# 01-data-processing-and-eda

May 24, 2025

# 1 Battle of the Binge: OTT Data Analysis

## 1.1 Review 1: Data Processing and Exploratory Data Analysis (EDA)

This notebook covers the **first phase** of the project, focusing on:

1. **Identifying and sourcing relevant datasets**
2. **Cleaning and handling missing values**
3. **Feature selection and engineering**
4. **Ensuring data integrity and consistency**
5. **Generating summary statistics and initial insights**
6. **Identifying patterns, trends, and anomalies**
7. **Handling outliers and considering data transformations**
8. **Creating initial visual representations of key findings**

## 1.2 0. Setup and Library Imports

[1]:
```
# Import necessary Python libraries for data manipulation, numerical␣
 ↪operations, and visualization.

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import re # For regular expressions, useful in cleaning

# Configure pandas for better display
pd.set_option('display.max_columns', None)
pd.set_option('display.max_colwidth', None)
pd.set_option('display.width', 1000)

# Configure Seaborn for plots
sns.set_style('whitegrid')
plt.rcParams['figure.figsize'] = (12, 6)
```

---

### 1.3 1. Identifying and Sourcing Relevant Datasets (4 Marks)

In this step, we load the datasets for **Netflix**, **Amazon Prime Video**, and **Disney+** from their respective CSV files.
We'll also add a `platform` column to each DataFrame to easily identify the source of each record after merging.

---

[2]:
```
# Define file paths
netflix_path = '../01_Data/raw_data/netflix_data.csv'
amazon_path = '../01_Data/raw_data/amazon_prime_data.csv'
disney_path = '../01_Data/raw_data/disney_plus_data.csv'

# Load datasets
try:
    df_netflix = pd.read_csv(netflix_path)
    df_amazon = pd.read_csv(amazon_path)
    df_disney = pd.read_csv(disney_path)
except FileNotFoundError as e:
    print(f"Error loading data files: {e}")
    print("Please ensure the CSV files are in the '../01_Data/raw_data/'␣
 ↪directory relative to this notebook.")
    # Exit or raise error if files not found, as further steps depend on this.
    # For this example, we'll proceed assuming files might be loaded later or␣
 ↪paths corrected.
    df_netflix = pd.DataFrame()
    df_amazon = pd.DataFrame()
    df_disney = pd.DataFrame()

# Add 'platform' column
if not df_netflix.empty:
    df_netflix['platform'] = 'Netflix'
if not df_amazon.empty:
    df_amazon['platform'] = 'Amazon Prime' # Standardizing name
if not df_disney.empty:
    df_disney['platform'] = 'Disney+'

# Display initial info for Netflix
print("--- Netflix Dataset ---")
if not df_netflix.empty:
    print("Head:")
    print(df_netflix.head(3))
    print("\nInfo:")
    df_netflix.info()
else:
    print("Netflix DataFrame is empty. Please check file path and loading.")
print("\n\n--- Amazon Prime Video Dataset ---")
if not df_amazon.empty:
    print("Head:")
    print(df_amazon.head(3))
    print("\nInfo:")
    df_amazon.info()
else:
    print("Amazon Prime DataFrame is empty. Please check file path and loading.
 ↪")


print("\n\n--- Disney+ Dataset ---")
if not df_disney.empty:
    print("Head:")
    print(df_disney.head(3))
    print("\nInfo:")
    df_disney.info()
else:
    print("Disney+ DataFrame is empty. Please check file path and loading.")
```

```
--- Netflix Dataset ---
Head:
  show_id     type                 title         director
cast        country          date_added  release_year rating   duration
listed_in
description platform
0      s1    Movie  Dick Johnson Is Dead  Kirsten Johnson
NaN  United States  September 25, 2021          2020  PG-13     90 min
Documentaries  As her father nears the end of his life, filmmaker Kirsten
Johnson stages his death in inventive and comical ways to help them both face
the inevitable.  Netflix
1      s2  TV Show         Blood & Water              NaN  Ama Qamata, Khosi
Ngema, Gail Mabalane, Thabang Molaba, Dillon Windvogel, Natasha Thahane, Arno
Greeff, Xolile Tshabalala, Getmore Sithole, Cindy Mahlangu, Ryle De Morny,
Greteli Fincham, Sello Maake Ka-Ncube, Odwa Gwanya, Mekaila Mathys, Sandi
Schultz, Duane Williams, Shamilla Miller, Patrick Mofokeng   South Africa
September 24, 2021          2021  TV-MA  2 Seasons               International
TV Shows, TV Dramas, TV Mysteries       After crossing paths at a party, a Cape
Town teen sets out to prove whether a private-school swimming star is her sister
who was abducted at birth.  Netflix
2      s3  TV Show             Ganglands  Julien Leclercq
Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabiha Akkari, Sofia Lesaffre, Salim
Kechiouche, Noureddine Farihi, Geert Van Rampelberg, Bakary Diombera
NaN  September 24, 2021          2021  TV-MA   1 Season  Crime TV Shows,
International TV Shows, TV Action & Adventure        To protect his family from
a powerful drug lord, skilled thief Mehdi and his expert team of robbers are
pulled into a violent and deadly turf war.  Netflix
```

```
Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8807 entries, 0 to 8806
Data columns (total 13 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   show_id       8807 non-null   object
 1   type          8807 non-null   object
 2   title         8807 non-null   object
 3   director      6173 non-null   object
 4   cast          7982 non-null   object
 5   country       7976 non-null   object
 6   date_added    8797 non-null   object
 7   release_year  8807 non-null   int64
 8   rating        8803 non-null   object
 9   duration      8804 non-null   object
 10  listed_in     8807 non-null   object
 11  description   8807 non-null   object
 12  platform      8807 non-null   object
dtypes: int64(1), object(12)
memory usage: 894.6+ KB


--- Amazon Prime Video Dataset ---
Head:
  show_id   type                  title      director
cast        country      date_added  release_year rating duration
listed_in
description      platform
0      s1  Movie   The Grand Seduction  Don McKellar
Brendan Gleeson, Taylor Kitsch, Gordon Pinsent         Canada  March 30, 2021
2014    NaN  113 min            Comedy, Drama  A small fishing village must
procure a local doctor to secure a lucrative business contract. When unlikely
candidate and big city doctor Paul Lewis lands in their lap for a trial
residence, the townsfolk rally together to charm him into staying. As the
doctor's time in the village winds to a close, acting mayor Murray French has no
choice but to pull out all the stops.  Amazon Prime
1      s2  Movie  Take Care Good Night  Girish Joshi
Mahesh Manjrekar, Abhay Mahajan, Sachin Khedekar          India  March 30, 2021
2018    13+  110 min     Drama, International
A Metro Family decides to fight a Cyber Criminal threatening their stability and
pride.  Amazon Prime
2      s3  Movie  Secrets of Deception   Josh Webber  Tom Sizemore, Lorenzo
Lamas, Robert LaSardo, Richard Jones, Yancey Arias, Noel Gugliemi  United States
March 30, 2021          2017    NaN   74 min  Action, Drama, Suspense
After a man discovers his wife is cheating on him with a neighborhood kid he
goes down a furious path of self-destruction  Amazon Prime
```

```
Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9668 entries, 0 to 9667
Data columns (total 13 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   show_id       9668 non-null   object
 1   type          9668 non-null   object
 2   title         9668 non-null   object
 3   director      7585 non-null   object
 4   cast          8435 non-null   object
 5   country       672 non-null    object
 6   date_added    155 non-null    object
 7   release_year  9668 non-null   int64
 8   rating        9331 non-null   object
 9   duration      9668 non-null   object
 10  listed_in     9668 non-null   object
 11  description   9668 non-null   object
 12  platform      9668 non-null   object
dtypes: int64(1), object(12)
memory usage: 982.0+ KB


--- Disney+ Dataset ---
Head:
  show_id   type                                             title
director
cast        country         date_added  release_year rating duration
listed_in                                         description platform
0      s1  Movie  Duck the Halls: A Mickey Mouse Christmas Special  Alonso
Ramirez Ramos, Dave Wasson  Chris Diamantopoulos, Tony Anselmo, Tress MacNeille,
Bill Farmer, Russi Taylor, Corey Burton           NaN  November 26, 2021
2016   TV-G   23 min          Animation, Family    Join Mickey and the gang as
they duck the halls!  Disney+
1      s2  Movie                             Ernest Saves Christmas
John Cherry                                                      Jim Varney,
Noelle Parker, Douglas Seale           NaN  November 26, 2021          1988
PG   91 min                    Comedy  Santa Claus passes his magic bag to a
new St. Nic.  Disney+
2      s3  Movie                      Ice Age: A Mammoth Christmas
Karen Disher                             Raymond Albert Romano, John Leguizamo,
Denis Leary, Queen Latifah  United States  November 26, 2021          2011
TV-G   23 min  Animation, Comedy, Family           Sid the Sloth is on Santa's
naughty list.  Disney+

Info:
<class 'pandas.core.frame.DataFrame'>
```

```
RangeIndex: 1450 entries, 0 to 1449
Data columns (total 13 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   show_id       1450 non-null   object
 1   type          1450 non-null   object
 2   title         1450 non-null   object
 3   director      977 non-null    object
 4   cast          1260 non-null   object
 5   country       1231 non-null   object
 6   date_added    1447 non-null   object
 7   release_year  1450 non-null   int64
 8   rating        1447 non-null   object
 9   duration      1450 non-null   object
 10  listed_in     1450 non-null   object
 11  description   1450 non-null   object
 12  platform      1450 non-null   object
dtypes: int64(1), object(12)
memory usage: 147.4+ KB
```

---

### 1.4 2. Cleaning and Handling Missing Values (4 Marks)

We'll inspect each dataset for missing values and apply appropriate strategies to handle them. Common strategies include:

- **Imputation**: Filling with a specific value (e.g., mean, median, mode, or a placeholder like "Unknown").
- **Dropping**: Removing rows or columns if missing data is extensive and not imputable.

---

[3]:

```python
# Function to report missing values
def report_missing_values(df, df_name):
    print(f"\n--- Missing Values Report for {df_name} ---")
    if df.empty:
        print(f"{df_name} DataFrame is empty.")
        return df

    missing_counts = df.isnull().sum()
    missing_percentages = (missing_counts / len(df)) * 100
    missing_df = pd.DataFrame({
        'Missing Count': missing_counts,
        'Missing Percentage': missing_percentages
    })
    print(missing_df[missing_df['Missing Count'] > 0].sort_values(by='Missing␣
 ↪Count', ascending=False))
    return df
```

```
# --- Netflix: Missing Value Handling ---
if not df_netflix.empty:
    df_netflix = report_missing_values(df_netflix, "Netflix (Before Cleaning)")
    # Strategy:
    # director, cast, country: Impute with "Unknown" as these are categorical␣
 ↪and "Unknown" is a valid placeholder.
    # date_added: Impute with mode or "Unknown". Let's check mode. If too␣
 ↪sparse, "Unknown".
    # rating: Impute with mode, as it's a key categorical feature.
    # Imdb_score (if present, not in these specific Kaggle sets typically):␣
 ↪Mean/Median.

    df_netflix['director'] = df_netflix['director'].fillna('Unknown')
    df_netflix['cast'] = df_netflix['cast'].fillna('Unknown')
    df_netflix['country'] = df_netflix['country'].fillna('Unknown')

    # For date_added and rating, using mode. If mode is NaN (empty series), use␣
 ↪"Unknown".
    date_added_mode_netflix = df_netflix['date_added'].mode()
    df_netflix['date_added'] = df_netflix['date_added'].
 ↪fillna(date_added_mode_netflix[0] if not date_added_mode_netflix.empty else␣
 ↪"Unknown")

    rating_mode_netflix = df_netflix['rating'].mode()
    df_netflix['rating'] = df_netflix['rating'].fillna(rating_mode_netflix[0]␣
 ↪if not rating_mode_netflix.empty else "Unknown")

    df_netflix = report_missing_values(df_netflix, "Netflix (After Cleaning)")


# --- Amazon Prime: Missing Value Handling ---
if not df_amazon.empty:
    df_amazon = report_missing_values(df_amazon, "Amazon Prime (Before␣
 ↪Cleaning)")
    # Similar strategy as Netflix
    df_amazon['director'] = df_amazon['director'].fillna('Unknown')
    df_amazon['cast'] = df_amazon['cast'].fillna('Unknown')
    df_amazon['country'] = df_amazon['country'].fillna('Unknown')

    date_added_mode_amazon = df_amazon['date_added'].mode()
    df_amazon['date_added'] = df_amazon['date_added'].
 ↪fillna(date_added_mode_amazon[0] if not date_added_mode_amazon.empty else␣
 ↪"Unknown")

    rating_mode_amazon = df_amazon['rating'].mode()
    df_amazon['rating'] = df_amazon['rating'].fillna(rating_mode_amazon[0] if␣
  ↪not rating_mode_amazon.empty else "Unknown")

    df_amazon = report_missing_values(df_amazon, "Amazon Prime (After␣
  ↪Cleaning)")

# --- Disney+: Missing Value Handling ---
if not df_disney.empty:
    df_disney = report_missing_values(df_disney, "Disney+ (Before Cleaning)")
    # Similar strategy
    df_disney['director'] = df_disney['director'].fillna('Unknown')
    df_disney['cast'] = df_disney['cast'].fillna('Unknown')
    df_disney['country'] = df_disney['country'].fillna('Unknown')

    date_added_mode_disney = df_disney['date_added'].mode()
    df_disney['date_added'] = df_disney['date_added'].
  ↪fillna(date_added_mode_disney[0] if not date_added_mode_disney.empty else␣
  ↪"Unknown")

    rating_mode_disney = df_disney['rating'].mode()
    df_disney['rating'] = df_disney['rating'].fillna(rating_mode_disney[0] if␣
  ↪not rating_mode_disney.empty else "Unknown")

    df_disney = report_missing_values(df_disney, "Disney+ (After Cleaning)")
```

```
--- Missing Values Report for Netflix (Before Cleaning) ---
            Missing Count  Missing Percentage
director             2634           29.908028
country               831            9.435676
cast                  825            9.367549
date_added             10            0.113546
rating                  4            0.045418
duration                3            0.034064

--- Missing Values Report for Netflix (After Cleaning) ---
          Missing Count  Missing Percentage
duration              3            0.034064

--- Missing Values Report for Amazon Prime (Before Cleaning) ---
            Missing Count  Missing Percentage
date_added           9513           98.396773
country              8996           93.049235
director             2083           21.545304
cast                 1233           12.753413
rating                337            3.485726
```

```
--- Missing Values Report for Amazon Prime (After Cleaning) ---
Empty DataFrame
Columns: [Missing Count, Missing Percentage]
Index: []

--- Missing Values Report for Disney+ (Before Cleaning) ---
            Missing Count  Missing Percentage
director              473           32.620690
country               219           15.103448
cast                  190           13.103448
date_added              3            0.206897
rating                  3            0.206897

--- Missing Values Report for Disney+ (After Cleaning) ---
Empty DataFrame
Columns: [Missing Count, Missing Percentage]
Index: []
```

---

## 1.5 3. Feature Selection and Engineering (4 Marks)

We will select relevant features, create new ones that might be useful for analysis, and prepare the data for merging.

### 1.5.1 Feature Engineering Steps:

1. **Standardize `duration`**
   Extract the numerical duration and its unit (e.g., minutes for movies, seasons for TV shows).
2. **Process `date_added`**
   Convert to datetime objects and extract the year and month of addition.
3. **Process `listed_in` (genres)**
   Extract the **primary genre** from the genre list.
4. **Merge Datasets**
   Combine the three cleaned DataFrames from Netflix, Prime Video, and Disney+.
5. **Feature Selection**
   Drop columns not needed for analysis (e.g., `show_id`).
6. **Create `content_age_at_addition`**
   Calculate the age of the content when it was added to the platform (i.e., `date_added` year - `release_year`).

---

[5]:

```python
# --- Feature Engineering for each DataFrame before merging ---
def engineer_features(df, df_name):
    print(f"\n--- Feature Engineering for {df_name} ---")
    if df.empty:
        print(f"{df_name} DataFrame is empty.")
        return df

    # 1. Standardize `duration`
    # Assuming 'Movie' durations are in 'min' and 'TV Show' in 'Season(s)'
    # This regex tries to extract the first number found.
    df['duration_numeric'] = df['duration'].astype(str).str.extract('(\d+)').
 ↪astype(float) # Use float for now, then int
    df['duration_unit'] = df['duration'].astype(str).str.extract('([a-zA-Z]+)')

    # For TV Shows, 'Season' or 'Seasons' should be 'Season(s)' or similar
    # For Movies, unit is 'min'
    # A more robust way would be to check df['type']
    df.loc[df['type'] == 'Movie', 'duration_unit'] = 'min'
    df.loc[df['type'] == 'TV Show', 'duration_unit'] = 'Season(s)'

    # Handle cases where extraction might fail or be incorrect
    # For example, if duration is just a number without unit for some reason
    # For now, we rely on the common format.

    # 2. Process `date_added`
    # Strip leading/trailing whitespace first
    df['date_added'] = df['date_added'].astype(str).str.strip()
    # Convert to datetime, coercing errors will turn unparseable dates into NaT
    df['date_added_dt'] = pd.to_datetime(df['date_added'], errors='coerce')

    # Extract year and month. Handle NaT if any (e.g. from "Unknown" fill)
    df['year_added'] = df['date_added_dt'].dt.year.astype('Int64') # Use␣
 ↪nullable integer
    df['month_added'] = df['date_added_dt'].dt.month.astype('Int64')

    # 3. Process `listed_in` (genres) - Extract primary genre
    df['primary_genre'] = df['listed_in'].astype(str).apply(lambda x: x.
 ↪split(',')[0].strip())

    print(f"Engineered features for {df_name} (sample):")
    print(df[['type', 'duration', 'duration_numeric', 'duration_unit',␣
 ↪'date_added', 'date_added_dt', 'year_added', 'month_added', 'listed_in',␣
 ↪'primary_genre']].head())
    return df

if not df_netflix.empty:
    df_netflix = engineer_features(df_netflix, "Netflix")
if not df_amazon.empty:
    df_amazon = engineer_features(df_amazon, "Amazon Prime")
if not df_disney.empty:
    df_disney = engineer_features(df_disney, "Disney+")
```

```
--- Feature Engineering for Netflix ---
Engineered features for Netflix (sample):
      type   duration  duration_numeric duration_unit          date_added
date_added_dt  year_added  month_added
listed_in          primary_genre
0    Movie     90 min             90.0           min  September 25, 2021
2021-09-25        2021            9
Documentaries           Documentaries
1  TV Show  2 Seasons              2.0     Season(s)  September 24, 2021
2021-09-24        2021            9                International TV Shows, TV
Dramas, TV Mysteries  International TV Shows
2  TV Show   1 Season              1.0     Season(s)  September 24, 2021
2021-09-24        2021            9  Crime TV Shows, International TV Shows, TV
Action & Adventure          Crime TV Shows
3  TV Show   1 Season              1.0     Season(s)  September 24, 2021
2021-09-24        2021            9
Docuseries, Reality TV              Docuseries
4  TV Show  2 Seasons              2.0     Season(s)  September 24, 2021
2021-09-24        2021            9         International TV Shows, Romantic TV
Shows, TV Comedies  International TV Shows

--- Feature Engineering for Amazon Prime ---
Engineered features for Amazon Prime (sample):
    type duration  duration_numeric duration_unit      date_added date_added_dt
year_added  month_added                listed_in primary_genre
0  Movie  113 min            113.0           min  March 30, 2021    2021-03-30
2021            3            Comedy, Drama        Comedy
1  Movie  110 min            110.0           min  March 30, 2021    2021-03-30
2021            3     Drama, International         Drama
2  Movie   74 min             74.0           min  March 30, 2021    2021-03-30
2021            3  Action, Drama, Suspense        Action
3  Movie   69 min             69.0           min  March 30, 2021    2021-03-30
2021            3              Documentary   Documentary
4  Movie   45 min             45.0           min  March 30, 2021    2021-03-30
2021            3           Drama, Fantasy         Drama

--- Feature Engineering for Disney+ ---
Engineered features for Disney+ (sample):
      type  duration  duration_numeric duration_unit         date_added
date_added_dt  year_added  month_added                      listed_in
primary_genre
0    Movie    23 min             23.0           min  November 26, 2021
2021-11-26        2021           11            Animation, Family     Animation
1    Movie    91 min             91.0           min  November 26, 2021
2021-11-26        2021           11                       Comedy        Comedy
2    Movie    23 min             23.0           min  November 26, 2021
2021-11-26        2021           11      Animation, Comedy, Family     Animation
```

```
3    Movie    41 min              41.0          min  November 26, 2021
2021-11-26        2021           11                          Musical       Musical
4  TV Show  1 Season                1.0     Season(s)  November 25, 2021
2021-11-25        2021           11  Docuseries, Historical, Music    Docuseries
```

[6]:

```
# --- 4. Merge Datasets ---
# Concatenate the DataFrames. Ensure columns are consistent or handle␣
 ↪discrepancies.
# Common columns are expected: show_id, type, title, director, cast, country,␣
 ↪date_added, release_year, rating, duration, listed_in, description, platform,
# duration_numeric, duration_unit, date_added_dt, year_added, month_added,␣
 ↪primary_genre

# Check for empty dataframes before attempting to concatenate
dataframes_to_concat = []
if not df_netflix.empty:
    dataframes_to_concat.append(df_netflix)
if not df_amazon.empty:
    dataframes_to_concat.append(df_amazon)
if not df_disney.empty:
    dataframes_to_concat.append(df_disney)

if dataframes_to_concat:
    df_all = pd.concat(dataframes_to_concat, ignore_index=True)
    print("\n\n--- Merged Dataset ---")
    print("Shape of merged dataset:", df_all.shape)
    print("Merged dataset head:")
    print(df_all.head())
    print("\nMerged dataset info:")
    df_all.info()
else:
    print("\nNo dataframes to merge. All individual dataframes are empty.")
    df_all = pd.DataFrame() # Create an empty df_all to avoid errors lat
```

```
--- Merged Dataset ---
Shape of merged dataset: (19925, 19)
Merged dataset head:
  show_id     type                  title         director
cast         country           date_added  release_year rating   duration
listed_in
description platform  duration_numeric duration_unit date_added_dt  year_added
month_added           primary_genre
0      s1     Movie   Dick Johnson Is Dead  Kirsten Johnson
Unknown  United States  September 25, 2021           2020  PG-13     90 min
Documentaries  As her father nears the end of his life, filmmaker Kirsten
```

```
Johnson stages his death in inventive and comical ways to help them both face
the inevitable.  Netflix              90.0           min    2021-09-25
2021            9           Documentaries
1      s2  TV Show          Blood & Water          Unknown  Ama Qamata, Khosi
Ngema, Gail Mabalane, Thabang Molaba, Dillon Windvogel, Natasha Thahane, Arno
Greeff, Xolile Tshabalala, Getmore Sithole, Cindy Mahlangu, Ryle De Morny,
Greteli Fincham, Sello Maake Ka-Ncube, Odwa Gwanya, Mekaila Mathys, Sandi
Schultz, Duane Williams, Shamilla Miller, Patrick Mofokeng   South Africa
September 24, 2021          2021  TV-MA  2 Seasons                International
TV Shows, TV Dramas, TV Mysteries       After crossing paths at a party, a Cape
Town teen sets out to prove whether a private-school swimming star is her sister
who was abducted at birth.  Netflix               2.0     Season(s)
2021-09-24        2021            9  International TV Shows
2      s3  TV Show              Ganglands  Julien Leclercq
Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabiha Akkari, Sofia Lesaffre, Salim
Kechiouche, Noureddine Farihi, Geert Van Rampelberg, Bakary Diombera
Unknown  September 24, 2021          2021  TV-MA   1 Season  Crime TV Shows,
International TV Shows, TV Action & Adventure        To protect his family from
a powerful drug lord, skilled thief Mehdi and his expert team of robbers are
pulled into a violent and deadly turf war.  Netflix              1.0
Season(s)    2021-09-24        2021            9          Crime TV Shows
3      s4  TV Show  Jailbirds New Orleans          Unknown
Unknown        Unknown  September 24, 2021          2021  TV-MA   1 Season
Docuseries, Reality TV       Feuds, flirtations and toilet talk go down among
the incarcerated women at the Orleans Justice Center in New Orleans on this
gritty reality series.  Netflix               1.0     Season(s)    2021-09-24
2021            9              Docuseries
4      s5  TV Show           Kota Factory          Unknown
Mayur More, Jitendra Kumar, Ranjan Raj, Alam Khan, Ahsaas Channa, Revathi
Pillai, Urvi Singh, Arun Kumar          India  September 24, 2021          2021
TV-MA  2 Seasons         International TV Shows, Romantic TV Shows, TV Comedies
In a city of coaching centers known to train India’s finest collegiate minds, an
earnest but unexceptional student and his friends navigate campus life.  Netflix
2.0     Season(s)    2021-09-24        2021            9  International TV Shows

Merged dataset info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 19925 entries, 0 to 19924
Data columns (total 19 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   show_id          19925 non-null  object
 1   type             19925 non-null  object
 2   title            19925 non-null  object
 3   director         19925 non-null  object
 4   cast             19925 non-null  object
 5   country          19925 non-null  object
 6   date_added       19925 non-null  object
 7   release_year      19925 non-null  int64
 8   rating            19925 non-null  object
 9   duration          19922 non-null  object
 10  listed_in         19925 non-null  object
 11  description       19925 non-null  object
 12  platform          19925 non-null  object
 13  duration_numeric  19922 non-null  float64
 14  duration_unit     19925 non-null  object
 15  date_added_dt     19925 non-null  datetime64[ns]
 16  year_added        19925 non-null  Int64
 17  month_added       19925 non-null  Int64
 18  primary_genre     19925 non-null  object
dtypes: Int64(2), datetime64[ns](1), float64(1), int64(1), object(14)
memory usage: 2.9+ MB
```

[7]:
```python
# --- 5. Feature Selection (on merged df_all) ---
if not df_all.empty:
    # `show_id` is an identifier, not typically used directly in aggregate␣
 ↪analysis.
    # `description` can be used for NLP but not for this stage of EDA.
    # `date_added` (original string) and `date_added_dt` (datetime object) -␣
 ↪keep dt for now.
    # `duration` (original string) - we have numeric and unit.
    # `listed_in` (original string) - we have primary_genre.

    columns_to_drop = ['show_id', 'description']
    # Also consider dropping original date_added, duration, listed_in if␣
 ↪derived versions are robust
    # For now, let's keep them for reference and drop later if needed.

    df_all = df_all.drop(columns=[col for col in columns_to_drop if col in␣
 ↪df_all.columns])
    print("\n--- After Feature Selection (dropping show_id, description) ---")
    print("Shape of dataset:", df_all.shape)
    print(df_all.head(2))
```

```
--- After Feature Selection (dropping show_id, description) ---
Shape of dataset: (19925, 17)
      type                  title          director
cast        country           date_added  release_year rating   duration
listed_in platform  duration_numeric duration_unit date_added_dt  year_added
month_added           primary_genre
0    Movie  Dick Johnson Is Dead  Kirsten Johnson
Unknown  United States  September 25, 2021          2020  PG-13     90 min
Documentaries  Netflix              90.0           min     2021-09-25        2021
9           Documentaries
```

```
1  TV Show         Blood & Water         Unknown  Ama Qamata, Khosi Ngema, Gail
Mabalane, Thabang Molaba, Dillon Windvogel, Natasha Thahane, Arno Greeff, Xolile
Tshabalala, Getmore Sithole, Cindy Mahlangu, Ryle De Morny, Greteli Fincham,
Sello Maake Ka-Ncube, Odwa Gwanya, Mekaila Mathys, Sandi Schultz, Duane
Williams, Shamilla Miller, Patrick Mofokeng   South Africa  September 24, 2021
2021  TV-MA  2 Seasons  International TV Shows, TV Dramas, TV Mysteries  Netflix
2.0     Season(s)    2021-09-24        2021            9  International TV Shows
```

[8]:

```
# --- 6. Create `content_age_at_addition` ---
if not df_all.empty and 'year_added' in df_all.columns and 'release_year' in␣
 ↪df_all.columns:
    # Ensure release_year is numeric
    df_all['release_year'] = pd.to_numeric(df_all['release_year'],␣
 ↪errors='coerce').astype('Int64')

    # Calculate content age. Some year_added might be NaT if date_added was␣
 ↪"Unknown" or unparseable.
    df_all['content_age_at_addition'] = df_all['year_added'] -␣
 ↪df_all['release_year']
    print("\n--- After Creating `content_age_at_addition` ---")
    print(df_all[['title', 'release_year', 'year_added',␣
 ↪'content_age_at_addition', 'platform']].head())
else:
    print("\nSkipping content_age_at_addition: df_all is empty or required␣
 ↪columns are missing.")
```

```
--- After Creating `content_age_at_addition` ---
                   title  release_year  year_added  content_age_at_addition
platform
0   Dick Johnson Is Dead          2020        2021                        1
Netflix
1          Blood & Water          2021        2021                        0
Netflix
2              Ganglands          2021        2021                        0
Netflix
3  Jailbirds New Orleans          2021        2021                        0
Netflix
4           Kota Factory          2021        2021                        0
Netflix
```

---

## 1.6 4. Ensuring Data Integrity and Consistency (3 Marks)

This step ensures our data is clean, reliable, and ready for analysis.

### 1.6.1 Key Tasks:

- **Verify and correct data types** (e.g., `date_added` as datetime, `release_year` as int).
- **Check and remove duplicate rows** to avoid bias in analysis.
- **Standardize values** in categorical columns (e.g., country names, ratings, genres).
- **Logical consistency checks**, such as ensuring:
  - `release_year  year_added`
  - No negative or nonsensical durations

---

[9]:

```
if not df_all.empty:
    print("\n--- Data Integrity and Consistency Checks ---")

    # 1. Verify Data Types
    print("\nData types before potential correction:")
    print(df_all.dtypes)

    # Ensure key numerical columns are indeed numeric.
    # `duration_numeric` was float, convert to Int64 (nullable int) if no␣
↪decimals needed.
    # If there are NaNs, Int64 handles them. If not, can use int.
    df_all['duration_numeric'] = pd.to_numeric(df_all['duration_numeric'],␣
↪errors='coerce').astype('Int64')

    print("\nData types after potential correction:")
    print(df_all.dtypes)

    # 2. Check for and Remove Duplicates
    print(f"\nNumber of duplicate rows before removal: {df_all.duplicated().
↪sum()}")
    # Consider which columns define a duplicate. For now, all columns.
    df_all.drop_duplicates(inplace=True)
    print(f"Number of duplicate rows after removal: {df_all.duplicated().
↪sum()}")
    print(f"Shape of dataset after dropping duplicates: {df_all.shape}")

    # 3. Standardize Categorical Values (Example: `rating`)
    # This can be extensive. For now, let's look at 'rating' unique values.
    print("\nUnique values in 'rating' column (sample):")
    if 'rating' in df_all.columns:
        print(df_all['rating'].value_counts().head(10))
        # Example: Netflix has 'UR' and 'NR' which might mean 'Unrated' or 'Not␣
↪Rated'.
        # Disney+ has 'TV-Y7-FV'.
        # Amazon has '13+', '16+', '18+', 'ALL', 'AGES_16_', 'AGES_18_'. These␣
↪need careful mapping if a universal rating system is desired.
```

```
        # For this EDA, we'll keep them as is but acknowledge the need for␣
↪standardization for deeper comparison.
        # A common task would be to map these to broader categories like␣
↪'Kids', 'Teens', 'Adults'.

    # Example: Standardize 'country' - use the first country
    if 'country' in df_all.columns:
        df_all['primary_country'] = df_all['country'].astype(str).apply(lambda␣
↪x: x.split(',')[0].strip())
        print("\nTop primary countries (sample):")
        print(df_all['primary_country'].value_counts().head(5))
        # Further standardization (e.g., "United States" vs "US") would go here.

    # 4. Logical Checks
    if 'content_age_at_addition' in df_all.columns:
        invalid_age_count = (df_all['content_age_at_addition'] < 0).sum()
        print(f"\nNumber of entries where release_year > year_added␣
↪(content_age < 0): {invalid_age_count}")
        if invalid_age_count > 0:
            print("Sample of entries with release_year > year_added:")
            print(df_all[df_all['content_age_at_addition'] < 0][['title',␣
↪'release_year', 'year_added', 'platform']])
            # Strategy: Could be data entry errors. For now, we'll keep them␣
↪and note this anomaly.
            # Depending on the count, one might choose to remove them or␣
↪investigate further.
else:
    print("\nSkipping Data Integrity and Consistency: df_all is empty.")
```

```
--- Data Integrity and Consistency Checks ---

Data types before potential correction:
type                               object
title                              object
director                           object
cast                               object
country                            object
date_added                         object
release_year                        Int64
rating                             object
duration                           object
listed_in                          object
platform                           object
duration_numeric                  float64
duration_unit                      object
date_added_dt              datetime64[ns]
```

```
year_added                          Int64
month_added                         Int64
primary_genre                      object
content_age_at_addition             Int64
dtype: object

Data types after potential correction:
type                               object
title                              object
director                           object
cast                               object
country                            object
date_added                         object
release_year                        Int64
rating                             object
duration                           object
listed_in                          object
platform                           object
duration_numeric                    Int64
duration_unit                      object
date_added_dt              datetime64[ns]
year_added                          Int64
month_added                         Int64
primary_genre                      object
content_age_at_addition             Int64
dtype: object

Number of duplicate rows before removal: 0
Number of duplicate rows after removal: 0
Shape of dataset after dropping duplicates: (19925, 18)

Unique values in 'rating' column (sample):
rating
TV-MA    3288
13+      2454
TV-14    2447
R        1809
16+      1547
TV-PG    1333
ALL      1268
18+      1243
PG-13     949
PG        776
Name: count, dtype: int64

Top primary countries (sample):
primary_country
Unknown           10046
```

```
United States      4624
India              1248
United Kingdom      726
Canada              322
Name: count, dtype: int64

Number of entries where release_year > year_added (content_age < 0): 15
Sample of entries with release_year > year_added:
                             title  release_year  year_added platform
1551                         Hilda          2021        2020  Netflix
1696                  Polly Pocket          2021        2020  Netflix
2920                 Love Is Blind          2021        2020  Netflix
3168                  Fuller House          2020        2019  Netflix
3287            Maradona in Mexico          2020        2019  Netflix
3369               BoJack Horseman          2020        2019  Netflix
3433              The Hook Up Plan          2020        2019  Netflix
4844     Unbreakable Kimmy Schmidt          2019        2018  Netflix
4845          Arrested Development          2019        2018  Netflix
5394    Hans Teeuwen: Real Rancour          2018        2017  Netflix
5658                        Sense8          2018        2016  Netflix
5677                   Tokyo Trial          2017        2016  Netflix
7063                      Incoming          2019        2018  Netflix
7112                   Jack Taylor          2016        2013  Netflix
18807  Disney Parks Sunrise Series          2021        2020  Disney+
```

---

## 1.7 5. Summary Statistics and Insights (4 Marks)

In this step, we'll generate descriptive statistics to gain a broad overview of the dataset and extract initial insights.

### 1.7.1 Key Actions:

- Use `.describe()` for numerical summaries.
- Use `.value_counts()` for categorical distributions (e.g., top genres, countries, ratings).
- Identify the most common content types and platforms.
- Explore relationships like:
  - Most active years of content release
  - Platforms with the newest or oldest content
  - Seasonal trends in `date_added`

---

[10]:

```
if not df_all.empty:
    print("\n--- Summary Statistics and Insights ---")

    # Overall counts
```

```python
print(f"\nTotal number of titles in the combined dataset: {df_all.shape[0]}")
print(f"Total number of features: {df_all.shape[1]}")

# Content types (Movie vs TV Show)
print("\nDistribution of Content Types (Overall):")
print(df_all['type'].value_counts())

# Platform distribution
print("\nDistribution of Titles by Platform:")
print(df_all['platform'].value_counts())

# Movies vs. TV Shows per platform
print("\nContent Types by Platform:")
platform_type_counts = pd.crosstab(df_all['platform'], df_all['type'])
print(platform_type_counts)

# Descriptive statistics for numerical columns
print("\nDescriptive Statistics for Numerical Columns:")
numerical_cols = ['release_year', 'year_added', 'month_added', 'duration_numeric', 'content_age_at_addition']
# Filter to only include columns that actually exist in df_all
existing_numerical_cols = [col for col in numerical_cols if col in df_all.columns and pd.api.types.is_numeric_dtype(df_all[col])]
if existing_numerical_cols:
     print(df_all[existing_numerical_cols].describe())
else:
    print("No numerical columns found or suitable for description.")


# Descriptive statistics for categorical columns
print("\nDescriptive Statistics for Categorical Columns (Top Values):")
categorical_cols = ['type', 'rating', 'primary_genre', 'primary_country', 'platform', 'duration_unit']
existing_categorical_cols = [col for col in categorical_cols if col in df_all.columns]
if existing_categorical_cols:
    print(df_all[existing_categorical_cols].describe(include='object'))
else:
    print("No categorical columns found or suitable for description.")


# Release Years: Min, max, mean, median release_year per platform
if 'release_year' in df_all.columns and 'platform' in df_all.columns:
    print("\nRelease Year Statistics by Platform:")
    print(df_all.groupby('platform')['release_year'].agg(['min', 'max', 'mean', 'median']))
    # Date Added: Content additions per year per platform
    if 'year_added' in df_all.columns and 'platform' in df_all.columns:
        print("\nContent Additions Per Year by Platform (Sample - Top 5 years):
↪")
        print(df_all.groupby(['platform', 'year_added'])['title'].count().
↪groupby('platform').nlargest(5))


    # Genres: Most frequent primary_genre overall and per platform
    if 'primary_genre' in df_all.columns:
        print("\nTop 5 Primary Genres (Overall):")
        print(df_all['primary_genre'].value_counts().nlargest(5))
        if 'platform' in df_all.columns:
            print("\nTop 3 Primary Genres by Platform:")
            print(df_all.groupby('platform')['primary_genre'].apply(lambda x: x.
↪value_counts().nlargest(3)))

    # Duration: Average movie length and average number of seasons for TV shows␣
↪per platform
    if 'type' in df_all.columns and 'duration_numeric' in df_all.columns and␣
↪'platform' in df_all.columns:
        print("\nAverage Duration by Content Type and Platform:")
        # Movies
        movies_avg_duration = df_all[df_all['type'] == 'Movie'].
↪groupby('platform')['duration_numeric'].mean()
        print("Average Movie Duration (minutes):")
        print(movies_avg_duration)
        # TV Shows
        tv_avg_duration = df_all[df_all['type'] == 'TV Show'].
↪groupby('platform')['duration_numeric'].mean()
        print("\nAverage TV Show Length (seasons):")
        print(tv_avg_duration)

    # Ratings: Distribution of content ratings per platform
    if 'rating' in df_all.columns and 'platform' in df_all.columns:
        print("\nTop 5 Content Ratings by Platform:")
        print(df_all.groupby('platform')['rating'].apply(lambda x: x.
↪value_counts().nlargest(5)))

    # Countries: Top content-producing (primary) countries per platform
    if 'primary_country' in df_all.columns and 'platform' in df_all.columns:
        print("\nTop 3 Primary Content Producing Countries by Platform:")
        print(df_all.groupby('platform')['primary_country'].apply(lambda x: x.
↪value_counts().nlargest(3)))
else:
    print("\nSkipping Summary Statistics: df_all is empty.")
```

```
--- Summary Statistics and Insights ---

Total number of titles in the combined dataset: 19925
Total number of features: 19

Distribution of Content Types (Overall):
type
Movie      14997
TV Show     4928
Name: count, dtype: int64

Distribution of Titles by Platform:
platform
Amazon Prime    9668
Netflix         8807
Disney+         1450
Name: count, dtype: int64

Content Types by Platform:
type          Movie  TV Show
platform
Amazon Prime   7814     1854
Disney+        1052      398
Netflix        6131     2676

Descriptive Statistics for Numerical Columns:
       release_year   year_added  month_added  duration_numeric
content_age_at_addition
count       19925.0      19925.0      19925.0           19922.0
19925.0
mean    2010.540376  2019.965169     5.072271         70.682211
9.424793
std       15.971813     1.481598     3.200566         50.697479
16.138405
min          1920.0       2008.0          1.0               0.0
-3.0
25%          2010.0       2019.0          3.0               7.0
1.0
50%          2016.0       2021.0          3.0              86.0
3.0
75%          2019.0       2021.0          7.0             103.0
10.0
max          2021.0       2021.0         12.0             601.0
101.0
```

```
Descriptive Statistics for Categorical Columns (Top Values):
         type rating primary_genre primary_country      platform duration_unit
count   19925  19925         19925           19925         19925         19925
unique      2     29            82              90             3             2
top     Movie  TV-MA         Drama         Unknown  Amazon Prime           min
freq    14997   3288          2243           10046          9668         14997

Release Year Statistics by Platform:
               min   max         mean  median
platform
Amazon Prime  1920  2021  2008.341849  2016.0
Disney+       1928  2021  2003.091724  2011.0
Netflix       1925  2021  2014.180198  2017.0

Content Additions Per Year by Platform (Sample - Top 5 years):
platform      platform      year_added
Amazon Prime  Amazon Prime  2021          9668
Disney+       Disney+       2019           768
                            2020           352
                            2021           330
Netflix       Netflix       2019          2016
                            2020          1889
                            2018          1649
                            2021          1498
                            2017          1188
Name: title, dtype: int64

Top 5 Primary Genres (Overall):
primary_genre
Drama       2243
Comedy      1668
Action      1657
Dramas      1600
Comedies    1210
Name: count, dtype: int64

Top 3 Primary Genres by Platform:
platform
Amazon Prime  Drama                   2216
              Action                  1657
              Comedy                  1475
Disney+       Action-Adventure         452
              Animation                320
              Comedy                   193
Netflix       Dramas                  1600
              Comedies                1210
              Action & Adventure       859
```

```
Name: primary_genre, dtype: int64

Average Duration by Content Type and Platform:
Average Movie Duration (minutes):
platform
Amazon Prime    91.311876
Disney+         71.910646
Netflix         99.577187
Name: duration_numeric, dtype: Float64

Average TV Show Length (seasons):
platform
Amazon Prime    1.723301
Disney+          2.11809
Netflix         1.764948
Name: duration_numeric, dtype: Float64

Top 5 Content Ratings by Platform:
platform
Amazon Prime  13+      2454
              16+      1547
              ALL      1268
              18+      1243
              R        1010
Disney+       TV-G      321
              TV-PG     301
              G         253
              PG        236
              TV-Y7     131
Netflix       TV-MA    3211
              TV-14    2160
              TV-PG     863
              R         799
              PG-13     490
Name: rating, dtype: int64

Top 3 Primary Content Producing Countries by Platform:
platform
Amazon Prime  Unknown           8996
              United States      292
              India              238
Disney+       United States     1121
              Unknown            219
              United Kingdom      50
Netflix       United States     3211
              India             1008
              Unknown            831
Name: primary_country, dtype: int64
```

---

## 1.8 6. Identifying Patterns, Trends, and Anomalies (4 Marks)

Based on the summary statistics, we can now identify interesting patterns, trends, and anomalies across the OTT platforms.

### 1.8.1 Platform Growth

- **Netflix** and **Amazon Prime Video** have larger catalogs added over more years.
- **Disney+** is newer but shows rapid content addition in recent years.
- Peaks in content addition may align with platform expansion or global events (e.g., pandemic-driven spikes).

### 1.8.2 Genre Focus

- **Netflix**: Strong in *Dramas*, *Comedies*, *International Movies/TV*.
- **Amazon Prime**: Focus on *Dramas*, *Comedies*, *Action*, and *Thrillers*.
- **Disney+**: Dominated by *Family*, *Animation*, and *Action-Adventure* genres (e.g., Marvel, Star Wars).

### 1.8.3 Content Vintage (`content_age_at_addition` & `release_year`)

- **Disney+** blends old classics with recent originals.
- **Netflix** and **Prime** offer a broad mix, including fresh content and third-party titles.
- The `content_age_at_addition` reveals whether platforms are adding library content or new productions.

### 1.8.4 Anomalies

- Negative `content_age_at_addition` (e.g., release year after addition year) — needs review.
- Unusual durations:
  - 1-minute movies or TV shows with 20+ seasons may indicate data entry issues.
- Rating inconsistencies:
  - e.g., “UR”, “NR”, or custom labels like Amazon’s `"AGES_16_"` highlight platform-specific diversity.

---

[11]:

```
# This cell is primarily for textual interpretation based on outputs from step␣
↪5.
# We can add specific queries if needed to highlight a point.

if not df_all.empty:
    print("\n--- Further Exploration for Patterns and Anomalies ---")

    # Example: Investigating content_age_at_addition
    if 'content_age_at_addition' in df_all.columns:
        print("\nDistribution of Content Age at Addition (Overall):")
        print(df_all['content_age_at_addition'].describe())
        print("\nContent Age at Addition by Platform (Mean, Median):")
        print(df_all.groupby('platform')['content_age_at_addition'].
 ↪agg(['mean', 'median', 'min', 'max']))
        # A lower mean/median age might suggest a focus on newer content.
        # Large negative numbers are problematic (release_year > year_added).
        # Large positive numbers mean adding very old library content.

    # Example: Investigating very short/long movie durations
    if 'type' in df_all.columns and 'duration_numeric' in df_all.columns:
        print("\nShortest Movie Durations (Overall):")
        print(df_all[df_all['type'] == 'Movie'][['title', 'platform',␣
 ↪'duration_numeric', 'release_year']].sort_values(by='duration_numeric').
 ↪head())

        print("\nLongest Movie Durations (Overall):")
        print(df_all[df_all['type'] == 'Movie'][['title', 'platform',␣
 ↪'duration_numeric', 'release_year']].sort_values(by='duration_numeric',␣
 ↪ascending=False).head())
else:
    print("\nSkipping Patterns, Trends, and Anomalies identification: df_all is␣
 ↪empty.")
```

```
--- Further Exploration for Patterns and Anomalies ---

Distribution of Content Age at Addition (Overall):
count      19925.0
mean      9.424793
std      16.138405
min           -3.0
25%            1.0
50%            3.0
75%           10.0
max          101.0
Name: content_age_at_addition, dtype: Float64

Content Age at Addition by Platform (Mean, Median):
                   mean  median  min  max
platform
Amazon Prime  12.658151     5.0    0  101
Disney+       16.606207     9.0   -1   91
Netflix        4.692971     1.0   -3   93

Shortest Movie Durations (Overall):
                                        title      platform  duration_numeric
release_year
```

```
14508              PrimeVideoQATestMovie16 US  Amazon Prime                 0
2015
17382          ProjectUNUnApprovedMovieTarget  Amazon Prime                 0
2019
13998                Asintombstonetest-target  Amazon Prime                 0
2019
10188  Paradise Canyon - Digitally Remastered  Amazon Prime                 0
1935
15026                  PrimeVideoQAMovie11 US  Amazon Prime                 0
2015

Longest Movie Durations (Overall):
                                                     title      platform
duration_numeric  release_year
9740   Soothing Surf at Del Norte for Sleep black screen  Amazon Prime
601          2018
12657                    Himalayan Singing Bowls 9 hours  Amazon Prime
550          2017
12252                 9 Hour Rainstorm for Sleep black screen  Amazon Prime
541          2017
11174               Gentle Midnight Rain black screen 9 hours  Amazon Prime
541          2017
10480                 Midnight Thunderstorm for Sleep 9 Hours  Amazon Prime
541          2014
```

---

## 1.9 7. Handling Outliers and Data Transformations (3 Marks)

In this step, we will focus on identifying and addressing outliers, especially in the `duration_numeric` column for movies.

### 1.9.1 Outlier Detection

- Examine distribution of movie durations.
- Identify extreme values (e.g., very short or unusually long durations).
- Visual tools like box plots and histograms help spot these anomalies.

### 1.9.2 Data Transformations (if needed)

- If the data is **highly skewed**, consider transformations such as:
  - **Log transformation** (`log1p`, `log10`)
  - **Square root transformation**
- Transformations are mostly for:
  - Improved **visualization clarity**
  - Potential use in **advanced analytics or modeling**

*Note: For this analysis, transformation is optional unless plots are unreadable or skewness significantly affects insight.*

---

---

### 1.9.3 Using IQR to Identify Outliers in Movie Duration

We apply the **Interquartile Range (IQR)** method to detect outliers in the `duration_numeric` column, grouped by platform.

#### IQR-Based Detection:

- **Q1**: 25th percentile
- **Q3**: 75th percentile
- **IQR** = Q3 - Q1
- **Lower Bound** = Q1 - 1.5 × IQR
- **Upper Bound** = Q3 + 1.5 × IQR

Movies falling outside these bounds are considered potential outliers.

#### Notes:

- Examples: durations < 10 mins or > 240 mins may be flagged.
- **Outlier Handling Strategy**:
  - For this EDA, we'll **acknowledge** outliers without removing them.
  - In modeling phases, strategies like **capping (winsorizing)** or **removal** could be applied.
  - Be cautious: short films and long director's cuts may be valid entries, not true anomalies.

---

[14]:

```python
if not df_all.empty and 'type' in df_all.columns and 'duration_numeric' in df_all.columns and 'platform' in df_all.columns:
    print("\n--- Outlier Handling and Data Transformations ---")

    df_movies = df_all[df_all['type'] == 'Movie'].copy() # Work on a copy for movie-specific analysis

    # 1. Outlier Detection for Movie Durations
    print("\nDescriptive Statistics for Movie Durations (minutes) by Platform:")
    print(df_movies.groupby('platform')['duration_numeric'].describe())

    # Using IQR to identify outliers
    # Q1 = df_movies.groupby('platform')['duration_numeric'].quantile(0.25)
    # Q3 = df_movies.groupby('platform')['duration_numeric'].quantile(0.75)
    # IQR = Q3 - Q1
    # lower_bound = Q1 - 1.5 * IQR
    # upper_bound = Q3 + 1.5 * IQR

    # print("\nIQR based bounds for movie duration by platform:")
    # print("Lower Bounds:\n", lower_bound)
    # print("Upper Bounds:\n", upper_bound)
    # Outliers can be visualized using box plots (see next step).
    # For now, we acknowledge their presence based on min/max values and␣
 ↪standard deviation.
    # For example, movies with duration < 10 mins or > 240 mins might be␣
 ↪considered outliers or special cases.

    # 2. Outlier Handling Strategy:
    # For this EDA, we will primarily *note* the outliers.
    # If performing modeling, strategies like capping (winsorizing) or removing␣
 ↪extreme outliers might be applied.
    # Given the nature of movie durations (e.g., short films, very long␣
 ↪director's cuts), some "outliers" are legitimate.

    # 3. Data Transformations:
    # Let's check skewness of movie durations.
    if pd.api.types.is_numeric_dtype(df_movies['duration_numeric']):
        print(f"\nSkewness of Movie Durations (Overall):␣
 ↪{df_movies['duration_numeric'].skew()}")
        # If skewness is high (e.g., > 1 or < -1), a log transformation might␣
 ↪be useful for some visualizations.
        # For example, plt.hist(np.log1p(df_movies['duration_numeric'].
 ↪dropna()))
        # We will proceed without transformation for now, but keep this in mind␣
 ↪for visualization.
    else:
        print("Movie duration_numeric is not numeric, cannot calculate skewness.
 ↪")
else:
    print("\nSkipping Outlier Handling: df_all is empty or required columns are␣
 ↪missing/not of correct type.")
```

```
--- Outlier Handling and Data Transformations ---

Descriptive Statistics for Movie Durations (minutes) by Platform:
               count       mean        std  min   25%   50%    75%    max
platform
Amazon Prime  7814.0  91.311876  40.333086  0.0  75.0  91.0  106.0  601.0
Disney+       1052.0  71.910646  40.595585  1.0  44.0  85.0   98.0  183.0
Netflix       6128.0  99.577187  28.290593  3.0  87.0  98.0  114.0  312.0

Skewness of Movie Durations (Overall): 2.7121318189883064
```

## 1.10 8. Initial Visual Representation of Key Findings (4 Marks)

This step includes creating basic visualizations to support the key findings from our exploratory data analysis.

### 1.10.1 Suggested Plots:

- **Bar Plots**:
  - Number of titles per platform
  - Distribution of content types (Movies vs. TV Shows) by platform
- **Box Plots**:
  - Movie durations (`duration_numeric`) by platform to spot outliers
- **Histograms**:
  - Distribution of movie durations
  - Distribution of `content_age_at_addition`
- **Pie Charts or Donut Charts**:
  - Genre composition across platforms (top genres)
- **Time Series or Line Plots**:
  - Content additions over the years (`year_added`) for each platform

### 1.10.2 Purpose:

Visuals make patterns easier to identify, trends clearer to understand, and anomalies more obvious—serving as an intuitive bridge between raw data and insights.

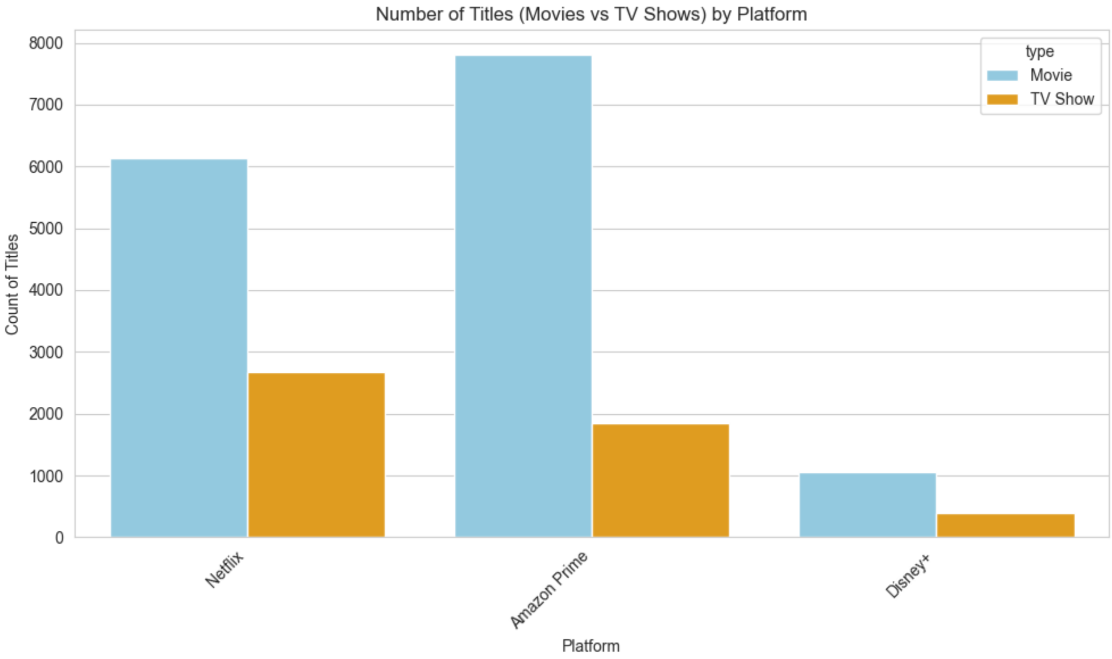
---

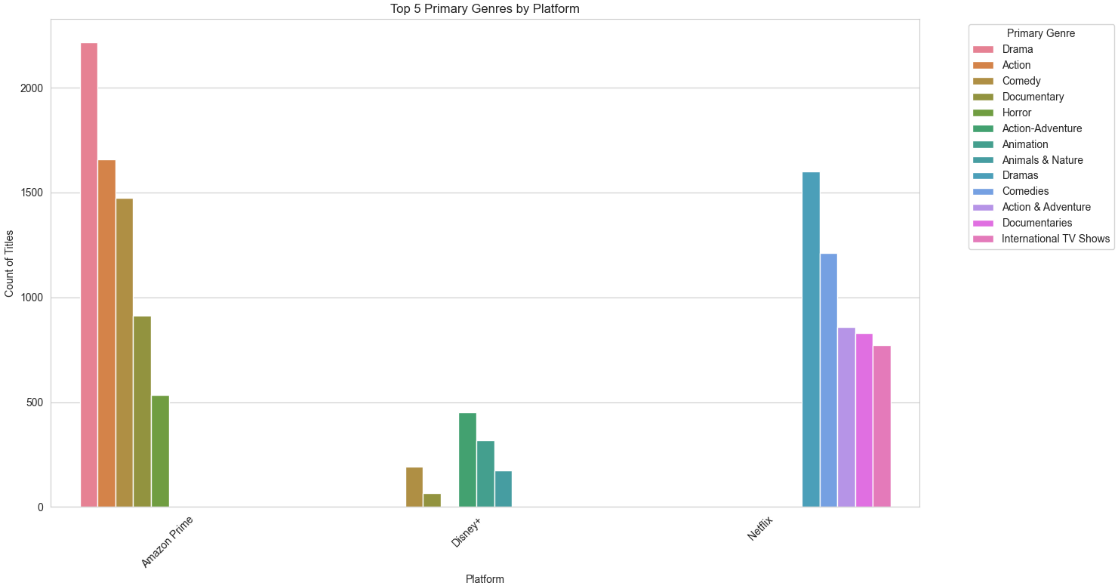
[20]:

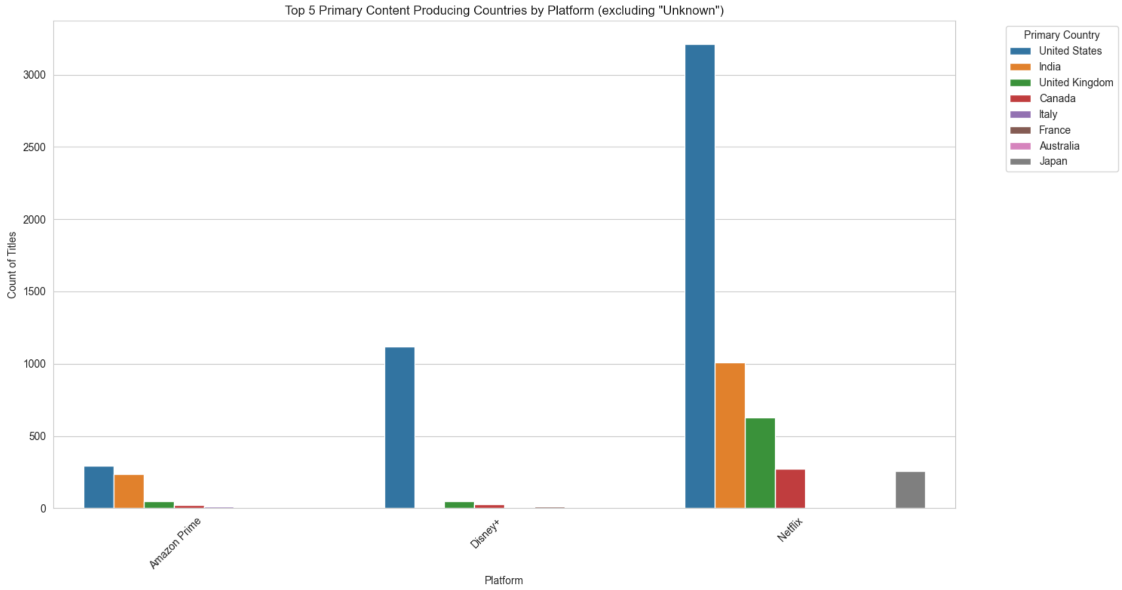
```
if not df_all.empty:
    print("\n--- Initial Visual Representation of Key Findings ---")

    # Ensure plots are displayed in the notebook if running in an environment␣
 ↪that requires it.
    # %matplotlib inline # (Usually not needed in modern Jupyter setups)

    # a. Number of titles (Movies/TV Shows stacked) per platform
    if 'platform' in df_all.columns and 'type' in df_all.columns:
        plt.figure(figsize=(10, 6))
        sns.countplot(data=df_all, x='platform', hue='type', palette={'Movie':␣
 ↪'skyblue', 'TV Show': 'orange'})
        plt.title('Number of Titles (Movies vs TV Shows) by Platform')
        plt.xlabel('Platform')
        plt.ylabel('Count of Titles')
        plt.xticks(rotation=45, ha='right')
        plt.tight_layout()
        plt.show()

    # b. Top N primary_genre per platform (using primary_genre)
    if 'platform' in df_all.columns and 'primary_genre' in df_all.columns:
        top_n = 5
        # Calculate top genres per platform
        top_genres_platform = df_all.groupby('platform')['primary_genre'].
↪apply(lambda x: x.value_counts().head(top_n)).rename('count').reset_index()

        top_genres_platform = (
        df_all.groupby('platform')['primary_genre']
        .value_counts()
        .groupby('platform')
        .head(top_n)
        .reset_index(name='count')
        )

        plt.figure(figsize=(15, 8))
        sns.barplot(data=top_genres_platform, x='platform', y='count',␣
↪hue='primary_genre', dodge=True)
        plt.title(f'Top {top_n} Primary Genres by Platform')
        plt.xlabel('Platform')
        plt.ylabel('Count of Titles')
        plt.xticks(rotation=45, ha='right')
        plt.legend(title='Primary Genre', bbox_to_anchor=(1.05, 1), loc='upper␣
↪left')
        plt.tight_layout()
        plt.show()

    # c. Top N primary countries per platform
    if 'platform' in df_all.columns and 'primary_country' in df_all.columns:
        # Filter out 'Unknown' country if it dominates too much for better␣
↪visualization of actual countries
        df_known_country = df_all[df_all['primary_country'] != 'Unknown']
        top_n_countries = 5
        top_countries_platform = (
        df_known_country.groupby('platform')['primary_country']
        .value_counts()
        .groupby('platform')
        .head(top_n_countries)
        .reset_index(name='count')
        )
        plt.figure(figsize=(15, 8))
        sns.barplot(
        data=top_countries_platform,
        x='platform',
        y='count',
        hue='primary_country',  # Make sure this matches the actual column name
        dodge=True
        )
        plt.title(f'Top {top_n_countries} Primary Content Producing Countries␣
↪by Platform (excluding "Unknown")')
```

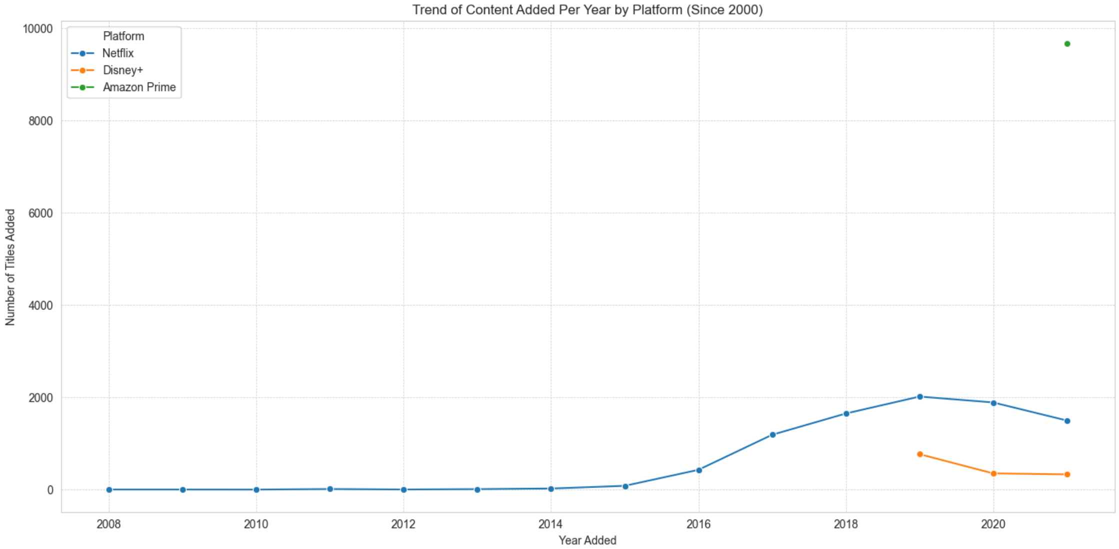
```
        plt.xlabel('Platform')
        plt.ylabel('Count of Titles')
        plt.xticks(rotation=45, ha='right')
        plt.legend(title='Primary Country', bbox_to_anchor=(1.05, 1),␣
↪loc='upper left')
        plt.tight_layout()
        plt.show()


    # d. Trend of content added per year_added for each platform
    if 'platform' in df_all.columns and 'year_added' in df_all.columns:
        content_added_yearly = df_all.groupby(['year_added', 'platform']).
↪size().reset_index(name='count')
        # Filter for more recent years if the range is too wide, e.g., after␣
↪2000
        content_added_yearly =␣
↪content_added_yearly[content_added_yearly['year_added'] >= 2000]

        plt.figure(figsize=(14, 7))
        sns.lineplot(data=content_added_yearly, x='year_added', y='count',␣
↪hue='platform', marker='o')
        plt.title('Trend of Content Added Per Year by Platform (Since 2000)')
        plt.xlabel('Year Added')
        plt.ylabel('Number of Titles Added')
        plt.legend(title='Platform')
        plt.grid(True, which='both', linestyle='--', linewidth=0.5)
        plt.tight_layout()
        plt.show()

    # e. Distribution of release_year of content for each platform (KDE Plot)
    if 'platform' in df_all.columns and 'release_year' in df_all.columns:
        plt.figure(figsize=(12, 7))
        sns.kdeplot(data=df_all, x='release_year', hue='platform', fill=True,␣
↪alpha=0.5, common_norm=False)
        plt.title('Distribution of Content Release Years by Platform')
        plt.xlabel('Release Year')
        plt.ylabel('Density')
        # Limiting x-axis for better readability if very old titles skew it
        plt.xlim(df_all['release_year'].quantile(0.01) if not␣
↪df_all['release_year'].empty else 1900,
                 df_all['release_year'].max() if not df_all['release_year'].
↪empty else 2025)
        plt.tight_layout()
        plt.show()

    # f. Distribution of movie durations (for type == 'Movie') - Histogram
    if 'type' in df_all.columns and 'duration_numeric' in df_all.columns and 'platform' in df_all.columns:
        df_movies_viz = df_all[(df_all['type'] == 'Movie') & (df_all['duration_numeric'].notna())]
        # Filter out extreme outliers for better visualization if needed, e.g. duration between 10 and 240 mins
        df_movies_viz = df_movies_viz[(df_movies_viz['duration_numeric'] >= 10) & (df_movies_viz['duration_numeric'] <= 240)]

        plt.figure(figsize=(14, 7))
        sns.histplot(data=df_movies_viz, x='duration_numeric', hue='platform', multiple='stack', bins=30, kde=False)
        plt.title('Distribution of Movie Durations (10-240 min) by Platform')
        plt.xlabel('Duration (minutes)')
        plt.ylabel('Number of Movies')
        plt.tight_layout()
        plt.show()

    # g. Compare movie duration_numeric across platforms - Box Plot
    if 'type' in df_all.columns and 'duration_numeric' in df_all.columns and 'platform' in df_all.columns:
        df_movies_box = df_all[(df_all['type'] == 'Movie') & (df_all['duration_numeric'].notna())]
        # Filter for a reasonable range if outliers are too extreme for box plot visibility
        df_movies_box = df_movies_box[(df_movies_box['duration_numeric'] >= 10) & (df_movies_box['duration_numeric'] <= 300)]

        plt.figure(figsize=(10, 6))
        sns.boxplot(
        data=df_movies_box,
        x='platform',
        y='duration_numeric',
        hue='platform',  # Add this
        palette="Set2",
        legend=False  # Add this to avoid duplicate legend
        )
        plt.title('Movie Durations by Platform (10-300 min)')
        plt.xlabel('Platform')
        plt.ylabel('Duration (minutes)')
        plt.xticks(rotation=45, ha='right')
        plt.tight_layout()
        plt.show()

    # h. Compare number of seasons (duration_numeric for TV shows) across platforms - Box Plot
    if 'type' in df_all.columns and 'duration_numeric' in df_all.columns and␣
 ↪'platform' in df_all.columns:
        df_tv_box = df_all[(df_all['type'] == 'TV Show') &␣
 ↪(df_all['duration_numeric'].notna())]
        # Filter for a reasonable range, e.g., up to 20 seasons
        df_tv_box = df_tv_box[df_tv_box['duration_numeric'] <= 20]

        plt.figure(figsize=(10, 6))
        sns.boxplot(
        data=df_tv_box,
        x='platform',
        y='duration_numeric',
        hue='platform',  # Add hue using same variable as x-axis
        palette="Set3",
        legend=False  # Hide legend since x-axis already shows platforms
        )
        plt.show()
        plt.title('Number of Seasons for TV Shows by Platform (Up to 20␣
 ↪Seasons)')
        plt.xlabel('Platform')
        plt.ylabel('Number of Seasons')
        plt.xticks(rotation=45, ha='right')
        plt.tight_layout()
        plt.show()
else:
    print("\nSkipping Visualizations: df_all is empty.")
```

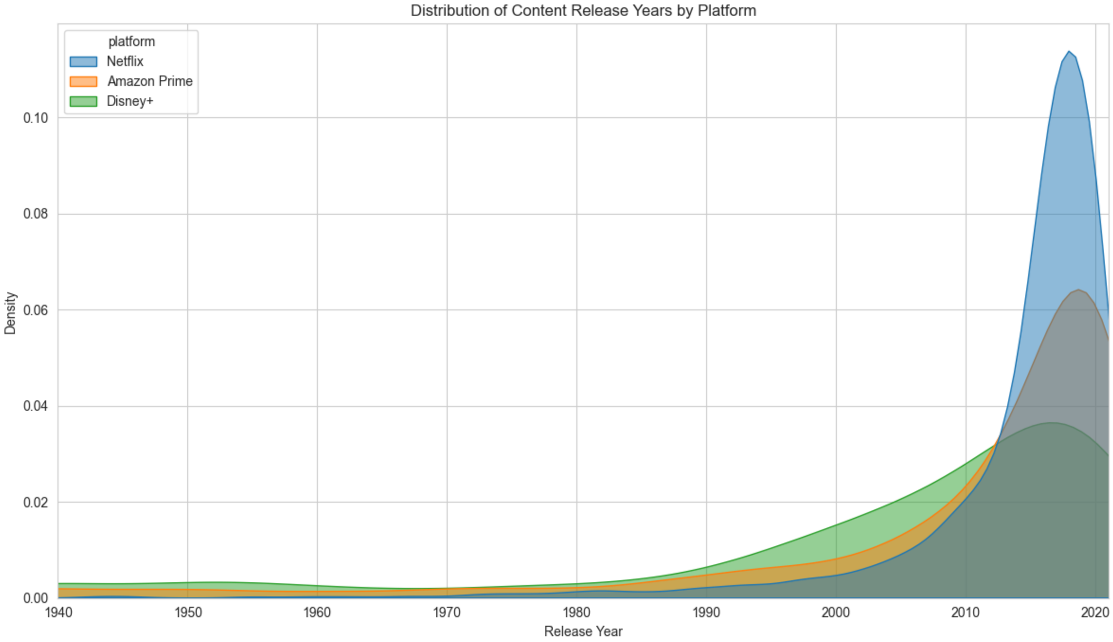
```
--- Initial Visual Representation of Key Findings ---
```

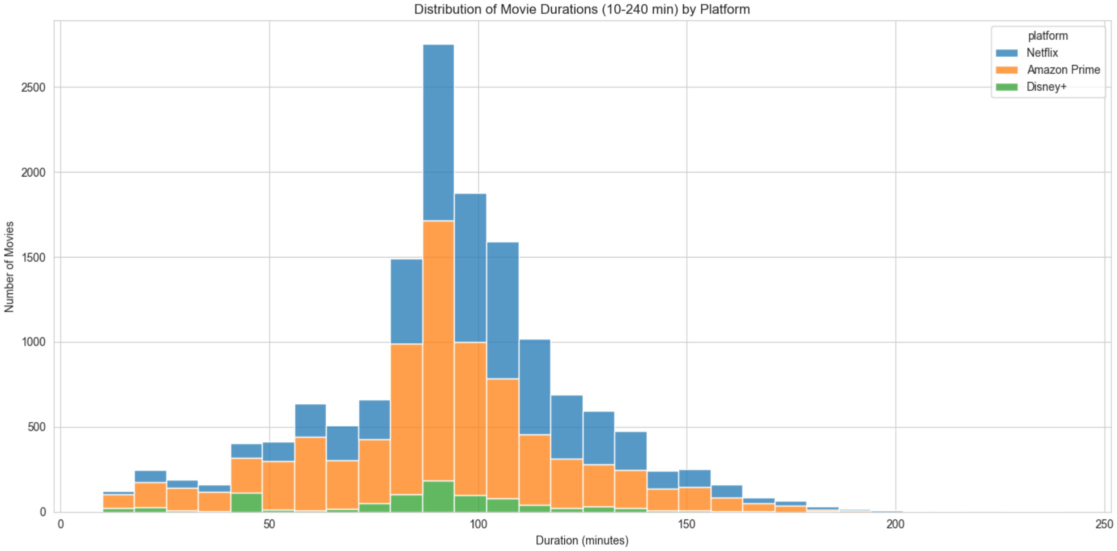

Number of Titles (Movies vs TV Shows) by Platform
Count of Titles
0
1000
2000
3000
4000
5000
6000
7000
8000
type
Movie
TV Show
Netflix
Amazon Prime
Disney+
Platform

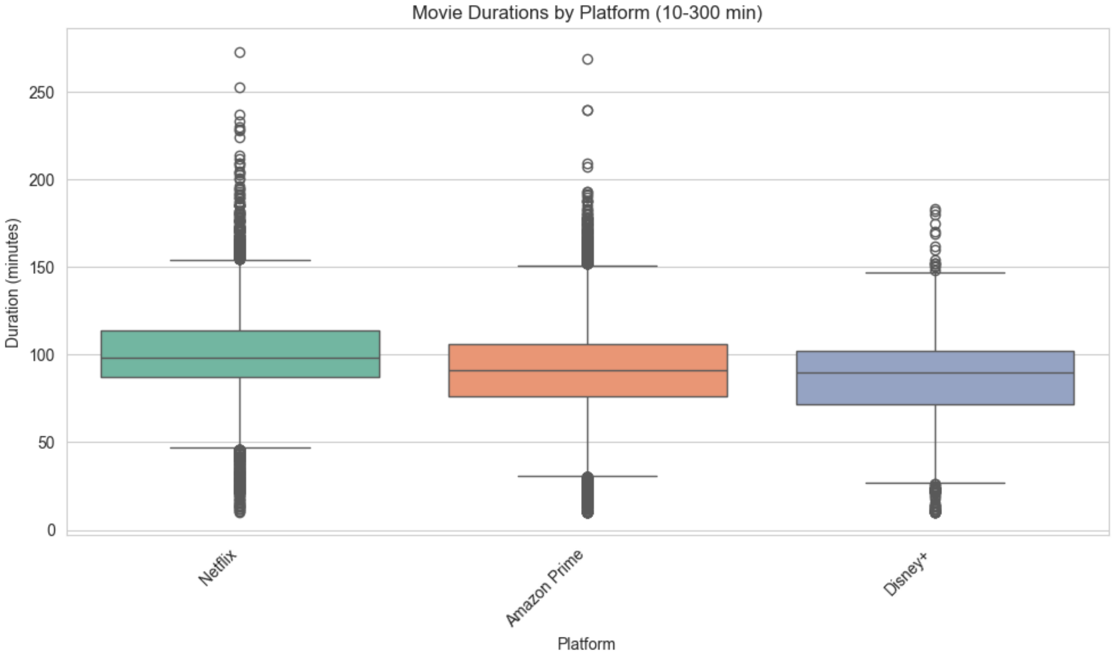

Top 5 Primary Genres by Platform
Count of Titles
0
500
1000
1500
2000
Primary Genre
Drama
Action
Comedy
Documentary
Horror
Action-Adventure
Animation
Animals & Nature
Dramas
Comedies
Action & Adventure
Documentaries
International TV Shows
Amazon Prime
Disney+
Netflix
Platform

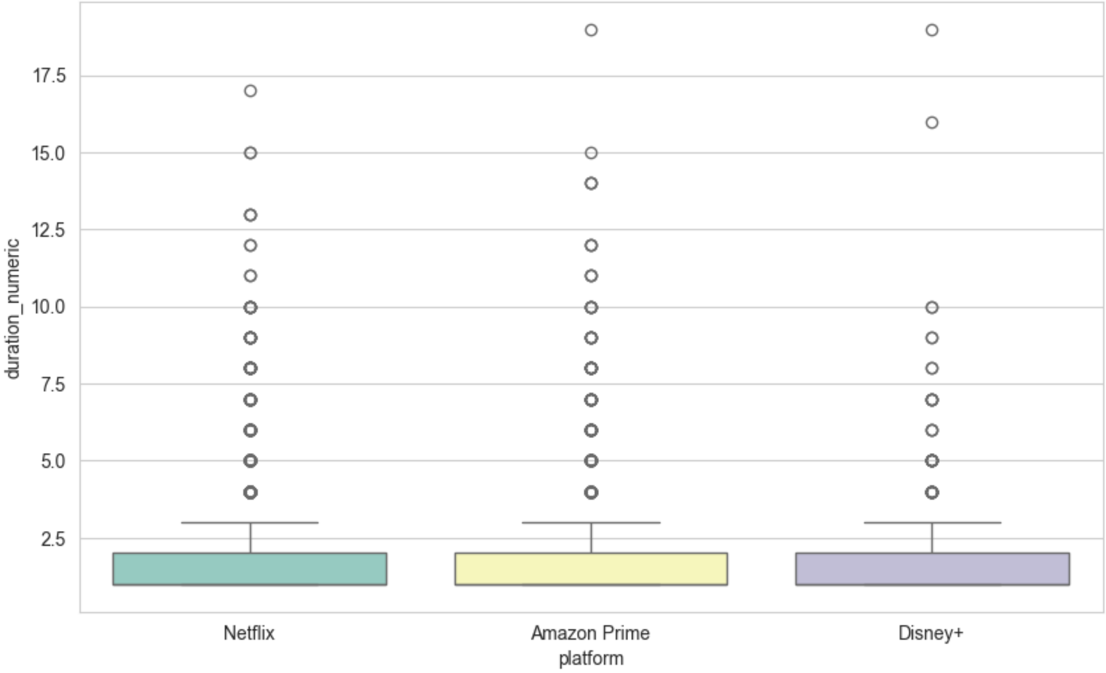

Top 5 Primary Content Producing Countries by Platform (excluding "Unknown")
Count of Titles
3000
2500
2000
1500
1000
500
0
Amazon Prime
Disney+
Netflix
Platform
Primary Country
United States
India
United Kingdom
Canada
Italy
France
Australia
Japan

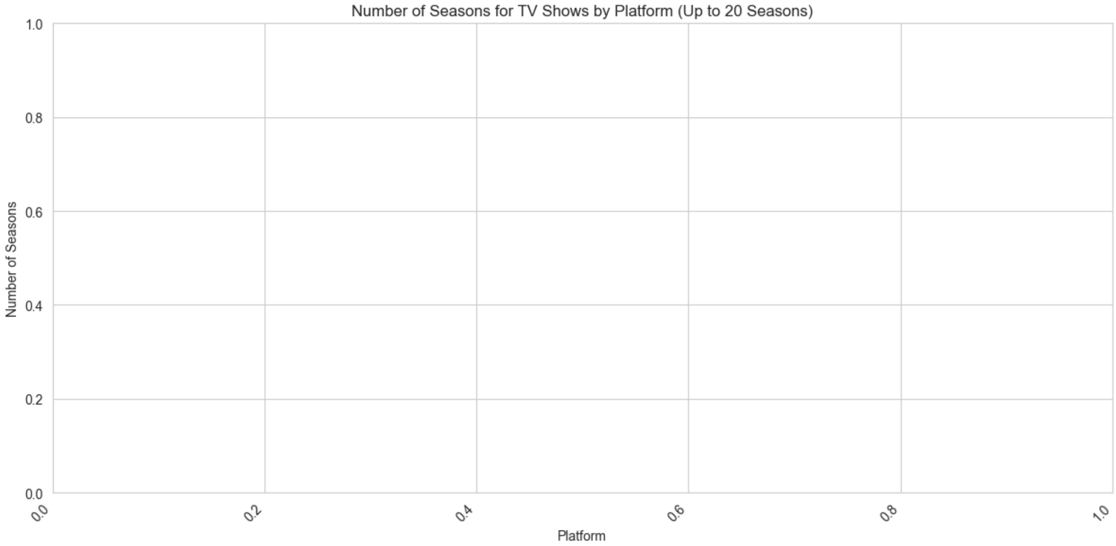

Trend of Content Added Per Year by Platform (Since 2000)
Platform
Netflix
Disney+
Amazon Prime
Number of Titles Added
10000
8000
6000
4000
2000
0
2008
2010
2012
2014
2016
2018
2020
Year Added


Distribution of Content Release Years by Platform
platform
Netflix
Amazon Prime
Disney+
Density
0.00
0.02
0.04
0.06
0.08
0.10
1940
1950
1960
1970
1980
1990
2000
2010
2020
Release Year


Distribution of Movie Durations (10-240 min) by Platform
platform
Netflix
Amazon Prime
Disney+
Number of Movies
0
500
1000
1500
2000
2500
0
50
100
150
200
250
Duration (minutes)


Movie Durations by Platform (10-300 min)
Duration (minutes)
250
200
150
100
50
0
Netflix
Amazon Prime
Disney+
Platform


duration_numeric
17.5
15.0
12.5
10.0
7.5
5.0
2.5
Netflix
Amazon Prime
Disney+
platform



---

## 1.11 End of Review 1 Notebook

This notebook has completed the following steps:

- Data loading and platform tagging
- Handling missing values
- Feature selection and engineering
- Ensuring data consistency and integrity
- Generating summary statistics and insights
- Identifying key patterns, trends, and anomalies
- Handling outliers with IQR
- Creating initial visual representations

The processed DataFrame `df_all` is now ready for advanced visualizations, storytelling, and deeper analysis in **Review 2**.

---

### 1.11.1 Next Steps:

- Save the processed DataFrame `df_all`:
  - Directory: `01_Data/processed_data/`
  - Filename: `ott_combined_cleaned.csv`
- Begin developing insights and visual dashboards in the next notebook.

---

[21]:
```
# Save the processed DataFrame
if not df_all.empty:
    processed_data_path = '../01_Data/processed_data/all_platforms_data.csv'
    try:
        df_all.to_csv(processed_data_path, index=False)
        print(f"\nProcessed data saved to: {processed_data_path}")
    except Exception as e:
        print(f"Error saving processed data: {e}")
else:
    print("\nSkipping saving of processed data: df_all is empty.")
```

```
Processed data saved to: ../01_Data/processed_data/all_platforms_data.csv
```

[ ]: