = pd.DataFrame(pd.read_csv(path + 'dodgers_statistics.csv'))
dodgers_df.head()
```

Out[187...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Los Angeles Dodgers	NL West	43	33	3	NaN	1827910.0	48103.0	1st of 15	$198,971,667	101	103	Dodger Stadium
1	2022	Los Angeles Dodgers	NL West	111	51	1	Lost NLDS (3-1)	3861408.0	47672.0	1st of 15	$261,180,131	101	103	Dodger Stadium
2	2021	Los Angeles Dodgers	NL West	106	56	2	Lost NLCS (4-2)	2804693.0	34626.0	1st of 15	$248,108,334	100	103	Dodger Stadium
3	2020	Los Angeles Dodgers	NL West	43	17	1	Won WS (4-2)	NaN	NaN	6th of 15	$216,508,333	97	99	Dodger Stadium
4	2019	Los Angeles Dodgers	NL West	106	56	1	Lost NLDS (3-2)	3974309.0	49066.0	1st of 15	$193,553,333	94	97	Dodger Stadium

In [188...

```
dodgers_df= dodgers_df[dodgers_df['Year'] > 2004]
dodgers_df
```

Out[188...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Los Angeles Dodgers	NL West	43	33	3	NaN	1827910.0	48103.0	1st of 15	$198,971,667	101	103	Dodger Stadium
1	2022	Los Angeles Dodgers	NL West	111	51	1	Lost NLDS (3-1)	3861408.0	47672.0	1st of 15	$261,180,131	101	103	Dodger Stadium
2	2021	Los Angeles Dodgers	NL West	106	56	2	Lost NLCS (4-2)	2804693.0	34626.0	1st of 15	$248,108,334	100	103	Dodger Stadium
3	2020	Los Angeles Dodgers	NL West	43	17	1	Won WS (4-2)	NaN	NaN	6th of 15	$216,508,333	97	99	Dodger Stadium
4	2019	Los Angeles Dodgers	NL West	106	56	1	Lost NLDS (3-2)	3974309.0	49066.0	1st of 15	$193,553,333	94	97	Dodger Stadium
5	2018	Los Angeles Dodgers	NL West	92	71	1	Lost WS (4-1)	3857500.0	47043.0	1st of 15	$164,703,429	96	98	Dodger Stadium
6	2017	Los Angeles Dodgers	NL West	104	58	1	Lost WS (4-3)	3765856.0	46492.0	1st of 15	$201,466,263	95	96	Dodger Stadium
7	2016	Los Angeles Dodgers	NL West	91	71	1	Lost NLCS (4-2)	3703312.0	45720.0	1st of 15	$231,342,096	96	97	Dodger Stadium
8	2015	Los Angeles Dodgers	NL West	92	70	1	Lost NLDS (3-2)	3764815.0	46479.0	1st of 15	$265,140,429	94	95	Dodger Stadium
9	2014	Los Angeles Dodgers	NL West	94	68	1	Lost NLDS (3-1)	3782337.0	46696.0	1st of 15	$233,386,026	95	96	Dodger Stadium
10	2013	Los Angeles Dodgers	NL West	92	70	1	Lost NLCS (4-2)	3743527.0	46216.0	1st of 15	$254,161,000	95	96	Dodger Stadium
11	2012	Los Angeles Dodgers	NL West	86	76	2	NaN	3324246.0	41040.0	3rd of 16	$177,033,600	96	96	Dodger Stadium
12	2011	Los Angeles Dodgers	NL West	82	79	3	NaN	2935139.0	36236.0	6th of 16	$103,785,477	96	96	Dodger Stadium
13	2010	Los Angeles Dodgers	NL West	80	82	4	NaN	3562320.0	43979.0	2nd of 16	$95,358,016	96	96	Dodger Stadium
14	2009	Los Angeles Dodgers	NL West	95	67	1	Lost NLCS (4-1)	3761655.0	46440.0	1st of 16	$102,117,592	95	95	Dodger Stadium
15	2008	Los Angeles Dodgers	NL West	84	78	1	Lost NLCS (4-1)	3730553.0	46056.0	2nd of 16	$118,588,536	97	98	Dodger Stadium
16	2007	Los Angeles Dodgers	NL West	82	80	4	NaN	3857036.0	47618.0	1st of 16	$108,454,524	100	101	Dodger Stadium
17	2006	Los Angeles Dodgers	NL West	88	74	2	Lost NLDS (3-0)	3758545.0	46402.0	1st of 16	$98,447,187	100	101	Dodger Stadium
18	2005	Los Angeles Dodgers	NL West	71	91	4	NaN	3603646.0	44489.0	1st of 16	$83,039,000	97	98	Dodger Stadium

In [189...

```
#Remove the dollar and comma signs from the 'Estimated Payroll' column:
dodgers_df['Est. Payroll'] = dodgers_df['Est. Payroll'].replace({'\$':''}, regex = True)
dodgers_df['Est. Payroll'] = dodgers_df['Est. Payroll'].replace({'\,':''}, regex = True)
dodgers_df.head()
```

Out[189...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium
0	2023	Los Angeles Dodgers	NL West	43	33	3	NaN	1827910.0	48103.0	1st of 15	198971667	101	103	Dodger Stadium
1	2022	Los Angeles Dodgers	NL West	111	51	1	Lost NLDS (3-1)	3861408.0	47672.0	1st of 15	261180131	101	103	Dodger Stadium
2	2021	Los Angeles Dodgers	NL West	106	56	2	Lost NLCS (4-2)	2804693.0	34626.0	1st of 15	248108334	100	103	Dodger Stadium
3	2020	Los Angeles Dodgers	NL West	43	17	1	Won WS (4-2)	NaN	NaN	6th of 15	216508333	97	99	Dodger Stadium
4	2019	Los Angeles Dodgers	NL West	106	56	1	Lost NLDS (3-2)	3974309.0	49066.0	1st of 15	193553333	94	97	Dodger Stadium

In [190...

```
dodgers_df['Est. Payroll'] = dodgers_df['Est. Payroll'].astype(float)
dodgers_df.dtypes
```

Out[190...

```
Year              int64
Tm               object
Lg               object
W                 int64
L                 int64
Finish            int64
Playoffs         object
Attendance      float64
Attend/G        float64
Rank             object
Est. Payroll    float64
PPF               int64
BPF               int64
Stadium          object
dtype: object
```

Create Binary feature that defines a successful year as wins greater than or equal to 50% of total games played

In [191...

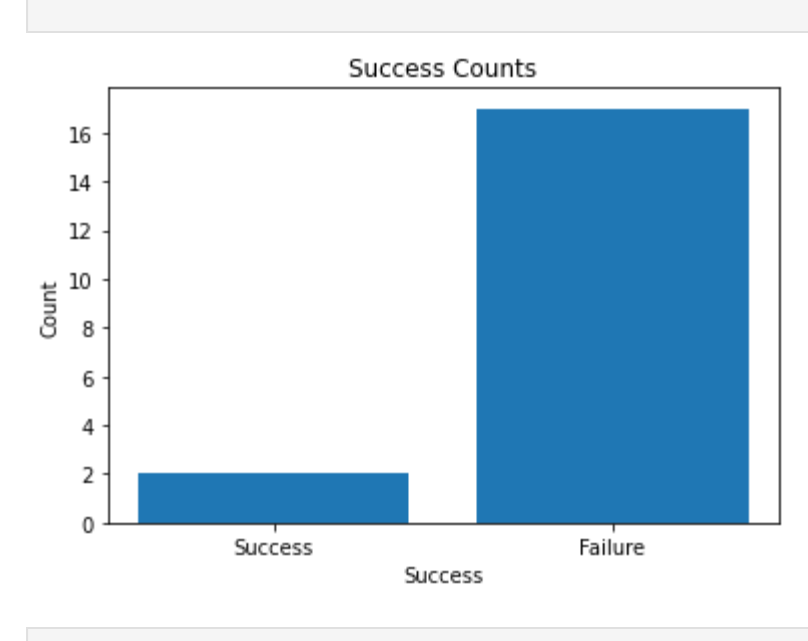
```
#Add a column to define a binary output that has a 1 if the team has a winning record for the year, and 0 if th
dodgers_df['success'] = (dodgers_df['W'] / (dodgers_df['W'] + dodgers_df['L']) >= 0.5).astype(int)
dodgers_df.head()
```

Out[191...

	Year	Tm	Lg	W	L	Finish	Playoffs	Attendance	Attend/G	Rank	Est. Payroll	PPF	BPF	Stadium	success
0	2023	Los Angeles Dodgers	NL West	43	33	3	NaN	1827910.0	48103.0	1st of 15	198971667.0	101	103	Dodger Stadium	1
1	2022	Los Angeles Dodgers	NL West	111	51	1	Lost NLDS (3-1)	3861408.0	47672.0	1st of 15	261180131.0	101	103	Dodger Stadium	1
2	2021	Los Angeles Dodgers	NL West	106	56	2	Lost NLCS (4-2)	2804693.0	34626.0	1st of 15	248108334.0	100	103	Dodger Stadium	1
3	2020	Los Angeles Dodgers	NL West	43	17	1	Won WS (4-2)	NaN	NaN	6th of 15	216508333.0	97	99	Dodger Stadium	1
4	2019	Los Angeles Dodgers	NL West	106	56	1	Lost NLDS (3-2)	3974309.0	49066.0	1st of 15	193553333.0	94	97	Dodger Stadium	1

In [192...

```
#Count the number of successes and failures
success_counts = dodgers_df['success'].value_counts()

#Create a bar plot
plt.bar(success_counts.index, success_counts.values)
plt.xticks(success_counts.index, ['Failure', 'Success'])
plt.xlabel('Success')
plt.ylabel('Count')
plt.title('Success Counts')

#Display the plot
plt.show()
```



In [193...

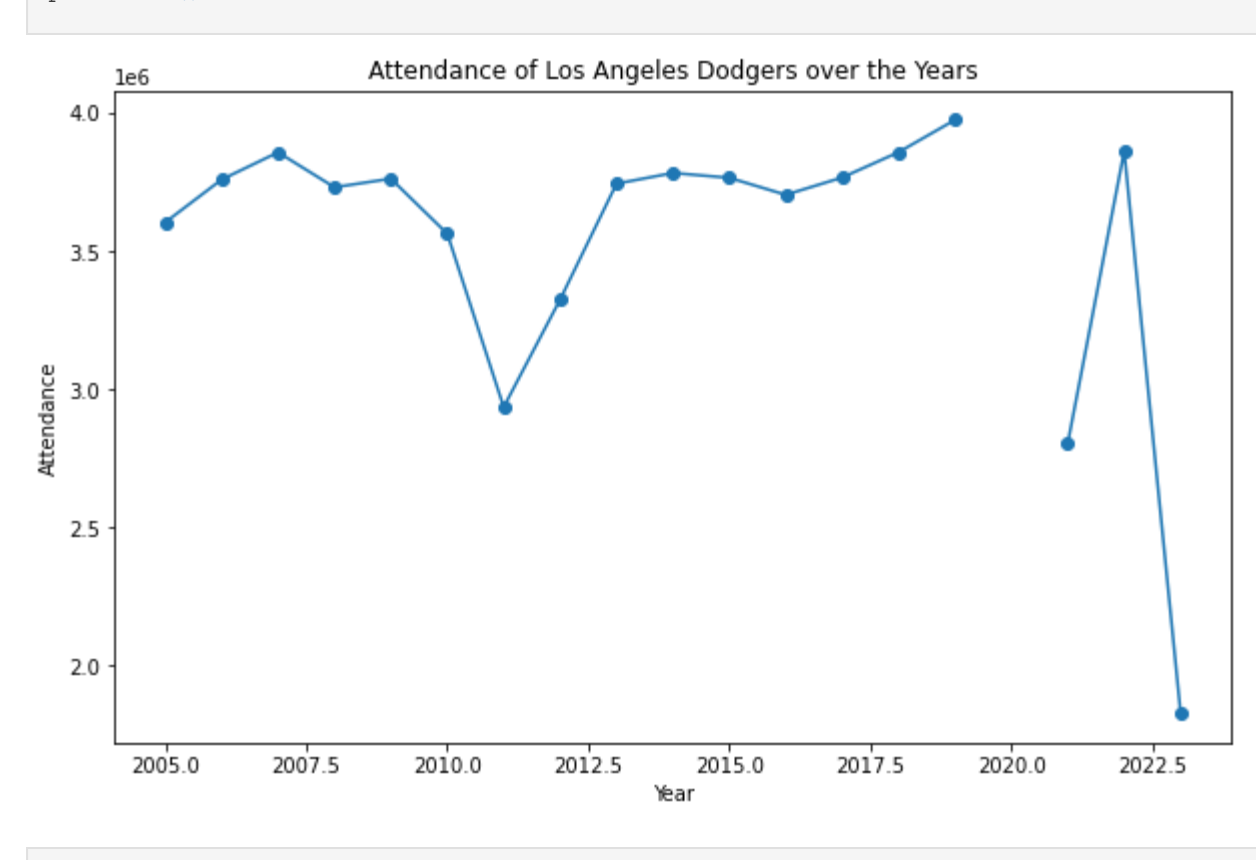
```
dodgers_df.describe()
```

Out[193...

	Year	W	L	Finish	Attendance	Attend/G	Est. Payroll	PPF	BPF	success
count	19.000000	19.000000	19.000000	19.000000	1.800000e+01	18.000000	1.900000e+01	19.000000	19.000000	19.000000
mean	2014.000000	86.421053	65.684211	1.842105	3.534378e+06	45020.722222	1.765971e+08	96.894737	98.105263	0.894737
std	5.627314	18.291819	17.666832	1.167293	5.282122e+05	3912.082668	6.489515e+07	2.330826	2.766762	0.315302
min	2005.000000	43.000000	17.000000	1.000000	1.827910e+06	34626.000000	8.303900e+07	94.000000	95.000000	0.000000
25%	2009.500000	82.000000	57.000000	1.000000	3.572652e+06	44796.750000	1.061200e+08	95.000000	96.000000	1.000000
50%	2014.000000	91.000000	70.000000	1.000000	3.751036e+06	46421.000000	1.935533e+08	96.000000	97.000000	1.000000
75%	2018.500000	94.500000	77.000000	2.500000	3.778217e+06	46956.250000	2.323641e+08	98.500000	100.000000	1.000000
max	2023.000000	111.000000	91.000000	4.000000	3.974309e+06	49066.000000	2.651404e+08	101.000000	103.000000	1.000000

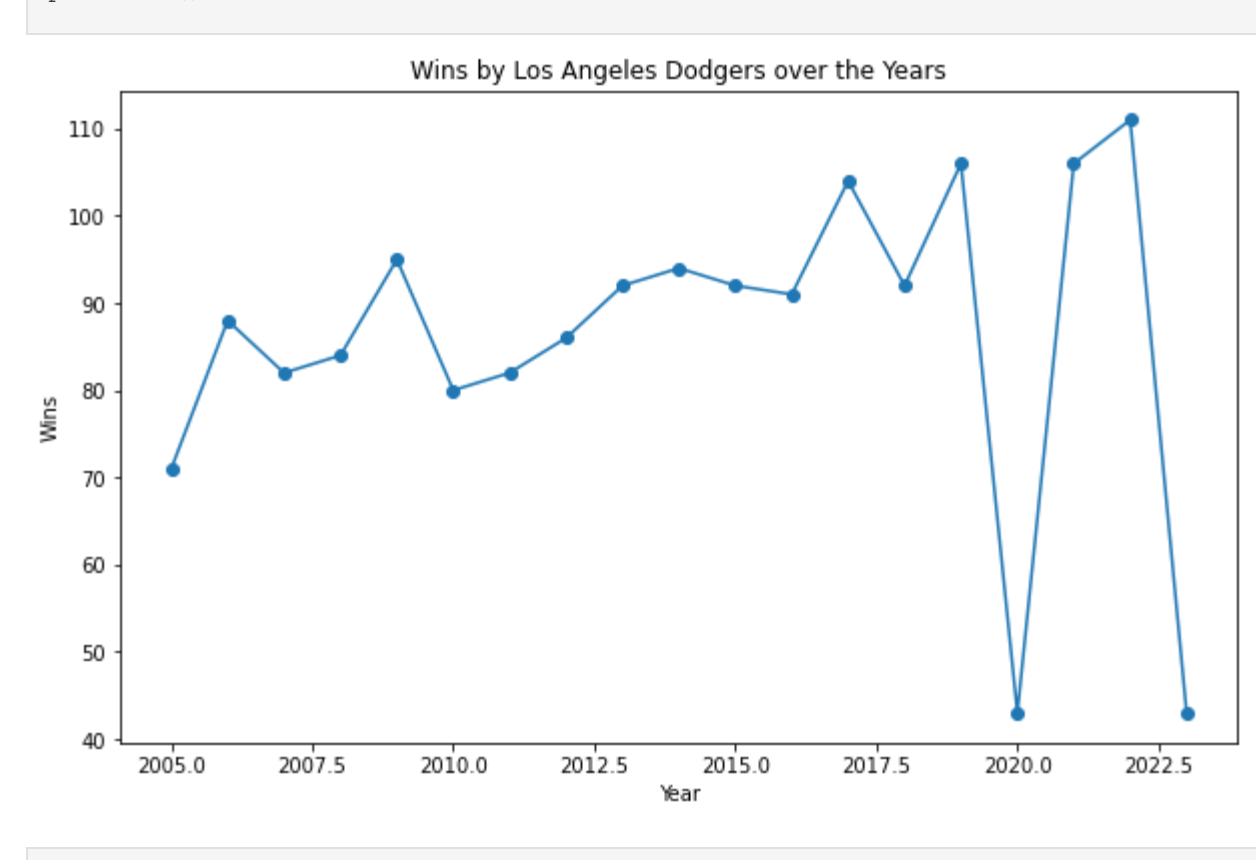
In [194...

```
#Plotting the data
#Convert columns to numpy arrays
year = np.array(dodgers_df['Year'])
attendance = np.array(dodgers_df['Attendance'])

plt.figure(figsize=(10, 6))

#Plotting Attendance over the years
plt.plot(year, attendance, marker='o')
plt.xlabel('Year')
plt.ylabel('Attendance')
plt.title('Attendance of Los Angeles Dodgers over the Years')

#Display the plot
plt.show()
```



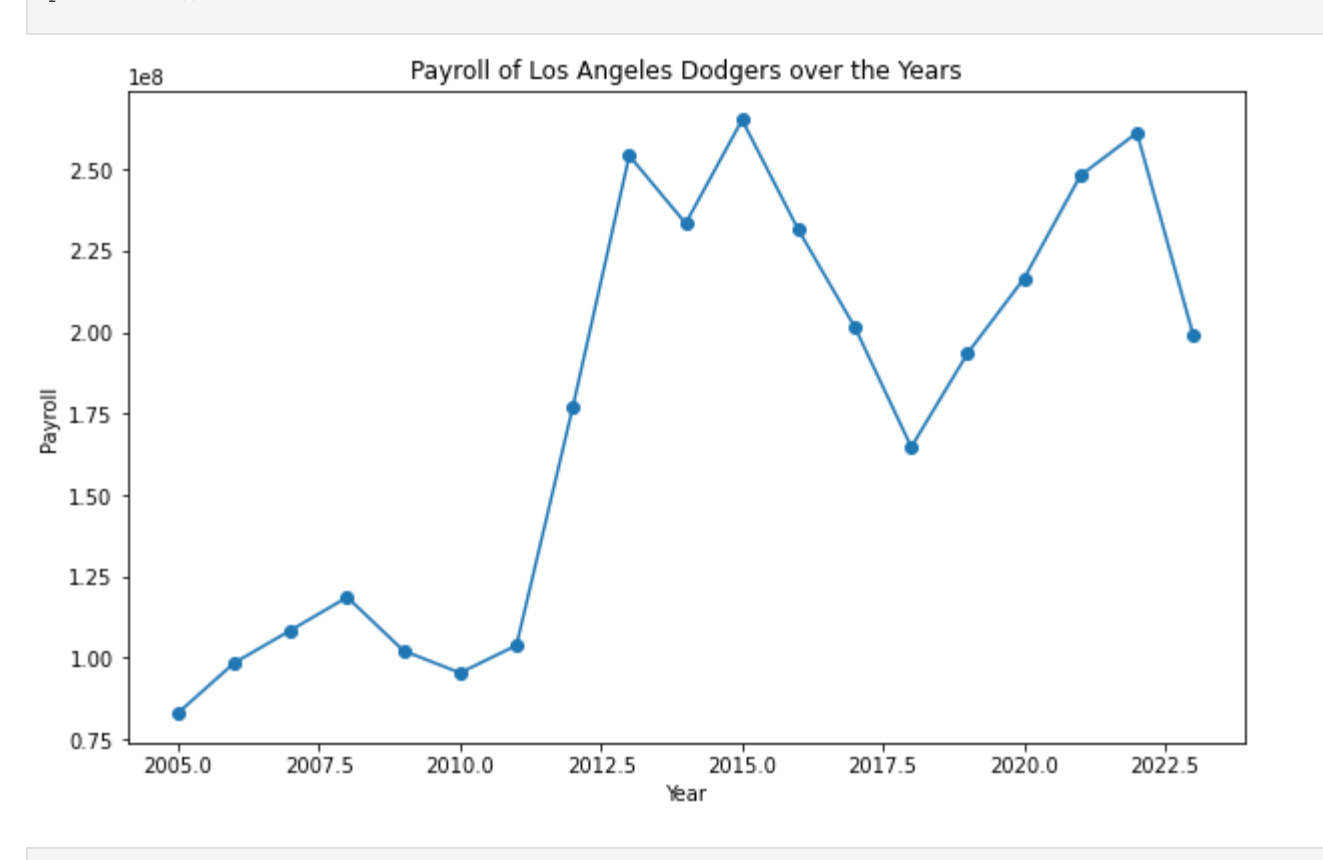
In [195...

```
#Plotting Wins over the years
year = np.array(dodgers_df['Year'])
wins = np.array(dodgers_df['W'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, wins, marker='o')
plt.xlabel('Year')
plt.ylabel('Wins')
plt.title('Wins by Los Angeles Dodgers over the Years')

#Display the plot
plt.show()
```



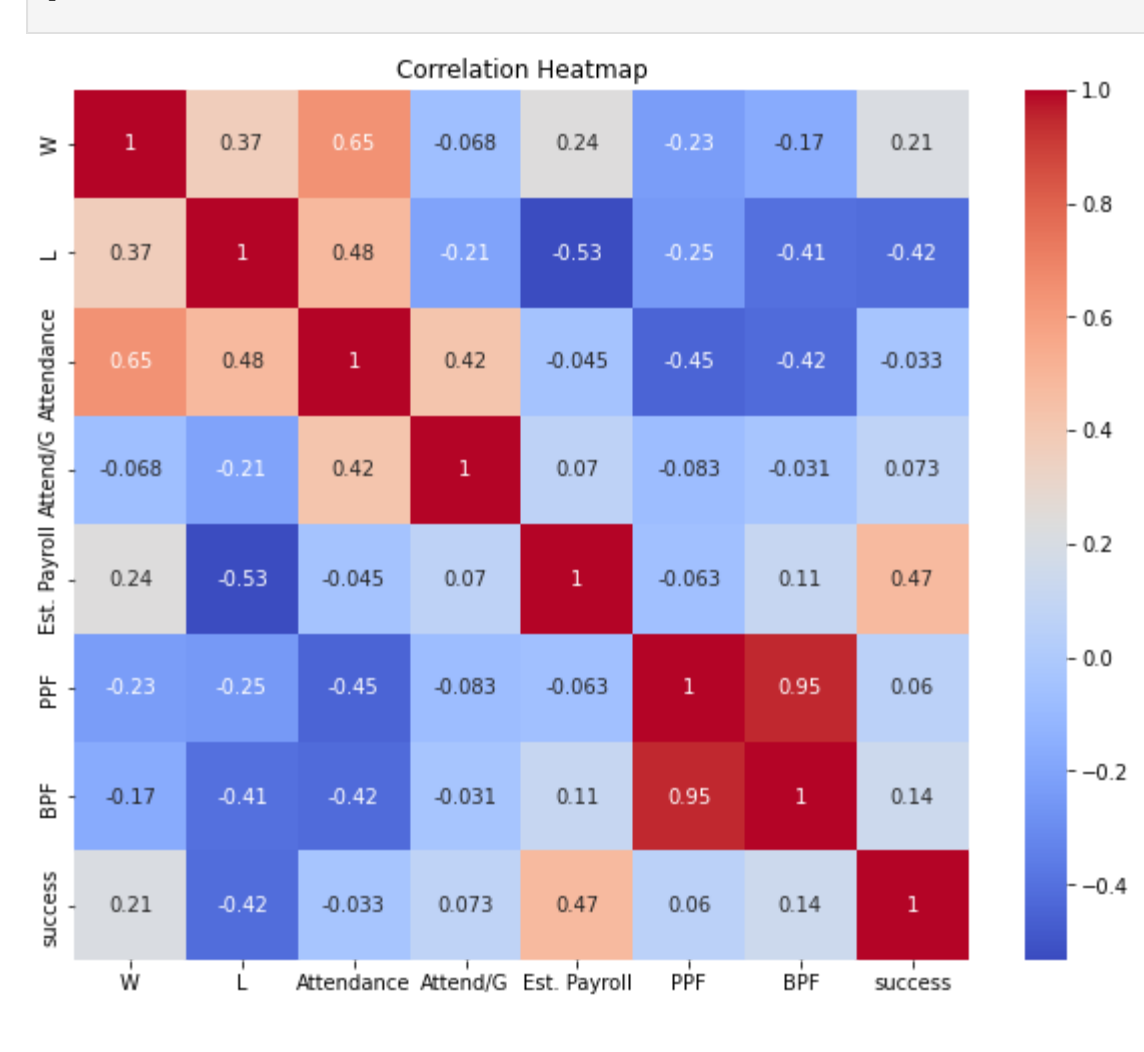
In [196...

```
#Plotting Payroll over the years
#Convert columns to numpy arrays
year = np.array(dodgers_df['Year'])
payroll = np.array(dodgers_df['Est. Payroll'])

plt.figure(figsize= (10,6))

#Plotting Attendance over the years
plt.plot(year, payroll, marker='o')
plt.xlabel('Year')
plt.ylabel('Payroll')
plt.title('Payroll of Los Angeles Dodgers over the Years')

#Display the plot
plt.show()
```



In [197...

```
#Select numeric columns for correlation analysis
numeric_cols = ['W', 'L', 'Attendance', 'Attend/G', 'Est. Payroll', 'PPF', 'BPF', 'success']
numeric_df = dodgers_df[numeric_cols]

#Correlation matrix
correlation = numeric_df.corr()

#Plotting the correlation heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(correlation, annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap')

#Display the plot
plt.show()
```



Add column to analyze whether blog post occurred in a successful year or not.

In [198...

```
#Extract the year from the "Date" column in df DataFrame
lad_df['Year'] = pd.to_datetime(lad_df['Date']).dt.year

#Merge df and athletics_df DataFrames on the "Year" column
merged_lad_df = pd.merge(lad_df, dodgers_df[['Year', 'success']], on='Year', how='left')

#Add a new column 'Year_Successful' based on 'success' column
merged_lad_df['Year_Successful'] = merged_lad_df['success'].fillna(0).astype(int)

merged_lad_df.head()
```

Out[198...

	Title	Author	Date	Content	Year	success	Year_Successful
0	Dodgers Notes: Muncy, Rotation, Thor	Nick Deeds	2023-06-24	Dodgers manager Dave Roberts told reporters today (including Mike DiGiovanna of the Los Angeles ...	2023	1	1
1	Dodgers To Stick With Emmet Sheehan In Rotation Next Week	Mark Polishuk	2023-06-24	Emmet Sheehan's MLB career is off to a tremendous start, as the Dodgers prospect has a 1.50 ERA ...	2023	1	1
2	Red Sox Acquire Tayler Scott From Dodgers	Darragh McDonald	2023-06-22	The Red Sox announced that they have acquired right-hander Tayler Scott from the Dodgers in exch...	2023	1	1
3	MLBTR Trade Rumors Podcast: Exciting Youth Movements in Cincinnati and Pittsburgh, Bad Central D...	Darragh McDonald	2023-06-21	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...	2023	1	1
4	Dodgers Sign David Dahl To Minor League Contract	Anthony Franco	2023-06-20	Veteran outfielder David Dahl has signed a minor league deal with the Dodgers, according to Trip...	2023	1	1

In [199...

```
len(merged_lad_df)
```

Out[199...

```
1000
```

Cleaning the Dodgers' Data

In [200...

```
#Identify any noise in the data
RE_SUSPICIOUS = re.compile(r'[&#<>{}\[\]\\]')

def impurity(text, min_len=10):
    """returns the share of suspicious characters in a text"""
    if text == None or len(text) < min_len:
        return 0
    else:
        return len(RE_SUSPICIOUS.findall(text))/len(text)
```

In [201...

```
merged_lad_df['Content'].apply
```

Out[201...

```
<bound method Series.apply of 0      Dodgers manager Dave Roberts told reporters today (including Mike DiGiovan
na of the Los Angeles ...
1      Emmet Sheehan's MLB career is off to a tremendous start, as the Dodgers prospect has a 1.50 ERA ...
2      The Red Sox announced that they have acquired right-hander Tayler Scott from the Dodgers in exch...
3      The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...
4      Veteran outfielder David Dahl has signed a minor league deal with the Dodgers, according to Trip...
                                                  ...
995    With the market showing a big appetite for star third basemen, the Rockies now appear to be incr...
996    With the offseason almost two months old, MLBTR is going through all 30 teams' remaining needs b...
997    Sunday: Chargois, as it turns out, has been acquired by the Rakuten Golden Eagles of NPB's Pacif...
998    The Dodgers have had a quiet start to the offseason, observes Andy McCullough of the Athletic. G...
999    TODAY: The Dodgers continue to be "very aggressive in pursuit of" Clevinger and Lindor, USA Toda...
Name: Content, Length: 1000, dtype: object>
```

In [202...

```
pd.options.display.max_colwidth = 100 ###
#Add new column to data frame
merged_lad_df['impurity'] = merged_lad_df['Content'].apply(impurity, min_len=10)

#Get the top 3 records
merged_lad_df[['Content', 'impurity']].sort_values(by='impurity', ascending=False).head(3)
```

Out[202...

	Content	impurity
91	The Dodgers took a step back this winter, so how aggressive will they be at the deadline this ye...	0.010753
885	According to the Centers for Disease Control and Prevention, people over the age of 65 and cance...	0.004571
963	In case you missed it — which, c'mon, you call yourself a MLBTR reader?! — the Red Sox have agre...	0.003989

The steps above displays the highest impurity levels for the Dodgers' data set. The impurity levels above are extremely low, being below 1% of all characters in each blog post appear suspicious.

Character Normalization and Tokenization

In [203...

```
#Example function to normalize the text in the "Contents" column
def normalize_text(text):
    #Lowercase the text
    text = text.lower()

    #Remove punctuation
    text = text.translate(str.maketrans("", "", string.punctuation))

    #Remove special characters and digits
    text = re.sub(r"[^a-zA-Z]", " ", text)

    #Tokenize the text
    tokens = word_tokenize(text)

    #Remove stopwords
    stop_words = set(stopwords.words("english"))
    tokens = [token for token in tokens if token not in stop_words]

    #Perform stemming
    stemmer = PorterStemmer()
    tokens = [stemmer.stem(token) for token in tokens]

    return tokens

#Apply normalization to the "Contents" column
merged_lad_df["Contents_Normalized"] = merged_lad_df["Content"].apply(normalize_text)

#Print the head of the DataFrame with the normalized contents
merged_lad_df[["Content", "Contents_Normalized"]].head()
```

Out[203...

	Content	Contents_Normalized
0	Dodgers manager Dave Roberts told reporters today (including Mike DiGiovanna of the Los Angeles ...	[dodger, manag, dave, robert, told, report, today, includ, mike, digiovanna, lo, angel, time, ex...
1	Emmet Sheehan's MLB career is off to a tremendous start, as the Dodgers prospect has a 1.50 ERA ...	[emmet, sheehan, mlb, career, tremend, start, dodger, prospect, era, first, inning, show, sheeha...
2	The Red Sox announced that they have acquired right-hander Tayler Scott from the Dodgers in exch...	[red, sox, announc, acquir, righthand, tayler, scott, dodger, exchang, cash, consider, scott, de...
3	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...	[latest, episod, mlb, trade, rumor, podcast, live, spotifi, appl, podcast, wherev, get, podcast,...
4	Veteran outfielder David Dahl has signed a minor league deal with the Dodgers, according to Trip...	[veteran, outfield, david, dahl, sign, minor, leagu, deal, dodger, accord, triplea, commun, dire...

In [204...

```
merged_lad_df['length'] = merged_lad_df['Contents_Normalized'].str.len()
merged_lad_df.head()
```

Out[204...

	Title	Author	Date	Content	Year	success	Year_Successful	impurity	Contents_Normalized	length
0	Dodgers Notes: Muncy, Rotation, Thor	Nick Deeds	2023-06-24	Dodgers manager Dave Roberts told reporters today (including Mike DiGiovanna of the Los Angeles ...	2023	1	1	0.0	[dodger, manag, dave, robert, told, report, today, includ, mike, digiovanna, lo, angel, time, ex...	277
1	Dodgers To Stick With Emmet Sheehan In Rotation Next Week	Mark Polishuk	2023-06-24	Emmet Sheehan's MLB career is off to a tremendous start, as the Dodgers prospect has a 1.50 ERA ...	2023	1	1	0.0	[emmet, sheehan, mlb, career, tremend, start, dodger, prospect, era, first, inning, show, sheeha...	96
2	Red Sox Acquire Tayler Scott From Dodgers	Darragh McDonald	2023-06-22	The Red Sox announced that they have acquired right-hander Tayler Scott from the Dodgers in exch...	2023	1	1	0.0	[red, sox, announc, acquir, righthand, tayler, scott, dodger, exchang, cash, consider, scott, de...	192
3	MLBTR Trade Rumors Podcast: Exciting Youth Movements in Cincinnati and Pittsburgh, Bad Central D...	Darragh McDonald	2023-06-21	The latest episode of the MLB Trade Rumors Podcast is now live on Spotify, Apple Podcasts, and w...	2023	1	1	0.0	[latest, episod, mlb, trade, rumor, podcast, live, spotifi, appl, podcast, wherev, get, podcast,...	124
4	Dodgers Sign David Dahl To Minor League Contract	Anthony Franco	2023-06-20	Veteran outfielder David Dahl has signed a minor league deal with the Dodgers, according to Trip...	2023	1	1	0.0	[veteran, outfield, david, dahl, sign, minor, leagu, deal, dodger, accord, triplea, commun, dire...	143

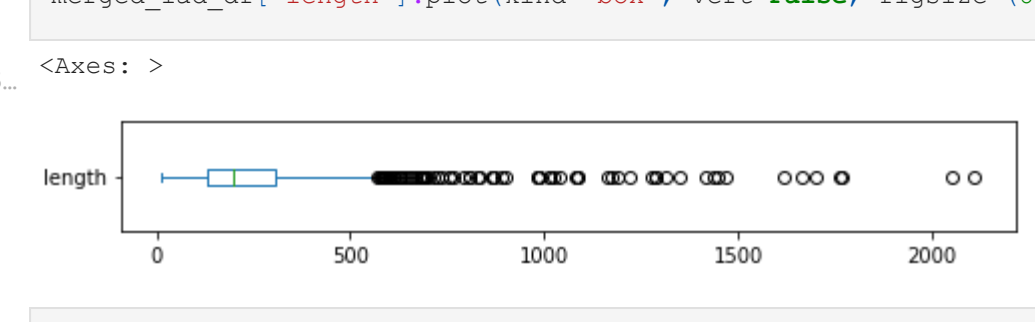
Analyze descriptive statistics for text in dataframe.

In [205...

```
merged_lad_df['length'].plot(kind='box', vert=False, figsize=(8, 1))
```

Out[205...

```
<Axes: >
```

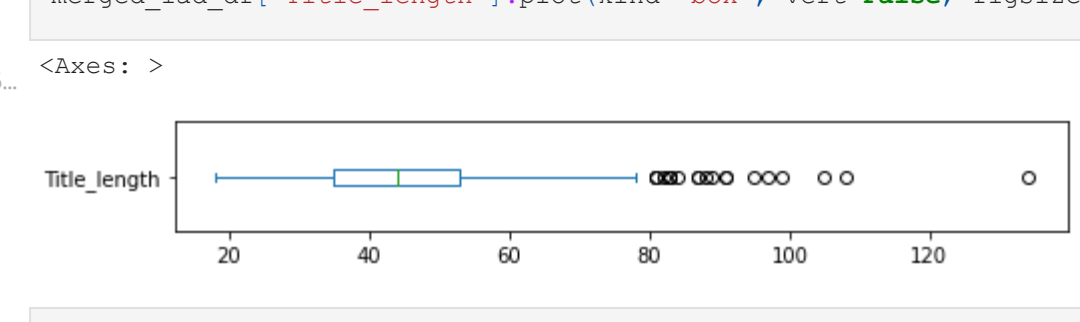


In [206...

```
merged_lad_df['Title_length'] = merged_lad_df['Title'].str.len()
merged_lad_df['Title_length'].plot(kind='box', vert=False, figsize=(8, 1))
```

Out[206...

```
<Axes: >
```

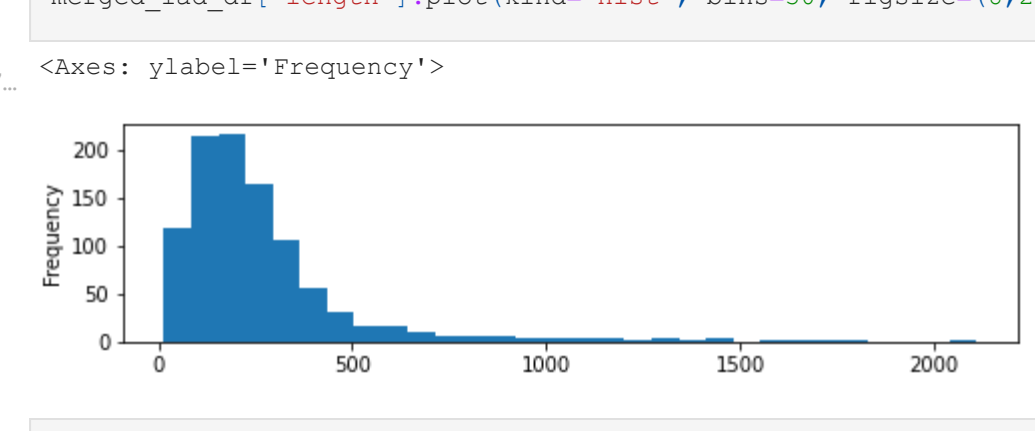


In [207...

```
merged_lad_df['length'].plot(kind='hist', bins=30, figsize=(8,2))
```

Out[207...

```
<Axes: ylabel='Frequency'>
```

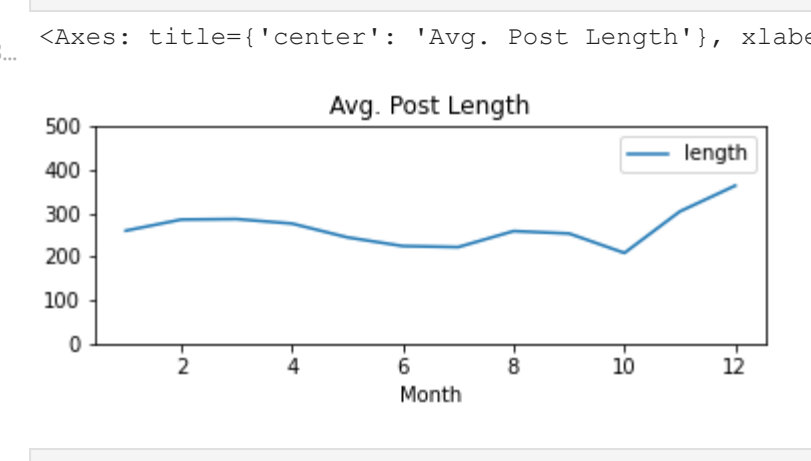


In [208...

```
#Extract the month from the date and create a new column
merged_lad_df['Month'] = merged_lad_df['Date'].dt.month

#Plot the average post length
merged_lad_df.groupby('Month').agg({'length': 'mean'}) \
  .plot(title="Avg. Post Length", ylim=(0,500), figsize=(6,2))
```

Out[208...

```
<Axes: title={'center': 'Avg. Post Length'}, xlabel='Month'>
```



In [209...

```
def count_words(df, column='Contents_Normalized', preprocess=None, min_freq=2):

    #Process tokens and update counter
    def update(doc):
        tokens = doc if preprocess is None else preprocess(doc)
        counter.update(tokens)

    #Create counter and run through all data
    counter = Counter()
    tqdm.pandas() #initialize tqdm for progress bar
    df[column].apply(update)

    #Transform counter into data frame
    freq_df = pd.DataFrame.from_dict(counter, orient='index', columns=['freq'])
    freq_df = freq_df.query('freq >= @min_freq')
    freq_df.index.name = 'token'

    return freq_df.sort_values('freq', ascending=False)
```

In [210...

```
freq_df = count_words(merged_lad_df)
freq_df.head(5)
```

Out[210...

token	freq
dodger	3838
season	3300
year	2410
mm	2127
leagu	1861

In [211...

```
#How many tokens are in the df?
len(freq_df)
```

Out[211...

```
6369
```

In [212...

```
#Top words with 10+ characters
count_words(merged_lad_df, column='Content',
            preprocess=lambda Content: re.findall(r"\w{10,}", Content)).head(5)
```

Out[212...

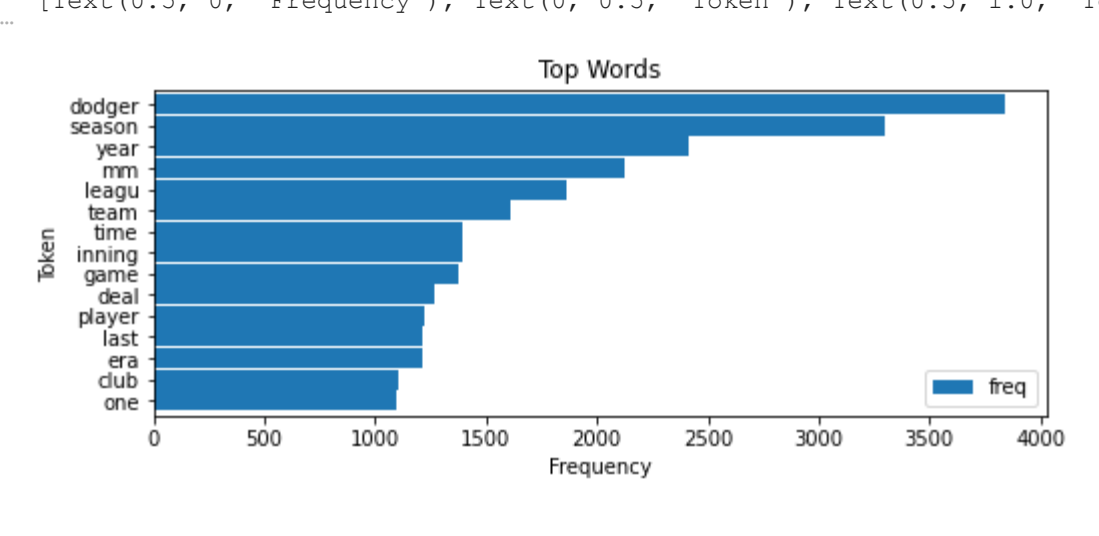
token	freq
appearances	642
assignment	281
outfielder	262
postseason	254
organization	236

In [213...

```
ax = freq_df.head(15).plot(kind='barh', width=0.95, figsize=(8,3))
ax.invert_yaxis()
ax.set(xlabel='Frequency', ylabel='Token', title='Top Words')
```

Out[213...

```
[Text(0.5, 0, 'Frequency'), Text(0, 0.5, 'Token'), Text(0.5, 1.0, 'Top Words')]
```



Combine merged team data into one dataframe for further analysis and modeling.

In [215...

```
comb_df = pd.concat([merged_wsh_df, merged_sd_df, merged_oa_df, merged_cws_df, merged_laa_df, merged_lad_df], i
len(comb_df)
```

Out[215...

```
6000
```

In [216...

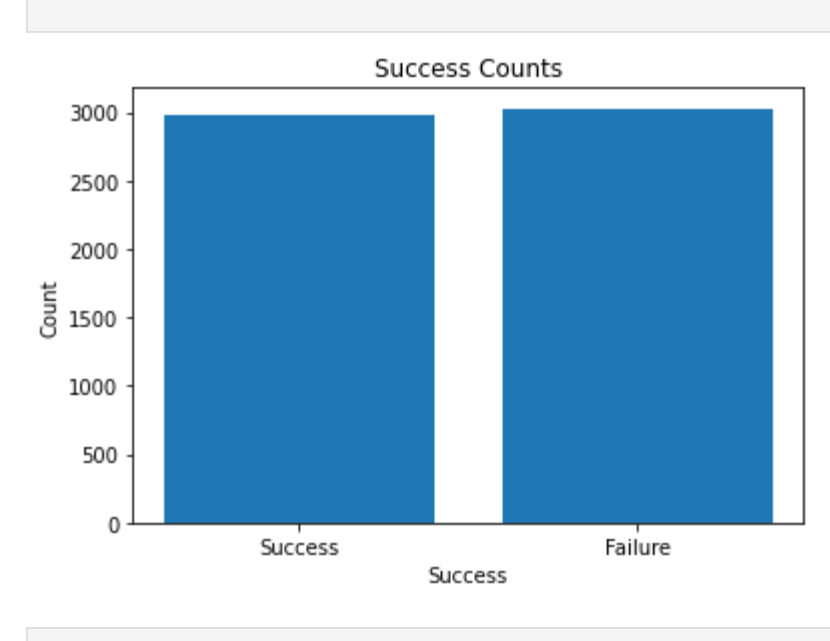
```
comb_df.head()
```

Out[216...

	Title	Author	Date	Content	Year	success	Year_Successful	impurity	Contents_Normalized	length	Title_length	Month
0	Nationals Designate Chad Kuhl For Assignment	Nick Deeds	2023-06-24	The Nationals announced this evening that the club has designated right-hander Chad Kuhl for ass...	2023	0	0	0.0	[nation, announc, even, club, design, righthand, chad, kuhl, assign, correspond, move, washingto...	240	44	6
1	Nationals Select Derek Hill, Place Victor Robles On Injured List	Steve Adams	2023-06-21	The Nationals have selected the contract of outfielder Derek Hill from Triple-A Rochester, per a...	2023	0	0	0.0	[nation, select, contract, outfield, derek, hill, triplea, rochest, per, team, announc, correspo...	239	64	6
2	Nationals, Orioles Reach Settlement On 2012-16 MASN Rights Fees	Anthony Franco	2023-06-20	The Nationals and Orioles have settled their dispute regarding MASN rights fees between 2012-16,...	2023	0	0	0.0	[nation, oriol, settl, disput, regard, masn, right, fee, first, report, chelsea, jane, ben, stra...	274	63	6
3	Sean Doolittle Completes Rehab Assignment, Heads To Triple-A Rochester	Steve Adams	2023-06-15	Veteran lefty Sean Doolittle was transferred from the Nationals' Double-A affiliate to their Tri...	2023	0	0	0.0	[veteran, lefti, sean, doolittl, transfer, nation, doublea, affili, triplea, club, thursday, sig...	60	70	6
4	Nationals Release Erasmo Ramirez	Darragh McDonald	2023-06-09	The Nationals have released right-hander Erasmo Ramirez, according to his transactions tracker a...	2023	0	0	0.0	[nation, releas, righthand, erasmo, ram, rez, accord, transact, tracker, mlbcom, design, assign,...	130	32	6

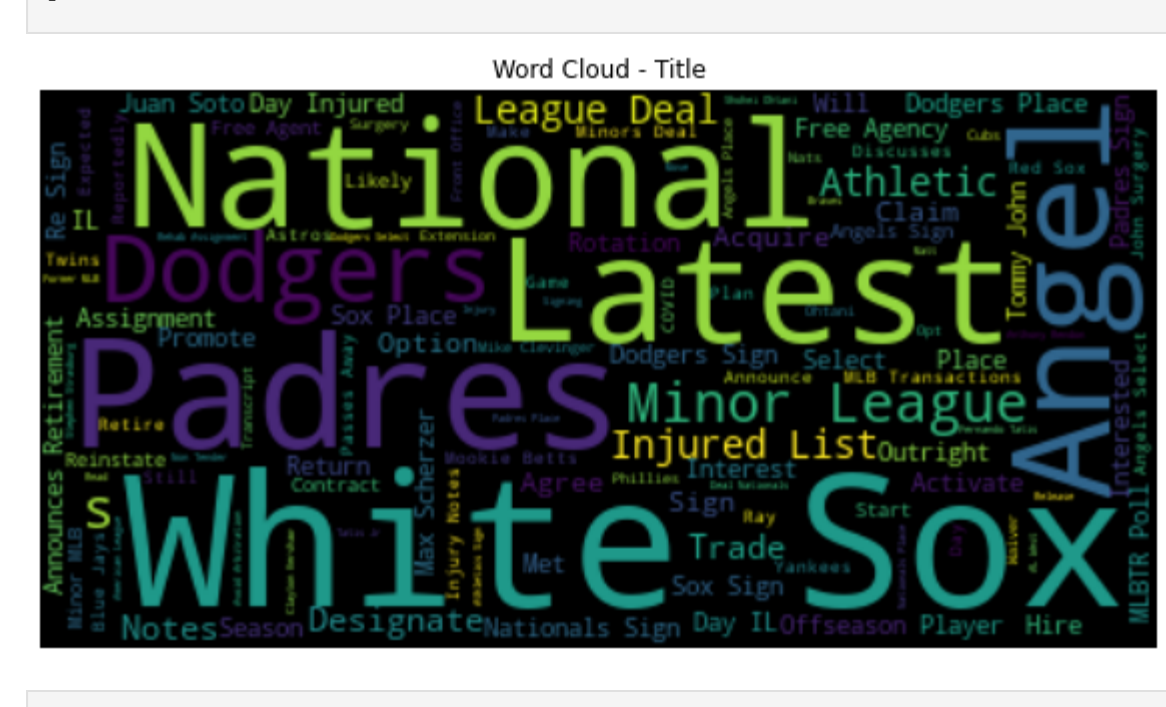
In [217...

```
# Count the number of successes and failures
success_counts = comb_df['success'].value_counts()

# Create a bar plot
plt.bar(success_counts.index, success_counts.values)
plt.xticks(success_counts.index, ['Failure', 'Success'])
plt.xlabel('Success')
plt.ylabel('Count')
plt.title('Success Counts')

# Display the plot
plt.show()
```



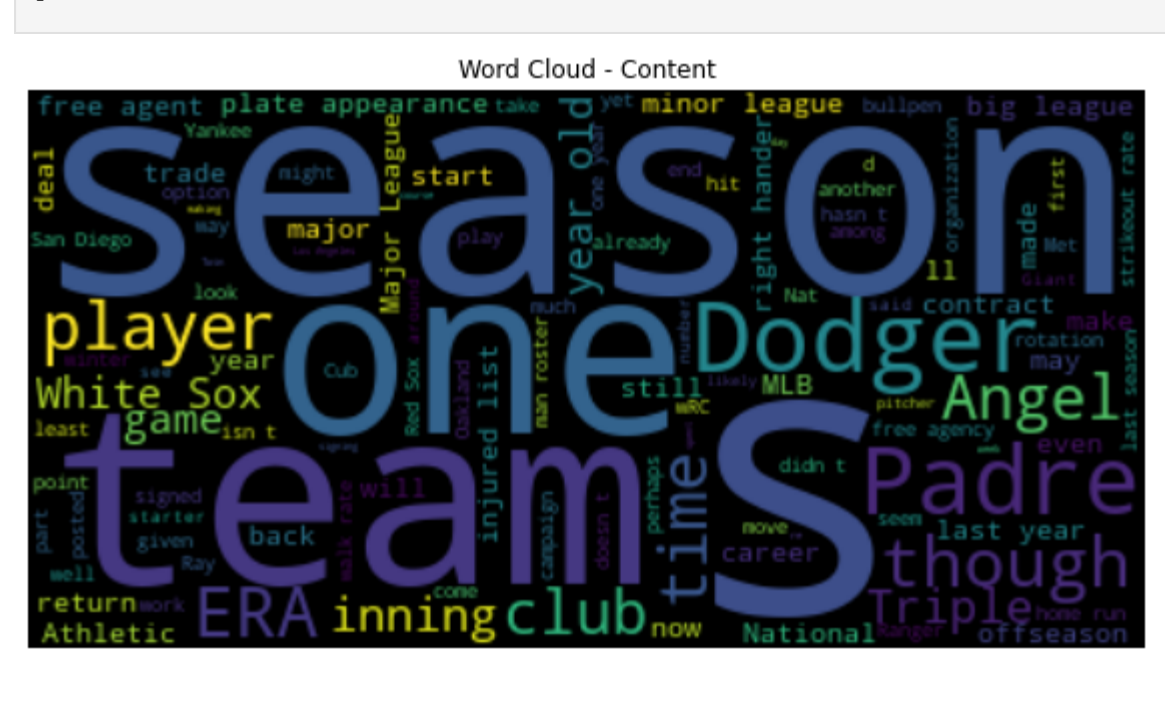
In [218...

```
from wordcloud import WordCloud
import matplotlib.pyplot as plt

 # Create a word cloud for the "Title" column
title_wordcloud = WordCloud().generate(' '.join(comb_df['Title'].dropna()))
plt.figure(figsize=(10, 6))
plt.imshow(title_wordcloud, interpolation='bilinear')
plt.axis('off')
plt.title('Word Cloud - Title')
plt.show()
```



In [219...

```
# Create a word cloud for the "Contents_Normalized" column
contents_wordcloud = WordCloud().generate(' '.join(comb_df['Content'].dropna()))
plt.figure(figsize=(10, 6))
plt.imshow(contents_wordcloud, interpolation='bilinear')
plt.axis('off')
plt.title('Word Cloud - Content')
plt.show()
```



Topic Modeling

Analyze both the general topics and the abstract topics garnered within a collection of the gathered blog posts

In [224...

```
#Count stopwords
stopwords = list(stopwords)
from sklearn.feature_extraction.text import TfidfVectorizer
tfidf_text_vectorizer = TfidfVectorizer(stop_words=stopwords, min_df=5, max_df=0.7)
tfidf_text_vectors = tfidf_text_vectorizer.fit_transform(comb_df['Content'])
tfidf_text_vectors.shape
```

Out[224...

```
(6000, 12111)
```

In [225...

```
from sklearn.decomposition import NMF

nmf_text_model = NMF(n_components=10, random_state=42)
W_text_matrix = nmf_text_model.fit_transform(tfidf_text_vectors)
H_text_matrix = nmf_text_model.components_
```

In [226...

```
from sklearn.feature_extraction.text import TfidfVectorizer
from spacy.lang.en.stop_words import STOP_WORDS as stopwords

def display_topics(model, feature_names, no_top_words=5):
    for topic_idx, topic in enumerate(model.components_):
        print(f"\nTopic {topic_idx}:")
        top_features_ind = topic.argsort()[:-no_top_words - 1:-1]
        top_features = [feature_names[i] for i in top_features_ind]
        weights = topic[top_features_ind]
        for feature, weight in zip(top_features, weights):
            print(f"{feature} ({weight})")
```

In [227...

```
#Display Topics with top-5 feature terms
tfidf_feature_names = list(tfidf_text_vectorizer.vocabulary_.keys())
display_topics(nmf_text_model, tfidf_feature_names)
```

```
Topic 0:
pagan (0.6148124755426609)
colas (0.608102953805686)
cuts (0.5956734841045294)
gosselin (0.5442948119434579)
lieutenant (0.5215348253110752)

Topic 1:
kt (0.6314216353220825)
224 (0.6055153923434654)
held (0.4633310611812178)
garza (0.44960233614118694)
interests (0.40199714333662223)

Topic 2:
pattern (1.4610200879160924)
avoidance (1.2640173978130975)
simeon (0.5720011132254754)
allen (0.3801362139696933)
donny (0.35416022944434306)

Topic 3:
000 (1.155462964992141)
delaplane (1.094642059657612)
eighty (0.9215887565063594)
224 (0.5592900793112495)
kay (0.5083019607414038)

Topic 4:
culture (1.447942461361509)
oscar (0.7886763000463056)
perception (0.6667427257964942)
committal (0.47919956459944407)
393 (0.39497219808913914)

Topic 5:
stratton (1.8615727805768556)
trent (0.9494023156369307)
fanbases (0.5188406530318043)
uncomfortable (0.5141113800589384)
eclipse (0.4834722600626102)

Topic 6:
characterizes (1.0552092668550668)
425mm (0.8180447661698501)
schaaf (0.6966382809408916)
pencil (0.5587008654376291)
encarnacion (0.5466705816124041)

Topic 7:
velo (1.761040041407068)
stunning (0.48021262629286204)
traction (0.41222253272832543)
2010 (0.40481119021376244)
leads (0.38901074098652605)

Topic 8:
extensions (1.3814033207536027)
prized (0.6218272249475292)
dropoff (0.561263221030135)
stove (0.4441136632327407)
infamous (0.3666172825883625)

Topic 9:
refusal (0.6612022142055134)
concern (0.5996383782481639)
204mm (0.41254874169126693)
mm (0.35685502480199005)
clauses (0.3519597135631397)
```

Modeling

Logistic Regression Modeling

In [228…

```
!pip install scikit-learn
```

```
Requirement already satisfied: scikit-learn in c:\users\andre\downloads\new folder\envs\r\lib\site-packages (1.
2.2)
Requirement already satisfied: joblib>=1.1.1 in c:\users\andre\downloads\new folder\envs\r\lib\site-packages (f
rom scikit-learn) (1.2.0)
Requirement already satisfied: scipy>=1.3.2 in c:\users\andre\downloads\new folder\envs\r\lib\site-packages (fr
om scikit-learn) (1.7.3)
Requirement already satisfied: numpy>=1.17.3 in c:\users\andre\downloads\new folder\envs\r\lib\site-packages (f
rom scikit-learn) (1.21.5)
Requirement already satisfied: threadpoolctl>=2.0.0 in c:\users\andre\downloads\new folder\envs\r\lib\site-pack
ages (from scikit-learn) (3.1.0)
```

In [229…

```
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
```

In [230…

```
#Split the data into 80/20 train-test sets
X_train, X_test, y_train, y_test = train_test_split(comb_df['Content'], comb_df['success'], test_size=0.2, ranc
```

In [231…

```
vectorizer = TfidfVectorizer()
X_train_vec = vectorizer.fit_transform(X_train)
X_test_vec = vectorizer.transform(X_test)
```

In [232…

```
model = LogisticRegression()
model.fit(X_train_vec, y_train)
```

Out[232…

```
▾ LogisticRegression
LogisticRegression()
```

In [233…

```
y_pred = model.predict(X_test_vec)
```

In [234…

```
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)
```

```
Accuracy: 0.7758333333333334
```

Penalized Logistic Regression

This model was penalized because of our data containing numerous variables, which resulted in shrinking the coefficients of the less contributive variables toward zero.

In [235…

```
import pandas as pd
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import GridSearchCV
```

In [236…

```
#Grid search was implemented to identify the ideal values for a model's hyperparameters.
#Set a grid of parameters to map estimator parameters to sequences of allowed values
param_grid = {'C': [0.001, 0.01, 0.1, 1, 10]}
grid_search = GridSearchCV(LogisticRegression(penalty='l2'), param_grid, cv=5)
grid_search.fit(X_train_vec, y_train)

best_C = grid_search.best_params_['C']
```

In [237…

```
model = LogisticRegression(penalty='l2', C=best_C)
model.fit(X_train_vec, y_train)
```

Out[237…

```
▾ LogisticRegression
LogisticRegression(C=1)
```

In [238…

```
y_pred = model.predict(X_test_vec)
```

In [239…

```
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)
print(classification_report(y_test, y_pred))
```

```
Accuracy: 0.7758333333333334
              precision    recall  f1-score   support

           0       0.79      0.78      0.78       627
           1       0.76      0.77      0.77       573

    accuracy                           0.78      1200
   macro avg       0.78      0.78      0.78      1200
weighted avg       0.78      0.78      0.78      1200
```

The results from our classification model indicates that the model is able to accurately predict if a blog post is associated with a winning MLB team roughly 77%-78% of the time.

In [240…

```
coefficients = model.coef_
print(coefficients)
```

```
[[ 0.00694685 -0.07996149 -0.03090452 ... -0.05781421 -0.00909974
  -0.10094782]]
```

In [241…

```
# Retrieve feature names from vectorizer
feature_names = vectorizer.get_feature_names_out()

# Calculate feature importance
feature_importance = np.abs(model.coef_[0])

# Sort feature importance in descending order
sorted_indices = np.argsort(feature_importance)[::-1]
sorted_feature_importance = feature_importance[sorted_indices]
sorted_feature_names = feature_names[sorted_indices]
```

In [243…

```
# Select top 20 features
top_feature_importance = sorted_feature_importance[:50]
top_feature_names = sorted_feature_names[:50]

# Plot top 20 feature importance
plt.figure(figsize=(15, 11))
plt.barh(range(len(top_feature_names)), top_feature_importance, align='center')
plt.yticks(range(len(top_feature_names)), top_feature_names)
plt.xlabel('Feature Importance')
plt.ylabel('Feature')
plt.title('Logistic Regression - Top 20 Feature Importance')
plt.show()
```


The bar chart of our logistic regression indicates that the features team and player names mention show greatest importance towards the model's prediction process. It also demonstrates a strong performance when predicting if a blog post is associated with a winning team.

Overall, our data text analysis demonstrates a concise analysis between texual data from blog posts and MLB team performance. This analysis is one that could be used to evaluate team decisions and if performance of teams is trending in the right direction. This also demonstrates that our text data has the potential to predict status of on team performance and determine if blog posts are associated with a winning or losing team.

Amid some limitations noted within our data analysis that included data as far back as 2019 being used, the 2020 COVID-19 year impacting outcomes, and further cleaning the data to remove team names while removing biases, the use of additional features like attendance, revenue, and payroll could enhance the predictability rating of our modeling process.