data_understanding_prepare_data

August 11, 2025

0.1 Prepare Data

0.1.1 Anime Recommendations Database

Anime Listing

[21]:
```
import pandas as pd
cuAnime = pd.read_csv("E:\\applied data science␣
 ↪capstone\\data\\CooperUnion\\archive\\anime.csv")
```

[22]:
```
# remove hentai genre and filter for tv and movie in the type feature
no_hentai_df = cuAnime.loc[cuAnime["genre"] != "Hentai", :]
cu_anime_df = no_hentai_df.loc[~no_hentai_df["type"].isin(["Music", "ONA",␣
 ↪"OVA", "Special"]), :]

genre_df = cu_anime_df["genre"].value_counts().to_frame()
genre_df = genre_df.reset_index()
genre_df.describe()
```

[22]:

	count
count	2197.000000
mean	2.778334
std	8.551703
min	1.000000
25%	1.000000
50%	1.000000
75%	2.000000
max	251.000000

[23]:
```
genre_df.head()
```

[23]:

	genre	count
0	Comedy	251
1	Kids	135
2	Dementia	124
3	Comedy, Slice of Life	98
4	Comedy, Kids	86

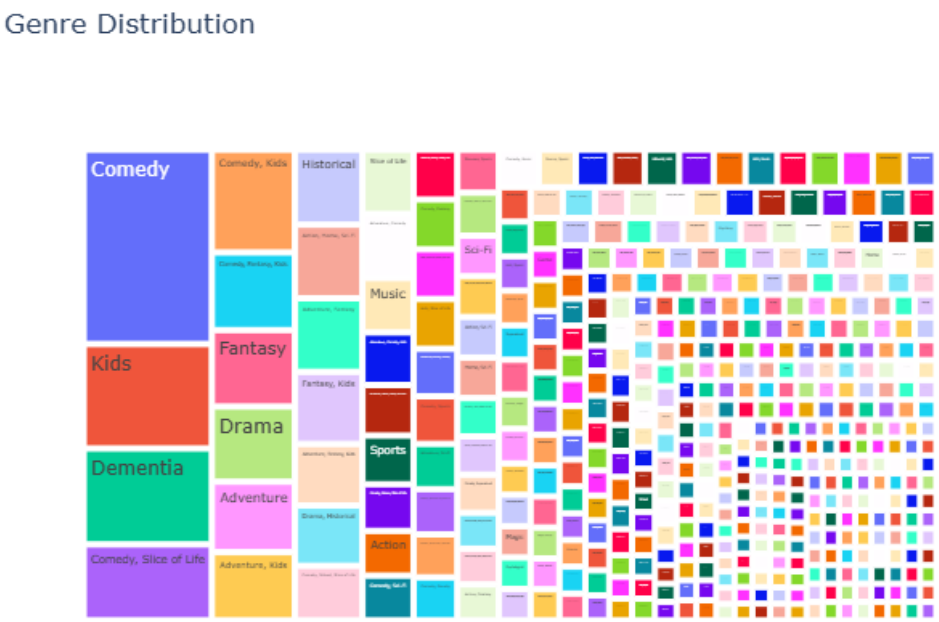
[24]:
```
import plotly.express as px
from IPython.display import Image
```

```
plots_location = "E:\\applied data science␣
↪capstone\\anime-recommendation\\preparation"
```

Hentai is no longer in the genre

[25]:
```
genre_df = genre_df[genre_df["count"] > 2]
fig = px.treemap(genre_df, path=['genre'], values='count', title="Genre␣
↪Distribution")
fig.
↪write_image(f"{plots_location}\\anime_recommendations_database\\genre_distribution.
↪png")
Image(filename=f"{plots_location}\\anime_recommendations_database\\genre_distribution.
↪png")
```

[25]:

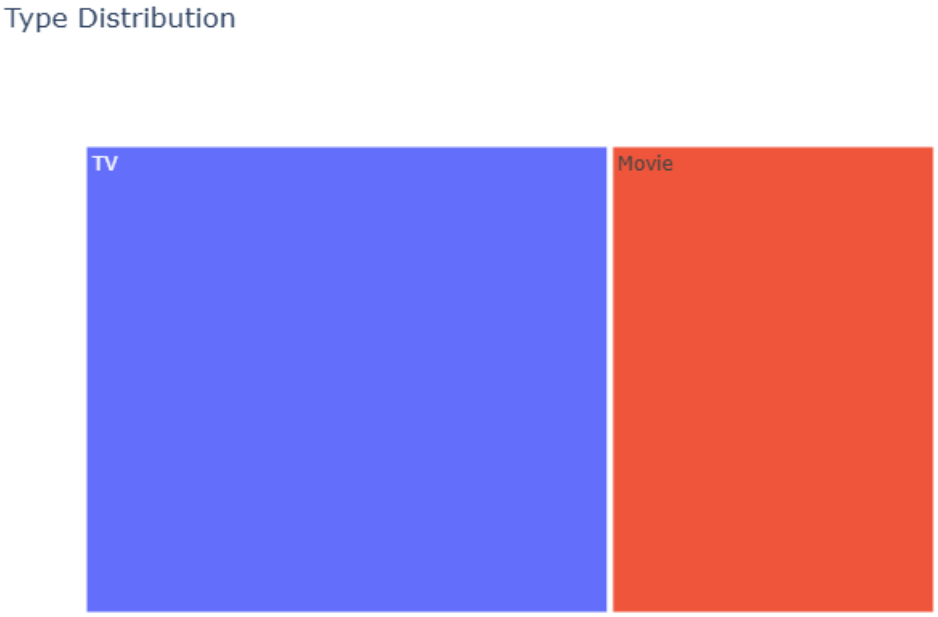


Left with the two types that we are interested in

[26]:
```
type_df = cu_anime_df["type"].value_counts().to_frame()
type_df = type_df.reset_index()
fig = px.treemap(type_df, path=['type'], values='count', title="Type␣
↪Distribution")
```

```
fig.
  ↪write_image(f"{plots_location}\\anime_recommendations_database\\type_distribution.
  ↪png")
Image(filename=f"{plots_location}\\anime_recommendations_database\\type_distribution.
  ↪png")
```

[26]:



[27]:
```
cu_anime_df.describe(include=object)
```

[27]:

	name	genre	type	episodes
count	6159	6104	6134	6159
unique	6159	2197	2	187
top	Kimi no Na wa.	Comedy	TV	1
freq	1	251	3787	2310

All the names are now unique
As we can see episodes is an object, we need to address that.

[28]:
```
cu_anime_df.describe()
```

[28]:

	anime_id	rating	members
count	6159.00000	5967.000000	6.159000e+03
mean	13165.83244	6.677637	3.022120e+04

```
std     11434.43139      1.051001  7.413151e+04
min         1.00000      1.920000  5.000000e+00
25%      2816.50000      6.150000  2.305000e+02
50%      9303.00000      6.800000  1.975000e+03
75%     23123.00000      7.390000  2.293150e+04
max     34527.00000     10.000000  1.013917e+06
```

Rating is what is called score in the other datasets and will be dropped.

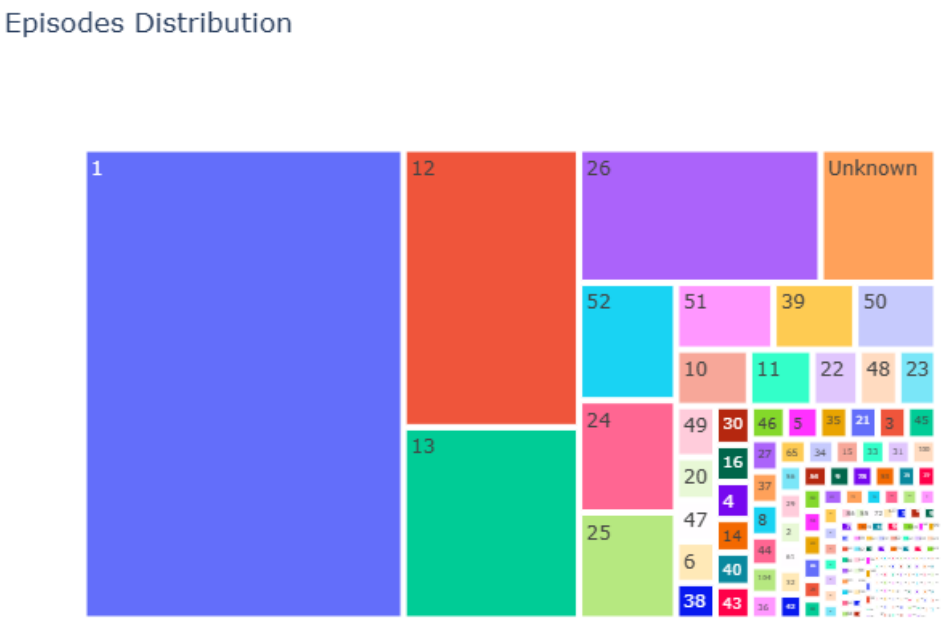
[29]:
```
cu_anime_df = cu_anime_df.drop(columns=["rating"])
```

[30]:
```
cu_anime_df["episodes"].unique()
```

[30]:
```
array(['1', '64', '51', '24', '10', '148', '13', '201', '25', '22', '75',
       '26', '12', '27', '43', '74', '37', '11', '2', '99', 'Unknown',
       '39', '101', '47', '50', '62', '33', '112', '23', '94', '40', '15',
       '203', '77', '291', '4', '120', '102', '96', '38', '79', '175',
       '103', '70', '153', '45', '21', '14', '63', '52', '5', '3', '145',
       '36', '69', '60', '178', '114', '35', '61', '34', '109', '49',
       '366', '97', '78', '358', '155', '20', '104', '113', '48', '54',
       '167', '161', '42', '142', '31', '373', '8', '220', '46', '195',
       '17', '1787', '73', '147', '127', '19', '6', '98', '150', '76',
       '53', '124', '29', '115', '224', '44', '58', '93', '154', '92',
       '67', '172', '9', '86', '30', '276', '59', '72', '330', '7', '41',
       '105', '128', '137', '56', '55', '65', '243', '193', '18', '191',
       '180', '91', '192', '66', '16', '182', '32', '164', '100', '296',
       '694', '95', '68', '117', '151', '130', '87', '170', '119', '84',
       '108', '28', '156', '140', '331', '305', '300', '510', '200', '88',
       '1471', '526', '143', '726', '136', '1818', '237', '1428', '365',
       '163', '283', '71', '260', '199', '225', '312', '240', '1306',
       '1565', '773', '110', '1274', '90', '475', '263', '83', '85',
       '1006', '80', '162', '132', '141', '125'], dtype=object)
```

[31]:
```
episodes_df = cu_anime_df["episodes"].value_counts().to_frame()
episodes_df = episodes_df.reset_index()
fig = px.treemap(episodes_df, path=['episodes'], values='count',␣
 ↪title="Episodes Distribution")
fig.
 ↪write_image(f"{plots_location}\\anime_recommendations_database\\episode_distribution.
 ↪png")
Image(filename=f"{plots_location}\\anime_recommendations_database\\episode_distribution.
 ↪png")
```

[31]:



Episodes have some missing values. After combining with the other datasets, we'll see if these are addressed.

[32]:
```
cu_anime_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 6159 entries, 0 to 12259
Data columns (total 6 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   anime_id  6159 non-null   int64
 1   name      6159 non-null   object
 2   genre     6104 non-null   object
 3   type      6134 non-null   object
 4   episodes  6159 non-null   object
 5   members   6159 non-null   int64
dtypes: int64(2), object(4)
memory usage: 336.8+ KB
```

Anime ratings for each user As a reminder we have some missing values in the form of negative values. These will be dropped

[33]:
```
cuRating = pd.read_csv("E:\\applied data science␣
 ↪capstone\\data\\CooperUnion\\archive\\rating.csv")
cuRating[cuRating["rating"] < 0].count()
```

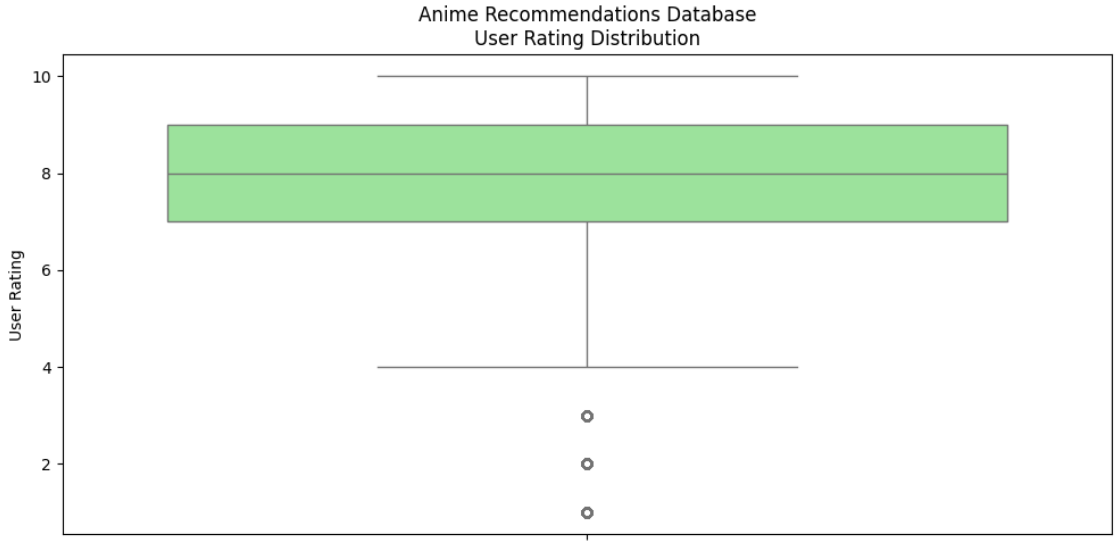
[33]:
```
user_id     1476496
anime_id    1476496
rating      1476496
dtype: int64
```

[34]:
```
cu_rating_df = cuRating[cuRating["rating"] >= 0]
cu_rating_df[cu_rating_df["rating"] < 0].count()
```

[34]:
```
user_id     0
anime_id    0
rating      0
dtype: int64
```

[35]:
```
import matplotlib.pyplot as plt
import seaborn as sns
```

[36]:
```
plt.figure(figsize=(10, 5))

sns.boxplot(data=cu_rating_df["rating"], color="lightgreen")
plt.title('Anime Recommendations Database\nUser Rating Distribution')
plt.ylabel('User Rating')

plt.tight_layout()
plt.
 ↪savefig(f"{plots_location}\\anime_recommendations_database\\user_rating_distribution.
 ↪png")
plt.show()
```



There are no more missing values.

0.1.2 Anime Recommendations Database 2020

Anime Listing First thing to do is to drop the scores features as it contains a lot of unknowns and they will not be used in the recommendation models.

[37]:
```
hernanAnime = pd.read_csv("E:\\applied data science␣
 ↪capstone\\data\\hernan4444\\archive\\anime-hernan.csv")
hernan_anime_df = hernanAnime.drop(columns=["Score-10", "Score-9", "Score-8",␣
 ↪"Score-7", "Score-6", "Score-5",
                                    "Score-4", "Score-3", "Score-2", "Score-1",␣
 ↪"Score"])
```

Removing the numeric columns that will not be used in the recommendation system as well as the Ranked column.

[38]:
```
hernan_anime_df = hernan_anime_df.drop(columns=["Popularity", "Members",␣
 ↪"Favorites", "Watching", "Completed", "On-Hold",
                                                 "Dropped", "Plan to Watch",␣
 ↪"Ranked"])
```

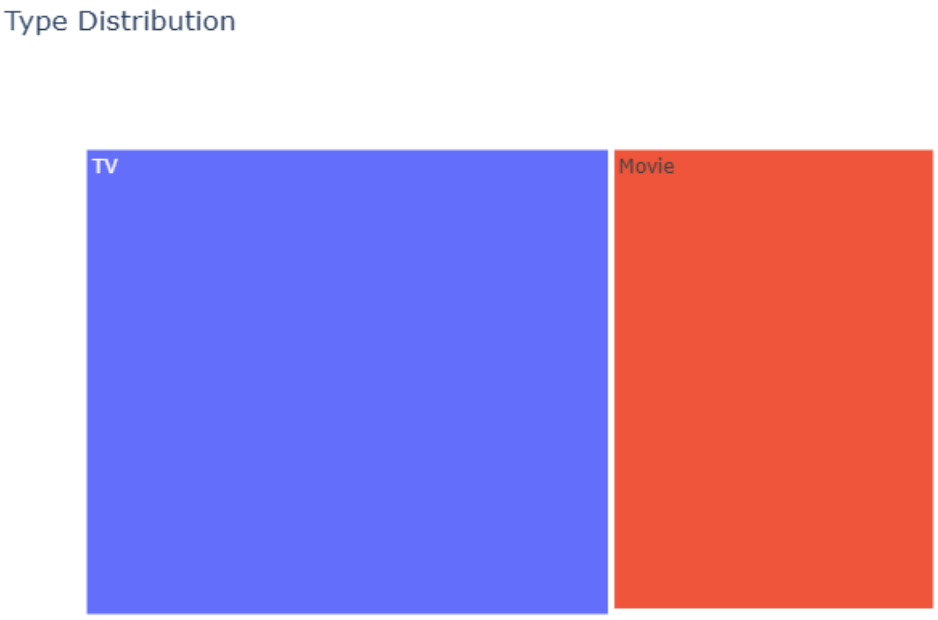
Rename the MAL_ID field to anime_id to make it easier to remove duplicate animes from the combined dataset in the future.

[39]:
```
hernan_anime_df = hernan_anime_df.rename(columns={"MAL_ID": "anime_id"})
```

Next is to remove the types that will provide no value. We will restrict the types to Tv, movie and unknown.

[40]:
```
hernan_anime_df = hernan_anime_df[hernan_anime_df["Type"].isin(["TV", "Movie",␣
 ↪"Unknown"])]
type_df = hernan_anime_df["Type"].value_counts().to_frame()
type_df = type_df.reset_index()
fig = px.treemap(type_df, path=['Type'], values='count', title="Type␣
 ↪Distribution")
fig.
 ↪write_image(f"{plots_location}\\anime_recommendation_2020\\type_distribution.
 ↪png")
Image(filename=f"{plots_location}\\anime_recommendation_2020\\type_distribution.
 ↪png")
```

[40]:



Unknown is a very small category with just 37. These may still be resolved once the datasets are combined.

Removing the English Name and Japanese Name columns. The name column can be used to determine the name of the anime. Also dropping the aired column.

[41]:
```
hernan_anime_df = hernan_anime_df.drop(columns=["English name", "Japanese␣
↪name", "Aired"])
```

Removing the adult content

[42]:
```
hernan_anime_df = hernan_anime_df[~hernan_anime_df["Genres"].str.
↪contains(r"(H|h)entai")]
```

```
C:\Users\Asus-Home\AppData\Local\Temp\ipykernel_26864\1558220493.py:1:
UserWarning:

This pattern is interpreted as a regular expression, and has match groups. To
actually get the groups, use str.extract.
```

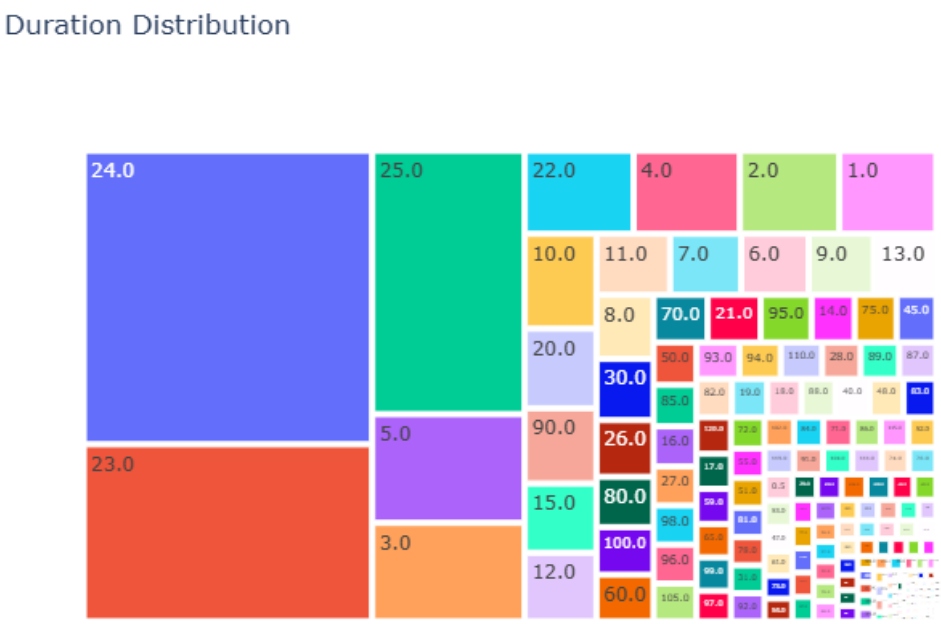
Converting the duration to minutes

[43]:
```
hernan_anime_df["Duration"] = hernan_anime_df["Duration"].apply(lambda x: x.
 ↪replace(" per ep.", ""))
```

[44]:
```
import numpy as np
def convert_duration_to_seconds(duration):
    if duration == "Unknown":
        return np.nan

    timeSplits = duration.split('.')
    seconds = 0

    for segment in timeSplits:
        segment = segment.strip()
        if 'sec' in segment:
            seconds += int(segment.split(' ')[0].strip())
        elif 'min' in segment:
            seconds += int(segment.split(' ')[0].strip()) * 60
        elif 'hr' in segment:
            seconds += int(segment.split(' ')[0].strip()) * 60 * 60

    return seconds
```

[45]:
```
hernan_anime_df["duration_in_minutes"] = hernan_anime_df["Duration"].
 ↪apply(lambda x: convert_duration_to_seconds(x) / 60)
hernan_anime_df = hernan_anime_df.drop(columns=["Duration"])

duration_df = hernan_anime_df["duration_in_minutes"].value_counts().to_frame()
duration_df = duration_df.reset_index()
fig = px.treemap(duration_df, path=['duration_in_minutes'], values='count',␣
 ↪title="Duration Distribution")
fig.
 ↪write_image(f"{plots_location}\\anime_recommendation_2020\\duration_in_distribution.
 ↪png")
Image(filename=f"{plots_location}\\anime_recommendation_2020\\duration_in_distribution.
 ↪png")
```

[45]:



Removing anime that are potentially music videos. Anime usually have a length of 23 minutes, anything below that is non-standard and has been removed if its genre is also music

[156]:
```
hernan_anime_df = hernan_anime_df[~((hernan_anime_df["Genres"] == "Music") \
    & (hernan_anime_df["duration_in_minutes"] < 20))]

hernan_anime_df.loc[hernan_anime_df["Type"] == "Unknown", ["Type"]] = None
hernan_anime_df.loc[hernan_anime_df["Genres"] == "Unknown", ["Genres"]] = None
hernan_anime_df.loc[hernan_anime_df["Premiered"] == "Unknown", ["Premiered"]] =␣
 ↪None
hernan_anime_df.loc[hernan_anime_df["Producers"] == "Unknown", ["Producers"]] =␣
 ↪None
hernan_anime_df.loc[hernan_anime_df["Licensors"] == "Unknown", ["Licensors"]] =␣
 ↪None
hernan_anime_df.loc[hernan_anime_df["Studios"] == "Unknown", ["Studios"]] = None
hernan_anime_df.loc[hernan_anime_df["Source"] == "Unknown", ["Source"]] = None
hernan_anime_df.loc[hernan_anime_df["Rating"] == "Unknown", ["Rating"]] = None

hernan_anime_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 8040 entries, 0 to 17561
```

```
Data columns (total 12 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   anime_id             8040 non-null   int64
 1   Name                 8040 non-null   object
 2   Genres               7988 non-null   object
 3   Type                 8003 non-null   object
 4   Episodes             8040 non-null   object
 5   Premiered            4739 non-null   object
 6   Producers            4958 non-null   object
 7   Licensors            2666 non-null   object
 8   Studios              5752 non-null   object
 9   Source               6443 non-null   object
 10  Rating               7585 non-null   object
 11  duration_in_minutes  7647 non-null   float64
dtypes: float64(1), int64(1), object(10)
memory usage: 816.6+ KB
```

Synopsis Data

[157]:
```
synopsis_df = pd.read_csv("E:\\applied data science capstone\\data\\hernan4444\\archive\\anime_with_synopsis.csv")
synopsis_df = synopsis_df.drop(columns=["Score"])
synopsis_df = synopsis_df.rename(columns={"MAL_ID": "anime_id", "sypnopsis": "synopsis"})
```

Fill the unknown synopsis with na so as to enable filling of missing values in the future

[158]:
```
synopsis_df.loc[synopsis_df["synopsis"].str.contains("No synopsis", na=False), "synopsis"] = np.nan
synopsis_df.describe(include=object)
```

[158]:
```
                                                   Name Genres  \
count                                             16214  16214
unique                                            16210   4857
top     Maou Gakuin no Futekigousha: Shijou Saikyou no…  Music
freq                                                  3    790

                    synopsis
count                  15461
unique                 15218
top     Furukawa Taku film.
freq                      13
```

[159]:
```
synopsis_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 16214 entries, 0 to 16213
Data columns (total 4 columns):
```

```
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   anime_id  16214 non-null  int64
 1   Name      16214 non-null  object
 2   Genres    16214 non-null  object
 3   synopsis  15461 non-null  object
dtypes: int64(1), object(3)
memory usage: 506.8+ KB
```

0.1.3 MyAnimeList Comment Dataset V2

Anime Listing Remove the id and jpName columns as well as consolidate the anime title column

[160]:
```
natleeAnime = pd.read_csv("E:\\applied data science␣
 ↪capstone\\data\\natlee\\archive\\anime_list.csv")
natlee_anime_df = natleeAnime.drop(columns=["id", "jpName", "score",␣
 ↪"scoredByUser", "aired"])

natlee_anime_df["title"] = natlee_anime_df["engName"]
natlee_anime_df["title"] = natlee_anime_df["title"].
 ↪fillna(natlee_anime_df["synonymsName"])
natlee_anime_df = natlee_anime_df.dropna(subset=["title"])
natlee_anime_df = natlee_anime_df.drop(columns=["engName", "synonymsName"])
```

Convert the episodes column to a numeric feature

[161]:
```
natlee_anime_df["episodes"] = pd.to_numeric(natlee_anime_df["episodes"],␣
 ↪errors='coerce')
```

Standardize the missing values

[162]:
```
natlee_anime_df.loc[natlee_anime_df["producer"] == "add some", "producer"] =␣
 ↪None
natlee_anime_df.loc[natlee_anime_df["licensors"] == "add some", "licensors"] =␣
 ↪None
natlee_anime_df.loc[natlee_anime_df["studios"] == "add some", "studios"] = None
natlee_anime_df.loc[natlee_anime_df["source"] == "Unknown", "source"] = None
```

Remove all types except for movie and tv

[163]:
```
natlee_anime_df = natlee_anime_df[natlee_anime_df["workType"].isin(["TV",␣
 ↪"Movie"])]
```

Remove adult content

[164]:
```
natlee_anime_df["genres"] = natlee_anime_df["genres"].astype(str)
natlee_anime_df = natlee_anime_df[~natlee_anime_df["genres"].str.
 ↪contains(r"(H|h)entai")]
```

```
C:\Users\Asus-Home\AppData\Local\Temp\ipykernel_16148\2037110495.py:2:
UserWarning:

This pattern is interpreted as a regular expression, and has match groups. To
actually get the groups, use str.extract.
```

Convert duration to minutes

[165]:
```
natlee_anime_df["duration_in_minutes"] = natlee_anime_df["duration"] \
    .apply(lambda x: convert_duration_to_seconds(x) / 60)
```

Remove unused columns

[166]:
```
natlee_anime_df = natlee_anime_df.drop(columns=["popularityRank", "allRank",␣
 ↪"members", "favorites", "lastUpdate", "duration"])
natlee_anime_df = natlee_anime_df.rename(columns={"workId": "anime_id",␣
 ↪"workType": "type"})

natlee_anime_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 8649 entries, 0 to 24588
Data columns (total 17 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   anime_id             8649 non-null   int64
 1   url                  8649 non-null   object
 2   type                 8649 non-null   object
 3   episodes             8452 non-null   float64
 4   status               8649 non-null   object
 5   premiered            4588 non-null   object
 6   producer             4987 non-null   object
 7   broadcast            5297 non-null   object
 8   licensors            2857 non-null   object
 9   studios              6032 non-null   object
 10  genres               8649 non-null   object
 11  themes               4986 non-null   object
 12  demographic          3774 non-null   object
 13  source               7277 non-null   object
 14  rating               8392 non-null   object
 15  title                8649 non-null   object
 16  duration_in_minutes  8402 non-null   float64
dtypes: float64(2), int64(1), object(14)
memory usage: 1.2+ MB
```

0.1.4 Combining datasets

Anime Listing

Combining natlee and cooper

[167]:
```
temp_merged_anime_df = natlee_anime_df.merge(cu_anime_df, \
    how="outer", on="anime_id", suffixes=("_nat", "_coop"))

temp_merged_anime_df["title"] = temp_merged_anime_df["title"] \
    .fillna(temp_merged_anime_df["name"])
temp_merged_anime_df["type_nat"] = temp_merged_anime_df["type_nat"] \
    .fillna(temp_merged_anime_df["type_coop"])
temp_merged_anime_df["episodes_nat"] = temp_merged_anime_df["episodes_nat"] \
    .fillna(temp_merged_anime_df["episodes_coop"])
temp_merged_anime_df["genres"] = temp_merged_anime_df["genres"] \
    .fillna(temp_merged_anime_df["genre"])

temp_merged_anime_df = temp_merged_anime_df.drop(columns=["name", "type_coop", \
    "episodes_coop", "genre", "members"])
temp_merged_anime_df = temp_merged_anime_df.rename(columns={"type_nat": "type",␣
 ↪\
    "episodes_nat": "episodes"})
```

Combining hernan and the combined dataset

[168]:
```
merged_anime_df = temp_merged_anime_df.merge(hernan_anime_df, how="outer", \
    on="anime_id", suffixes=("_orig", "_hern"))

merged_anime_df["title"] = merged_anime_df["title"].
 ↪fillna(merged_anime_df["Name"])
merged_anime_df["type"] = merged_anime_df["type"].
 ↪fillna(merged_anime_df["Type"])
merged_anime_df["episodes"] = merged_anime_df["episodes"].
 ↪fillna(merged_anime_df["Episodes"])
merged_anime_df["premiered"] = merged_anime_df["premiered"].
 ↪fillna(merged_anime_df["Premiered"])
merged_anime_df["producer"] = merged_anime_df["producer"].
 ↪fillna(merged_anime_df["Producers"])
merged_anime_df["licensors"] = merged_anime_df["licensors"].
 ↪fillna(merged_anime_df["Licensors"])
merged_anime_df["studios"] = merged_anime_df["studios"].
 ↪fillna(merged_anime_df["Studios"])
merged_anime_df["genres"] = merged_anime_df["genres"].
 ↪fillna(merged_anime_df["Genres"])
merged_anime_df["source"] = merged_anime_df["source"].
 ↪fillna(merged_anime_df["Source"])
merged_anime_df["rating"] = merged_anime_df["rating"].
 ↪fillna(merged_anime_df["Rating"])
merged_anime_df["duration_in_minutes_orig"] =␣
 ↪merged_anime_df["duration_in_minutes_orig"] \
    .fillna(merged_anime_df["duration_in_minutes_hern"])
```

```
merged_anime_df = merged_anime_df.drop(columns=["Name", "Type", "Episodes",␣
 ↪"Premiered", "Producers",
                                                "Licensors",␣
 ↪"Studios", "Genres", "Source", "Rating", "duration_in_minutes_hern"])
merged_anime_df = merged_anime_df.rename(columns={"duration_in_minutes_orig":␣
 ↪"duration_in_minutes"})

merged_anime_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10062 entries, 0 to 10061
Data columns (total 17 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   anime_id             10062 non-null  int64
 1   url                  8649 non-null   object
 2   type                 10040 non-null  object
 3   episodes             9902 non-null   object
 4   status               8649 non-null   object
 5   premiered            5295 non-null   object
 6   producer             5732 non-null   object
 7   broadcast            5297 non-null   object
 8   licensors            3009 non-null   object
 9   studios              6802 non-null   object
 10  genres               10035 non-null  object
 11  themes               4986 non-null   object
 12  demographic          3774 non-null   object
 13  source               8252 non-null   object
 14  rating               9622 non-null   object
 15  title                10062 non-null  object
 16  duration_in_minutes  9640 non-null   float64
dtypes: float64(1), int64(1), object(15)
memory usage: 1.3+ MB
```

Combining synopsis data

[169]:
```
anime_with_synopsis_df = merged_anime_df.merge(synopsis_df, how="left", \
    on="anime_id", suffixes=("_orig", "_syn"))
anime_with_synopsis_df["genres"] = anime_with_synopsis_df["genres"] \
    .fillna(anime_with_synopsis_df["Genres"])
anime_with_synopsis_df = anime_with_synopsis_df.drop(columns=["Name", "Genres"])

anime_with_synopsis_df.describe(include=object)
```

[169]:

	url	type	episodes	\
count	8649	10040	9902.0	
unique	8649	2	299.0	

```
top     https://myanimelist.net/anime/1/Cowboy_Bebop     TV       1.0
freq                                                1   6079    3271.0

                  status    premiered producer broadcast   licensors  \
count               8649         5295     5732      5297        3009
unique                 3          241     3267       525         212
top     Finished Airing  Spring 2017      NHK   Unknown  Funimation
freq                8360           87      130      2375         719

                studios genres      themes demographic    source  \
count              6802  10061        4986        3774      8252
unique              843   1222         596           5        17
top     Toei Animation    nan  Historical        Kids  Original
freq                560    900         351        1913      3351

                           rating           title             synopsis
count                        9622           10062                 7690
unique                          5            9937                 7544
top     PG-13 - Teens 13 or older  Butt Detective  Furukawa Taku film.
freq                         3736               7                   13
```

[170]:
```
anime_with_synopsis_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10062 entries, 0 to 10061
Data columns (total 18 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   anime_id             10062 non-null  int64
 1   url                  8649 non-null   object
 2   type                 10040 non-null  object
 3   episodes             9902 non-null   object
 4   status               8649 non-null   object
 5   premiered            5295 non-null   object
 6   producer             5732 non-null   object
 7   broadcast            5297 non-null   object
 8   licensors            3009 non-null   object
 9   studios              6802 non-null   object
 10  genres               10061 non-null  object
 11  themes               4986 non-null   object
 12  demographic          3774 non-null   object
 13  source               8252 non-null   object
 14  rating               9622 non-null   object
 15  title                10062 non-null  object
 16  duration_in_minutes  9640 non-null   float64
 17  synopsis             7690 non-null   object
dtypes: float64(1), int64(1), object(16)
memory usage: 1.4+ MB
```

There are still considerable missing data. The unofficial api will be used to gather additional information for the missing data. See additional-synopsis.py in appendix for code used to retrieve the additional synopsis data.
The data will be retrieved from the csv file it was stored in.

[171]:
```
anime_with_synopsis_df.to_csv("E:\\applied data science␣
↪capstone\\data\\documentation\\anime_with_synopsis.csv", index=False)
```

Additional Synopsis

[172]:
```
additional_synopsis_df = pd.read_csv("E:\\applied data science␣
↪capstone\\data\\combined\\anime_with_missing_synopses.csv")
additional_synopsis_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5283 entries, 0 to 5282
Data columns (total 18 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   mal_id        5283 non-null   int64
 1   url           5283 non-null   object
 2   title         5283 non-null   object
 3   type          5276 non-null   object
 4   source        5283 non-null   object
 5   episodes      5223 non-null   float64
 6   status        5283 non-null   object
 7   premiered     5180 non-null   object
 8   duration      5283 non-null   object
 9   rating        5200 non-null   object
 10  synopsis      3418 non-null   object
 11  broadcast     1217 non-null   object
 12  producers     2204 non-null   object
 13  licensors     686 non-null    object
 14  studios       2872 non-null   object
 15  genres        4131 non-null   object
 16  themes        2487 non-null   object
 17  demographics  1792 non-null   object
dtypes: float64(1), int64(1), object(16)
memory usage: 743.1+ KB
```

[173]:
```
additional_synopsis_df = additional_synopsis_df.rename(columns={"mal_id":␣
↪"anime_id"})
combined_synopsis_df = anime_with_synopsis_df.merge(additional_synopsis_df,␣
↪how="left", on="anime_id", suffixes=("_orig", "_add"))
combined_synopsis_df["synopsis_orig"] = combined_synopsis_df["synopsis_orig"].
↪fillna(combined_synopsis_df["synopsis_add"])
combined_synopsis_df.loc[combined_synopsis_df["synopsis_orig"].str.contains("No␣
↪synopsis")
```

```
                        & ~combined_synopsis_df["synopsis_orig"].isna(),␣
↪"synopsis_orig"] = None
```

Fill in missing data where possible

[174]:
```
combined_synopsis_df["url_orig"] = combined_synopsis_df["url_orig"] \
    .fillna(combined_synopsis_df["url_add"])
combined_synopsis_df["episodes_orig"] = combined_synopsis_df["episodes_orig"] \
    .fillna(combined_synopsis_df["episodes_add"])
combined_synopsis_df["status_orig"] = combined_synopsis_df["status_orig"] \
    .fillna(combined_synopsis_df["status_add"])
combined_synopsis_df["premiered_orig"] = combined_synopsis_df["premiered_orig"]␣
↪\
    .fillna(combined_synopsis_df["premiered_add"])
combined_synopsis_df["broadcast_orig"] = combined_synopsis_df["broadcast_orig"]␣
↪\
    .fillna(combined_synopsis_df["broadcast_add"])
combined_synopsis_df["licensors_orig"] = combined_synopsis_df["licensors_orig"]␣
↪\
    .fillna(combined_synopsis_df["licensors_add"])
combined_synopsis_df["studios_orig"] = combined_synopsis_df["studios_orig"] \
    .fillna(combined_synopsis_df["studios_add"])
combined_synopsis_df["genres_orig"] = combined_synopsis_df["genres_orig"] \
    .fillna(combined_synopsis_df["genres_add"])
combined_synopsis_df["themes_orig"] = combined_synopsis_df["themes_orig"] \
    .fillna(combined_synopsis_df["themes_add"])
combined_synopsis_df["source_orig"] = combined_synopsis_df["source_orig"] \
    .fillna(combined_synopsis_df["source_add"])
combined_synopsis_df["rating_orig"] = combined_synopsis_df["rating_orig"] \
    .fillna(combined_synopsis_df["rating_add"])
combined_synopsis_df["producer"] = combined_synopsis_df["producer"] \
    .fillna(combined_synopsis_df["producers"])
combined_synopsis_df["demographic"] = combined_synopsis_df["demographic"] \
    .fillna(combined_synopsis_df["demographics"])

combined_synopsis_df[combined_synopsis_df["synopsis_orig"].isna()].head()
```

[174]:

	anime_id	url_orig	type_orig	episodes_orig	status_orig	premiered_orig	producer
1266	2265	NaN	Movie	1	NaN	NaN	NaN
1267	2268	NaN	TV	98	NaN	NaN	NaN
1422	2626	https://myanimelist.net/anime/2626/The%E2%98%8…	Movie				
1423	2628	https://myanimelist.net/anime/2628/The%E2%98%8…	Movie				
1425	2633	https://myanimelist.net/anime/2633/The%E2%98%8…	Movie				

```
1422           1.0  Finished Airing  1998-03-07T00:00:00+00:00      NaN
1423           1.0  Finished Airing  1999-03-06T00:00:00+00:00      NaN
1425           1.0  Finished Airing  2000-03-11T00:00:00+00:00      NaN

     broadcast_orig licensors_orig       studios_orig  … duration  \
1266            NaN            NaN                NaN  …      NaN
1267            NaN            NaN                NaN  …      NaN
1422            NaN            NaN  Shin-Ei Animation  …   16 min
1423            NaN            NaN  Shin-Ei Animation  …   16 min
1425            NaN            NaN  Shin-Ei Animation  …   17 min

         rating_add synopsis_add broadcast_add producers licensors_add  \
1266            NaN          NaN           NaN       NaN           NaN
1267            NaN          NaN           NaN       NaN           NaN
1422  PG - Children          NaN           NaN       NaN           NaN
1423  PG - Children          NaN           NaN       NaN           NaN
1425  PG - Children          NaN           NaN       NaN           NaN

            studios_add                          genres_add themes_add  \
1266                NaN                                 NaN        NaN
1267                NaN                                 NaN        NaN
1422  Shin-Ei Animation                             Fantasy        NaN
1423  Shin-Ei Animation                             Fantasy        NaN
1425  Shin-Ei Animation  Adventure, Comedy, Fantasy, Sci-Fi        NaN

       demographics
1266            NaN
1267            NaN
1422            NaN
1423            NaN
1425  Kids, Shounen

[5 rows x 35 columns]
```

Filling in the missing data for Doraemon

[175]:
```
combined_synopsis_df.loc[combined_synopsis_df["title_orig"].str.
 ↪contains("Doraemon") \
   & combined_synopsis_df["synopsis_orig"].isna(), "synopsis_orig"] = "Another␣
 ↪entry in the Doraemon media franchise"
combined_synopsis_df[combined_synopsis_df["synopsis_orig"].isna()].head()
```

[175]:
```
      anime_id                                          url_orig type_orig  \
1266      2265                                               NaN     Movie
1267      2268                                               NaN        TV
1426      2636  https://myanimelist.net/anime/2636/Dorami-chan…     Movie
1428      2642  https://myanimelist.net/anime/2642/Dorami-chan…     Movie
```

```
1474      2701  https://myanimelist.net/anime/2701/Susie-chan_…        TV

     episodes_orig      status_orig             premiered_orig  \
1266             1              NaN                        NaN
1267            98              NaN                        NaN
1426           1.0  Finished Airing  1991-03-09T00:00:00+00:00
1428           1.0  Finished Airing  1994-03-12T00:00:00+00:00
1474         104.0  Finished Airing                Spring 1999

                   producer broadcast_orig licensors_orig       studios_orig  \
1266                    NaN            NaN            NaN                NaN
1267                    NaN            NaN            NaN                NaN
1426                    NaN            NaN            NaN  Shin-Ei Animation
1428                    NaN            NaN            NaN  Shin-Ei Animation
1474  Shogakukan Productions        Unknown            NaN              Xebec

      …       duration    rating_add synopsis_add broadcast_add  \
1266  …            NaN           NaN          NaN           NaN
1267  …            NaN           NaN          NaN           NaN
1426  …         40 min  G - All Ages          NaN           NaN
1428  …         15 min  G - All Ages          NaN           NaN
1474  …  15 min per ep           NaN          NaN       Unknown

                   producers licensors_add        studios_add genres_add  \
1266                    NaN           NaN                NaN        NaN
1267                    NaN           NaN                NaN        NaN
1426                    NaN           NaN  Shin-Ei Animation    Fantasy
1428                    NaN           NaN  Shin-Ei Animation    Fantasy
1474  Shogakukan Productions           NaN              Xebec     Comedy

     themes_add demographics
1266        NaN          NaN
1267        NaN          NaN
1426        NaN          NaN
1428        NaN         Kids
1474        NaN         Kids

[5 rows x 35 columns]
```

Filling in the missing data for Dorami-chan

[176]:
```
combined_synopsis_df.loc[combined_synopsis_df["title_orig"].str.
 ↪contains("Dorami-chan") \
   & combined_synopsis_df["synopsis_orig"].isna(), "synopsis_orig"] = "Another␣
 ↪entry in the Dorami-chan media franchise"
combined_synopsis_df[combined_synopsis_df["synopsis_orig"].isna()].head()
```

[176]:

```
      anime_id                                          url_orig type_orig  \
1266      2265                                               NaN     Movie
1267      2268                                               NaN        TV
1474      2701  https://myanimelist.net/anime/2701/Susie-chan_…        TV
1481      2708      https://myanimelist.net/anime/2708/Wankorobee        TV
1591      2930  https://myanimelist.net/anime/2930/Tensai_Dr_H…        TV

     episodes_orig      status_orig premiered_orig  \
1266             1              NaN            NaN
1267            98              NaN            NaN
1474         104.0  Finished Airing    Spring 1999
1481            26  Finished Airing      Fall 1996
1591            12  Finished Airing      Fall 2007

                                     producer          broadcast_orig  \
1266                                      NaN                     NaN
1267                                      NaN                     NaN
1474                    Shogakukan Productions                 Unknown
1481                                      NaN  Sundays at 10:30 (JST)
1591  Trans Arts, Tohokushinsha Film Corporation                 Unknown

     licensors_orig               studios_orig  …       duration  \
1266            NaN                        NaN  …            NaN
1267            NaN                        NaN  …            NaN
1474            NaN                      Xebec  …  15 min per ep
1481            NaN  Ajia-Do, TMS Entertainment  …  15 min per ep
1591            NaN              Production I.G  …  23 min per ep

       rating_add                                        synopsis_add  \
1266          NaN                                                 NaN
1267          NaN                                                 NaN
1474          NaN                                                 NaN
1481  G - All Ages                                                NaN
1591  G - All Ages  No synopsis has been added for this series yet…

              broadcast_add                                    producers  \
1266                    NaN                                          NaN
1267                    NaN                                          NaN
1474                Unknown                       Shogakukan Productions
1481  Sundays at 10:30 (JST)                                         NaN
1591                Unknown  Production I.G, Tohokushinsha Film Corporation

     licensors_add                studios_add       genres_add themes_add  \
1266           NaN                        NaN              NaN        NaN
1267           NaN                        NaN              NaN        NaN
1474           NaN                      Xebec           Comedy        NaN
1481           NaN  Ajia-do, TMS Entertainment  Comedy, Fantasy        NaN
```

```
1591          NaN                  Trans Arts          Comedy        NaN

     demographics
1266          NaN
1267          NaN
1474         Kids
1481         Kids
1591          NaN

[5 rows x 35 columns]
```

[177]:
```
combined_synopsis_df.loc[combined_synopsis_df["title_orig"].str.
 ↪contains("Cynical Hysterie Hour"), \
    ["anime_id", "title_orig", "synopsis_orig" ,"synopsis_add"]]
```

[177]:
```
      anime_id                                 title_orig synopsis_orig  \
2567      6759       Cynical Hysterie Hour: Trip Coaster           None
2568      6760    Cynical Hysterie Hour: Ch Ch Ch Change           None
2569      6761  Cynical Hysterie Hour: Through the Night           None
2570      6762     Cynical Hysterie Hour: Utakata no Uta           None

                                          synopsis_add
2567  No synopsis has been added for this series yet…
2568  No synopsis has been added for this series yet…
2569  No synopsis has been added for this series yet…
2570  No synopsis has been added for this series yet…
```

[178]:
```
combined_synopsis_df.loc[combined_synopsis_df["title_orig"].str.
 ↪contains("Cynical Hysterie Hour") \
    & combined_synopsis_df["synopsis_orig"].isna(), "synopsis_orig"] =␣
 ↪"'Selfish, mean and manipulative'. These are some of the words that people␣
 ↪use about Tsuneko. But Tsuneko herself has no doubt that she is the most␣
 ↪popular person in her elementary school class. Her best friends are Kiriko,␣
 ↪the calm one, Hanako, the little madam, Nono, the cutie, Shee, the firm one,␣
 ↪and Tsunta, the punk. These stories of their day-to-day lives are full of␣
 ↪delightful observations about being a child and growing up in Japan."
combined_synopsis_df.loc[combined_synopsis_df["title_orig"].str.
 ↪contains("Pleasant Goat and Big Big Wolf") & \
    combined_synopsis_df["synopsis_orig"].isna(), ["anime_id", "title_orig",␣
 ↪"synopsis_orig", "synopsis_add"]].head()
```

[178]:
```
      anime_id                                        title_orig  \
8299     43983    Pleasant Goat and Big Big Wolf: Joys of Seasons
8300     43984      Pleasant Goat and Big Big Wolf: Smart Dodging
8301     43985  Pleasant Goat and Big Big Wolf: Happy, Happy, …
8302     43986  Pleasant Goat and Big Big Wolf: The Athletic C…
8303     43987    Pleasant Goat and Big Big Wolf: The Happy Diary
```

```
     synopsis_orig synopsis_add
8299           NaN          NaN
8300           NaN          NaN
8301           NaN          NaN
8302           NaN          NaN
8303           NaN          NaN
```

[179]:
```
combined_synopsis_df.loc[combined_synopsis_df["title_orig"].str.
 ↪contains("Pleasant Goat and Big Big Wolf") & \
    combined_synopsis_df["synopsis_orig"].isna(), "synopsis_orig"] = "Another␣
 ↪entry in the Pleasant Goat and Big Big Wolf franchise"
combined_synopsis_df =␣
 ↪combined_synopsis_df[~combined_synopsis_df["synopsis_orig"].isna()]
combined_synopsis_df = combined_synopsis_df.drop(columns=["url_add",␣
 ↪"title_add", "type_add", "source_add", "episodes_add", "status_add", \
    "premiered_add", "duration", "rating_add", "synopsis_add", "broadcast_add",␣
 ↪"producers", \
        "licensors_add", "studios_add", "genres_add", "themes_add",␣
 ↪"demographics"])

name_map = { col:col.split("_")[0] for col in combined_synopsis_df.columns if␣
 ↪len(col.split("_")) > 1 \
    and col.split("_")[1] == "orig"}
combined_synopsis_df = combined_synopsis_df.rename(columns=name_map)

combined_synopsis_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 8759 entries, 0 to 10061
Data columns (total 18 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   anime_id        8759 non-null   int64
 1   url             7569 non-null   object
 2   type            8743 non-null   object
 3   episodes        8748 non-null   object
 4   status          7569 non-null   object
 5   premiered       5773 non-null   object
 6   producer        5721 non-null   object
 7   broadcast       4688 non-null   object
 8   licensors       3080 non-null   object
 9   studios         6578 non-null   object
 10  genres          8759 non-null   object
 11  themes          4685 non-null   object
 12  demographic     2891 non-null   object
 13  source          7488 non-null   object
```

```
 14  rating                8500 non-null   object
 15  title                 8759 non-null   object
 16  duration_in_minutes   8413 non-null   float64
 17  synopsis              8759 non-null   object
dtypes: float64(1), int64(1), object(16)
memory usage: 1.3+ MB
```

Store anime_id of anime with missing data to retrieve additional information from the API

[180]:
```
missingAnime = combined_synopsis_df.loc[combined_synopsis_df["url"].isna(),␣
 ↪"anime_id"].to_list()
missingAnime = combined_synopsis_df.loc[combined_synopsis_df["type"].isna(),␣
 ↪"anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["episodes"].
 ↪isna(), "anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["status"].isna(),␣
 ↪"anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["premiered"].
 ↪isna(), "anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["producer"].
 ↪isna(), "anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["broadcast"].
 ↪isna(), "anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["licensors"].
 ↪isna(), "anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["studios"].
 ↪isna(), "anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["genres"].isna(),␣
 ↪"anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["themes"].isna(),␣
 ↪"anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["demographic"].
 ↪isna(), "anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["source"].isna(),␣
 ↪"anime_id"].to_list()
missingAnime += combined_synopsis_df.loc[combined_synopsis_df["rating"].isna(),␣
 ↪"anime_id"].to_list()
missingAnime += combined_synopsis_df.
 ↪loc[combined_synopsis_df["duration_in_minutes"].isna(), "anime_id"] \
    .to_list()

missingAnime = list(set(missingAnime))
missingAnime = pd.Series(missingAnime, name="anime_id")

missingAnime.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime_with_missing_data_11_Jun.csv", \
    index=False)
```

Used contents in **anime-narrowing/anime-reduced.py** to retrieve the missing data from the API

[181]:
```
additional_anime_data_df = pd.read_csv("E:\\applied data science␣
↪capstone\\data\\combined\\anime-data-12-Jun\\anime_list_12_Jun.csv")
additional_anime_data_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8636 entries, 0 to 8635
Data columns (total 18 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   mal_id        8636 non-null   int64
 1   url           8636 non-null   object
 2   title         8636 non-null   object
 3   type          8635 non-null   object
 4   source        8636 non-null   object
 5   episodes      8586 non-null   float64
 6   status        8636 non-null   object
 7   premiered     8606 non-null   object
 8   duration      8636 non-null   object
 9   rating        8484 non-null   object
 10  synopsis      8605 non-null   object
 11  broadcast     5269 non-null   object
 12  producers     5694 non-null   object
 13  licensors     3195 non-null   object
 14  studios       6834 non-null   object
 15  genres        8066 non-null   object
 16  themes        5357 non-null   object
 17  demographics  3251 non-null   object
dtypes: float64(1), int64(1), object(16)
memory usage: 1.2+ MB
```

[182]:
```
additional_anime_data_df = additional_anime_data_df.rename(columns={"mal_id":␣
↪"anime_id"})

merged_df = combined_synopsis_df.merge(additional_anime_data_df, how="left", \
    on="anime_id", suffixes=("", "_add"))

merged_df["url"] = merged_df["url"].fillna(merged_df["url_add"])
merged_df["type"] = merged_df["type"].fillna(merged_df["type_add"])
merged_df["source"] = merged_df["source"].fillna(merged_df["source_add"])
merged_df["episodes"] = merged_df["episodes"].fillna(merged_df["episodes_add"])
merged_df["status"] = merged_df["status"].fillna(merged_df["status_add"])
merged_df["premiered"] = merged_df["premiered"].
↪fillna(merged_df["premiered_add"])
merged_df["producer"] = merged_df["producer"].fillna(merged_df["producers"])
```

```
merged_df["broadcast"] = merged_df["broadcast"].
  ↪fillna(merged_df["broadcast_add"])
merged_df["licensors"] = merged_df["licensors"].
  ↪fillna(merged_df["licensors_add"])
merged_df["studios"] = merged_df["studios"].fillna(merged_df["studios_add"])
merged_df["genres"] = merged_df["genres"].fillna(merged_df["genres_add"])
merged_df["themes"] = merged_df["themes"].fillna(merged_df["themes_add"])
merged_df["demographic"] = merged_df["demographic"].
  ↪fillna(merged_df["demographics"])
merged_df["rating"] = merged_df["rating"].fillna(merged_df["rating_add"])
merged_df["duration_in_minutes"] = merged_df["duration_in_minutes"].
  ↪fillna(merged_df["duration"])

merged_df = merged_df.drop(columns=["url_add", "title_add", "type_add",␣
  ↪"source_add", "episodes_add", "status_add", \
     "premiered_add", "duration", "rating_add", "synopsis_add", "broadcast_add",␣
  ↪"producers", \
         "licensors_add", "studios_add", "genres_add", "themes_add",␣
  ↪"demographics"])

merged_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8759 entries, 0 to 8758
Data columns (total 18 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   anime_id             8759 non-null   int64
 1   url                  8646 non-null   object
 2   type                 8743 non-null   object
 3   episodes             8748 non-null   object
 4   status               8646 non-null   object
 5   premiered            8636 non-null   object
 6   producer             5956 non-null   object
 7   broadcast            5310 non-null   object
 8   licensors            3220 non-null   object
 9   studios              6908 non-null   object
 10  genres               8759 non-null   object
 11  themes               5424 non-null   object
 12  demographic          3370 non-null   object
 13  source               8738 non-null   object
 14  rating               8562 non-null   object
 15  title                8759 non-null   object
 16  duration_in_minutes  8704 non-null   object
 17  synopsis             8759 non-null   object
dtypes: int64(1), object(17)
memory usage: 1.2+ MB
```

[183]:
```
missing_placeholder = "Unknown"
merged_df["url"] = merged_df["url"].fillna(missing_placeholder)

merged_df["status"].value_counts()
```

[183]:
```
status
Finished Airing     8363
Not yet aired        197
Currently Airing      86
Name: count, dtype: int64
```

[184]:
```
merged_df = merged_df.loc[~merged_df["status"].isin(["Not yet aired"]), :]
```

Remove the not yet aired anime as they would not have been rated

[185]:
```
def is_number(s):
    try:
        float(s)
        return True
    except ValueError:
        return False

def convert_duration_to_seconds(duration):
    if duration is None:
        return 0

    if is_number(duration):
        return float(duration) * 60

    timeSplits = duration.split('.')
    seconds = 0

    for segment in timeSplits:
        segment = segment.strip()
        if 'sec' in segment:
            seconds += int(segment.split(' ')[0].strip())
        elif 'min' in segment:
            seconds += int(segment.split(' ')[0].strip()) * 60
        elif 'hr' in segment:
            seconds += int(segment.split(' ')[0].strip()) * 60 * 60

    return seconds
```

Convert duration of new anime to minutes using function defined above

[186]:
```
merged_df["duration_in_minutes"] = merged_df["duration_in_minutes"] \
    .apply(lambda x: convert_duration_to_seconds(x) / 60)
```

Take a look at anime with a duration less than 20 minutes

[187]:
```
merged_df.loc[merged_df["duration_in_minutes"] < 20, :].head()
```

[187]:

```
     anime_id                                                url type  \
83        112  https://myanimelist.net/anime/112/Chou_Henshin…   TV
85        114  https://myanimelist.net/anime/114/Sakigake_Cro…   TV
88        119   https://myanimelist.net/anime/119/Final_Approach   TV
151       197        https://myanimelist.net/anime/197/Rizelmine   TV
172       231  https://myanimelist.net/anime/231/Asagiri_no_Miko   TV

    episodes           status    premiered  \
83       8.0  Finished Airing  Winter 2004
85      26.0  Finished Airing    Fall 2003
88        13  Finished Airing    Fall 2004
151       24  Finished Airing  Spring 2002
172     26.0  Finished Airing  Summer 2002

                                          producer  \
83                                          m.o.e.
85                                TV Tokyo Music
88                             Trinet Entertainment
151                                         m.o.e.
172  Starchild Records, TV Tokyo Music, Shounen Gah…

                broadcast                                       licensors  \
83                Unknown                                             NaN
85   Fridays at 01:00 (JST)  ADV Films, Sentai Filmworks, Discotek Media
88                Unknown                                             NaN
151               Unknown                                             NaN
172               Unknown                   Media Blasters, NYAV Post

                  studios                                          genres  \
83     Imagin, Studio Live  Action, Adventure, Comedy, Fantasy, Sci-Fi, Ecchi
85          Production I.G                                          Comedy
88                   Zexcs             Comedy, Drama, Romance, Slice of Life
151       Madhouse, Imagin            Comedy, Ecchi, Romance, School, Sci-Fi
172  Chaos Project, GANSIS             Action, Comedy, Fantasy, Supernatural

                          themes demographic        source  \
83                    Super Power         NaN      Original
85   Delinquents, Gag Humor, School     Shounen         Manga
88                              NaN         NaN  Visual novel
151                          School         NaN         Manga
172                     Mythology      Seinen         Manga

                       rating                        title  \
83   PG-13 - Teens 13 or older    The Cosmopolitan Prayers
85   PG-13 - Teens 13 or older       Cromartie High School
```

```
88    PG-13 - Teens 13 or older              Final Approach
151           R+ - Mild Nudity                   Rizelmine
172              PG - Children  Shrine of the Morning Mist

     duration_in_minutes                                          synopsis
83                  17.0  Koto unknowingly seals away the Sun Goddess Am…
85                  12.0  Takashi Kamiyama is your typical mild-mannered…
88                  14.0  Ever since their parents died a few years ago,…
151                 15.0  Iwaki Tomonori is an average 15-year-old boy w…
172                 12.0  Since childhood, Tadahiro Amatsu has two diffe…
```

Removed them because anime have a standard duration of about 20 minutes

[188]:
```
merged_df = merged_df.loc[merged_df["duration_in_minutes"] >= 20, :]
merged_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 6085 entries, 0 to 8749
Data columns (total 18 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   anime_id             6085 non-null   int64
 1   url                  6085 non-null   object
 2   type                 6085 non-null   object
 3   episodes             6084 non-null   object
 4   status               6056 non-null   object
 5   premiered            6055 non-null   object
 6   producer             4673 non-null   object
 7   broadcast            3954 non-null   object
 8   licensors            3023 non-null   object
 9   studios              5471 non-null   object
 10  genres               6085 non-null   object
 11  themes               4299 non-null   object
 12  demographic          2530 non-null   object
 13  source               6077 non-null   object
 14  rating               5973 non-null   object
 15  title                6085 non-null   object
 16  duration_in_minutes  6085 non-null   float64
 17  synopsis             6085 non-null   object
dtypes: float64(1), int64(1), object(16)
memory usage: 903.2+ KB
```

[189]:
```
merged_df.loc[merged_df["episodes"] == "Unknown", "episodes"] = None
merged_df[merged_df["episodes"].isna()].head()
```

[189]:
```
      anime_id                                              url type  \
11          21         https://myanimelist.net/anime/21/One_Piece   TV
176        235  https://myanimelist.net/anime/235/Detective_Conan   TV
```

```
644        966  https://myanimelist.net/anime/966/Crayon_Shin-…   TV
1114      1960  https://myanimelist.net/anime/1960/Sore_Ike_An…   TV
1317      2406       https://myanimelist.net/anime/2406/Sazae-san   TV

     episodes            status    premiered  \
11       None  Currently Airing    Fall 1999
176      None  Currently Airing  Winter 1996
644      None  Currently Airing  Spring 1992
1114     None  Currently Airing    Fall 1988
1317     None  Currently Airing    Fall 1969

                                          producer                 broadcast  \
11                          Fuji TV, TAP, Shueisha    Sundays at 09:30 (JST)
176   Yomiuri Telecasting, TMS-Kyokuchi, Shogakukan  Saturdays at 18:00 (JST)
644                                       TV Asahi    Fridays at 19:30 (JST)
1114              Sotsu, Nippon Television Network    Fridays at 16:20 (JST)
1317                                       Fuji TV    Sundays at 18:30 (JST)

                           licensors            studios  \
11    Funimation, 4Kids Entertainment     Toei Animation
176           Funimation, Crunchyroll  TMS Entertainment
644                         Funimation  Shin-Ei Animation
1114                               NaN  TMS Entertainment
1317                               NaN              Eiken

                         genres     themes demographic        source  \
11    Action, Adventure, Fantasy        NaN     Shounen         Manga
176   Adventure, Comedy, Mystery  Detective     Shounen         Manga
644                Comedy, Ecchi     School      Seinen         Manga
1114             Comedy, Fantasy        NaN        Kids  Picture book
1317       Comedy, Slice of Life        NaN         NaN  4-koma manga

                         rating                                         title  \
11    PG-13 - Teens 13 or older                                     One Piece
176   PG-13 - Teens 13 or older                                   Case Closed
644                 G - All Ages                                     Shin Chan
1114              PG - Children  Soreike! Anpanman, Go! Anpanman, Anpanman TV
1317                G - All Ages                                     Mrs. Sazae

      duration_in_minutes                                              synopsis
11                   24.0  Gol D. Roger was known as the "Pirate King," t…
176                  25.0  Shinichi Kudou, a high school student of astou…
644                  21.0  There is no such thing as an uneventful day in…
1114                 24.0  One night, a Star of Life falls down the chimn…
1317                 24.0  The main character is a mother named Sazae-san…
```

Handling missing episodes count

[190]:
```
merged_df.loc[merged_df["anime_id"] == 21, "episodes"] = 1133
merged_df.loc[merged_df["anime_id"] == 235, "episodes"] = 1165
merged_df.loc[merged_df["anime_id"] == 966, "episodes"] = 1267
merged_df.loc[merged_df["anime_id"] == 1960, "episodes"] = 1700
merged_df.loc[merged_df["anime_id"] == 2406, "episodes"] = 2771
merged_df.loc[merged_df["anime_id"] == 6149, "episodes"] = 1468
merged_df.loc[merged_df["anime_id"] == 8687, "episodes"] = 837
merged_df.loc[merged_df["anime_id"] == 18941, "episodes"] = 321
merged_df.loc[merged_df["anime_id"] == 27783, "episodes"] = 0 # needs to be␣
 ↪dropped
merged_df.loc[merged_df["anime_id"] == 31049, "episodes"] = 51
merged_df.loc[merged_df["anime_id"] == 32568, "episodes"] = 47
merged_df.loc[merged_df["anime_id"] == 32717, "episodes"] = 100
merged_df.loc[merged_df["anime_id"] == 33027, "episodes"] = 12
merged_df.loc[merged_df["anime_id"] == 33089, "episodes"] = 12
merged_df.loc[merged_df["anime_id"] == 33371, "episodes"] = 12
merged_df.loc[merged_df["anime_id"] == 33540, "episodes"] = 0 # needs to be␣
 ↪dropped
merged_df.loc[merged_df["anime_id"] == 33737, "episodes"] = 28
merged_df.loc[merged_df["anime_id"] == 33839, "episodes"] = 0 # needs to be␣
 ↪dropped
merged_df.loc[merged_df["anime_id"] == 34077, "episodes"] = 52
merged_df.loc[merged_df["anime_id"] == 34208, "episodes"] = 0 # needs to be␣
 ↪dropped
merged_df.loc[merged_df["anime_id"] == 34289, "episodes"] = 13
merged_df.loc[merged_df["anime_id"] == 34338, "episodes"] = 0 # needs to be␣
 ↪dropped
merged_df.loc[merged_df["anime_id"] == 34427, "episodes"] = 12
merged_df.loc[merged_df["anime_id"] == 34474, "episodes"] = 13
merged_df.loc[merged_df["anime_id"] == 34832, "episodes"] = 28 # needs to be␣
 ↪dropped
merged_df.loc[merged_df["anime_id"] == 37008, "episodes"] = 13
merged_df.loc[merged_df["anime_id"] == 37096, "episodes"] = 339
merged_df.loc[merged_df["anime_id"] == 39725, "episodes"] = 12
merged_df.loc[merged_df["anime_id"] == 39893, "episodes"] = 56
merged_df.loc[merged_df["anime_id"] == 39905, "episodes"] = 1 # change type to␣
 ↪movie
merged_df.loc[merged_df["anime_id"] == 40327, "episodes"] = 98
merged_df.loc[merged_df["anime_id"] == 40506, "episodes"] = 48
merged_df.loc[merged_df["anime_id"] == 40608, "episodes"] = 24
merged_df.loc[merged_df["anime_id"] == 40935, "episodes"] = 10
merged_df.loc[merged_df["anime_id"] == 41521, "episodes"] = 12
merged_df.loc[merged_df["anime_id"] == 42205, "episodes"] = 52
merged_df.loc[merged_df["anime_id"] == 42385, "episodes"] = 0 # needs to be␣
 ↪removed
merged_df.loc[merged_df["anime_id"] == 43735, "episodes"] = 24
```

```
merged_df.loc[merged_df["anime_id"] == 43778, "episodes"] = 25
merged_df.loc[merged_df["anime_id"] == 44940, "episodes"] = 14
merged_df.loc[merged_df["anime_id"] == 45665, "episodes"] = 12
merged_df.loc[merged_df["anime_id"] == 46381, "episodes"] = 41
merged_df.loc[merged_df["anime_id"] == 47160, "episodes"] = 13
merged_df.loc[merged_df["anime_id"] == 48365, "episodes"] = 214
merged_df.loc[merged_df["anime_id"] == 48391, "episodes"] = 51
merged_df.loc[merged_df["anime_id"] == 48417, "episodes"] = 13
merged_df.loc[merged_df["anime_id"] == 48483, "episodes"] = 12
merged_df.loc[merged_df["anime_id"] == 53876, "episodes"] = 45
```

[191]:
```
merged_df.loc[merged_df["anime_id"] == 27783, "episodes"] = 0 # needs to be␣
↪dropped
merged_df = merged_df.loc[~merged_df["anime_id"].isin([27783, 33540, 33839,␣
↪34208, 34338, 34832, 42385]), :]
merged_df.loc[merged_df["anime_id"] == 39905, "type"] = "Movie"
```

Handling missing status

[192]:
```
merged_df.loc[merged_df["status"].isna(), :].head()
```

[192]:

	anime_id	url	type	episodes	status	premiered	producer	broadcast	licensors	studios	genres	themes	demographic	source	rating
265	342	Unknown	TV	13	NaN	Winter 2005	Geneon Universal Entertainment	NaN	Geneon Entertainment USA	J.C.Staff	Drama, Military, Sci-Fi, Space	NaN	NaN	Light novel	PG-13 - Teens 13 or older
515	760	Unknown	Movie	1	NaN	NaN	NaN	NaN	NaN	Madhouse	Adventure, Drama, Martial Arts, Romance, Shoun…	NaN	NaN	Manga	R - 17+ (violence & profanity)
675	1032	Unknown	Movie	1	NaN	NaN	Yomiko Advertising	NaN	Discotek Media	Studio Pierrot	Adventure, Drama, Historical, Romance	NaN	NaN	Novel	G - All Ages
859	1451	Unknown	Movie	1	NaN	NaN	NaN	NaN	Manga Entertainment	Production Reed	Action, Historical, Supernatural, Thriller	NaN	NaN	Novel	R+ - Mild Nudity
957	1621	Unknown	Movie	1	NaN	NaN	NaN	NaN	NaN	Asahi Production	Action, Comedy, School	NaN	NaN	NaN	NaN

```
957    NaN         NaN  Visual novel       PG-13 - Teens 13 or older

                                     title  duration_in_minutes  \
265                      Starship Operators                 24.0
515            Tenjou Tenge: The Past Chapter                 92.0
675             Kumo no You ni Kaze no You ni                 80.0
859  Shuranosuke Zanmaken: Shikamamon no Otoko                 49.0
957    Haru no Ashioto The Movie: Ourin Dakkan                 20.0

                                             synopsis
265  For the 73rd class of cadets of the Defense Un…
515  suomi Takayanagi and Maya Natsume both want to…
675  Ginga, a small town girl sets out to become th…
859  Shurannosuke Sakaki is a masterless samurai wi…
957  One day the else so peaceful mood in the Ourin…
```

[193]:
```
merged_df.loc[merged_df["anime_id"] == 342, "status"] = "Finished Airing"
merged_df.loc[merged_df["anime_id"] == 760, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 1032, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 1451, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 1621, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 2691, "status"] = "Finished Airing" # to␣
 ↪be dropped
merged_df.loc[merged_df["anime_id"] == 3258, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 4112, "status"] = "Finished Airing" # to␣
 ↪be dropped not an anime
merged_df.loc[merged_df["anime_id"] == 5272, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 5673, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 7664, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 8149, "status"] = "Finished Airing"
merged_df.loc[merged_df["anime_id"] == 10330, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 10463, "status"] = "Finished Airing"
merged_df.loc[merged_df["anime_id"] == 13169, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 13171, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
```

```
merged_df.loc[merged_df["anime_id"] == 13173, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 13175, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 19683, "status"] = "Finished Airing"
merged_df.loc[merged_df["anime_id"] == 33540, "status"] = "Finished Airing"
merged_df.loc[merged_df["anime_id"] == 35025, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 35210, "status"] = "Finished Airing" #␣
 ↪to be dropped, not yet aired
merged_df.loc[merged_df["anime_id"] == 35213, "status"] = "Finished Airing"
merged_df.loc[merged_df["anime_id"] == 37149, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 37767, "status"] = "Finished Airing"
merged_df.loc[merged_df["anime_id"] == 38781, "status"] = "Finished Airing"
merged_df.loc[merged_df["anime_id"] == 40035, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 42143, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
merged_df.loc[merged_df["anime_id"] == 42209, "status"] = "Unknown" # to be␣
 ↪dropped not an anime
```

[194]:
```
merged_df = merged_df.loc[~merged_df["anime_id"].isin([2691, 4112, 35210]), :]
merged_df = merged_df[merged_df["status"] != "Unknown"]
```

[195]:
```
merged_df.loc[merged_df["premiered"].isna(), :].head()
```

[195]:

```
      anime_id                                                url   type  \
22          32  https://myanimelist.net/anime/32/Neon_Genesis_…  Movie
2858      8149                                           Unknown  Movie
3160      9818  https://myanimelist.net/anime/9818/McDull__Bol…  Movie
3795     15347  https://myanimelist.net/anime/15347/Meitantei_…  Movie
4199     19683                                           Unknown  Movie

     episodes           status premiered  \
22        1.0  Finished Airing       NaN
2858        1  Finished Airing       NaN
3160      1.0  Finished Airing       NaN
3795      1.0  Finished Airing       NaN
4199        1  Finished Airing       NaN

                                           producer broadcast  \
22    TV Tokyo, Toei Animation, Kadokawa Shoten, Mov…       NaN
2858                                              NaN       NaN
3160                                  Bliss Pictures       NaN
3795                                              NaN       NaN
4199                                              NaN       NaN
```

```
                        licensors                 studios  \
22    GKIDS, Manga Entertainment  Gainax, Production I.G
2858                         NaN          Toei Animation
3160                         NaN                     NaN
3795                         NaN       TMS Entertainment
4199                         NaN          Toei Animation

                                              genres                themes  \
22                          Avant Garde, Drama, Sci-Fi  Mecha, Psychological
2858  Adventure, Comedy, Fantasy, Horror, Supernatural                   NaN
3160                                           Comedy       Anthropomorphic
3795                          Adventure, Comedy, Mystery                   NaN
4199                                Shounen, Sports                   NaN

     demographic    source            rating  \
22           NaN  Original  R+ - Mild Nudity
2858         NaN       NaN      G - All Ages
3160        Kids       NaN      G - All Ages
3795         NaN     Novel      G - All Ages
4199         NaN       NaN               NaN

                                              title  duration_in_minutes  \
22       Neon Genesis Evangelion: The End of Evangelion                 86.0
2858                      Gegege no Kitarou (1968 Movie)                 46.0
3160                           McDull, Prince de la Bun                  77.0
3795  Sherlock Hound: The Adventure of the Blue Carb…                 46.0
4199                                  Kick no Oni (1971)                 25.0

                                              synopsis
22    h the final Angel vanquished, Nerv has one las…
2858      lling of episodes 5-6 from the 1968 TV anime.
3160  cDull, Prince de la Bun is a 2004 animated Hon…
3795  The famous blue ruby is stolen in such an elab…
4199                                  Kick no Oni Movie.
```

Handling missing premiered

[196]:
```
merged_df.loc[merged_df["anime_id"] == 32, "premiered"] = "1997-07-19"
merged_df.loc[merged_df["anime_id"] == 8149, "premiered"] = "1968-01-03"
merged_df.loc[merged_df["anime_id"] == 9818, "premiered"] = "2004-06-24"
merged_df.loc[merged_df["anime_id"] == 10463, "premiered"] = "1991-09-27"
merged_df.loc[merged_df["anime_id"] == 15347, "premiered"] = "1984-03-11"
merged_df.loc[merged_df["anime_id"] == 19683, "premiered"] = "1971-03-20"
merged_df.loc[merged_df["anime_id"] == 28091, "premiered"] = "2003-03-01"
merged_df.loc[merged_df["anime_id"] == 33540, "premiered"] = "2013-05-10"
```

```
merged_df.loc[merged_df["anime_id"] == 35213, "premiered"] = "2013-05-10" # to␣
↪be dropped
merged_df.loc[merged_df["anime_id"] == 37767, "premiered"] = "2018-01-05"
merged_df.loc[merged_df["anime_id"] == 38781, "premiered"] = "2018-04-18"

merged_df = merged_df.loc[merged_df["anime_id"] != 35213, :]
```

Handling missing source

[197]:
```
merged_df.loc[merged_df["source"].isna(), :].head()
```

[197]:
```
      anime_id                                                url   type  \
1957      4024  https://myanimelist.net/anime/4024/Sanrio_Anim…     TV
2858      8149                                           Unknown  Movie
3160      9818  https://myanimelist.net/anime/9818/McDull__Bol…  Movie
4199     19683                                           Unknown  Movie
4838     28091  https://myanimelist.net/anime/28091/Asu_wo_Tsu…  Movie

     episodes           status   premiered          producer broadcast  \
1957     13.0  Finished Airing   Fall 1987            Sanrio   Unknown
2858        1  Finished Airing  1968-01-03               NaN       NaN
3160      1.0  Finished Airing  2004-06-24    Bliss Pictures       NaN
4199        1  Finished Airing  1971-03-20               NaN       NaN
4838      1.0  Finished Airing  2003-03-01  Mushi Production       NaN

     licensors           studios  \
1957       NaN               NaN
2858       NaN    Toei Animation
3160       NaN               NaN
4199       NaN    Toei Animation
4838       NaN  Mushi Production

                                          genres            themes  \
1957                             Adventure, Fantasy               NaN
2858  Adventure, Comedy, Fantasy, Horror, Supernatural               NaN
3160                                       Comedy  Anthropomorphic
4199                                Shounen, Sports               NaN
4838                                           nan       Historical

     demographic source        rating  \
1957        Kids    NaN  G - All Ages
2858         NaN    NaN  G - All Ages
3160        Kids    NaN  G - All Ages
4199         NaN    NaN           NaN
4838         NaN    NaN  G - All Ages

                                          title  duration_in_minutes  \
```

```
1957                   Hello Kitty's Furry Tale Theater                 24.0
2858                     Gegege no Kitarou (1968 Movie)                 46.0
3160                          McDull, Prince de la Bun                  77.0
4199                                Kick no Oni (1971)                  25.0
4838  The Man Who Has Changed the History: A Drannag…                  70.0

                                                  synopsis
1957  Hello Kitty and other Sanrio characters star i…
2858      lling of episodes 5-6 from the 1968 TV anime.
3160  cDull, Prince de la Bun is a 2004 animated Hon…
4199                                Kick no Oni Movie.
4838  fusion of live action and animation to tell th…
```

Filling remaining missing data with *Unknown*

[198]:
```
anime_df = merged_df.fillna(missing_placeholder)
anime_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 6056 entries, 0 to 8749
Data columns (total 18 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   anime_id             6056 non-null   int64
 1   url                  6056 non-null   object
 2   type                 6056 non-null   object
 3   episodes             6056 non-null   object
 4   status               6056 non-null   object
 5   premiered            6056 non-null   object
 6   producer             6056 non-null   object
 7   broadcast            6056 non-null   object
 8   licensors            6056 non-null   object
 9   studios              6056 non-null   object
 10  genres               6056 non-null   object
 11  themes               6056 non-null   object
 12  demographic          6056 non-null   object
 13  source               6056 non-null   object
 14  rating               6056 non-null   object
 15  title                6056 non-null   object
 16  duration_in_minutes  6056 non-null   float64
 17  synopsis             6056 non-null   object
dtypes: float64(1), int64(1), object(16)
memory usage: 898.9+ KB
```

Extract month and year for premiered column

[199]:
```
from datetime import datetime

def determine_season(month):
```

```
    match month:
        case 1 | 2 | 3:
            return "Winter"
        case 4 | 5 | 6:
            return "Spring"
        case 7 | 8 | 9:
            return "Summer"
        case 10 | 11 | 12:
            return "Fall"
        case _:
            raise ValueError("Value must be a month of the year")

def extract_season_and_year(date_and_time):
    date = date_and_time.split("T")[0]
    format_code = "%Y-%m-%d"

    date_obj = datetime.strptime(date, format_code)
    season = determine_season(date_obj.month)
    year = date_obj.year
    return "{} {}".format(season, year)
```

[200]:
```
premiered_in_scope_split = anime_df["premiered"].apply(lambda x:␣
 ↪extract_season_and_year(x) \
    if "-" in x else x)
expanded_premiered = premiered_in_scope_split.str.split(" ", expand=True)
anime_df["premiered_season"] = expanded_premiered[0]
anime_df["premiered_year"] = expanded_premiered[1]
anime_df = anime_df.drop(columns=["premiered"])
```

Looking at the kids demographic

[201]:
```
anime_df[anime_df["demographic"].isin(["Kids, Shoujo", "Kids, Shounen"])].head()
```

[201]:
```
      anime_id                                                url   type  \
371        501         https://myanimelist.net/anime/501/Doraemon     TV
733       1138         https://myanimelist.net/anime/1138/Medarot     TV
929       1572   https://myanimelist.net/anime/1572/Jungle_Taitei     TV
1419      2625  https://myanimelist.net/anime/2625/The%E2%98%8…  Movie
1431      2649  https://myanimelist.net/anime/2649/Doraemon__O…  Movie

     episodes           status                                producer  \
371      26.0  Finished Airing                                 Unknown
733      52.0  Finished Airing  TV Tokyo, Nihon Ad Systems, Nelvana
929      52.0  Finished Airing                                 Unknown
1419      1.0  Finished Airing                                 Unknown
1431      1.0  Finished Airing                                 Unknown

                   broadcast                                licensors  \
```

```
371   Sundays at 19:00 (JST)                                    Unknown
733   Fridays at 18:00 (JST)  ADV Films, Discotek Media, Shout! Factory
929                  Unknown       Nozomi Entertainment, Media Blasters
1419                 Unknown                                   Unknown
1431                 Unknown                                   Unknown

                studios                                  genres  \
371      Nippon TV Douga             Adventure, Comedy, Fantasy
733            Bee Train              Adventure, Comedy, Sci-Fi
929     Mushi Production                          Adventure
1419  Shin-Ei Animation                Comedy, Fantasy, Sci-Fi
1431  Shin-Ei Animation  Award Winning, Comedy, Fantasy, Sci-Fi

                themes    demographic   source         rating  \
371   Anthropomorphic  Kids, Shounen    Manga  PG - Children
733           Unknown  Kids, Shounen     Game  PG - Children
929           Unknown  Kids, Shounen    Manga   G - All Ages
1419          Unknown  Kids, Shounen  Unknown  PG - Children
1431          Unknown  Kids, Shounen  Unknown  PG - Children

                                                  title  duration_in_minutes  \
371                                   Doraemon (1973)                 25.0
733                                          Medabots                 24.0
929                                Kimba the White Lion                 25.0
1419  The Doraemons: Kaitou Dorapin Nazo no Chousenjou!                 31.0
1431           Doraemon: A Grandmother's Recollections                 27.0

                                               synopsis premiered_season  \
371   Nobita Nobi is so hapless that his 22nd centur…           Spring
733   dabots-powerful robots granted artificial inte…           Summer
929   o the white lion was born on an ocean liner th…             Fall
1419  The mysterious thief Dorapin sets up a scheme …           Winter
1431  Nobita misses his granny that died a few years…           Winter

     premiered_year
371            1973
733            1999
929            1965
1419           1997
1431           2000
```

Anything with kids in it will be set to a kids demographic, as the additional categories are used to distinguish those for boys (shounen) and those for girls (shoujo). Neither of which are of particular importance for this system.

[202]:
```
anime_df.loc[anime_df["demographic"].isin(["Kids, Shounen", "Kids, Shoujo"]),␣
↪["demographic"]] = "Kids"
```

[203]:
```
import re
```

Clean title and synopsis

[204]:
```
anime_df["synopsis"] = anime_df["synopsis"].apply(lambda text: \
    re.sub(r'[^a-zA-Z0-9.,!?;:\'"()[\]{}\---_/\&@#$%*+=<>\s]', '', text))
anime_df["title"] = anime_df["title"].apply(lambda text: \
    re.sub(r'[^a-zA-Z0-9.,!?;:\'"()[\]{}\---_/\&@#$%*+=<>\s]', '', text))
```

Store the dataframe

[205]:
```
anime_df.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\anime_list_27_Jun.csv",␣
 ↪index=False)
```

Anime Reviews Used contents in **anime-narrowing/reviews.py** to retrieve the reviews for each anime

[206]:
```
anime_reviews = pd.read_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-data-11-Jun\\anime_reviews_11_Jun.csv")
anime_reviews["review"] = anime_reviews["review"].apply(lambda text: \
    re.sub(r'[^a-zA-Z0-9.,!?;:\'"()[\]{}\---_/\&@#$%*+=<>\s]', '', str(text)))
```

Utility class used in saving the reviews to a json file

[207]:
```
import json
import numpy as np

class NumpyEncoder(json.JSONEncoder):
    def default(self, obj):
        if isinstance(obj, np.integer):
            return int(obj)
        elif isinstance(obj, np.floating):
            return float(obj)
        elif isinstance(obj, np.ndarray):
            return obj.tolist()
        return json.JSONEncoder.default(self, obj)
```

[208]:
```
matching_reviews = anime_reviews[anime_reviews["anime_id"].
 ↪isin(anime_df["anime_id"])]
anime_ids = matching_reviews["anime_id"].unique()

reviews_collection = []
for id in anime_ids:
    title = anime_df.loc[anime_df["anime_id"] == id, "title"].iloc[0]
    reviewDict = {"anime_id": id, "title": title }
    targetReviews = matching_reviews.loc[matching_reviews["anime_id"] == id, :]
    reviewsList = [{"date": row.date, "review": row.review, "id": row.mal_id}␣
 ↪for row in targetReviews.itertuples()]
```

```
    reviewDict["reviews"] = reviewsList
    reviews_collection += [reviewDict]

filename = "E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\anime_reviews.json"

# Open the file in write mode and use json.dump()
with open(filename, 'w') as file:
    json.dump(reviews_collection, file, cls=NumpyEncoder)

print(f"Reviews successfully saved to {filename}")
```

```
Reviews successfully saved to E:\applied data science
capstone\data\combined\anime-for-db-27-Jun\anime_reviews.json
```

User Rating Decided to use Hernan ratings as it was from a more recent dataset and there may have been overlap with some users and ratings. It is assumed that anime recommendations database 2020 had all the anime and ratings that would have been present in anime recommendations database. It also had no missing values and consists of 58 million records.

[209]:
```
rating_df = pd.read_csv("E:\\applied data science␣
 ↪capstone\\data\\hernan4444\\archive\\rating_complete.csv")
rating_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 57633278 entries, 0 to 57633277
Data columns (total 3 columns):
 #   Column    Dtype
---  ------    -----
 0   user_id   int64
 1   anime_id  int64
 2   rating    int64
dtypes: int64(3)
memory usage: 1.3 GB
```

Remove the reviews that were for anime not in the anime dataset after preparation.

[210]:
```
rating_df = rating_df[rating_df["anime_id"].isin(anime_df["anime_id"])]
rating_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 44617516 entries, 0 to 57633277
Data columns (total 3 columns):
 #   Column    Dtype
---  ------    -----
 0   user_id   int64
 1   anime_id  int64
 2   rating    int64
dtypes: int64(3)
```

```
memory usage: 1.3 GB
```

Save ratings data

[211]:
```
rating_df.to_csv("E:\\applied data science␣
↪capstone\\data\\combined\\anime-for-db-27-Jun\\anime_rating_15_Jun.csv", \
    index=False)
```

0.1.5 Prepare data for relational database

[212]:
```
import itertools

def extractTable(animeList, sourceAttribute, targetAttribute):
    series = list(animeList[sourceAttribute].unique())
    seriesExpanded = [item.split(",") for item in series]
    seriesExpandedFlatlist = list(itertools.chain(*seriesExpanded))
    seriesExpandedFlatlist = [item.strip() for item in seriesExpandedFlatlist]

    series = pd.Series(seriesExpandedFlatlist, name=targetAttribute)
    series = series.drop_duplicates()
    series = series.sort_values()

    df = pd.DataFrame(series)
    df["{}_id".format(targetAttribute)] = range(1, len(df) + 1)
    return df

def extractJoinsTable(animeList, secondaryTable, sourceAttribute,␣
↪targetAttribute):
    idAttribute = "anime_id"
    joinsDf = pd.DataFrame(columns=[idAttribute, targetAttribute])
    for i in animeList.index:
        animeId = animeList.loc[i, [idAttribute]]
        row = animeList.loc[i, [sourceAttribute]]
        rowExpanded = [item.split(",") for item in row]
        rowExpandedFlatlist = list(itertools.chain(*rowExpanded))
        rowExpandedFlatlist = [item.strip() for item in rowExpandedFlatlist]

        for item in rowExpandedFlatlist:
            joinsDf.loc[len(joinsDf)] = [animeId.get(idAttribute), item]

    mergedDf = joinsDf.merge(secondaryTable, how="inner", suffixes=["_left",␣
↪"_right"])
    mergedDf = mergedDf.drop(columns=[targetAttribute])
    return mergedDf
```

Extract tables and joins tables

[213]:
```
producers = extractTable(anime_df, "producer", "producer")
producersJoin = extractJoinsTable(anime_df, producers, "producer", "producer")
licensors = extractTable(anime_df, "licensors", "licensor")
licensorsJoin = extractJoinsTable(anime_df, licensors, "licensors", "licensor")
studios = extractTable(anime_df, "studios", "studio")
studiosJoin = extractJoinsTable(anime_df, studios, "studios", "studio")
genres = extractTable(anime_df, "genres", "genre")
genresJoin = extractJoinsTable(anime_df, genres, "genres", "genre")
themes = extractTable(anime_df, "themes", "theme")
themesJoin = extractJoinsTable(anime_df, themes, "themes", "theme")

df_for_db = anime_df.drop(columns=["licensors", "studios", "genres", "themes",␣
 ↪"producer"])
```

Store data in csv files for later writing to database

[214]:
```
df_for_db.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\anime_list_27_Jun.csv",␣
 ↪index=False)
producers.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\producers_27_Jun.csv",␣
 ↪index=False)
licensors.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\licensors_27_Jun.csv",␣
 ↪index=False)
studios.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\studios_27_Jun.csv",␣
 ↪index=False)
genres.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\genres_27_Jun.csv",␣
 ↪index=False)
themes.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\themes_27_Jun.csv",␣
 ↪index=False)
producersJoin.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\anime_producer_27_Jun.csv",␣
 ↪index=False)
licensorsJoin.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\anime_licensors_27_Jun.csv",␣
 ↪index=False)
studiosJoin.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\anime_studios_27_Jun.csv",␣
 ↪index=False)
genresJoin.to_csv("E:\\applied data science␣
 ↪capstone\\data\\combined\\anime-for-db-27-Jun\\anime_genres_27_Jun.csv",␣
 ↪index=False)
```

```
themesJoin.to_csv("E:\\applied data science␣
↪capstone\\data\\combined\\anime-for-db-27-Jun\\anime_themes_27_Jun.csv",␣
↪index=False)
```