Netflix Dataset Analysis

The dataset I'm about to analyze contains various info about one of the most popular streaming platform "Netflix". I'll answer some questions regarding the content of this streaming platfrom according to info available on this dataset.

1. How does the amount of content on Netflix grow over the year? What year did Netflix add the most content on its platform? What is the most popular month for Netflix to add new content?

2. What type of content dominates the platform? What kind of genre dominates the most for each type?

3. How does the duration of shows vary? Is there any correlation between duration and genre that dominates?

4. Which (maturity) rating has the most amount on both type of content? Does that reflects Netflix's target audience?

5. Which country has the most content?

6. Which actor/actress shows up most frequently? What about director? Which one shows up most frequently? Is there any correlation between the two (actor and director)? Which actor - director pairing shows up the most?

The analysis process will be divided to 2:

1. Data Preprocessing
2. Explorary Data Analysis (EDA)

Importing Library

In [1]:

```
import pandas as pd
import numpy as np
%matplotlib inline
from matplotlib import pyplot as plt
from matplotlib.patches import Patch
import matplotlib as mpl
import matplotlib.lines as lines
import seaborn as sns
from collections import Counter
```

Reading-In Data

In [2]:

```
df = pd.read_csv("netflix_titles.csv")
```

In [3]:

```
df.head()
```

Out[3]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
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, filmm...
1	s2	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	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 t...
2	s3	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	September 24, 2021	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...	To protect his family from a powerful drug lor...
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docuseries, Reality TV	Feuds, flirtations and toilet talk go down amo...
4	s5	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...	In a city of coaching centers known to train I...

Data Preprocessing

Before starting EDA, the data needs to be processed/cleaned. By looking at the dataset, this process will include:

1. Straigthen up the dataset (giving columns unique and logical name, removing empty rows, etc).
2. Checking for duplicates and remove them
3. Fixing structural errors such as formatting, spelling error, spaces, etc.
4. Handling missing data
5. Deleting rows that contains a lot of empty value on key information

Since the dataset is relatively small in terms of column amount, this process won't include removing unneeded columns, and since there's no numerical data there won't be any need to check for or remove unwanted outlier.

1) Straighten up the dataset

In [4]:

```
df.columns
```

Out[4]:

```
Index(['show_id', 'type', 'title', 'director', 'cast', 'country', 'date_added',
       'release_year', 'rating', 'duration', 'listed_in', 'description'],
      dtype='object')
```

In [5]:

```
#Check for whole empty row
empty_row = df.isnull().all(axis=1)
df[empty_row]
```

Out[5]:

show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description

After a quick check, I decided that one change is needed: Changing the 'listed_in' column name to 'genre' for more clarity.

Since there's no whole empty row, no removal action is needed.

In [6]:

```
df.rename(columns={'listed_in':'genre'}, inplace=True)
```

In [7]:

```
df.columns
print("'listed_in' has successfully been changed to 'genre'" )
```

```
'listed_in' has successfully been changed to 'genre'
```

2) Checking for duplicates

```
In [8]: print(f"Number of duplicates: {df.duplicated().sum()}")
```

```
Number of duplicates: 0
```

3) Fixing structural errors

```
In [9]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8807 entries, 0 to 8806
Data columns (total 12 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  genre         8807 non-null   object
 11  description   8807 non-null   object
dtypes: int64(1), object(11)
memory usage: 447.3+ KB
```

Looking at the column info, few things catch attention:

```
a) The date column isn't 'date' type so that'll be changed first.
```

b) Column with single entry such as type, release_year, rating and duration will be cheked if there's any unwanted typo or wrong spacing.

c) Checking the more difficult column with multiple entries such as cast, country, director, duration (doesn't really have multiple entries but is a continuous data) and genre.

d) Title and description column won't be checked as those 2 columns contain a very unique/specific (and long) entries.

a. Fixing column that contains date

First I'll be checking if there're any broken format before changing the whole column to date type.

This is done by checking suspicious length that differs from others.

```
In [10]: date_length = df['date_added'].str.len()
         date_length.value_counts()
```

```
Out[10]: 17.0    1589
         16.0    1567
         13.0    1452
         14.0    1258
         15.0    1178
         12.0    1040
         18.0     439
         11.0     272
         19.0       2
         Name: date_added, dtype: int64
```

```
In [11]: date_len_filt = date_length == 19
         df['date_added'].loc[date_len_filt]
```

Out[11]:

```
7457     September 16, 2018
7729     September 22, 2016
Name: date_added, dtype: object
```

All good, no broken format found.

Now to actually change this column data type to 'date' type.

In [12]:

```
df['date_added'] = pd.to_datetime(df['date_added'])
df.dtypes
```

Out[12]:

```
show_id                 object
type                    object
title                   object
director                object
cast                    object
country                 object
date_added      datetime64[ns]
release_year             int64
rating                  object
duration                object
genre                   object
description             object
dtype: object
```

The 'date_added' column has been succesfully changed to date type.

b. Checking the unique value for the column listed above.

In [13]:

```
check_s_col = ['type', 'release_year', 'rating']
for col_s in check_s_col:
    print(f"{col_s}= {df[col_s].unique()}\n")
```

```
type= ['Movie' 'TV Show']

release_year= [2020 2021 1993 2018 1996 1998 1997 2010 2013 2017 1975 1978 1983 1987
 2012 2001 2014 2002 2003 2004 2011 2008 2009 2007 2005 2006 1994 2015
 2019 2016 1982 1989 1990 1991 1999 1986 1992 1984 1980 1961 2000 1995
 1985 1976 1959 1988 1981 1972 1964 1945 1954 1979 1958 1956 1963 1970
 1973 1925 1974 1960 1966 1971 1962 1969 1977 1967 1968 1965 1946 1942
 1955 1944 1947 1943]

rating= ['PG-13' 'TV-MA' 'PG' 'TV-14' 'TV-PG' 'TV-Y' 'TV-Y7' 'R' 'TV-G' 'G'
 'NC-17' '74 min' '84 min' '66 min' 'NR' nan 'TV-Y7-FV' 'UR']
```

It seems like there's a few mistake inside the rating column.

74 min, 84 min and 66 min are clearly not rating and are supposed to go into the duration column.

In [14]:

```
wrong_rating = df['rating'].isin(['74 min', '84 min', '66 min'])
df[wrong_rating].index
```

Out[14]:

```
Int64Index([5541, 5794, 5813], dtype='int64')
```

In [15]:

```
for wr_index in df[wrong_rating].index:
    df.at[wr_index, 'duration'] = df.loc[wr_index, 'rating']
df[wrong_rating]
```

Out[15]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	description
5541	s5542	Movie	Louis C.K. 2017	Louis C.K.	Louis C.K.	United States	2017-04-04	2017	74 min	74 min	Movies	Louis C.K. muses on religion, eternal love, gi...
5794	s5795	Movie	Louis C.K.: Hilarious	Louis C.K.	Louis C.K.	United States	2016-09-16	2010	84 min	84 min	Movies	Emmy-winning comedy writer Louis C.K. brings h...
5813	s5814	Movie	Louis C.K.: Live at the Comedy Store	Louis C.K.	Louis C.K.	United States	2016-08-15	2015	66 min	66 min	Movies	The comic puts his trademark hilarious/thought...

Now that the 3 wrong entries have been removed, Changes are also needed for these now missing values.

Because there're only 3 rows, we can easily do a google search on the correct rating for these movies and add the correct value in. Coincidentally all of these movies have the same rating 'TV-MA'.

In [16]:

```python
for wr_index in df[wrong_rating].index:
    df.at[wr_index, 'rating'] = 'TV-MA'
df[wrong_rating]
```

Out[16]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	description
5541	s5542	Movie	Louis C.K. 2017	Louis C.K.	Louis C.K.	United States	2017-04-04	2017	TV-MA	74 min	Movies	Louis C.K. muses on religion, eternal love, gi...
5794	s5795	Movie	Louis C.K.: Hilarious	Louis C.K.	Louis C.K.	United States	2016-09-16	2010	TV-MA	84 min	Movies	Emmy-winning comedy writer Louis C.K. brings h...
5813	s5814	Movie	Louis C.K.: Live at the Comedy Store	Louis C.K.	Louis C.K.	United States	2016-08-15	2015	TV-MA	66 min	Movies	The comic puts his trademark hilarious/thought...

All good now, everything looks properly formatted.

c. Checking the more difficult columns with multiple entries in a single row (cast, country, director, duration and genre).

In [17]:

```python
cast_count = {}
for casts in df['cast']:
    if type(casts) != float:
        for cast in casts.split(","):
            cast = cast.strip()
            cast_count[cast] = cast_count.get(cast, 0) + 1
# cast_count
```

In [18]:

```python
country_count = {}
for countries in df['country']:
    if type(countries) != float:
        for country in countries.split(","):
            country = country.strip()
            if country != '':
                country_count[country] = country_count.get(country, 0) + 1
# country_count
```

In [19]:

```
director_count = {}
for directs in df['director']:
    if type(directs) != float:
        for direct in directs.split(","):
            dir_s = direct.strip()
            director_count[dir_s] = director_count.get(dir_s, 0) + 1
# director_count
```

In [20]:

```
duration_count = {}
for durs in df['duration']:
    if type(durs) != float:
        for dur in durs.split(","):
            dur = dur.strip()
            duration_count[dur] = duration_count.get(dur, 0) + 1
# duration_count
```

In [21]:

```
genre_count = {}
for genres in df['genre']:
    if type(genres) != float:
        for genre in genres.split(","):
            genre = genre.strip()
            genre_count[genre] = genre_count.get(genre, 0) + 1
# genre_count
```

Everything looks good after a quick glance at each result. There's no spacing issue, capitalization issue or anything along that line. The result output is commented out because it takes up too much space.

Everything is properly formatted.

4) Handling Missing Data

In [22]:

```
null_count = df.isna().sum()
empty_count = df.eq("").sum()
missing_total = null_count + empty_count
missing_pct = (missing_total / df.shape[0]) * 100
missing_data = {'Null': null_count, 'Empty': empty_count, 'Total': missing_total, 'Missing %': missing_pct.round(2)}
m_data_index = null_count.keys()
pd.DataFrame(data= missing_data, index=m_data_index)
```

Out[22]:

	Null	Empty	Total	Missing %
show_id	0	0	0	0.00
type	0	0	0	0.00
title	0	0	0	0.00
director	2634	0	2634	29.91
cast	825	0	825	9.37
country	831	0	831	9.44
date_added	10	0	10	0.11
release_year	0	0	0	0.00
rating	4	0	4	0.05
duration	0	0	0	0.00
genre	0	0	0	0.00
description	0	0	0	0.00

Fortunately there's no row with empty value but there're quite a few columns with Null values in it that needs to be handled.

Here's how I'm going to handle these missing values:

1. **'rating' column** = Impute the missing values with info from a simple google search since it only has 4 missing values.

2. **'date_added' column** = Impute with info from google search as well since there are only 10 missing values.

3. **'country' column** = Making a function that predicts the movie's country based on the cast and director.

4. **'cast' column** = Since cast column contains a very specific information (name) that can't easily be replaced, the missing value will just be replaced with a new category 'Data Not Available'. The rows with missing value won't be dropped because 1) the amount of missing value (800+) is a lot, 2) the dropped rows might possess valuable information on other columns.

5. **'director' column** = Replace missing value with new category 'Data Not Available' for the same reason as 'cast' column.

6. Dropping rows where all 3 columns (country, director, cast) have missing value.

--- 'rating' column ---

In [23]:

```
rating_filt = df['rating'].isna()
df[rating_filt]
```

Out[23]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	description
5989	s5990	Movie	13TH: A Conversation with Oprah Winfrey & Ava ...	NaN	Oprah Winfrey, Ava DuVernay	NaN	2017-01-26	2017	NaN	37 min	Movies	Oprah Winfrey sits down with director Ava DuVe...
6827	s6828	TV Show	Gargantia on the Verdurous Planet	NaN	Kaito Ishikawa, Hisako Kanemoto, Ai Kayano, Ka...	Japan	2016-12-01	2013	NaN	1 Season	Anime Series, International TV Shows	After falling through a wormhole, a space-dwel...
7312	s7313	TV Show	Little Lunch	NaN	Flynn Curry, Olivia Deeble, Madison Lu, Oisín ...	Australia	2018-02-01	2015	NaN	1 Season	Kids' TV, TV Comedies	Adopting a child's perspective, this show take...
7537	s7538	Movie	My Honor Was Loyalty	Alessandro Pepe	Leone Frisa, Paolo Vaccarino, Francesco Miglio...	Italy	2017-03-01	2015	NaN	115 min	Dramas	Amid the chaos and horror of World War II, a c...

In [24]:

```
df.at[5989, 'rating'] = 'PG-13'
df.at[6827, 'rating'] = 'TV-PG'
df.at[7312, 'rating'] = 'PG'
df.at[7537, 'rating'] = 'TV-MA'
df[rating_filt]
```

Out[24]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	description
5989	s5990	Movie	13TH: A Conversation with Oprah Winfrey & Ava ...	NaN	Oprah Winfrey, Ava DuVernay	NaN	2017-01-26	2017	PG-13	37 min	Movies	Oprah Winfrey sits down with director Ava DuVe...
6827	s6828	TV Show	Gargantia on the Verdurous Planet	NaN	Kaito Ishikawa, Hisako Kanemoto, Ai Kayano, Ka...	Japan	2016-12-01	2013	TV-PG	1 Season	Anime Series, International TV Shows	After falling through a wormhole, a space-dwel...
7312	s7313	TV Show	Little Lunch	NaN	Flynn Curry, Olivia Deeble, Madison Lu, Oisín ...	Australia	2018-02-01	2015	PG	1 Season	Kids' TV, TV Comedies	Adopting a child's perspective, this show take...
7537	s7538	Movie	My Honor Was Loyalty	Alessandro Pepe	Leone Frisa, Paolo Vaccarino, Francesco Miglio...	Italy	2017-03-01	2015	TV-MA	115 min	Dramas	Amid the chaos and horror of World War II, a c...

Empty value from 'rating' column has been successfully filled in.

--- 'date_added' column ---

In [25]:

```
nodate_filt = df['date_added'].isna()
df[nodate_filt]
```

Out[25]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	description
6066	s6067	TV Show	A Young Doctor's Notebook and Other Stories	NaN	Daniel Radcliffe, Jon Hamm, Adam Godley, Chris...	United Kingdom	NaT	2013	TV-MA	2 Seasons	British TV Shows, TV Comedies, TV Dramas	Set during the Russian Revolution, this comic ...
6174	s6175	TV Show	Anthony Bourdain: Parts Unknown	NaN	Anthony Bourdain	United States	NaT	2018	TV-PG	5 Seasons	Docuseries	This CNN original series has chef Anthony Bour...
6795	s6796	TV Show	Frasier	NaN	Kelsey Grammer, Jane Leeves, David Hyde Pierce...	United States	NaT	2003	TV-PG	11 Seasons	Classic & Cult TV, TV Comedies	Frasier Crane is a snooty but lovable Seattle ...
6806	s6807	TV Show	Friends	NaN	Jennifer Aniston, Courteney Cox, Lisa Kudrow, ...	United States	NaT	2003	TV-14	10 Seasons	Classic & Cult TV, TV Comedies	This hit sitcom follows the merry misadventure...
6901	s6902	TV Show	Gunslinger Girl	NaN	Yuuka Nanri, Kanako Mitsuhashi, Eri Sendai, Am...	Japan	NaT	2008	TV-14	2 Seasons	Anime Series, Crime TV Shows	On the surface, the Social Welfare Agency appe...
7196	s7197	TV Show	Kikoriki	NaN	Igor Dmitriev	NaN	NaT	2010	TV-Y	2 Seasons	Kids' TV	A wacky rabbit and his gang of animal pals hav...
7254	s7255	TV Show	La Familia P. Luche	NaN	Eugenio Derbez, Consuelo Duval, Luis Manuel Áv...	United States	NaT	2012	TV-14	3 Seasons	International TV Shows, Spanish-Language TV Sh...	This irreverent sitcom featues Ludovico, Feder...
7406	s7407	TV Show	Maron	NaN	Marc Maron, Judd Hirsch,	United States	NaT	2016	TV-MA	4 Seasons	TV Comedies	Marc Maron stars as Marc

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	description
					Josh Brener, Nora Zeh...							Maron, who interviews...
7847	s7848	TV Show	Red vs. Blue	NaN	Burnie Burns, Jason Saldaña, Gustavo Sorola, G...	United States	NaT	2015	NR	13 Seasons	TV Action & Adventure, TV Comedies, TV Sci-Fi ...	This parody of first-person shooter games, mil...
8182	s8183	TV Show	The Adventures of Figaro Pho	NaN	Luke Jurevicius, Craig Behenna, Charlotte Haml...	Australia	NaT	2015	TV-Y7	2 Seasons	Kids' TV, TV Comedies	Imagine your worst fears, then multiply them: ...

In [26]:

```
missing_date = ['15-09-2014',
                'June 1, 2020',
                'April 6, 2016',
                'January 1, 2015',
                'January 4, 2016',
                'July 6, 2017',
                'June 1, 2015',
                'March 10, 2020',
                'September 15, 2014',
                'September 15, 2014']

for date_idx, nodate_index in enumerate(df[nodate_filt].index):
    df.at[nodate_index, 'date_added'] = pd.to_datetime(missing_date[date_idx])

df[nodate_filt]
```

Out[26]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	description
6066	s6067	TV Show	A Young Doctor's Notebook and Other Stories	NaN	Daniel Radcliffe, Jon Hamm, Adam Godley, Chris...	United Kingdom	2014-09-15	2013	TV-MA	2 Seasons	British TV Shows, TV Comedies, TV Dramas	Set during the Russian Revolution, this comic ...
6174	s6175	TV Show	Anthony Bourdain: Parts Unknown	NaN	Anthony Bourdain	United States	2020-06-01	2018	TV-PG	5 Seasons	Docuseries	This CNN original series has chef Anthony Bour...
6795	s6796	TV Show	Frasier	NaN	Kelsey Grammer, Jane Leeves, David Hyde Pierce...	United States	2016-04-06	2003	TV-PG	11 Seasons	Classic & Cult TV, TV Comedies	Frasier Crane is a snooty but lovable Seattle ...
6806	s6807	TV Show	Friends	NaN	Jennifer Aniston, Courteney Cox, Lisa Kudrow, ...	United States	2015-01-01	2003	TV-14	10 Seasons	Classic & Cult TV, TV Comedies	This hit sitcom follows the merry misadventure...
6901	s6902	TV Show	Gunslinger Girl	NaN	Yuuka Nanri, Kanako Mitsuhashi, Eri Sendai, Am...	Japan	2016-01-04	2008	TV-14	2 Seasons	Anime Series, Crime TV Shows	On the surface, the Social Welfare Agency appe...
7196	s7197	TV Show	Kikoriki	NaN	Igor Dmitriev	NaN	2017-07-06	2010	TV-Y	2 Seasons	Kids' TV	A wacky rabbit and his gang of animal pals hav...
7254	s7255	TV Show	La Familia P. Luche	NaN	Eugenio Derbez, Consuelo Duval, Luis Manuel Áv...	United States	2015-06-01	2012	TV-14	3 Seasons	International TV Shows, Spanish-Language TV Sh...	This irreverent sitcom featues Ludovico, Feder...
7406	s7407	TV Show	Maron	NaN	Marc Maron, Judd Hirsch,	United States	2020-03-10	2016	TV-MA	4 Seasons	TV Comedies	Marc Maron stars as Marc

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	description
					Josh Brener, Nora Zeh...							Maron, who interviews...
7847	s7848	TV Show	Red vs. Blue	NaN	Burnie Burns, Jason Saldaña, Gustavo Sorola, G...	United States	2014-09-15	2015	NR	13 Seasons	TV Action & Adventure, TV Comedies, TV Sci-Fi ...	This parody of first-person shooter games, mil...
8182	s8183	TV Show	The Adventures of Figaro Pho	NaN	Luke Jurevicius, Craig Behenna, Charlotte Haml...	Australia	2014-09-15	2015	TV-Y7	2 Seasons	Kids' TV, TV Comedies	Imagine your worst fears, then multiply them: ...

Empty value from 'date_added' column has been successfully filled in.

--- 'director', 'cast' and 'country' column ---

In [27]:

```
country_count = {}
for countries in df['country']:
    if type(countries) != float:
        for country in countries.split(","):
            country = country.strip()
            if country != '':
                country_count[country] = country_count.get(country, 0) + 1
country_count_sorted = dict(sorted(country_count.items(), key=lambda x: x[1], reverse=True))
```

In [28]:

```
director_count = {}
for directs in df['director']:
    if type(directs) != float:
        for direct in directs.split(","):
            dir_s = direct.strip()
            director_count[dir_s] = director_count.get(dir_s, 0) + 1
dir_count_sorted = dict(sorted(director_count.items(), key=lambda x: x[1], reverse=True))
```

In [29]:

```
cast_count = {}
for casts in df['cast']:
    if type(casts) != float:
        for cast in casts.split(","):
            cast = cast.strip()
            cast_count[cast] = cast_count.get(cast, 0) + 1
cast_count_sorted = dict(sorted(cast_count.items(), key=lambda x: x[1], reverse=True))
```

Filling in 'country' column's missing values:

In [30]:

```
# Grouping Cast by Country

# Grouping every actor/actress based on the show's country.
# Can't use simple groupby function from pandas because there're multiple entries for cast and country column in 1 row
cast_country= {}
for ctry_idx, countries2 in enumerate(df['country']):
    if type(countries2) != float:
        for country2 in countries2.split(","):
            country2 = country2.strip()
            casts2 = df.loc[ctry_idx, 'cast']
            if type(casts2) != float:
                casts2 = casts2.split(",")
                for cast2 in casts2:
                    cast2 = cast2.strip()
                    if country2 != '':
                        cast_country[country2] = cast_country.get(country2, []) + [cast2]

# Counter in case we need to know how many times an actor/actress cast in one country (mode)
cast_country_count = {}
for cc_pair in cast_country:
    cast_country_count[cc_pair] = Counter(cast_country[cc_pair])

# The actual actor/actress's dictionary grouped by show's countries they appeared in
cast_country_unique = {}
for cc_keys in cast_country:
    cast_country_unique[cc_keys] = set(cast_country[cc_keys])
```

In [31]:

```
# Grouping Director by Country
```

```python
# Grouping every director based on the show's country.
dir_country = {}
for ctry_idx, countries2 in enumerate(df['country']):
    if type(countries2) != float:
        for country2 in countries2.split(","):
            country2 = country2.strip()
            dirs2 = df.loc[ctry_idx, 'director']
            if type(dirs2) != float:
                dirs2 = dirs2.split(",")
                for dir2 in dirs2:
                    dir2 = dir2.strip()
                    if country2 != '':
                        dir_country[country2] = dir_country.get(country2, []) + [dir2]

# Counter in case we need to know how many times a director direct direct a movie from that country (mode)
dir_country_count = {}
for dc_pair in dir_country:
    dir_country_count[dc_pair] = Counter(dir_country[dc_pair])

# The director's dictionary grouped by show's countries they appeared in
dir_country_unique = {}
for dc_keys in dir_country:
    dir_country_unique[dc_keys] = set(dir_country[dc_keys])
```

Listing index of rows with key info missing to be removed later:

In [32]:

```python
# Listing index of rows where all 3 country, direcor, and cast columns have missing value
all_na = df['director'].isna() & df['cast'].isna() & df['country'].isna()
not_na = all_na == False
df[all_na].shape[0] + df[not_na].shape[0]
all_na_idx = df[all_na].index
# print(all_na_idx)
print(f"\nTotal rows with country, director, and cast (all of them) missing: {len(all_na_idx)}")
```

```
Total rows with country, director, and cast (all of them) missing: 96
```

Function to search for missing country based on cast:

In [33]:

```python
# Function to look for what country an actor/actress is from based on the groupby dict made earlier
missing_msg = 'Data Not Available'

def cast_country_acc(name):
    ans = missing_msg
    ct = 0
    for country in cast_country_count:
        if name in cast_country_count[country]:
            ct_now = cast_country_count[country][name]
            if ct_now > ct:
                ct = ct_now
                ans = country
    return ans

def search_cast_country(cnames):
    if type(cnames) == list:
        ans = [cast_country_acc(cname.strip()) for cname in cnames]
    else: ans = cast_country_acc(cnames)

    if type(ans) == list:
        return max(ans, key= ans.count)
    else: return ans
```

Function to search for missing country based on director:

In [34]:

```python
# Function to look for what country a director is from based on the groupby dict made earlier
def dir_country_acc(name):
    ans = missing_msg
    ct = 0
    for country in dir_country_count:
        if name in dir_country_count[country]:
            ct_now = dir_country_count[country][name]
            if ct_now > ct:
                ct = ct_now
                ans = country
    return ans

def search_dir_country(dnames):
    if type(dnames) == list:
        ans = [dir_country_acc(dname.strip()) for dname in dnames]
    else: ans = dir_country_acc(dnames)

    if type(ans) == list:
        return max(ans, key= ans.count)
    else: return ans
```

Function to fill country's missing value that combines the 2 previously made function above:

In [35]:

```
def fill_country(idx, data):
    ans = data
    if (type(data) == float) & (idx not in all_na_idx):
        d_names = df.loc[idx, 'director']
        c_names = df.loc[idx, 'cast']
        if type(d_names) != float:
            ans = search_dir_country(d_names.split(","))
            if (ans == missing_msg) & (type(c_names) != float):
                ans = search_cast_country(c_names.split(","))
        else:
            c_names = df.loc[idx, 'cast']
            ans = search_cast_country(c_names.split(","))
    return ans
```

Execute Function:

In [36]:

```
# Replacing missing value on the country column with the function I just made above
print(f"Total missing from 'country column' (before): {df['country'].isna().sum()}")
for idx, data in enumerate(df['country']):
    df.at[idx, 'country'] = fill_country(idx, data)
print("Process Completed!")
print(f"Total missing from 'country' column (after): {df['country'].isna().sum()}")
```

```
Total missing from 'country column' (before): 831
Process Completed!
Total missing from 'country' column (after): 96
```

Some of missing value from 'country' column has successfully been filled with available info.

5) Deleting rows which is missing a lot of key information

In [37]:

```
print(f"\nTotal rows with country, director, and cast (all of them) missing: {len(all_na_idx)}")
df.drop(index=all_na_idx, inplace=True)
all_na_n = df['director'].isna() & df['cast'].isna() & df['country'].isna()
print(f"\nTotal rows with country, director, and cast (all of them) missing: {len(df[all_na_n].index)}")
```

```
Total rows with country, director, and cast (all of them) missing: 96

Total rows with country, director, and cast (all of them) missing: 0
```

Filling in 'director' column and 'cast' column's missing values:

In [38]:

```
print(f'''Total missing value -> \tFrom 'director' column: {df['director'].isna().sum()}
                        From 'cast' column: {df['cast'].isna().sum()}''')
df['director'].fillna(missing_msg, inplace=True)
df['cast'].fillna(missing_msg, inplace=True)
print("\nProcess Completed!\n")
print(f'''Total missing value -> \tFrom 'director' column: {df['director'].isna().sum()}
                        From 'cast' column: {df['cast'].isna().sum()}''')
```

```
Total missing value ->  From 'director' column: 2538
                        From 'cast' column: 729

Process Completed!

Total missing value ->  From 'director' column: 0
                        From 'cast' column: 0
```

Missing value from 'director' column and 'cast' has successfully been filled with 'Data Not Avalilable'.

Fixing Index:

In [39]:

```
df.reset_index(inplace=True)
print("Index Reset Completed!")
```

```
Index Reset Completed!
```

In [40]:

```
print(f"Total missing data from dataset:\n{df.isna().sum()}")
```

```
Total missing data from dataset:
index           0
show_id         0
type            0
title           0
director        0
cast            0
country         0
date_added      0
release_year    0
rating          0
duration        0
genre           0
description     0
dtype: int64
```

No more empty data. Data Preprocessing completed.

In [41]:

```
df.to_csv('netflix_utitle.csv', index=False)
```

Explorary Data Analysis

In [42]:

```
df.head()
```

Out[42]:

	index	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	description
0	0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	Data Not Available	United States	2021-09-25	2020	PG-13	90 min	Documentaries	As her father nears the end of his life, filmm...
1	1	s2	TV Show	Blood & Water	Data Not Available	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries	After crossing paths at a party, a Cape Town t...
2	2	s3	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	France	2021-09-24	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...	To protect his family from a powerful drug lor...
3	4	s5	TV Show	Kota Factory	Data Not Available	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...	In a city of coaching centers known to train I...
4	5	s6	TV Show	Midnight Mass	Mike Flanagan	Kate Siegel, Zach Gilford, Hamish Linklater, H...	United States	2021-09-24	2021	TV-MA	1 Season	TV Dramas, TV Horror, TV Mysteries	The arrival of a charismatic young priest brin...

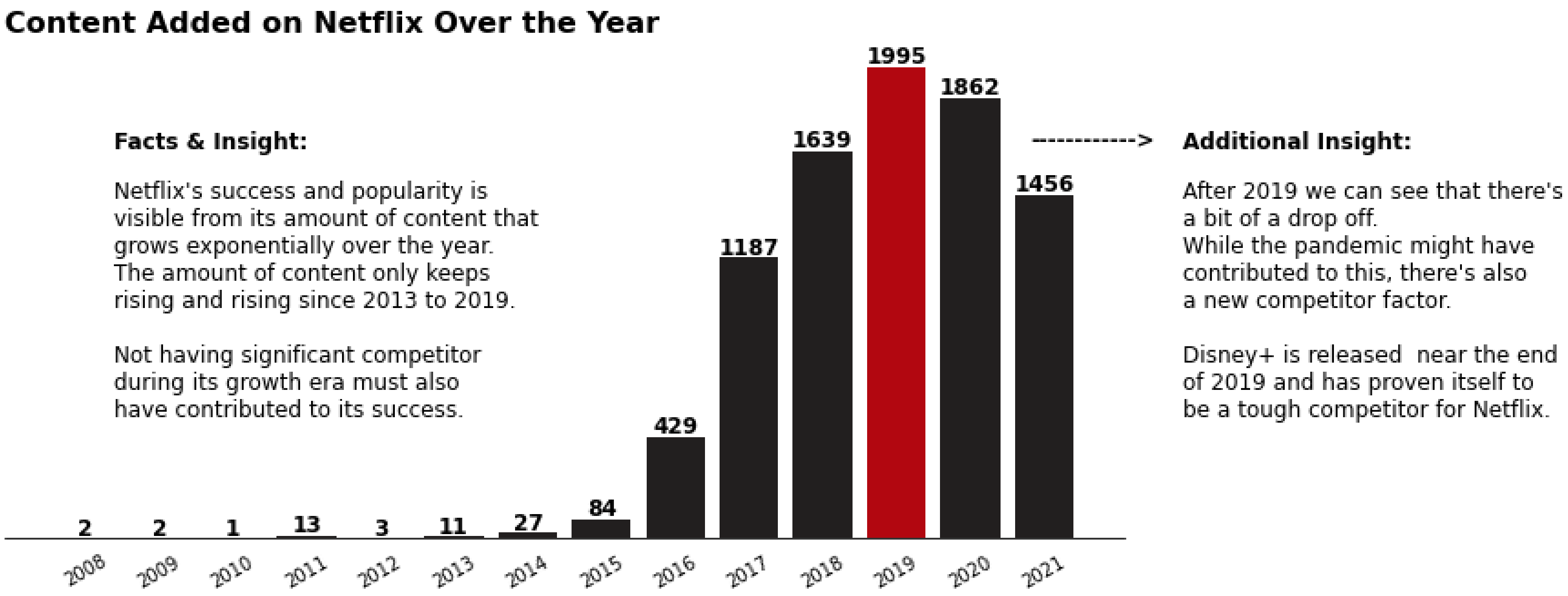
In [43]:

```
#Netflix color pallete
dr = '#B20710'
nr = '#E50914'
blk = '#221F1F'
wht = '#F5F5F1'
```

1a & 1b) How does the amount of content on Netflix grows over the year? What year did Netflix add the most content on its platform?

In [44]:

```
dt_x = df['date_added'].dt.year.value_counts().keys().tolist()
dt_y = df['date_added'].dt.year.value_counts().tolist()

fig, ax = plt.subplots(figsize=(11, 5))
bar_clr = [dr] + (([blk]*(len(dt_x)-1)))

ax.bar(dt_x, dt_y, color= bar_clr)
ax.set_xticks(dt_x)
ax.set_xticklabels(ax.get_xticks(), rotation = 30)
# ax.set_ylabel("Content Count", size=11, weight='bold')
ax.set_title("Content Added on Netflix Over the Year", size=16, fontweight='bold', loc='left')

for b in ['top', 'right', 'left']:
    ax.spines[b].set_visible(False)

for rect in ax.patches:
    ax.text(rect.get_x() + rect.get_width() / 2, rect.get_height()+15, rect.get_height(),
            ha='center', fontsize = 12, fontweight='bold')

fig.text(0.2, 0.72, "Facts & Insight:", fontsize=12, fontweight='bold')

fig.text(0.2, 0.27, '''
Netflix's success and popularity is
visible from its amount of content that
grows exponentially over the year.
The amount of content only keeps
rising and rising since 2013 to 2019.

Not having significant competitor
during its growth era must also
have contributed to its success.
''', fontsize = 12)

speculation = '''there's also the possibility
that Netflix has too much content that their
subscriber can't catch up with everything,
thus leaving some shows not as succesful
or as memorable as the one before.'''

fig.text(0.94, 0.72, "Additional Insight:", fontsize=12, fontweight='bold')

fig.text(0.94, 0.27, '''
After 2019 we can see that there's
a bit of a drop off.
While the pandemic might have
contributed to this, there's also
a new competitor factor.

Disney+ is released  near the end
of 2019 and has proven itself to
be a tough competitor for Netflix.
''', fontsize = 12)

fig.text(0.835, 0.68, '''
------------>
''', fontsize = 12, fontweight= 'bold')

ax.tick_params(bottom=False)
ax.set_yticks([])
plt.show()
```



Content Added on Netflix Over the Year

Facts & Insight:

Netflix's success and popularity is visible from its amount of content that grows exponentially over the year. The amount of content only keeps rising and rising since 2013 to 2019.

Not having significant competitor during its growth era must also have contributed to its success.

------------> Additional Insight:

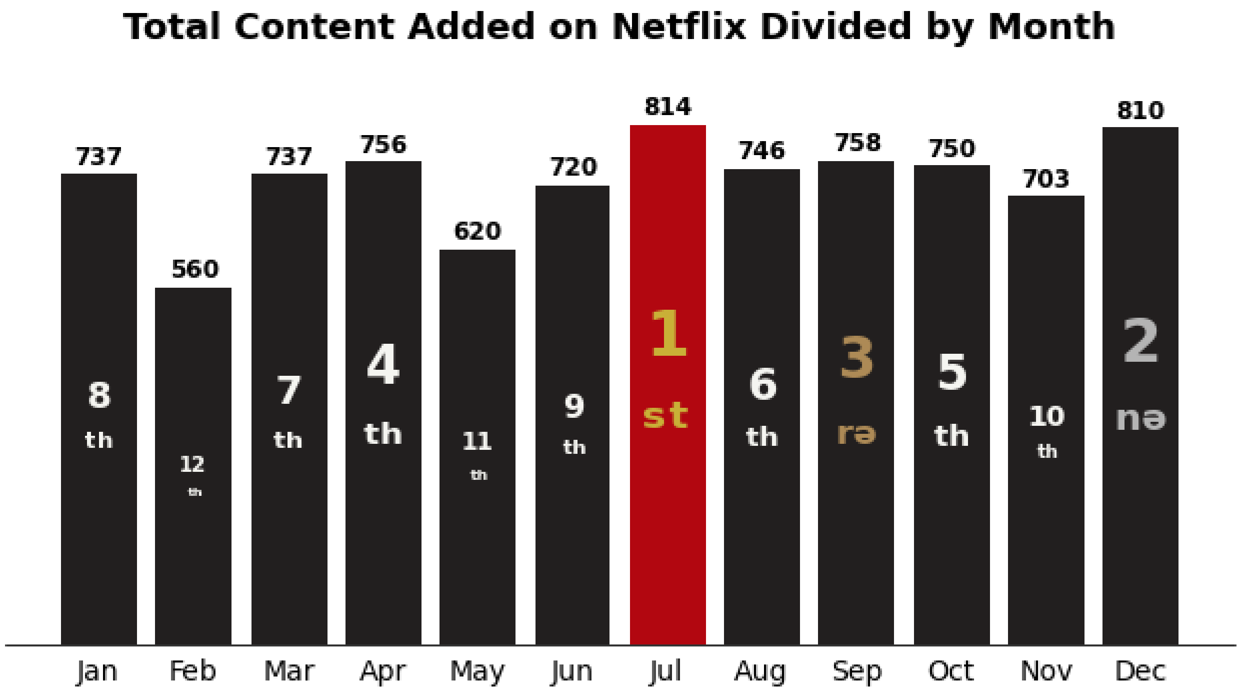
After 2019 we can see that there's a bit of a drop off. While the pandemic might have contributed to this, there's also a new competitor factor.

Disney+ is released near the end of 2019 and has proven itself to be a tough competitor for Netflix.

1c) What is the most popular month for Netflix to add new content?

In [45]:
```
#Additional Color Palette
gld = '#C9B037'
slv = '#B4B4B4'
brz = '#AD8A56'

dt_mx = df['date_added'].dt.month.value_counts().keys().tolist()
dt_my = df['date_added'].dt.month.value_counts().tolist()

fig, ax = plt.subplots(figsize=(11, 5))
# fig, ax = plt.subplots()
bar_clr = [dr] + (([blk]*(len(dt_mx)-1)))

ax.bar(dt_mx, dt_my, color= bar_clr)
mnth_xticks = df['date_added'].dt.month_name().value_counts().keys().str[:3].tolist()
ax.set_xticks(dt_mx)
```

```python
ax.set_xticklabels(mnth_xticks, fontsize= 14)
ax.set_yticks([])
ax.tick_params(bottom=False)
# ax.set_ylabel("Content Count", size=11, weight='bold')
ax.set_title("Total Content Added on Netflix Divided by Month"
             , size=18, fontweight='bold', loc='center', pad=30)

for b in ['top', 'right', 'left']:
    ax.spines[b].set_visible(False)

suf = ["st", "nə", "rə"] + (["th"]*len(dt_mx))
clr_s = [gld, slv, brz] + ([wht]*len(dt_mx))
for pos, rect in enumerate(ax.patches):
    ax.text(rect.get_x() + rect.get_width() / 2, rect.get_height()+15, rect.get_height(),
            ha='center', fontsize = 12, fontweight='bold')
    ax.text(rect.get_x() + rect.get_width() / 2, rect.get_height() / 2.4, f"{pos+1}\n{suf[pos]}",
            ha='center', fontsize = 32-(pos*2), fontweight='bold', color= clr_s[pos])

plt.show()
```



As we can see from the graph above:

1. **July** is Netflix's favorite month to add new content -> In US, July is when summer begins

2. **December** is a close second -> December is Christmas and also holiday season everywhere in the world, not just US.

So we can infer that these 2 months is when people has lot of free time on their hands and wants to fill it with some sort of activity, usually entertainment, and Netflix is one of the best sources for it!

- **For July**, it is perfect for teenager on their summer holiday who wants to binge watch TV Show so they can shake their feeling of FOMO.
- **For December**, it is also perfect for family time when they don't have anything planned at home.

With Netflix's wide variety of choices, surely any age group can find the content they want/need whether they want to spend time alone or with family.

2a & 2b) What type of content dominates the platform? What kind of genre dominates the most for each type?

In [46]:

```
#Movie's Top Genre
mov_filt = df['type'] == 'Movie'
mov_genre = df[mov_filt]['genre']
m_genre = {}
for gs in mov_genre:
    for g in gs.split(","):
        g = g.strip()
        m_genre[g] = m_genre.get(g, 0) + 1
m_genre_sorted = dict(sorted(m_genre.items(), key=lambda x: x[1], reverse=True))
# m_genre_sorted
```

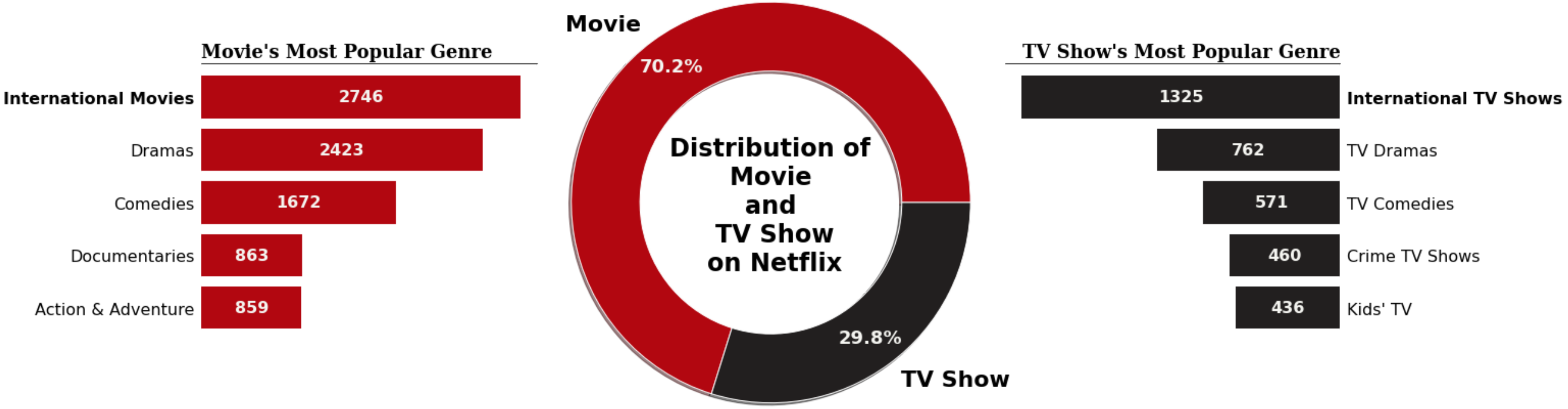
In [47]:

```
#TV Show's Top Genre
tv_filt = df['type'] == 'TV Show'
tvs_genre = df[tv_filt]['genre']
tv_genre = {}
for tgs in tvs_genre:
    for tg in tgs.split(","):
        tg = tg.strip()
        tv_genre[tg] =tv_genre.get(tg, 0) + 1
tv_genre_sorted = dict(sorted(tv_genre.items(), key=lambda x: x[1], reverse=True))
# tv_genre_sorted
```

In [48]:

```
#Pie
type_slice = df['type'].value_counts()
slices_lst = df['type'].value_counts().keys().tolist()
slices = [x for x in slices_lst]
size = 0.62
fig, (ax1,ax,ax2) = plt.subplots(1,3, figsize=(20,5))
patches, texts, autotexts = ax.pie(type_slice, labels=slices, autopct='%1.1f%%', radius=1.8, colors=[dr,blk]
                                   , wedgeprops=dict(width=size, edgecolor='w'), pctdistance=0.84, shadow=True
                                   , textprops={'weight':'bold', 'fontsize':22, 'fontfamily':'sans-serif'})
plt.setp(autotexts, color=wht, fontweight='bold', fontsize=18)

fig.text(0.515, 0.32, '''Distribution of
Movie
and
TV Show
on Netflix'''
         , fontsize=24, fontweight='bold', ha='center')

#Bar
mov_gx = [movg for movg in m_genre_sorted.keys()][:5]
mov_gy = [movgc for movgc in m_genre_sorted.values()][:5]
ax1.barh(mov_gx, mov_gy, color=[dr]*len(mov_gx))
ax1.set_xticks([])
ax1.tick_params(axis='y', which='major', labelsize=16, left=False)
ax1.invert_yaxis()
ax1.set_title("Movie's Most Popular Genre", loc='left', fontsize=18, fontweight='bold', fontfamily='serif')
for pos, val in enumerate(mov_gy):
    ax1.annotate(f"{val}", xy=(val-(val*0.5), pos), ha='center', va='center', color=wht,
                fontweight='bold', fontsize=16)

tv_gx = [tvg for tvg in tv_genre_sorted.keys()][:5]
tv_gy = [tvgc for tvgc in tv_genre_sorted.values()][:5]
ax2.barh(tv_gx, tv_gy, color=[blk]*len(tv_gx))
ax2.set_xticks([])
ax2.invert_yaxis()
```

```
ax2.invert_xaxis()
ax2.yaxis.set_label_position("right")
ax2.yaxis.tick_right()
ax2.tick_params(axis='y', which='major', labelsize=16, right=False)
ax2.set_title("TV Show's Most Popular Genre", loc='right', fontsize=18, fontweight='bold', fontfamily='serif')
for pos, val in enumerate(tv_gy):
    ax2.annotate(f"{val}", xy=(val-(val*0.5), pos), ha='center', va='center', color=wht,
                 fontweight='bold', fontsize=16)

ax1.get_yticklabels()[0].set_fontweight('bold')
ax2.get_yticklabels()[0].set_fontweight('bold')

for b in ['right', 'bottom', 'left']:
    ax1.spines[b].set_visible(False)
    ax2.spines[b].set_visible(False)

plt.show()
```



1. **International (both Movie and TV Show)** is a tag given for a foreign content. Given this description, it's only natural that most content would have this tag because there are a lot of international content on Netflix.

2. **Dramas** is the 2nd most popular genre for Netflix's content. Drama is a neutral genre. All forms of cinema or television that involve fictional stories are forms of drama in the broader sense if their storytelling is achieved by means of actors who represent characters. An

   action movie or tv show can be a sub-genre for drama, romance can be a sub-genre for drama, fantasy can be a sub-genre for drama, mystery an also be a sub-genre for drama, a lot of other genres can be categorized into drama.

   In facts, most watched/popular/talked-about TV Shows on Netflix are drama genre.

   - Squid Game season 1: 1.65 billion hours -> Drama
   - Stranger Things (season 3 + 4): 582.1 million hours + 1.35 billion hours -> Drama
   - Dahmer – Monster: The Jeffrey Dahmer Story: 856.2 million hours -> Thriller, Crime Fiction
   - Money Heist (part 4 + 5): 619 million hours + 792.2 million hours -> Drama
   - Bridgerton (season 1 + 2): 625.5 million hours + 656.2 million hours -> Historical Drama
   - Lucifer season 5: 569.5 million hours -> Comedy Drama
   - All of Us Are Dead season 1: 560.8 million hours -> Korean Drama
   - The Witcher season 1: 541 million hours -> Drama
   - Inventing Anna: 511.9 million hours -> Drama
   - 13 Reasons Why season 2: 496.1 million hours -> Drama
   - Ozark season 4: 491.1 million hours -> Drama

   9 out of 11 on those list are drama series. So, it's not a surprise that Netflix put a lot of drama type content on their database.

3. **Comedy** is one of the most popular genre that people loved to watch. People can always rely on comedy genre to lighten our mood or as a neutral type of genre to watch together with family or friends.

Those 3 genres are the most popular genre shared between the 2 type of contents (Movie & TV Show).

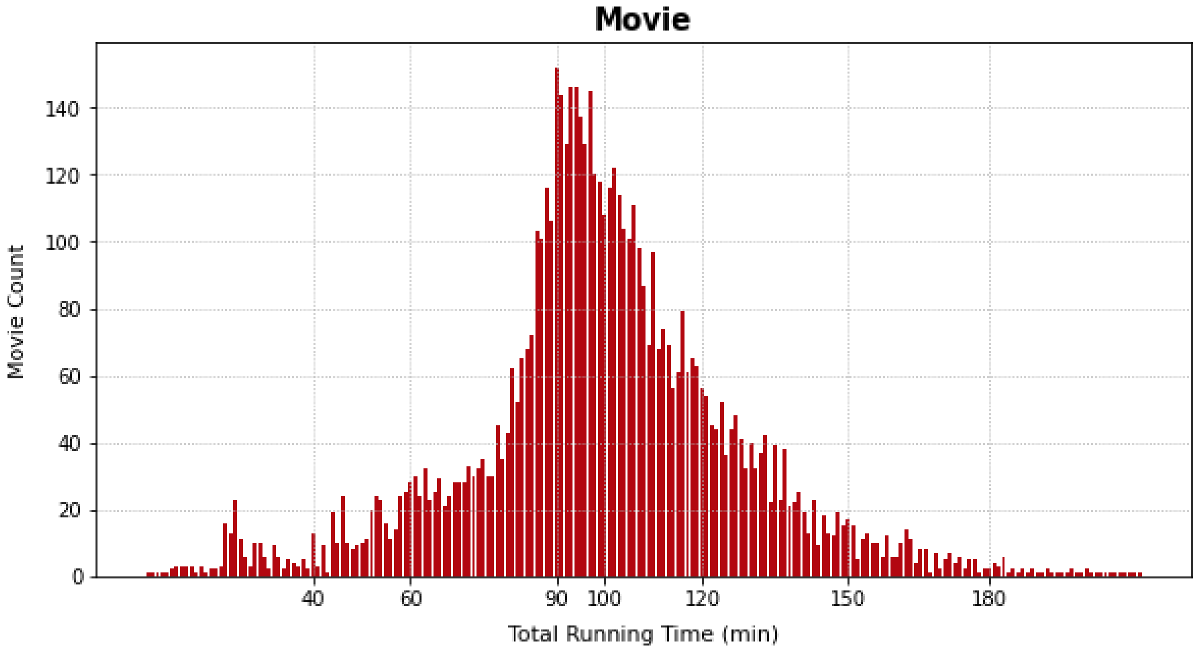
2c) How does the duration of shows vary?

In [77]:

```
lblsize = 11
lpad = 8

#Movie
mfilt = df['type'] == 'Movie'
keys = df[mfilt]['duration'].value_counts().keys().tolist()
values = df[mfilt]['duration'].value_counts().tolist()
mins_count = dict(zip(keys, values))
mins_count_sorted = dict(sorted(mins_count.items(), key = lambda x: int(x[0].split(" ")[0])))
```

```
mrt_x = [x.split(" ")[0] for x in mins_count_sorted.keys()]
mrt_y = mins_count_sorted.values()
fig, ax = plt.subplots(figsize=(10,5))
# d = 5
# clr = ([dr]*d) + ([blk]*d)
ax.bar(mrt_x, mrt_y, color=dr)
ax.set_xticks([34,54,84,94,114,144,173])
ax.set_ylabel("Movie Count", fontsize=lblsize, labelpad=lpad)
ax.set_xlabel("Total Running Time (min)", fontsize=lblsize, labelpad=lpad)
ax.set_title("Movie", fontweight='bold', fontsize=15)
plt.grid(axis='both', linestyle=':')

fig.text(0.959, 0.81, '''
Summary:
'''
         , fontsize=12, fontweight='bold',  fontfamily='serif')

fig.text(0.95, 0.075, '''
- The graph has a variance of 798 and a std
  deviation of 28,25. It's a bit skewed to
  the right because of a few outliers
  (mean=99.64, median=98, mode=90).

- Most movies run at around ± 95 minutes.

- The highest amount is at 90 minutes of
  runtime with a count of 152 movies.

- A surprisingly decent amount of movies
  run for more than 3 hours.

- The lowest runtime is 3 minutes (which is
  categorized as short movie) while the
  highest runtime is 312 minutes (which is
  around 5.2 hours!).
'''
         , fontsize=12, fontweight='light',  fontfamily='serif')
```

```
# mov = pd.DataFrame({'minutes':movdata})
# mov.describe().applymap('{:.2f}'.format)
# mov.aggregate(['sum', 'median', 'var', 'sem', 'mad', 'prod']).applymap('{:.2f}'.format)

#TV Show
tvsfilt = df['type'] == 'TV Show'
tvsval = df[tvsfilt]['duration'].value_counts()
durx = [x.split(" ")[0] for x in tvsval.keys()]
dury = tvsval.values
fig, ax = plt.subplots(figsize = (9.85,5))
ax.bar(durx, dury, color=[blk]*len(durx))
ax.set_title('TV Show', fontweight='bold', fontsize=15)
ax.set_ylabel('TV Show Count', fontsize=lblsize, labelpad=lpad)
ax.set_xlabel('Number of Seasons', fontsize=lblsize, labelpad=lpad)
for rect in ax.patches:
    ax.text(rect.get_x() + rect.get_width() / 2, rect.get_height()+15, rect.get_height(),
            ha='center', fontsize = 10, fontweight='bold', color=blk)

fig.text(0.959, 0.8, '''
Summary:
'''
         , fontsize=12, fontweight='bold',  fontfamily='serif')

fig.text(0.95, 0.095, '''
- A lot of TV Show only have 1 season which
  shows how hard competing in a TV Show
  industry is.

- The number of TV Show is showing a constant
  decrease as the number of seasons increase.

- Highest number of decrease if we exclude
  season 1 (because it's where the majority
  of TV Show is) is from season 2 to season 3.
  This goes to show, even if a show managed
  to get to season 2, it doesn't mean it'll gain
  the same popularity as the season prior.

- Only less than 10 shows managed to get to
  season 9.
'''
         , fontsize=12, fontweight='light',  fontfamily='serif')

# tvdata = []
# for dur in df['duration']:
#     show = (dur.split(" ")[1]).strip()
#     if show.startswith("Season") or show.startswith("Seasons"):
#         num_mins = int(dur.split(" ")[0])
#         tvdata.append(num_mins)
# len(tvdata)

plt.grid(axis='y', linestyle=':')
plt.show()
```



Summary:

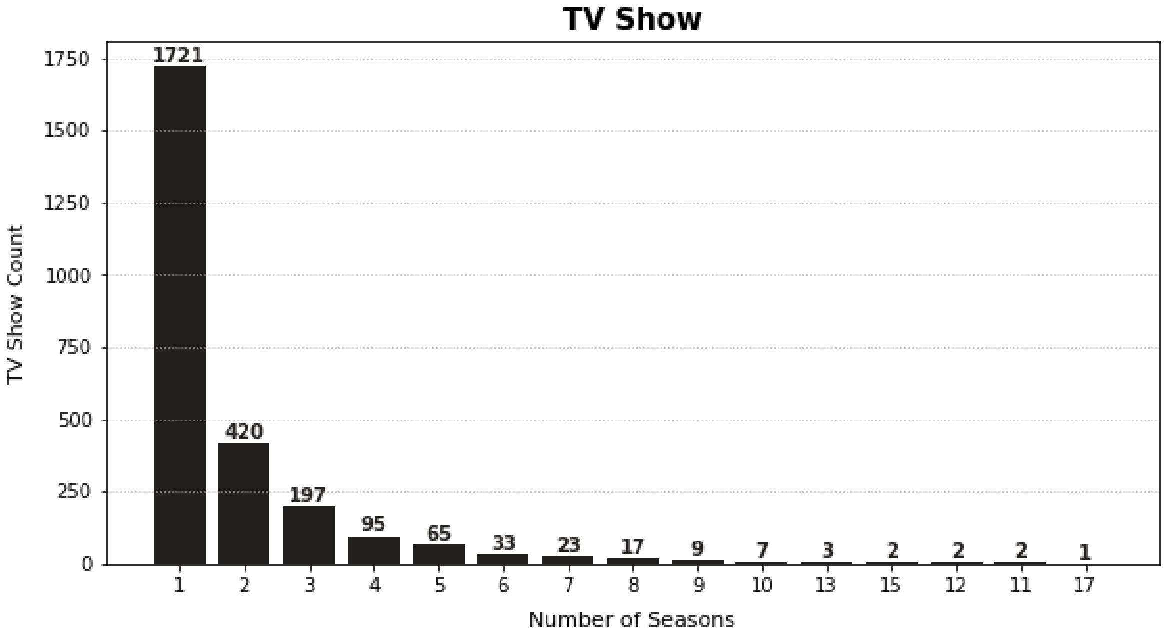
- The graph has a variance of 798 and a std deviation of 28,25. It's a bit skewed to the right because of a few outliers (mean=99.64, median=98, mode=90).

- Most movies run at around ± 95 minutes.

- The highest amount is at 90 minutes of runtime with a count of 152 movies.

- A surprisingly decent amount of movies run for more than 3 hours.

- The lowest runtime is 3 minutes (which is categorized as short movie) while the highest runtime is 312 minutes (which is around 5.2 hours!).



Summary:

- A lot of TV Show only have 1 season which shows how hard competing in a TV Show industry is.

- The number of TV Show is showing a constant decrease as the number of seasons increase.

- Highest number of decrease if we exclude season 1 (because it's where the majority of TV Show is) is from season 2 to season 3. This goes to show, even if a show managed to get to season 2, it doesn't mean it'll gain the same popularity as the season prior.

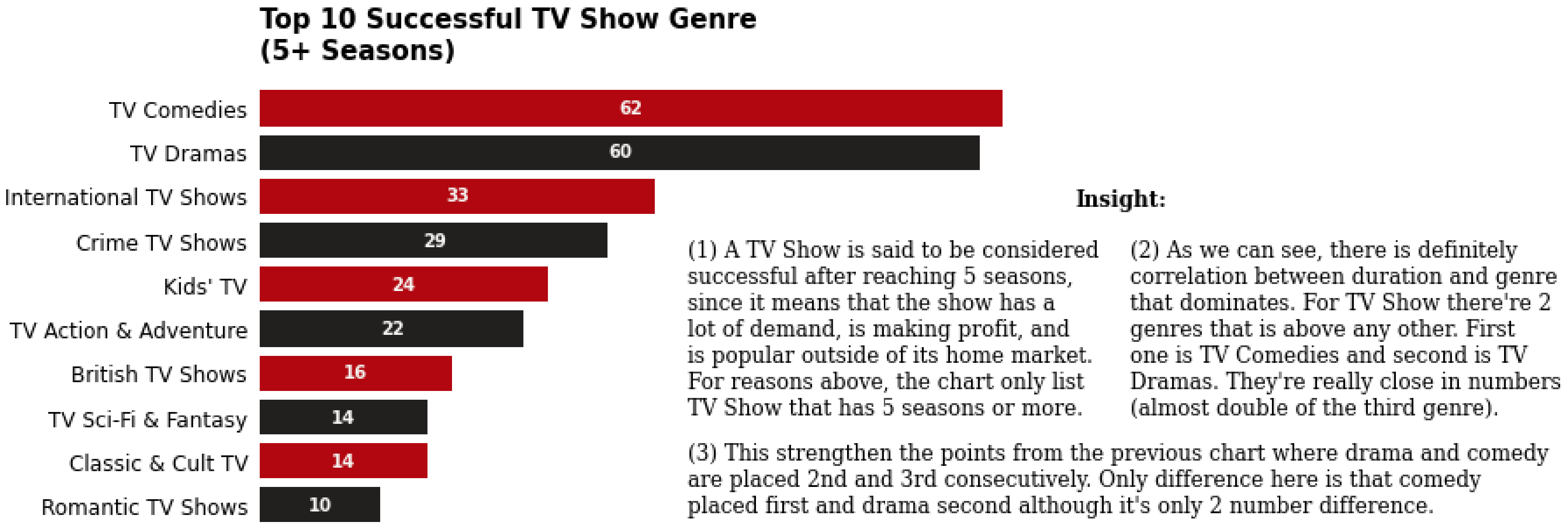
- Only less than 10 shows managed to get to season 9.

2d) Is there any correlation between duration and genre that dominates? (both TV Show and Movie separately)

TV Show

In [50]:

```python
fivesplus = []
for idx, seasons in enumerate(df['duration']):
    num_season = int(seasons.split(" ")[0])
    show = seasons.split(" ")[1]
    if num_season >= 5 and (show.startswith("Seasons") or show.startswith("Season")):
        fivesplus.append((idx, df.loc[idx, 'title']))

fivesplus_c = {}
for titles in fivesplus:
    for genres in [df.loc[titles[0], 'genre']]:
        for genre in genres.split(","):
            g = genre.strip()
            fivesplus_c[g] = fivesplus_c.get(g, 0) + 1
fivesplus_c_sorted = dict(sorted(fivesplus_c.items(), key = lambda x: x[1], reverse=True))

fsx = [x for x in fivesplus_c_sorted.keys()][:10]
fsy = [x for x in fivesplus_c_sorted.values()][:10]

fig, ax = plt.subplots(figsize=(8,5))
ax.barh(fsx, fsy, color = [dr, blk])
ax.invert_yaxis()
ax.set_xticks([])
# ax.invert_xaxis() #mirror position
# ax.yaxis.set_label_position("right") #mirror position
# ax.yaxis.tick_right() #mirror position
ax.tick_params(bottom=False, left=False, labelsize=12)
ax.set_title("Top 10 Successful TV Show Genre\n(5+ Seasons)", weight='bold', size=15, loc='left')
for pos, val in enumerate(fsy):
    ax.annotate(f"{val}", xy=(val-(val*0.5), pos), ha='center', va='center', color=wht,
                fontweight='bold', fontsize=10)
for b in ['right', 'top', 'left', 'bottom']:
    ax.spines[b].set_visible(False)

fig.text(0.935, 0.62, '''
Insight:
'''
         , fontsize=12, fontweight='bold',  fontfamily='serif')

fig.text(0.55, 0.29,'''
(1) A TV Show is said to be considered
successful after reaching 5 seasons,
since it means that the show has a
lot of demand, is making profit, and
is popular outside of its home market.
For reasons above, the chart only list
TV Show that has 5 seasons or more.
'''
        , fontsize=12, fontweight='light',  fontfamily='serif')

fig.text(.99, 0.29, '''
(2) As we can see, there is definitely
correlation between duration and genre
that dominates. For TV Show there're 2
genres that is above any other. First
one is TV Comedies and second is TV
Dramas. They're really close in numbers
(almost double of the third genre).
'''
         , fontsize=12, fontweight='light',  fontfamily='serif')

fig.text(0.55, 0.135, '''
(3) This strengthen the points from the previous chart where drama and comedy
are placed 2nd and 3rd consecutively. Only difference here is that comedy
placed first and drama second although it's only 2 number difference.
'''
         , fontsize=12, fontweight='light',  fontfamily='serif')

plt.show()
```



Insight:

(1) A TV Show is said to be considered successful after reaching 5 seasons, since it means that the show has a lot of demand, is making profit, and is popular outside of its home market. For reasons above, the chart only list TV Show that has 5 seasons or more.

(2) As we can see, there is definitely correlation between duration and genre that dominates. For TV Show there're 2 genres that is above any other. First one is TV Comedies and second is TV Dramas. They're really close in numbers (almost double of the third genre).

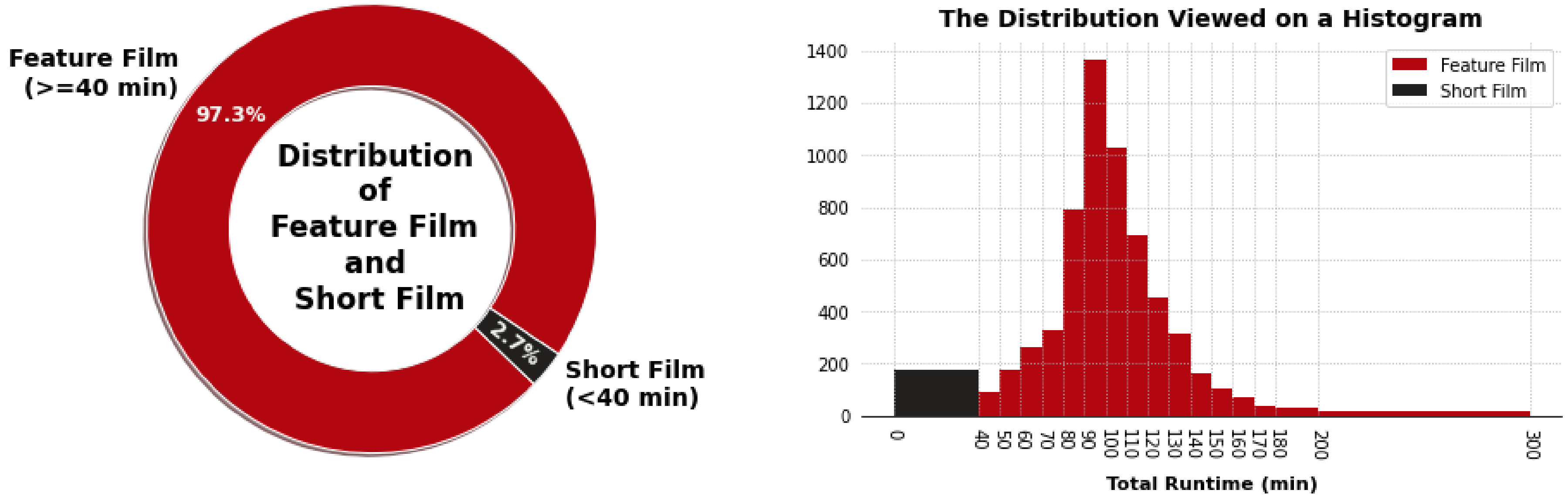
(3) This strengthen the points from the previous chart where drama and comedy are placed 2nd and 3rd consecutively. Only difference here is that comedy placed first and drama second although it's only 2 number difference.

Movie

In [51]:

```
ff = "Feature Film\n(>=40 min)"
sf = "Short Film\n(<40 min)"
min_cat = {}
for mins in df['duration']:
    mins = mins.split(" ")
    unit = mins[1].strip()
    if unit.startswith("min") or unit.startswith("mins"):
        mint = int(mins[0].strip())
        if mint < 40:
            min_cat[sf] = min_cat.get(sf, 0) + 1
        elif mint >= 40:
            min_cat[ff] = min_cat.get(ff, 0) + 1

fig, (ax,ax2) = plt.subplots(1,2, figsize=(16,4))
slices_keys = min_cat.keys()
slices_val = min_cat.values()
slices = [x for x in slices_keys]
size = 0.55

patches, texts, autotexts = ax.pie(slices_val, labels=slices, autopct='%1.1f%%', radius=1.5, colors=[dr,blk]
                                   , wedgeprops=dict(width=size, edgecolor='w'), pctdistance=0.81, shadow=True
                                   , textprops={'weight':'bold', 'fontsize':14, 'fontfamily':'sans-serif'}
                                  , startangle = -34)
plt.setp(autotexts[1], color=wht, fontweight='bold', fontsize=12, rotation=-38)
plt.setp(autotexts[0], color=wht, fontweight='bold', fontsize=12, rotation=0)

fig.text(0.305, 0.27, '''
Distribution
of
Feature Film
and
Short Film
'''
         , fontsize=17, fontweight='bold', ha='center')

movdata = []
for dur in df['duration']:
    show = (dur.split(" ")[1]).strip()
    if show.startswith("min") or show.startswith("mins"):
        num_mins = int(dur.split(" ")[0])
```

```python
        movdata.append(num_mins)

h_sf = [x for x in movdata if x <= 40]
h_ff = [x for x in movdata if x > 40]
bins = [0,40,50,60,70,80,90,100,110,120,130,140,150,160,170,180,200,300]

ax2.hist(h_ff, bins=bins, color=[dr], label='Feature Film')
ax2.hist(h_sf, bins=[0,40], color=[blk], label= 'Short Film')
ax2.set_xticks(bins)
ax2.set_xticklabels(ax2.get_xticks(), rotation=270)
ax2.set_title("The Distribution Viewed on a Histogram", weight='bold', size=14, va='bottom')
ax2.tick_params(axis='both', which='major', labelsize=10, left=False, bottom=False)
ax2.set_xlabel("Total Runtime (min)", labelpad=9, fontsize=11, weight='bold')

for b in ['right', 'left', 'top']:
    ax2.spines[b].set_visible(False)

# fig.text(0.66, 0.16, min_cat[ff], color=wht, fontweight='bold', fontsize=12)
# fig.text(0.576, 0.16, min_cat[sf], color=wht, fontweight='bold', fontsize=12)
plt.legend()
plt.grid(axis='both', linestyle=':')
plt.show()
```



Unfortunately for movie, duration can't really be a metric for success. For TV Show the duration data is presented in season so it can be a decent indicator, but for movie a longer runtime doesn't always equal success. Since duration can't be a metric for success, **we don't have a way of filtering what counts as a successful genre here in movie category.**

That said, we can still take a look at the chart above just for reference. According to Yale University Library website, a movie with less than 40 minutes running time is considered a **'Short Film'** and a full length films with a running time of 40 minutes or more is called **'Feature Film'** so I divided the category to those 2 part.

The result is shown on chart above, the black colored bar on histogram represent the short film while the rest is feature film. From the histogram presented above you can see the overwhelming difference between short film and feature film plus some other fact:

- The total number for short movie doesn't even reach 200 (the total movie on this dataset is 6114).
- Unlike the previous chart, here we can clearly see that 90-100 minute category has the most amount of film.
- The second most popular running time range is 100-110 minutes and third is 80-90 minutes.
- Movie with more than 2.5 hours of running time is a minority (it's within 2 standard deviation of the mean).

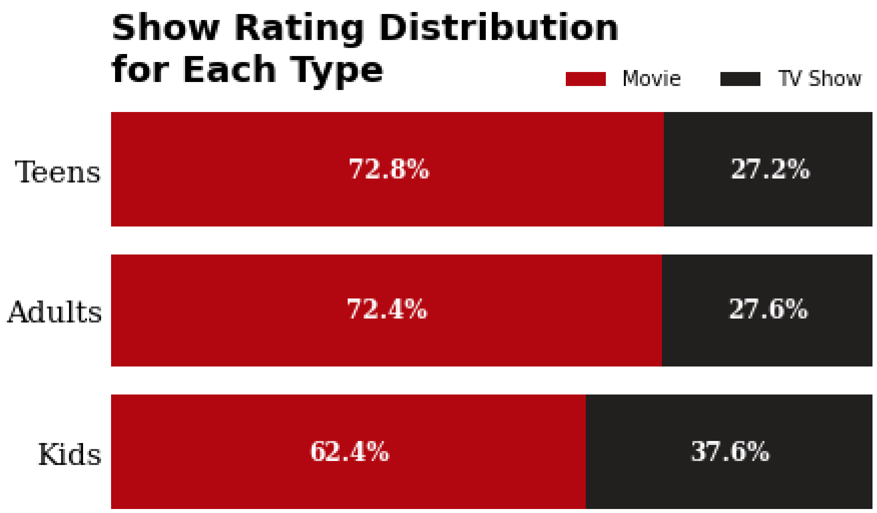
3a & 3b) Which (maturity) rating has the most amount on both type of content? Does that reflects Netflix's target audience?

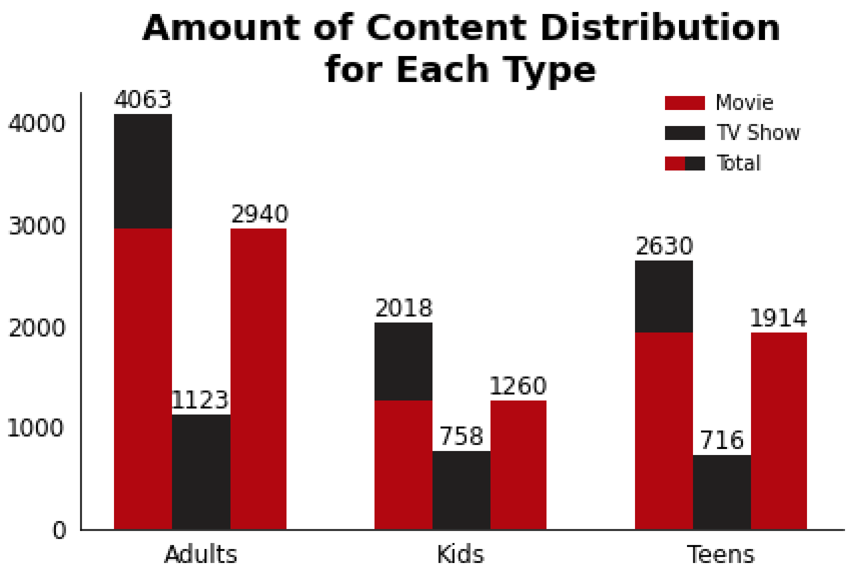
In [52]:

```
#Conversion
mr = {'TV-MA': 'Adults',
     'TV-14': 'Teens',
     'R': 'Adults',
     'TV-PG': 'Kids',
     'PG-13': 'Teens',
     'PG': 'Kids',
     'TV-Y7': 'Kids',
     'TV-G': 'Kids',
     'TV-Y': 'Kids',
     'NR': 'Adults',
     'G': 'Kids',
     'TV-Y7-FV': 'Kids',
     'NC-17': 'Adults',
     'UR': 'Adults'}
```

```
df['age_rating'] = df['rating']
df['age_rating'] = df['age_rating'].map(mr)
type_grp = df.groupby('type')
# type_grp['age_rating'].value_counts()

#Visualization
pivot_r = type_grp['age_rating'].value_counts().unstack(level=0)
pivot_r['sum'] = pivot_r.sum(axis=1)
pivot_ratio = (pivot_r.T / pivot_r['sum']).T[['Movie', 'TV Show']].sort_values(by='Movie',ascending=False)[::-1]
fig, (ax, ax2) = plt.subplots(1,2, figsize = (15,4))

ax.barh(pivot_ratio.index, pivot_ratio['Movie'], color=dr, label='Movie')
ax.barh(pivot_ratio.index, pivot_ratio['TV Show'], left=pivot_ratio['Movie'], color=blk, label='TV Show')

ax.set_xlim(0, 1)
ax.set_xticks([])
ax.set_yticks(pivot_ratio.index)
ax.set_yticklabels(pivot_ratio.index, fontfamily='serif', fontsize=11)
ax.tick_params(axis='y', which='major', labelsize=15)
ax.tick_params(axis=u'both', which=u'both',length=0)
ax.legend(ncol=2, loc='upper right', bbox_to_anchor=(1.01, 1.095), frameon=False)
ax.set_title("Show Rating Distribution\nfor Each Type", size=18, loc='left', weight='bold')

for b in ['top', 'left', 'right', 'bottom']:
    ax.spines[b].set_visible(False)

for i in pivot_ratio.index:
    ax.annotate(f"{pivot_ratio['Movie'][i]*100:.3}%",
                   xy=(pivot_ratio['Movie'][i]/2, i),
                   va = 'center', ha= 'center',fontsize= 12, fontweight= 'bold', fontfamily= 'serif',
                   color= 'white')

for i in pivot_ratio.index:
    ax.annotate(f"{pivot_ratio['TV Show'][i]*100:.3}%",
                   xy=(pivot_ratio['Movie'][i] + pivot_ratio['TV Show'][i]/2, i),
                   va = 'center', ha= 'center',fontsize= 12, fontweight= 'bold', fontfamily= 'serif',
                   color= 'white')

grp_x = pivot_r['Movie'].keys()
```

```python
ind = np.arange(len(grp_x))
width = 0.22

rects1 = ax2.bar(ind+width+width, pivot_r['Movie'].values.tolist(), width, label='Movie', color=dr)
rects2 = ax2.bar(ind+width, pivot_r['TV Show'].values.tolist(), width, label='TV Show', color=blk)
rects3 = ax2.bar(grp_x, pivot_r['Movie'].values.tolist(), width, label='Total', color=dr)
rects4 = ax2.bar(grp_x, pivot_r['TV Show'].values.tolist(), width, bottom=pivot_r['Movie'].values.tolist(), color=blk)

ax2.set_yticks([x for x in range(0, 5000, 1000)])
ax2.set_yticklabels([x for x in range(0, 5000, 1000)])
ax2.tick_params(left=False, axis='y', which='major', labelsize=12)
ax2.tick_params(bottom=False)
ax2.set_xticks(ind + width)
ax2.set_xticklabels(grp_x, fontsize=12)
# ax2.legend(loc='upper right', bbox_to_anchor=(0.97, 1.04), frameon=False)
ax2.set_title('Amount of Content Distribution\nfor Each Type', size=18, loc='center', weight='bold')

ax2.bar_label(rects1, padding=0.5, fontsize=12)
ax2.bar_label(rects2, padding=0.5, fontsize=12)
ax2.bar_label(rects4, padding=0.5, fontsize=12)

#Legend_Left
m1 = Patch(facecolor=dr) #movie left
tv1 = Patch(facecolor=blk) #tv show left
tot1 = Patch(facecolor=dr) #total left
#Legend Right
m2 = Patch(facecolor=dr) #movie right
tv2 = Patch(facecolor=blk) #tv show right
tot2 = Patch(facecolor=blk) #total right

ax2.legend(handles=[m1, tv1, tot1, m2, tv2, tot2],
          labels=['', '', '', 'Movie', 'TV Show', 'Total'],
          ncol=2, handletextpad=0.5, handlelength=1, columnspacing=-0.5, loc='upper right'
          , bbox_to_anchor=(0.97, 1.04), frameon=False)

for b in ['top', 'right']:
    ax2.spines[b].set_visible(False)

plt.show()
```





By looking at Netflix's content show rating, we can roughly infer what their target audiences are. I grouped the show rating into 3 different categories based on Netflix's maturity rating.

1. Adults

- R : Restricted. May be inappropriate for ages under 17
- TV-MA : For Mature Audiences
- NC-17 : Inappropriate for ages 17 and under
- NR : Not Rated. A film that has not been submitted for a rating or is an uncut version of a film that was submitted
- UR : Unrated. Similiar to NR, the two terms are used interchangeably

2. Teens

- PG-13 : Parents strongly cautioned. May be inappropriate for ages under 13
- TV-14 : Parents strongly cautioned. May not be suitable for ages under 14

3. Kids

- TV-PG : Parental Guidance suggested

- PG : Parental Guidance suggested
- G : Suitable for General Audiences
- TV-G : Suitable for General Audiences
- TV-Y : Designed to be appropriate for all children
- TV-Y7 : Suitable for ages 7 and up
- TV-Y7-FV : The FV stands for Fantasy Violence. This is used to indicate that a TV-Y7-rated program contains behavior that, while violent and often combative, is fictional and can be shown to children who understand the difference between fantasy and reality.

We can see from the graph above that most content on Netflix are Movies as we already know from the graph before this. It turns out this holds true for every rating category on Netflix. Although the comparison percentage (between movie and tv show) for teens and adults looked similiar, the amount of content that the adult rating has is almost doubled to that of teens and more than double to that of kids category. So we can conclude that Netflix's target audiences are mostly adults aged 17+.

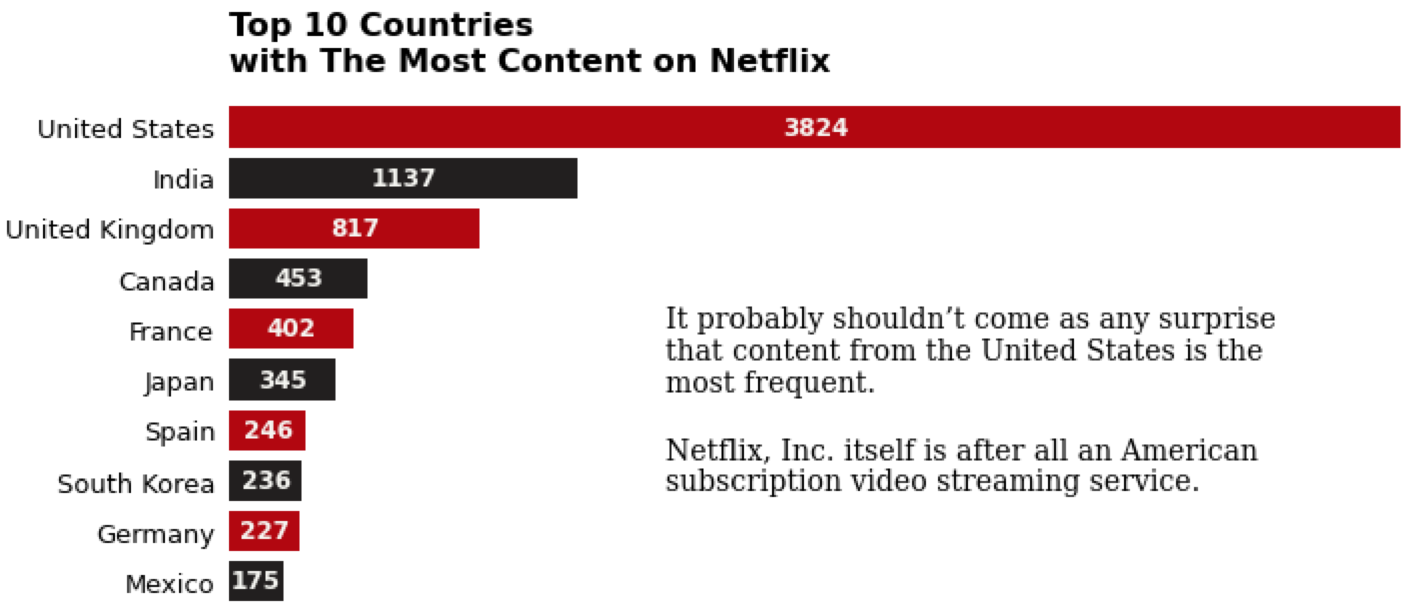
4) Which country has the most content?

In [53]:

```
country_count = {}
for countries in df['country']:
    if type(countries) != float:
        for country in countries.split(","):
            country = country.strip()
            if country != '' and country != missing_msg:
                country_count[country] = country_count.get(country, 0) + 1
country_count_sorted = dict(sorted(country_count.items(), key=lambda x: x[1], reverse=True))

ctry_x = [ctry for ctry in country_count_sorted.keys()][:10]
ctry_y = [ctry_count for ctry_count in country_count_sorted.values()][:10]

fig, ax = plt.subplots(1,1, figsize = (11,5))

ax.barh(ctry_x, ctry_y, color =[dr, blk]*len(ctry_x))
for pos, val in enumerate(ctry_y):
    ax.annotate(f"{val}", xy=(val-(val*0.5), pos), ha='center', va='center', color=wht,
                fontweight='bold', fontsize=12)

ax.set_title("Top 10 Countries\nwith The Most Content on Netflix", size=16, loc='left', weight='bold')
```

```
# ax.tick_params(axis='x', which='major', labelsize=10)
ax.tick_params(axis='y', which='major', labelsize=13, left=False)
ax.set_xticks([])
ax.invert_yaxis()
for b in ['top', 'right', 'bottom', 'left']:
    ax.spines[b].set_visible(False)

fig.text(0.4, 0.27, '''
It probably shouldn’t come as any surprise
that content from the United States is the
most frequent.

Netflix, Inc. itself is after all an American
subscription video streaming service.
'''
         , fontsize=14, fontweight='light',  fontfamily='serif')

#TV Show only Country
tv_filt = df['type'] == 'TV Show'
tvs_country = df[tv_filt]['country']
tv_country = {}
for tcs in tvs_country:
    for tc in tcs.split(","):
        tc = tc.strip()
        if tc != missing_msg:
            tv_country[tc] =tv_country.get(tc, 0) + 1
tv_country_sorted = dict(sorted(tv_country.items(), key=lambda x: x[1], reverse=True))


#Movie only Country
mov_filt = df['type'] == 'Movie'
movs_country = df[mov_filt]['country']
mov_country = {}
for mcs in movs_country:
    for mc in mcs.split(","):
        mc = mc.strip()
        if mc != missing_msg:
            mov_country[mc] =mov_country.get(mc, 0) + 1
mov_country_sorted = dict(sorted(mov_country.items(), key=lambda x: x[1], reverse=True))
```

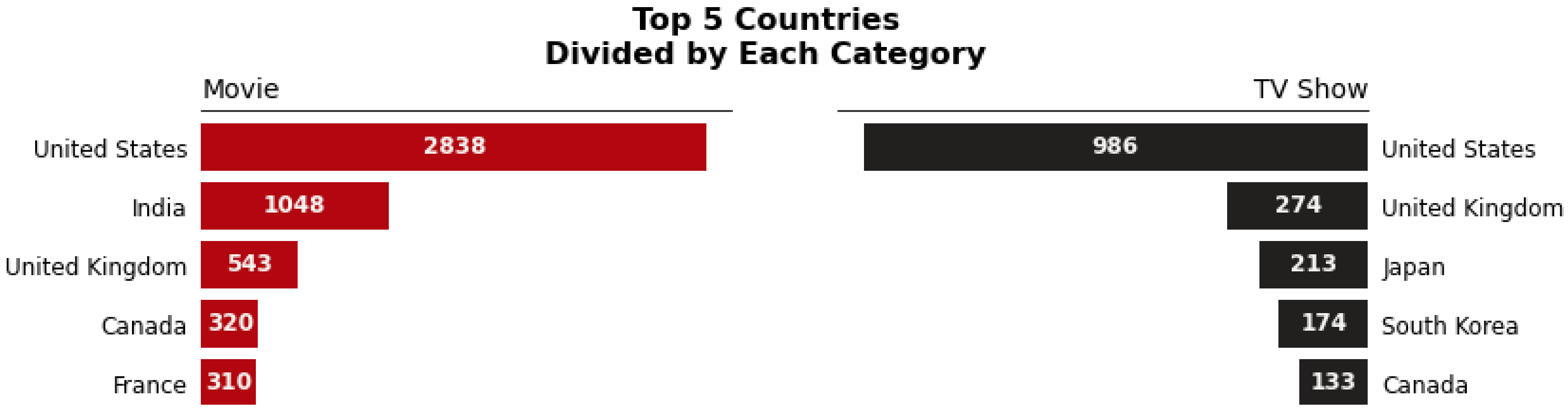
```python
mctry_x = [ctry for ctry in mov_country_sorted.keys()][:5]
mctry_y = [ctry_count for ctry_count in mov_country_sorted.values()][:5]

tvctry_x = [ctry for ctry in tv_country_sorted.keys()][:5]
tvctry_y = [ctry_count for ctry_count in tv_country_sorted.values()][:5]

fig, (ax1, ax2) = plt.subplots(1,2, figsize = (11,3))

ax1.barh(mctry_x, mctry_y, color=[dr]*len(mctry_x))
ax1.set_title("Movie", size=14, loc='left')
ax1.invert_yaxis()
ax1.tick_params(axis='y', which='major', labelsize=12, left=False)
ax1.set_xticks([])
for pos, val in enumerate(mctry_y):
    ax1.annotate(f"{val}", xy=(val-(val*0.5), pos), ha='center', va='center', color=wht,
                 fontweight='bold', fontsize=12)

ax2.barh(tvctry_x, tvctry_y, color=[blk]*len(mctry_x))
ax2.set_title("TV Show", size=14, loc='right')
ax2.invert_yaxis()
ax2.invert_xaxis() #mirror position
ax2.yaxis.set_label_position("right") #mirror position
ax2.yaxis.tick_right() #mirror position
ax2.tick_params(axis='y', which='major', labelsize=12, right=False)
ax2.set_xticks([])
for pos, val in enumerate(tvctry_y):
    ax2.annotate(f"{val}", xy=(val-(val*0.5), pos), ha='center', va='center', color=wht,
                 fontweight='bold', fontsize=12)

for b in ['right', 'bottom', 'left']:
    ax1.spines[b].set_visible(False)
    ax2.spines[b].set_visible(False)

sup_xr = 0.9
sup_yr = 1.01
fig.suptitle("Top 5 Countries\nDivided by Each Category", fontweight='bold', fontsize='16'
             , va='bottom', ha='center')

plt.show()
```



Top 10 Countries
with The Most Content on Netflix

It probably shouldn’t come as any surprise that content from the United States is the most frequent.

Netflix, Inc. itself is after all an American subscription video streaming service.



Top 5 Countries
Divided by Each Category

1. **US** came first as country with most content available on Netflix even when the category is split
2. **India** is second for country with the most content even on movie category. It's not that surprising as Bollywood is by far the largest film industry in the world in terms of number of films produced. But the same thing cannot be said for TV Show, India isn't even on top 5 list for TV Show category.

3. **UK** is third for the most content overall and on Movie, but is second ranked for TV Show category. The gap is quite far between 1st place and 2nd place for TV Show but not as far against 3rd.
4. **Canada** is in the 4th spot for overall and movie category, but is 5th on TV Show.
5. **France** sits at 5th on overall and movie category and isn't even top 5 on TV Show.

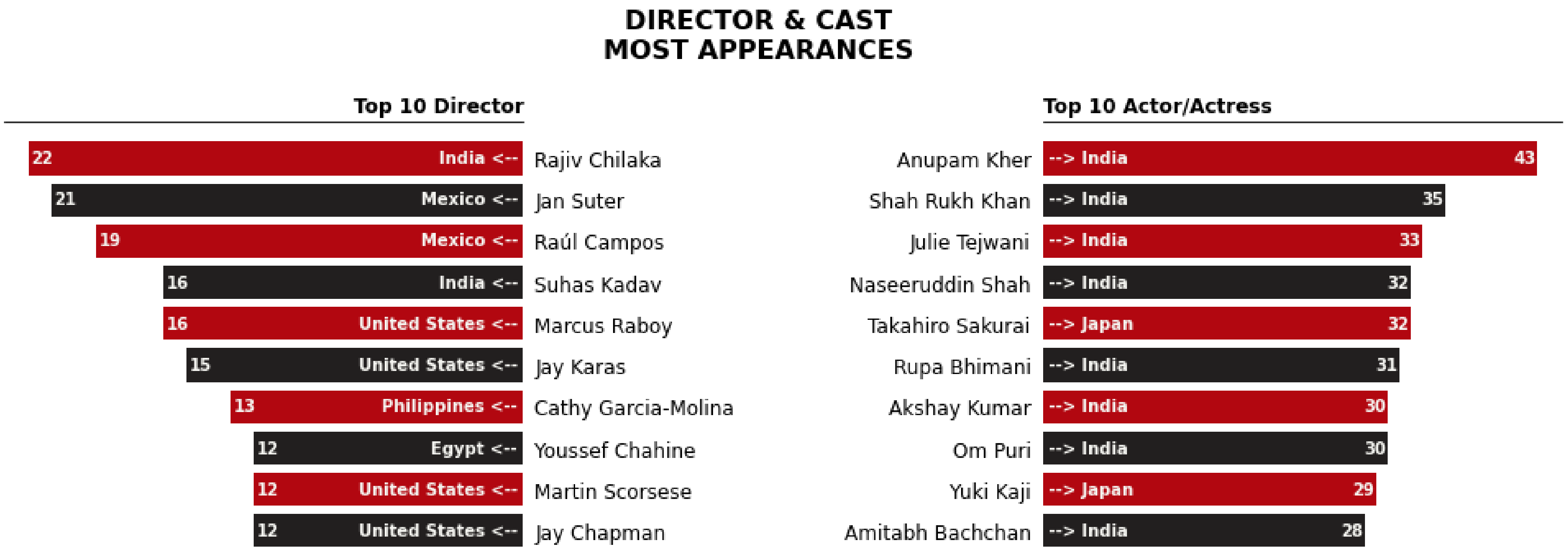
Most top 5 for remains almost identical even when the category is split, only ranking varies. The only difference is 4th place for TV Show which is occupied by **South Korea** who is 8th on overall content ranking. Lately, K-Dramas grow bigger audiences around the world so it only make sense that Netflix also started to make those show available on their platform.

5a & 5b & 5c) Which actor/actress shows up most frequently? What about director? Which one shows up most frequently? Is there any correlation between the two (actor and director)?

In [54]:

```
director_count = {}
for directs in df['director']:
    if type(directs) != float:
        for direct in directs.split(","):
            dir_s = direct.strip()
            if dir_s != missing_msg:
                director_count[dir_s] = director_count.get(dir_s, 0) + 1
dir_count_sorted = dict(sorted(director_count.items(), key=lambda x: x[1], reverse=True))

cast_count = {}
for casts in df['cast']:
    if type(casts) != float:
        for cast in casts.split(","):
            cast = cast.strip()
            if cast != missing_msg:
                cast_count[cast] = cast_count.get(cast, 0) + 1
cast_count_sorted = dict(sorted(cast_count.items(), key=lambda x: x[1], reverse=True))

fig, (ax2, ax1) = plt.subplots(1, 2, figsize = (17,5))

cast_x = [cast for cast in cast_count_sorted][:10]
cast_y = [cast_num for cast_num in cast_count_sorted.values()][:10]

ax1.barh(cast_x, cast_y, color=[dr, blk]*len(cast_x))
```

```python
ax1.set_xticks([])
ax1.tick_params(axis='y', which='major', labelsize=12, left=False)
ax1.invert_yaxis() #same as reverse list
ax1.set_title("Top 10 Actor/Actress", loc='left', fontweight='bold')
for pos, val in enumerate(cast_y):
    ax1.annotate(f"{val}", xy=(val-0.1, pos), ha='right', va='center', color=wht, fontweight='bold')
    ax1.annotate(f" --> {search_cast_country(cast_x[pos])}", xy=(val-val, pos)
                 , ha='left', va='center', color=wht, fontweight='bold')

dir_x = [dirctr for dirctr in dir_count_sorted][:10]
dir_y = [dir_num for dir_num in dir_count_sorted.values()][:10]

ax2.barh(dir_x, dir_y, color=[dr, blk]*len(dir_x))
ax2.set_xticks([])
ax2.invert_yaxis() #same as reverse list
ax2.invert_xaxis() #mirror position
ax2.yaxis.set_label_position("right") #mirror position
ax2.yaxis.tick_right() #mirror position
ax2.tick_params(axis='y', which='major', labelsize=12, right=False)
ax2.set_title("Top 10 Director", loc='right', fontweight='bold')
for pos, val in enumerate(dir_y):
    ax2.annotate(f"{val}", xy=(val-0.1, pos), ha='left', va='center', color=wht, fontweight='bold')
    ax2.annotate(f"{search_dir_country(dir_x[pos])} <-- ", xy=(val-val, pos)
                 , ha='right', va='center', color=wht, fontweight='bold')

for b in ['right', 'bottom', 'left']:
    ax1.spines[b].set_visible(False)
    ax2.spines[b].set_visible(False)

fig.suptitle("DIRECTOR & CAST\nMOST APPEARANCES", fontweight='bold', fontsize='16', va='bottom')
plt.subplots_adjust(wspace=1)
plt.show()
```



1. **The Director** ranking consists of:
   - 4 from US,
   - 2 from India,
   - 2 from Mexico,
   - 1 from Philiphines and
   - 1 from Egypt.
2. **The Cast** ranking consists of:
   - 8 from India and
   - 2 from Japan.

Unlike the complete country data (after processed), the director and cast's missing data had to be filled with 'Data Not Available' since they contain name data (something that can't easily be predicted).

4 Director from US isn't a surprise at all since we already knew from the previous graph that US tops the ranking for most content on Netflix's database.

8 Actor/Actress from India is quite a surprise since India is nowhere to be found within the top 5 ranking for TV Show. This probably just shows that India tends to use the same (popular) actor/actress frequently while US casting list is more variative.

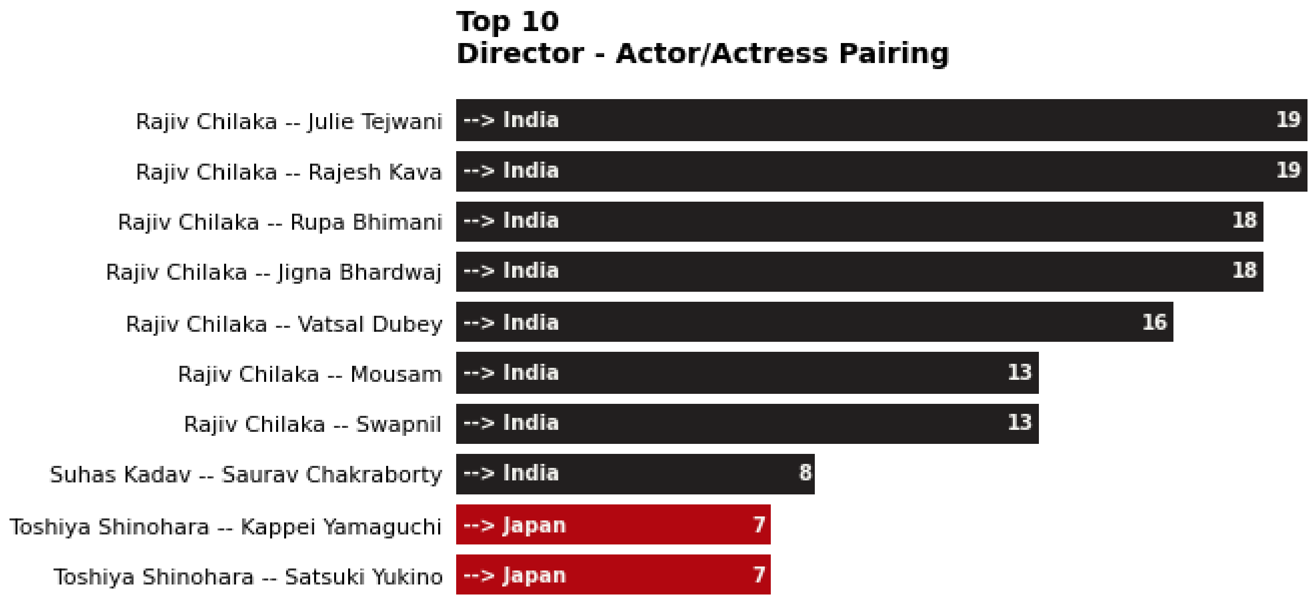
The only correlation I can see between director chart and cast chart is that they're both topped by India. Again, it's probably because the variability of the top movie's director and actor/actress in India is low.

5d) Which actor - director pairing shows up the most?

In [55]:

```
dir_cast_pair = {}
for idx, dirs in enumerate(df['director']):
    if (dirs != missing_msg) & (df.loc[idx, 'cast'] != missing_msg):
        for director in dirs.split(","):
            director = director.strip()
            for casts in [df.at[idx, 'cast']]:
                for cast in casts.split(","):
                    cast = cast.strip()
                    dir_cast_pair[f"{director} -- {cast}"] = dir_cast_pair.get(f"{director} -- {cast}", 0) + 1
dcpair_sorted = dict(sorted(dir_cast_pair.items(), key=lambda x: x[1], reverse=True))

fig, ax = plt.subplots(figsize=(8,5))

pair_x = [pair for pair in dcpair_sorted][:10]
pair_y = [pair_num for pair_num in dcpair_sorted.values()][:10]

ax.barh(pair_x, pair_y, color=([blk]*8) + [dr]*2)
ax.set_xticks([])
ax.tick_params(axis='y', which='major', labelsize=11, left=False)
ax.invert_yaxis() #same as reverse list
ax.set_title("Top 10\nDirector - Actor/Actress Pairing", loc='left', fontweight='bold', fontsize=14)
for pos, val in enumerate(pair_y):
    ax.annotate(f"{val}", xy=(val-0.1, pos), ha='right', va='center', color=wht, fontweight='bold')
    ax.annotate(f" --> {search_dir_country(pair_x[pos].split('--')[0].strip())}", xy=(val-val, pos)
                , ha='left', va='center', color=wht, fontweight='bold')
```

```
for b in ['right', 'bottom', 'left', 'top']:
    ax.spines[b].set_visible(False)

plt.show()
```



- Similiar to the top ranking for most actor/actress cast, this pairing ranking is dominated by India (8 pairings, black colored bar) and 2 from Japan (red colored bar).
- This strengthen the point from the previous graph even more that India tends to use the same director and/or actor/actress for their movie/show.

--- End of Analysis ---------------------------- -------------------------------

Conclusion

1. - How does the amount of content on Netflix grow over the year? **Exponentially (it keeps rising till 2020)**.
   - What year did Netflix add the most content on its platform? **2019**.
   - What is the most popular month for Netflix to add new content? **July and December**.
2. - What type of content dominates the platform? **Movie. The ratio is 2.35:1 against TV Show**.
   - What kind of genre dominates the most? **International, Drama and Comedy**.
   - How does the duration of shows vary? **For Movie: normally distributed. For TV show: a constant decrease in number each time the number of seasons increase**.
   - Is there any correlation between duration and genre that dominates? **Yes for TV Show. No for Movie**.
3. - Which (maturity) rating has the most amount on both type of content? **Adult (R, TV-MA, NC-17, NR, UR)**.
   - Does that reflects Netflix's target audience? **Yes**.
4. Which country has the most content? **United States**.
5. - Which actor/actress shows up most frequently? **Anupam Kher from India**.
   - What about director? Which one shows up most frequently? **Rajiv Chilaka from India**.
   - Is there any correlation between the two (actor and director)? **Yes, they're both from India**.
   - Which actor - director pairing shows up the most? **Rajiv Chilaka - Julie Tejwani. Both from India**.

Thank you for reading, have a great day!