investigate-a-dataset-movie

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1 Project: Investigate a Dataset The Movie

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Introduction

> In this project I use Movie Data. This dataset contains information about 10,000 movies collected from The Movie Database (TMDb). Contains data such as title, cast, director, runtime, budget, revenue, release year etc. - Certain columns, like 'cast' and 'genres', contain multiple values separated by pipe (|) characters. - The final two columns ending with "_adj" show the budget and revenue of the associated movie in terms of 2010 dollars, accounting for inflation over time.

Research Question Questions in the projects are as follows:

1.1.1 Part 1: General

Which movie earns the highest and lowest profit?
Which movie have the highest and lowest revenue?
Which movie have the highest and lowest budget?
Which movie have the longest and shortest runtime?
How much movie released year by year?
How distribution of profit in different popularity levels in recent ten years?
How distribution of profit in different vote average levels in recent ten years?

1.1.2 Part 2: Find Associate Variable Movie Genre with Movie Metric

What movie genre that associated with high popularity?
What movie genre that associated with high revenue?
What movie genre that associated with high vote average?
What movie genre that associated with profit?

1.1.3 Part 3: Find Some Trend

What is the trend of the genre every 10 years
Data Wrangling

In this section I will load the data and print the example of data so I know the data sample value

In [1]:
```
# import packages
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import re
from collections import Counter
%matplotlib inline
```

In [2]:
```
# Load data
df = pd.read_csv("tmdb-movies.csv")
# Print first row to see the example of data
df.head(1)
```

Out[2]:
```
       id    imdb_id  popularity     budget     revenue  original_title  \
0  135397  tt0369610   32.985763  150000000  1513528810  Jurassic World

                                                cast  \
0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...

                        homepage          director             tagline  ...  \
0  http://www.jurassicworld.com/  Colin Trevorrow  The park is open.  ...

                                            overview runtime  \
0  Twenty-two years after the events of Jurassic ...     124

                                      genres  \
0  Action|Adventure|Science Fiction|Thriller

                                production_companies release_date vote_count  \
0  Universal Studios|Amblin Entertainment|Legenda...       6/9/15       5562

   vote_average  release_year    budget_adj   revenue_adj
0           6.5          2015  1.379999e+08  1.392446e+09

[1 rows x 21 columns]
```

In [3]:
```
# find shape of data
r,c = df.shape
print("Dataset Movie contains %d rows and %d columns" % (r,c))
```

```
Dataset Movie contains 10866 rows and 21 columns
```

1.1.4 Data Cleaning

In this section I will find column that unnecessary for this research, find duplicate data, find missing data, and change some format data that can make this research easier.

1. Find Missing Value and Unnecessary Columns

```
In [4]: # print the information about count of not null data value and data types
        df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10866 entries, 0 to 10865
Data columns (total 21 columns):
id                      10866 non-null int64
imdb_id                 10856 non-null object
popularity              10866 non-null float64
budget                  10866 non-null int64
revenue                 10866 non-null int64
original_title          10866 non-null object
cast                    10790 non-null object
homepage                2936 non-null object
director                10822 non-null object
tagline                 8042 non-null object
keywords                9373 non-null object
overview                10862 non-null object
runtime                 10866 non-null int64
genres                  10843 non-null object
production_companies    9836 non-null object
release_date            10866 non-null object
vote_count              10866 non-null int64
vote_average            10866 non-null float64
release_year            10866 non-null int64
budget_adj              10866 non-null float64
revenue_adj             10866 non-null float64
dtypes: float64(4), int64(6), object(11)
memory usage: 1.7+ MB
```

From information above we know that column which missing values are: 1. imdb_id (object) 2. homepage (object) 3. tagline (object) 4. director (object) 5. overview (object) 6. keywords (object) 7. production_companies (object) 8. cast (object) 9. genres (object)

I don't need some columns such as imdb_id, homepage, tagline, and overview. So I will delete them.

1.1 Delete Unnecessary Columns

```
In [5]: # list of unnecessary columns
        col = ['imdb_id', 'homepage', 'tagline', 'overview']
```

```
    # delete unnecessary columns
    df.drop(col,axis=1,inplace=True)
```

In [6]:
```
# print statistical summary from numeric columns to find if any weird value
df.describe()
```

Out[6]:
```
                  id    popularity        budget       revenue       runtime  \
count   10866.000000  10866.000000  1.086600e+04  1.086600e+04  10866.000000
mean    66064.177434      0.646441  1.462570e+07  3.982332e+07    102.070863
std     92130.136561      1.000185  3.091321e+07  1.170035e+08     31.381405
min         5.000000      0.000065  0.000000e+00  0.000000e+00      0.000000
25%     10596.250000      0.207583  0.000000e+00  0.000000e+00     90.000000
50%     20669.000000      0.383856  0.000000e+00  0.000000e+00     99.000000
75%     75610.000000      0.713817  1.500000e+07  2.400000e+07    111.000000
max    417859.000000     32.985763  4.250000e+08  2.781506e+09    900.000000

         vote_count  vote_average  release_year    budget_adj   revenue_adj
count  10866.000000  10866.000000  10866.000000  1.086600e+04  1.086600e+04
mean     217.389748      5.974922   2001.322658  1.755104e+07  5.136436e+07
std      575.619058      0.935142     12.812941  3.430616e+07  1.446325e+08
min       10.000000      1.500000   1960.000000  0.000000e+00  0.000000e+00
25%       17.000000      5.400000   1995.000000  0.000000e+00  0.000000e+00
50%       38.000000      6.000000   2006.000000  0.000000e+00  0.000000e+00
75%      145.750000      6.600000   2011.000000  2.085325e+07  3.369710e+07
max     9767.000000      9.200000   2015.000000  4.250000e+08  2.827124e+09
```

From summary above we found some weird data about budget, revenue, and runtime because the minimal value is zero. Lets output 1 sample of row that have zero number to check that is really zero or just another missing value.

In [7]:
```
# print sample that have budget zero to know is this real zero or not
df.query('budget == 0').head(1)
```

Out[7]:
```
        id  popularity  budget   revenue original_title  \
30  280996    3.927333       0  29355203     Mr. Holmes

                                                 cast     director  \
30  Ian McKellen|Milo Parker|Laura Linney|Hattie M...  Bill Condon

                              keywords  runtime         genres  \
30  london|detective|sherlock holmes       103  Mystery|Drama

                                 production_companies release_date  \
30  BBC Films|See-Saw Films|FilmNation Entertainme...      6/19/15

    vote_count  vote_average  release_year  budget_adj   revenue_adj
30         425           6.4          2015         0.0  2.700677e+07
```

I found from google that Mr.Holmes budget is 10 million USD, so in that data I assumed zero number is mean missing value. Because of that I will change zero to NA so we can know there is some missing value from function 'info'

1.2 Change Zero Value to NA

In [8]:
```
# change zero number to NA
zero_col = ['budget', 'revenue', 'runtime','budget_adj', 'revenue_adj']

# replace all zero value from to NAN in the list
df[zero_col] = df[zero_col].replace(0, np.NAN)
```

In [9]:
```
# see the update info
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10866 entries, 0 to 10865
Data columns (total 17 columns):
id                      10866 non-null int64
popularity              10866 non-null float64
budget                  5170 non-null float64
revenue                 4850 non-null float64
original_title          10866 non-null object
cast                    10790 non-null object
director                10822 non-null object
keywords                9373 non-null object
runtime                 10835 non-null float64
genres                  10843 non-null object
production_companies    9836 non-null object
release_date            10866 non-null object
vote_count              10866 non-null int64
vote_average            10866 non-null float64
release_year            10866 non-null int64
budget_adj              5170 non-null float64
revenue_adj             4850 non-null float64
dtypes: float64(7), int64(3), object(7)
memory usage: 1.4+ MB
```

From updated info we find some columns with small missing value (>= 95% from all row or >= 10322 data) they are cast, director, runtime, and genres. I choose 95% as threshold because I didn't want to delete too much data

1.3 Remove Missing Value

In [10]:
```
# list the column that we want to remove missing value
col_mv = ['cast', 'director', 'runtime', 'genres']

# remove missing value
```

```
df.dropna(subset=col_mv, inplace=True)

# see the update information
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 10704 entries, 0 to 10865
Data columns (total 17 columns):
id                      10704 non-null int64
popularity              10704 non-null float64
budget                  5151 non-null float64
revenue                 4844 non-null float64
original_title          10704 non-null object
cast                    10704 non-null object
director                10704 non-null object
keywords                9294 non-null object
runtime                 10704 non-null float64
genres                  10704 non-null object
production_companies    9760 non-null object
release_date            10704 non-null object
vote_count              10704 non-null int64
vote_average            10704 non-null float64
release_year            10704 non-null int64
budget_adj              5151 non-null float64
revenue_adj             4844 non-null float64
dtypes: float64(7), int64(3), object(7)
memory usage: 1.5+ MB
```

2. Drop Duplicated

```
In [11]: # drop duplicate row in data
         df.drop_duplicates(inplace=True)

         # see the update info
         df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 10703 entries, 0 to 10865
Data columns (total 17 columns):
id                      10703 non-null int64
popularity              10703 non-null float64
budget                  5150 non-null float64
revenue                 4843 non-null float64
original_title          10703 non-null object
cast                    10703 non-null object
director                10703 non-null object
keywords                9293 non-null object
```

```
runtime                 10703 non-null float64
genres                  10703 non-null object
production_companies    9759 non-null object
release_date            10703 non-null object
vote_count              10703 non-null int64
vote_average            10703 non-null float64
release_year            10703 non-null int64
budget_adj              5150 non-null float64
revenue_adj             4843 non-null float64
dtypes: float64(7), int64(3), object(7)
memory usage: 1.5+ MB
```

3. Change Data Type

from the update info we can see that columns release_date have type as object, so I will change it in type date.

```
In [12]: # change string to date format
         df.release_date = pd.to_datetime(df['release_date'])

         # see the update info
         df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 10703 entries, 0 to 10865
Data columns (total 17 columns):
id                      10703 non-null int64
popularity              10703 non-null float64
budget                  5150 non-null float64
revenue                 4843 non-null float64
original_title          10703 non-null object
cast                    10703 non-null object
director                10703 non-null object
keywords                9293 non-null object
runtime                 10703 non-null float64
genres                  10703 non-null object
production_companies    9759 non-null object
release_date            10703 non-null datetime64[ns]
vote_count              10703 non-null int64
vote_average            10703 non-null float64
release_year            10703 non-null int64
budget_adj              5150 non-null float64
revenue_adj             4843 non-null float64
dtypes: datetime64[ns](1), float64(7), int64(3), object(6)
memory usage: 1.5+ MB
```

Clean Data Information

In [13]:
```
# the last data info
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 10703 entries, 0 to 10865
Data columns (total 17 columns):
id                      10703 non-null int64
popularity              10703 non-null float64
budget                  5150 non-null float64
revenue                 4843 non-null float64
original_title          10703 non-null object
cast                    10703 non-null object
director                10703 non-null object
keywords                9293 non-null object
runtime                 10703 non-null float64
genres                  10703 non-null object
production_companies    9759 non-null object
release_date            10703 non-null datetime64[ns]
vote_count              10703 non-null int64
vote_average            10703 non-null float64
release_year            10703 non-null int64
budget_adj              5150 non-null float64
revenue_adj             4843 non-null float64
dtypes: datetime64[ns](1), float64(7), int64(3), object(6)
memory usage: 1.5+ MB
```

In [14]:
```
# the last statistica summary from data
df.describe()
```

Out[14]:
```
                  id    popularity        budget       revenue       runtime  \
count   10703.000000  10703.000000  5.150000e+03  4.843000e+03  10703.000000
mean    64904.988321      0.653818  3.084401e+07  8.933981e+07    102.736896
std     91161.996308      1.005687  3.893782e+07  1.621546e+08     30.079331
min         5.000000      0.000188  1.000000e+00  2.000000e+00      3.000000
25%     10538.500000      0.211533  6.000000e+06  7.779664e+06     90.000000
50%     20235.000000      0.388036  1.750000e+07  3.191160e+07     99.000000
75%     73637.000000      0.722438  4.000000e+07  1.000000e+08    112.000000
max    417859.000000     32.985763  4.250000e+08  2.781506e+09    900.000000

         vote_count  vote_average  release_year    budget_adj   revenue_adj
count  10703.000000  10703.000000  10703.000000  5.150000e+03  4.843000e+03
mean     220.333178      5.966112   2001.235355  3.701495e+07  1.152341e+08
std      579.481969      0.930155     12.825920  4.198674e+07  1.989424e+08
min       10.000000      1.500000   1960.000000  9.210911e-01  2.370705e+00
25%       17.000000      5.400000   1995.000000  8.210996e+06  1.048057e+07
50%       39.000000      6.000000   2006.000000  2.294283e+07  4.402879e+07
75%      149.000000      6.600000   2011.000000  5.024535e+07  1.317599e+08
max     9767.000000      9.200000   2015.000000  4.250000e+08  2.827124e+09
```

Exploratory Data Analysis

in this section I will answer the question was declare in introduction

I define some function that can help to answer the question
list function name: Function as_currency Function get_movie_info Function get_hi_low

In [15]:
```
# change numeric format to dollar format
def as_currency(amount):
    if amount >= 0:
        return '${:,.2f}'.format(amount)
    else:
        return '-${:,.2f}'.format(-amount)
```

In [16]:
```
# get movie information
def get_movie_info(index, title):
    info = pd.DataFrame(df.loc[index])

    currency_col = ['budget','revenue','profit','budget_adj','revenue_adj','profit_adj'
    for idx in currency_col:
        info.loc[idx] = as_currency(info.loc[idx].item())

    info.columns = [title]
    return info
```

In [17]:
```
# get hihgest and lowes data information
def get_hi_low(column):
    # highest
    ## get the index value of the highest number
    highest_idx = df[column].idxmax(skipna=True)
    ## get data from index before
    title = "Highest " + column
    highest_data = get_movie_info(highest_idx,title)

    # lowest
    ## get the index value of the highest number
    lowest_idx = df[column].idxmin(skipna=True)
    ## get data from index before
    title = "Lowest " + column
    lowest_data = get_movie_info(lowest_idx,title)

    #concatenating two dataframes
    hi_low_data = pd.concat([highest_data, lowest_data], axis = 1)

    return hi_low_data
```

General Question
1. Which movie earns the highest and lowest profit?

```
In [18]: # add column profit in data
         df['profit'] = df['revenue']-df['budget']
         df['profit_adj'] = df['revenue_adj']-df['budget_adj']

         # previewing the changes in the dataset
         df.head(3)
```

```
Out[18]:        id  popularity       budget       revenue      original_title  \
         0  135397   32.985763  150000000.0  1.513529e+09      Jurassic World
         1   76341   28.419936  150000000.0  3.784364e+08  Mad Max: Fury Road
         2  262500   13.112507  110000000.0  2.952382e+08           Insurgent

                                                          cast          director  \
         0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...   Colin Trevorrow
         1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...     George Miller
         2  Shailene Woodley|Theo James|Kate Winslet|Ansel...  Robert Schwentke

                                                     keywords  runtime  \
         0  monster|dna|tyrannosaurus rex|velociraptor|island    124.0
         1   future|chase|post-apocalyptic|dystopia|australia    120.0
         2  based on novel|revolution|dystopia|sequel|dyst...    119.0

                                               genres  \
         0  Action|Adventure|Science Fiction|Thriller
         1  Action|Adventure|Science Fiction|Thriller
         2         Adventure|Science Fiction|Thriller

                                        production_companies release_date  vote_count  \
         0  Universal Studios|Amblin Entertainment|Legenda...   2015-06-09        5562
         1  Village Roadshow Pictures|Kennedy Miller Produ...   2015-05-13        6185
         2  Summit Entertainment|Mandeville Films|Red Wago...   2015-03-18        2480

            vote_average  release_year    budget_adj   revenue_adj        profit  \
         0           6.5          2015  1.379999e+08  1.392446e+09  1.363529e+09
         1           7.1          2015  1.379999e+08  3.481613e+08  2.284364e+08
         2           6.3          2015  1.012000e+08  2.716190e+08  1.852382e+08

              profit_adj
         0  1.254446e+09
         1  2.101614e+08
         2  1.704191e+08
```

```
In [19]: # check the update data, kolom profit and profit_adj will have na value because some re
         df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 10703 entries, 0 to 10865
Data columns (total 19 columns):
```

```
id                      10703 non-null int64
popularity              10703 non-null float64
budget                  5150 non-null float64
revenue                 4843 non-null float64
original_title          10703 non-null object
cast                    10703 non-null object
director                10703 non-null object
keywords                9293 non-null object
runtime                 10703 non-null float64
genres                  10703 non-null object
production_companies    9759 non-null object
release_date            10703 non-null datetime64[ns]
vote_count              10703 non-null int64
vote_average            10703 non-null float64
release_year            10703 non-null int64
budget_adj              5150 non-null float64
revenue_adj             4843 non-null float64
profit                  3849 non-null float64
profit_adj              3849 non-null float64
dtypes: datetime64[ns](1), float64(9), int64(3), object(6)
memory usage: 1.6+ MB
```

list used function: Function get_hi_low

In [20]:
```
# Find highest and lowest profit
get_hi_low('profit')
```

Out[20]:
```
                                                          Highest profit  \
id                                                                 19995
popularity                                                       9.43277
budget                                                   $237,000,000.00
revenue                                                $2,781,505,847.00
original_title                                                    Avatar
cast                    Sam Worthington|Zoe Saldana|Sigourney Weaver|S...
director                                                   James Cameron
keywords                culture clash|future|space war|space colony|so...
runtime                                                              162
genres                          Action|Adventure|Fantasy|Science Fiction
production_companies    Ingenious Film Partners|Twentieth Century Fox ...
release_date                                         2009-12-10 00:00:00
vote_count                                                          8458
vote_average                                                         7.1
release_year                                                        2009
budget_adj                                               $240,886,902.89
revenue_adj                                            $2,827,123,750.41
profit                                                 $2,544,505,847.00
profit_adj                                             $2,586,236,847.52
```

```
                                                     Lowest profit
id                                                           46528
popularity                                                 0.25054
budget                                             $425,000,000.00
revenue                                             $11,087,569.00
original_title                                     The Warrior's Way
cast                  Kate Bosworth|Jang Dong-gun|Geoffrey Rush|Dann...
director                                                Sngmoo Lee
keywords              assassin|small town|revenge|deception|super speed
runtime                                                        100
genres                        Adventure|Fantasy|Action|Western|Thriller
production_companies                     Boram Entertainment Inc.
release_date                                   2010-12-02 00:00:00
vote_count                                                      74
vote_average                                                   6.4
release_year                                                  2010
budget_adj                                         $425,000,000.00
revenue_adj                                         $11,087,569.00
profit                                            -$413,912,431.00
profit_adj                                        -$413,912,431.00
```

from information above we know that the highest profit movie is Avatar(2009) which is \$2,544,505,847 and the lowest profit is The Warrior's Way(2010) which is -\$413,912,431.00, so that movie was loss money. from the information movie we know that columns ending with "_adj" show the budget and revenue of the associated movie in terms of 2010 dollars, accounting for inflation over time. So I also want to check the highest and lowest profit movie if we accounting for inflation over time

list used function: Function get_hi_low

In [21]:
```python
# Find highest and lowest profit_adj
get_hi_low('profit_adj')
```

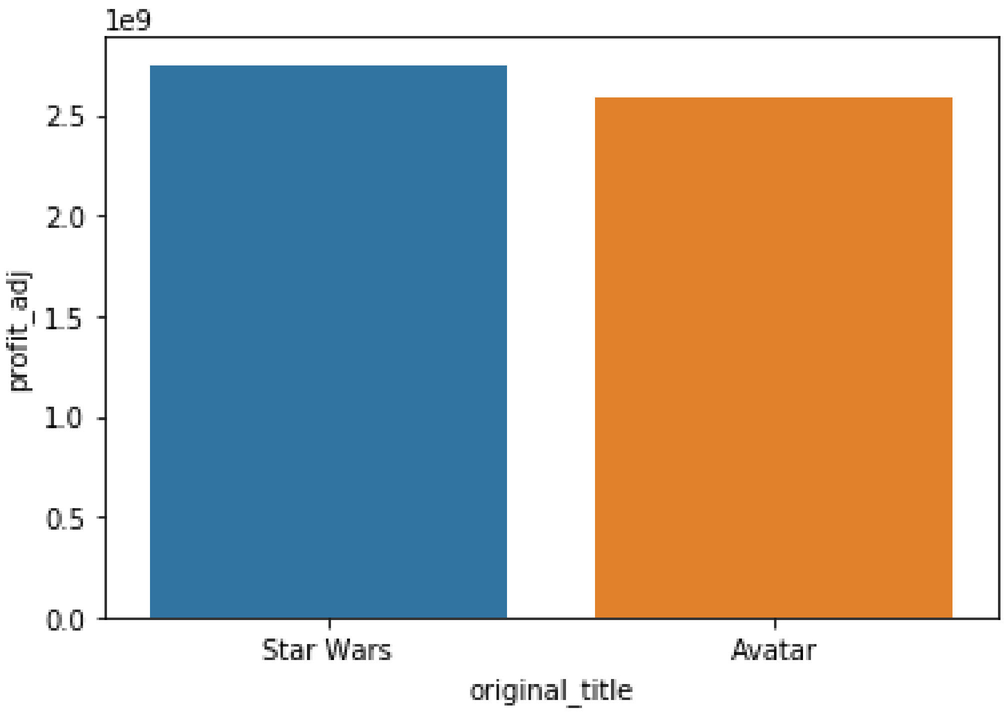
Out[21]:
```
                                                 Highest profit_adj  \
id                                                               11
popularity                                                  12.0379
budget                                               $11,000,000.00
revenue                                             $775,398,007.00
original_title                                            Star Wars
cast                  Mark Hamill|Harrison Ford|Carrie Fisher|Peter ...
director                                               George Lucas
keywords                   android|galaxy|hermit|death star|lightsaber
runtime                                                         121
genres                               Adventure|Action|Science Fiction
production_companies   Lucasfilm|Twentieth Century Fox Film Corporation
release_date                                    1977-03-20 00:00:00
vote_count                                                     4428
vote_average                                                    7.9
```

```
release_year                                                    1977
budget_adj                                            $39,575,591.36
revenue_adj                                        $2,789,712,242.28
profit                                               $764,398,007.00
profit_adj                                         $2,750,136,650.92

                                                   Lowest profit_adj
id                                                             46528
popularity                                                   0.25054
budget                                               $425,000,000.00
revenue                                               $11,087,569.00
original_title                                     The Warrior's Way
cast                    Kate Bosworth|Jang Dong-gun|Geoffrey Rush|Dann...
director                                                  Sngmoo Lee
keywords                assassin|small town|revenge|deception|super speed
runtime                                                          100
genres                          Adventure|Fantasy|Action|Western|Thriller
production_companies                        Boram Entertainment Inc.
release_date                                     2010-12-02 00:00:00
vote_count                                                        74
vote_average                                                     6.4
release_year                                                    2010
budget_adj                                           $425,000,000.00
revenue_adj                                           $11,087,569.00
profit                                              -$413,912,431.00
profit_adj                                          -$413,912,431.00
```

from information above we know that the highest profit movie from all movie in our data is Star Wars(1977) which is \$2,750,136,650.92 that is the highest profit if we accounting for inflation over time. The profit from Start Wars is \$163,899,803.4 more than Avatar. The lowest movie profit is still The Warrior's Way(2010) which is -\$413,912,431.00

In [22]:
```
# visualize different profit_adj from Star Wars and Avatar
highest_profit = df[['original_title','profit_adj']].query("original_title in ['Star Wa
sns.barplot(x="original_title", y="profit_adj", data=highest_profit)
```

Out[22]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff0b73b05c0>
```



Answer Question General 1

- The highest profit movie is Avatar(2009), but if we check the inflation over time so the highest profit move is Star Wars(1977)
- The lowest profit movie is The Warrior's Way(2010)

Go To List Question
2. Which movie have the highest and lowest revenue?
list used function: Function get_hi_low

In [23]:
```
# Highest and lowest revenue
get_hi_low('revenue')
```

Out[23]:
```
                                                        Highest revenue  \
id                                                                19995
popularity                                                      9.43277
budget                                                  $237,000,000.00
revenue                                               $2,781,505,847.00
original_title                                                   Avatar
cast                  Sam Worthington|Zoe Saldana|Sigourney Weaver|S...
director                                                  James Cameron
keywords              culture clash|future|space war|space colony|so...
runtime                                                             162
genres                         Action|Adventure|Fantasy|Science Fiction
production_companies  Ingenious Film Partners|Twentieth Century Fox ...
```

```
release_date                                  2009-12-10 00:00:00
vote_count                                                   8458
vote_average                                                  7.1
release_year                                                 2009
budget_adj                                        $240,886,902.89
revenue_adj                                     $2,827,123,750.41
profit                                          $2,544,505,847.00
profit_adj                                      $2,586,236,847.52

                                                   Lowest revenue
id                                                          13537
popularity                                               0.462609
budget                                              $6,000,000.00
revenue                                                     $2.00
original_title                                     Shattered Glass
cast                 Hayden Christensen|Peter Sarsgaard|ChloÃ« Sevi...
director                                                Billy Ray
keywords                                                      NaN
runtime                                                        94
genres                                              Drama|History
production_companies  Lions Gate Films|Cruise/Wagner Productions|Bau...
release_date                                  2003-11-14 00:00:00
vote_count                                                     46
vote_average                                                  6.4
release_year                                                 2003
budget_adj                                          $7,112,115.87
revenue_adj                                                 $2.37
profit                                             -$5,999,998.00
profit_adj                                         -$7,112,113.50
```

from information above we know that the highest revenue movie is Avatar(2009) which is \$2,781,505,847. The lowest movie revenue is Shattered Glass(2003) which is \$2

list used function: Function get_hi_low

In [24]:
```python
# Highest and lowest revenue_adj
get_hi_low('revenue_adj')
```

Out[24]:
```
                                              Highest revenue_adj  \
id                                                          19995
popularity                                                9.43277
budget                                            $237,000,000.00
revenue                                         $2,781,505,847.00
original_title                                             Avatar
cast                 Sam Worthington|Zoe Saldana|Sigourney Weaver|S...
director                                            James Cameron
keywords             culture clash|future|space war|space colony|so...
runtime                                                       162
```

```
genres                                   Action|Adventure|Fantasy|Science Fiction
production_companies  Ingenious Film Partners|Twentieth Century Fox ...
release_date                                              2009-12-10 00:00:00
vote_count                                                               8458
vote_average                                                              7.1
release_year                                                             2009
budget_adj                                                    $240,886,902.89
revenue_adj                                                 $2,827,123,750.41
profit                                                      $2,544,505,847.00
profit_adj                                                  $2,586,236,847.52

                                                           Lowest revenue_adj
id                                                                      13537
popularity                                                           0.462609
budget                                                          $6,000,000.00
revenue                                                                 $2.00
original_title                                                Shattered Glass
cast                  Hayden Christensen|Peter Sarsgaard|ChloÃ« Sevi...
director                                                            Billy Ray
keywords                                                                  NaN
runtime                                                                    94
genres                                                          Drama|History
production_companies  Lions Gate Films|Cruise/Wagner Productions|Bau...
release_date                                              2003-11-14 00:00:00
vote_count                                                                 46
vote_average                                                              6.4
release_year                                                             2003
budget_adj                                                      $7,112,115.87
revenue_adj                                                             $2.37
profit                                                         -$5,999,998.00
profit_adj                                                     -$7,112,113.50
```

from information above we know that the highest revenue movie from all movie in our data is Avatar(2009) which is \$2,781,505,847 The lowest movie revenue is still Shattered Glass(2003) which is -\$2.37

Answer Question General 2

- The highest revenue movie is Avatar(2009)
- The lowest revenue movie is Shattered Glass(2003)

From answer question 1 we found that profit Avatar is lower than Star Wars so we can make conclusion that budget Star Wars is lower than Avatar because revenue Avatar is biger than Star Wars

Go To List Question

3. Which movie have the highest and lowest budget?

list used function: Function get_hi_low

```
In [25]: # Highest and lowest budget
         get_hi_low('budget')
```

```
Out[25]:                                                    Highest budget  \
        id                                                           46528
        popularity                                                 0.25054
        budget                                             $425,000,000.00
        revenue                                             $11,087,569.00
        original_title                                     The Warrior's Way
        cast                  Kate Bosworth|Jang Dong-gun|Geoffrey Rush|Dann...
        director                                                Sngmoo Lee
        keywords              assassin|small town|revenge|deception|super speed
        runtime                                                        100
        genres                        Adventure|Fantasy|Action|Western|Thriller
        production_companies                      Boram Entertainment Inc.
        release_date                                   2010-12-02 00:00:00
        vote_count                                                      74
        vote_average                                                   6.4
        release_year                                                  2010
        budget_adj                                         $425,000,000.00
        revenue_adj                                         $11,087,569.00
        profit                                            -$413,912,431.00
        profit_adj                                        -$413,912,431.00

                                                             Lowest budget
        id                                                          287524
        popularity                                                0.177102
        budget                                                       $1.00
        revenue                                                      -$nan
        original_title                                         Fear Clinic
        cast                  Thomas Dekker|Robert Englund|Cleopatra Coleman...
        director                                              Robert Hall
        keywords                                        phobia|doctor|fear
        runtime                                                         95
        genres                                                      Horror
        production_companies  Dry County Films|Anchor Bay Entertainment|Movi...
        release_date                                   2014-10-31 00:00:00
        vote_count                                                      15
        vote_average                                                   4.1
        release_year                                                  2014
        budget_adj                                                   $0.92
        revenue_adj                                                  -$nan
        profit                                                       -$nan
        profit_adj                                                   -$nan
```

from information above we know that the highest budget movie is The Warrior's Way(2010) which is \$425,000,000 The lowest movie budget is Fear Clinic(2014) which is \$1.

list used function: Function get_hi_low

```
In [26]: # Highest and lowest budget_adj
```

```
get_hi_low('budget_adj')
```

```
Out[26]:                                                     Highest budget_adj  \
id                                                                46528
popularity                                                      0.25054
budget                                                  $425,000,000.00
revenue                                                  $11,087,569.00
original_title                                          The Warrior's Way
cast                 Kate Bosworth|Jang Dong-gun|Geoffrey Rush|Dann...
director                                                    Sngmoo Lee
keywords             assassin|small town|revenge|deception|super speed
runtime                                                             100
genres                       Adventure|Fantasy|Action|Western|Thriller
production_companies                         Boram Entertainment Inc.
release_date                                       2010-12-02 00:00:00
vote_count                                                           74
vote_average                                                        6.4
release_year                                                       2010
budget_adj                                              $425,000,000.00
revenue_adj                                              $11,087,569.00
profit                                                 -$413,912,431.00
profit_adj                                             -$413,912,431.00

                                                      Lowest budget_adj
id                                                               287524
popularity                                                     0.177102
budget                                                            $1.00
revenue                                                           -$nan
original_title                                                Fear Clinic
cast                 Thomas Dekker|Robert Englund|Cleopatra Coleman...
director                                                    Robert Hall
keywords                                             phobia|doctor|fear
runtime                                                              95
genres                                                           Horror
production_companies Dry County Films|Anchor Bay Entertainment|Movi...
release_date                                       2014-10-31 00:00:00
vote_count                                                           15
vote_average                                                        4.1
release_year                                                       2014
budget_adj                                                        $0.92
revenue_adj                                                       -$nan
profit                                                            -$nan
profit_adj                                                        -$nan
```

from information above we know that the highest budget_adj movie is The Warrior's Way(2010) which is \$425,000,000 The lowest movie budget_adj is Fear Clinic(2014) which is \$1.

Answer Question General 3

- The highest budget movie is The Warrior's Way(2010)
- The lowest budget movie is Fear Clinic(2014) From answer question 1 we found that profit The Warrior's Way(2010) is lowest maybe because it is have a highest budget

Go To List Question
4. Which movie have the longest and shortest runtime?
list used function: Function get_hi_low

In [27]:
```
# Highest and lowest runtime
get_hi_low('runtime')
```

Out[27]:
```
                                                          Highest runtime  \
id                                                                 125336
popularity                                                       0.006925
budget                                                              -$nan
revenue                                                             -$nan
original_title                                 The Story of Film: An Odyssey
cast                        Mark Cousins|Jean-Michel Frodon|Cari Beauchamp...
director                                                     Mark Cousins
keywords                    cinema|nouvelle vague|hindi cinema|cinema novo...
runtime                                                               900
genres                                                        Documentary
production_companies                                                  NaN
release_date                                          2011-09-03 00:00:00
vote_count                                                             14
vote_average                                                          9.2
release_year                                                         2011
budget_adj                                                          -$nan
revenue_adj                                                         -$nan
profit                                                              -$nan
profit_adj                                                          -$nan

                                                           Lowest runtime
id                                                                 264170
popularity                                                       0.202776
budget                                                              -$nan
revenue                                                             -$nan
original_title                                        Batman: Strange Days
cast                                  Kevin Conroy|Brian George|Tara Strong
director                                                       Bruce Timm
keywords                    dc comics|superhero|based on comic book|noir|p...
runtime                                                                 3
genres                                                   Action|Animation
production_companies                                            DC Comics
release_date                                          2014-04-09 00:00:00
vote_count                                                             20
vote_average                                                          7.6
release_year                                                         2014
```

```
budget_adj                                                        -$nan
revenue_adj                                                       -$nan
profit                                                            -$nan
profit_adj                                                        -$nan
```

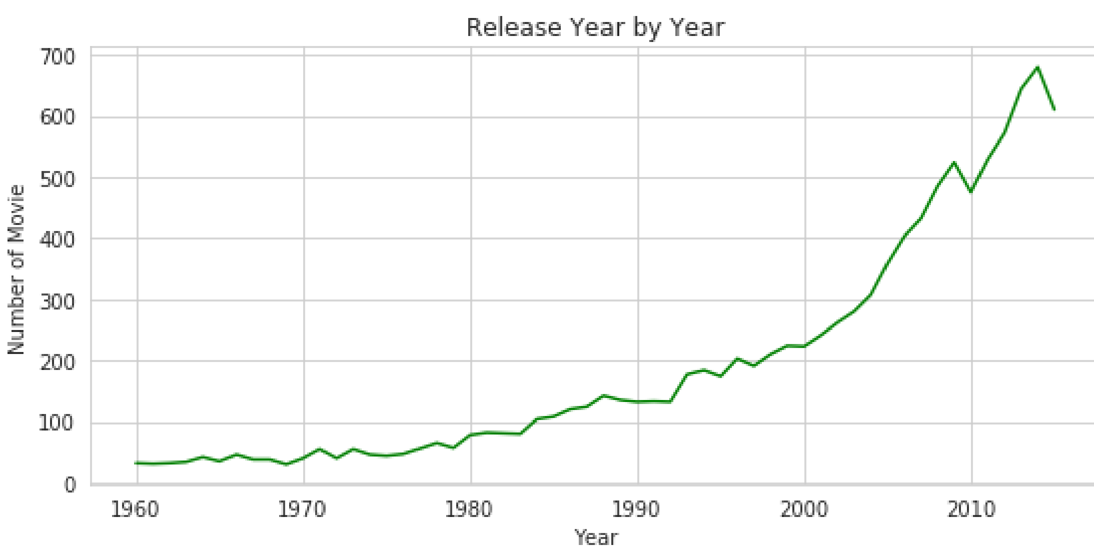
Answer Question General 4

- The longest runtime movie is The Story of Film: An Odyssey(2011) that is 900 minutes
- The shortest runtime movie is Batman: Strange Days(2014) that is 3 minutes

Go To List Question
5. How much movie released year by year?

In [28]:
```
# get number of movie group by release year
release = df.groupby('release_year').size()
# get index number of movie group by release year
release_idx = release.index
```

In [29]:
```
# visualisation
# set style
sns.set_style('whitegrid')
# set x, y axis data
x, y = release_idx, release
# set size
plt.figure(figsize=(9, 4))
# plot line chart for number of release
plt.plot(x, y, color = 'g', label = 'mean')
# set title and labels
plt.title('Release Year by Year')
plt.xlabel('Year')
plt.ylabel('Number of Movie');
```



Answer Question General 5

from figure above we know that movie number always increassing every year, but in 2010 we have some slope.

Go To List Question

6. How distribution of profit in different popularity levels in recent ten years?

To help the next process, I will make some function

list function name: Function get_class Function plot_by_year

In [30]:
```
# make level from quantile to help categories column
def get_class(df, column):
    # find quantile to decide that class
    min_value = df[column].min()
    quantile_1 = df[column].describe()[4]
    quantile_2 = df[column].describe()[5]
    quantile_3 = df[column].describe()[6]
    max_value = df[column].max()

    # Bin edges that will be used to "cut" the data into groups
    bin_level = [ min_value, quantile_1, quantile_2, quantile_3, max_value]
    # Labels for the four budget level groups
    bin_name = [ 'Low', 'Medium', 'High', 'Very High']
    # Creates budget_levels column
    name = '{}_levels'.format(column)
    df[name] = pd.cut(df[column], bin_level, labels=bin_name, include_lowest = True)
    return df
```

In [31]:
```
# plot data group by year of year
def plot_by_year(df,column,object_column,dfyear):
    # Setting the positions and width for the bars
    pos = list(range(len(df.query('%s =="Low"' % column))))
    width = 0.2

    # Plotting the bars
    fig, ax = plt.subplots(figsize=(20,5))

    # Create a bar with Low data, in position pos,
    plt.bar(pos,
            #using 'Low' data,
            df.query('%s =="Low"' % column)[object_column],
            # of width
            width,
            # with alpha 0.5
            alpha=0.5,
            # with color
            color='#FFFF00',
```

```
        # with label Low
        label= 'Low')

# Create a bar with Medium data, in position pos + some width buffer
plt.bar([p + width for p in pos],
        #using Medium data,
        df.query('%s =="Medium"'% column)[object_column],
        # of width
        width,
        # with alpha 0.5
        alpha=0.5,
        # with color
        color='#FFD700',
        # with label Medium
        label='Medium')

# Create a bar with High data, in position pos + some width buffer,
plt.bar([p + width*2 for p in pos],
        #using Moderately High data,
        df.query('%s =="High"' % column)[object_column],
        # of width
        width,
        # with alpha 0.5
        alpha=0.5,
        # with color
        color='#ADFF2F',
        # with label High
        label='High')

# Create a bar with Very High data,
# in position pos + some width buffer,
plt.bar([p + width*3 for p in pos],
        #using High data,
        df.query('%s =="Very High"'% column)[object_column],
        # of width
        width,
        # with alpha 0.5
        alpha=0.5,
        # with color
        color='#008000',
        # with label High
        label='Very High')

# Set the y axis label
ax.set_ylabel(object_column)

# Set the chart's title
ax.set_title('%s in different %s levels in recent 10 years' % (object_column,column
```

```
    # Set the position of the x ticks
    ax.set_xticks([p + 1.5 * width for p in pos])

    # Set the labels for the x ticks
    ax.set_xticklabels(dfyear)

    # Set the y ticks
    ax.set_ylim([min(df[object_column]),max(df[object_column])])

    # Adding the legend and showing the plot
    plt.legend( loc='upper left')
    plt.grid()
    plt.show()
```

Lets find distribution of profit in different popularity levels in recent ten years

list used function: Function get_class

```
In [32]: # get popularity level
         # choose the recent 10 years
         dfyear = np.sort(df.release_year.unique())[-10:]
         # creat a empty df to assign df with popularity levels
         df_popularity = pd.DataFrame()

         #for each year, do the following procedure
         for year in dfyear:
             df_temp = df.query('release_year == "%s"' % year).copy() # filter data with the sel
             df_temp = get_class(df_temp,'popularity') # get popularity level
             df_popularity = df_popularity.append(df_temp) # append to df_popularity
         df_popularity.head(3)
```

```
Out[32]:        id  popularity       budget       revenue  \
         6554  834    5.838503   50000000.0  1.113408e+08
         6555   58    4.205992  200000000.0  1.065660e+09
         6556  920    3.941265  120000000.0  4.619831e+08

                                          original_title  \
         6554                        Underworld: Evolution
         6555  Pirates of the Caribbean: Dead Man's Chest
         6556                                         Cars

                                                          cast  \
         6554  Kate Beckinsale|Scott Speedman|Tony Curran|Sha...
         6555  Johnny Depp|Orlando Bloom|Keira Knightley|Bill...
         6556  Owen Wilson|Paul Newman|Bonnie Hunt|Larry the ...

                        director  \
         6554        Len Wiseman
```

```
6555          Gore Verbinski
6556  John Lasseter|Joe Ranft

                                                keywords  runtime  \
6554              budapest|key|light|werewolf|evolution    106.0
6555  witch|fortune teller|bondage|exotic island|mon...    151.0
6556    car race|car journey|village and town|road|auto    117.0

                                      genres  \
6554  Fantasy|Action|Science Fiction|Thriller
6555                 Adventure|Fantasy|Action
6556        Animation|Adventure|Comedy|Family

                                   production_companies release_date  \
6554                Lakeshore Entertainment|Screen Gems   2006-01-12
6555  Walt Disney Pictures|Jerry Bruckheimer Films|S...   2006-06-20
6556       Walt Disney Pictures|Pixar Animation Studios   2006-06-08

      vote_count  vote_average  release_year    budget_adj   revenue_adj  \
6554        1015           6.3          2006  5.408346e+07  1.204339e+08
6555        3181           6.8          2006  2.163338e+08  1.152691e+09
6556        2336           6.4          2006  1.298003e+08  4.997129e+08

           profit    profit_adj popularity_levels
6554   61340801.0  6.635045e+07         Very High
6555  865659812.0  9.363575e+08         Very High
6556  341983149.0  3.699126e+08         Very High
```

In [33]:
```
# lets find statistic summary from popularity to know how the quantile cut the levels,
df_popularity.describe()
```

Out[33]:
```
                  id   popularity        budget       revenue      runtime  \
count    5354.000000  5354.000000  2.379000e+03  2.165000e+03  5354.000000
mean   113436.690325     0.713095  3.475924e+07  1.031749e+08    99.186029
std    107304.567574     1.219587  4.695805e+07  1.968944e+08    30.217657
min        17.000000     0.000620  1.000000e+00  3.000000e+00     3.000000
25%     19715.750000     0.206118  6.000000e+06  3.338228e+06    89.000000
50%     71861.500000     0.390016  1.700000e+07  3.155486e+07    96.000000
75%    201730.750000     0.771668  4.000000e+07  1.075972e+08   108.000000
max    417859.000000    32.985763  4.250000e+08  2.781506e+09   900.000000

        vote_count  vote_average  release_year    budget_adj   revenue_adj  \
count  5354.000000   5354.000000   5354.000000  2.379000e+03  2.165000e+03
mean    268.594135      5.891688   2010.928838  3.421956e+07  1.010225e+08
std     681.641308      0.992524      2.831724  4.604534e+07  1.914991e+08
min      10.000000      1.500000   2006.000000  9.210911e-01  3.038360e+00
25%      18.000000      5.300000   2009.000000  5.816388e+06  3.171821e+06
50%      42.000000      5.900000   2011.000000  1.682670e+07  3.038360e+07
```

```
75%     182.000000      6.600000   2013.000000  4.065602e+07  1.055790e+08
max    9767.000000      9.200000   2015.000000  4.250000e+08  2.827124e+09

             profit    profit_adj
count  1.712000e+03  1.712000e+03
mean   8.334300e+07  8.133364e+07
std    1.793768e+08  1.743710e+08
min   -4.139124e+08 -4.139124e+08
25%   -2.220506e+06 -2.191682e+06
50%    2.152898e+07  2.145700e+07
75%    9.400637e+07  9.068777e+07
max    2.544506e+09  2.586237e+09
```

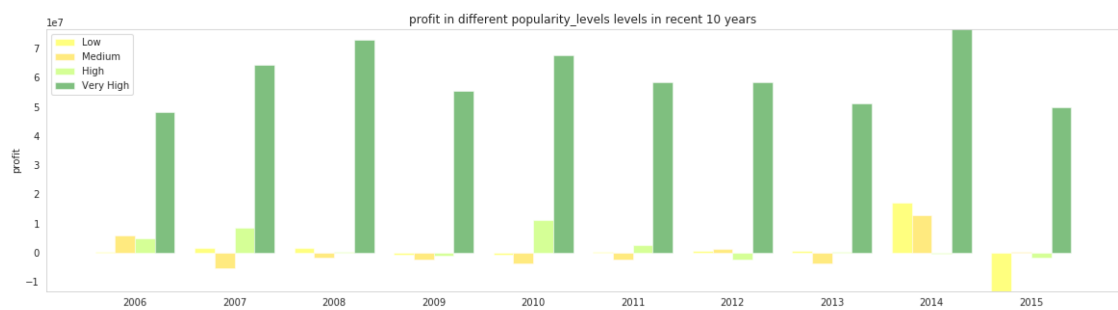
In [34]:
```
# group the dataframe we created above with each popularity_levels in each year, find t
# I choose median because it not have effect from outlier data
df_popularity_by_year = df_popularity.groupby(['release_year','popularity_levels']).med
df_popularity_by_year.head(8)
```

Out[34]:
```
                                     id  popularity      budget     revenue  \
release_year popularity_levels
2006         Low                14872.0    0.113193   7000000.0   4687766.0
             Medium             12225.0    0.297434   8500000.0  11290263.5
             High                9806.5    0.546223  20000000.0  23629912.0
             Very High           7551.0    1.182280  40000000.0  93161322.5
2007         Low                15117.5    0.139703  10000000.0  10337477.0
             Medium             13517.5    0.298249  10000000.0   3478080.0
             High               10966.0    0.519439  19000000.0  22179430.0
             Very High           4748.0    1.188489  47500000.0  95652995.5

                                runtime  vote_count  vote_average  \
release_year popularity_levels
2006         Low                   95.0        17.0          5.90
             Medium                95.0        27.0          5.80
             High                 100.0        72.5          5.90
             Very High            106.0       306.0          6.30
2007         Low                   93.5        16.0          5.85
             Medium                96.0        26.0          5.80
             High                  97.5        64.0          6.00
             Very High            105.0       453.0          6.20

                                  budget_adj   revenue_adj      profit  \
release_year popularity_levels
2006         Low                7.571684e+06  5.070612e+06    166000.0
             Medium             9.194188e+06  1.221233e+07   5796544.0
             High               2.163338e+07  2.555975e+07   4910153.5
             Very High          4.326677e+07  1.007697e+08  48197993.0
2007         Low                1.051669e+07  1.087160e+07   1392364.0
             Medium             1.051669e+07  3.657787e+06  -5349184.5
```

```
                    High                1.998170e+07  2.332541e+07   8511656.5
                    Very High           4.995426e+07  1.005953e+08  64373941.0

                                          profit_adj
release_year popularity_levels
2006         Low                        1.795571e+05
             Medium                     6.269943e+06
             High                       5.311162e+06
             Very High                  5.213428e+07
2007         Low                        1.464305e+06
             Medium                    -5.625569e+06
             High                       8.951442e+06
             Very High                  6.770005e+07
```

list used function: Function plot_by_year

```
In [35]: # visualitation
         plot_by_year(df_popularity_by_year, 'popularity_levels', 'profit',dfyear)
```



Answer Question General 6

from figure above we found that the highest popularity didn't mean the highest profit, but for very high of popularity have highest profit. So keep the movie get very high popularity levels, with minimum popularity is 0.710151 to get high profit.

Go To List Question

7. How distribution of profit in different vote average levels in recent ten years?

list used function: Function get_class

```
In [36]: # lets make rating level just like question before
         # choose the recent 10 years
         dfyear = np.sort(df.release_year.unique())[-10:]
         # creat a empty df to assign df with vote average levels
         df_vote_average = pd.DataFrame()

         #for each year, do the following procedure
         for year in dfyear:
             df_temp = df.query('release_year == "%s"' % year).copy() # filter data with the sel
             df_temp = get_class(df_temp,'vote_average') # get vote average level
```

```
    df_vote_average = df_vote_average.append(df_temp) # append to df_popularity
df_vote_average.head(3)
```

Out[36]:

```
       id  popularity       budget       revenue  \
6554  834    5.838503   50000000.0  1.113408e+08
6555   58    4.205992  200000000.0  1.065660e+09
6556  920    3.941265  120000000.0  4.619831e+08

                                   original_title  \
6554                          Underworld: Evolution
6555  Pirates of the Caribbean: Dead Man's Chest
6556                                           Cars

                                                  cast  \
6554  Kate Beckinsale|Scott Speedman|Tony Curran|Sha...
6555  Johnny Depp|Orlando Bloom|Keira Knightley|Bill...
6556  Owen Wilson|Paul Newman|Bonnie Hunt|Larry the ...

                   director  \
6554            Len Wiseman
6555         Gore Verbinski
6556  John Lasseter|Joe Ranft

                                               keywords  runtime  \
6554            budapest|key|light|werewolf|evolution    106.0
6555  witch|fortune teller|bondage|exotic island|mon...    151.0
6556    car race|car journey|village and town|road|auto    117.0

                                      genres  \
6554  Fantasy|Action|Science Fiction|Thriller
6555                Adventure|Fantasy|Action
6556      Animation|Adventure|Comedy|Family

                                    production_companies release_date  \
6554               Lakeshore Entertainment|Screen Gems   2006-01-12
6555  Walt Disney Pictures|Jerry Bruckheimer Films|S...   2006-06-20
6556      Walt Disney Pictures|Pixar Animation Studios   2006-06-08

      vote_count  vote_average  release_year    budget_adj   revenue_adj  \
6554        1015           6.3          2006  5.408346e+07  1.204339e+08
6555        3181           6.8          2006  2.163338e+08  1.152691e+09
6556        2336           6.4          2006  1.298003e+08  4.997129e+08

           profit    profit_adj vote_average_levels
6554   61340801.0  6.635045e+07                High
6555  865659812.0  9.363575e+08           Very High
6556  341983149.0  3.699126e+08                High
```

In [37]:

```
# lets find statistic summary from vote avg to know how the quantile cut the levels, an
```

```
df_vote_average.describe()
```

Out[37]:

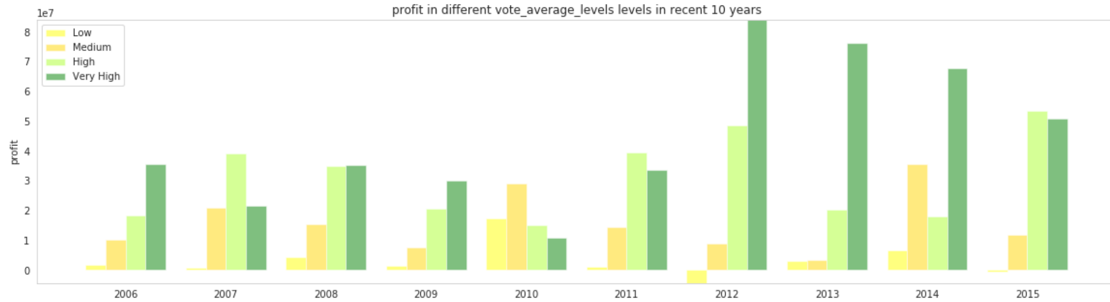
	id	popularity	budget	revenue	runtime
count	5354.000000	5354.000000	2.379000e+03	2.165000e+03	5354.000000
mean	113436.690325	0.713095	3.475924e+07	1.031749e+08	99.186029
std	107304.567574	1.219587	4.695805e+07	1.968944e+08	30.217657
min	17.000000	0.000620	1.000000e+00	3.000000e+00	3.000000
25%	19715.750000	0.206118	6.000000e+06	3.338228e+06	89.000000
50%	71861.500000	0.390016	1.700000e+07	3.155486e+07	96.000000
75%	201730.750000	0.771668	4.000000e+07	1.075972e+08	108.000000
max	417859.000000	32.985763	4.250000e+08	2.781506e+09	900.000000

	vote_count	vote_average	release_year	budget_adj	revenue_adj
count	5354.000000	5354.000000	5354.000000	2.379000e+03	2.165000e+03
mean	268.594135	5.891688	2010.928838	3.421956e+07	1.010225e+08
std	681.641308	0.992524	2.831724	4.604534e+07	1.914991e+08
min	10.000000	1.500000	2006.000000	9.210911e-01	3.038360e+00
25%	18.000000	5.300000	2009.000000	5.816388e+06	3.171821e+06
50%	42.000000	5.900000	2011.000000	1.682670e+07	3.038360e+07
75%	182.000000	6.600000	2013.000000	4.065602e+07	1.055790e+08
max	9767.000000	9.200000	2015.000000	4.250000e+08	2.827124e+09

	profit	profit_adj
count	1.712000e+03	1.712000e+03
mean	8.334300e+07	8.133364e+07
std	1.793768e+08	1.743710e+08
min	-4.139124e+08	-4.139124e+08
25%	-2.220506e+06	-2.191682e+06
50%	2.152898e+07	2.145700e+07
75%	9.400637e+07	9.068777e+07
max	2.544506e+09	2.586237e+09

list used function: Function plot_by_year

In [38]:
```
# group the dataframe we created above with each popularity_levels in each year, find t
# I choose median because it not have effect from outlier data
df_vote_average_by_year = df_vote_average.groupby(['release_year','vote_average_levels'
# visualitation
plot_by_year(df_vote_average_by_year, 'vote_average_levels', 'profit',dfyear)
```



Answer Question General 7

from figure above we found that the highest level of vote average not always mean the movie get the highest profit, especially to 2010 which medium vote have higher profit than high and very high vote average.

Go To List Question

Associated Question

1. What genre that associated with high popularity?

> Because I want to check the associate of genre and genre are multiple value with delimiter | , so I decide to devide the column into single value in each row so it will be a binner data with their popularity level to make the process easy, I make some function

list function name: Function remove_punctuation Function define_dict Function get_data_frame

In [39]:
```
# remove punctuation, decimal, and space uneeded, so the string just containt character
def remove_punctuation(sentence, chars: list = ['[^\w\s]', '_', '\d', '\n', '\r']):
    sentence = sentence.strip()
    sentence = re.sub("|".join(chars), " ", sentence)
    sentence = sentence.replace(' +', ' ')

    return sentence
```

In [40]:
```
# define dictionary to help make dataframe with binner value,
# the key of dictionary will save the column name, and the value will be number
def define_dict(columns):
    d = {}
    for c in columns:
        d[c] = 0
    return d
```

In [41]:
```
# make binner dataframe with column we needed
# metric are column level name
def get_data_frame(old_df,column,metric):
    names = set()
    r = old_df.shape[0] # nrow of data
    c = old_df.shape[1] # nrow of columns

    # get set of data to generate column
    for i in range(0,r):
        temp = str(old_df.iloc[i,old_df.columns.get_loc(column)]).split("|")
        for j in range(len(temp)):
            last_name = remove_punctuation(temp[j].lower()).split(" ")[-1]
            if last_name!='' and last_name!='nan':
                names.add(last_name)

    df_temp = pd.DataFrame(columns = names) # empty data frame to save the final data
```

```
    for i in range(r):
        dict_column = define_dict(names) # dictionary with name as key and zero as valu
        dict_column[metric] = old_df.iloc[i,old_df.columns.get_loc(metric)]
        temp = str(remove_punctuation(old_df.iloc[i,old_df.columns.get_loc(column)]).lo
        for name in names:
            dict_column[name] += temp.count(name)
        df_add = pd.DataFrame(dict_column, index=[0])
        df_temp = df_temp.append(df_add,ignore_index=True,sort=False)

    return df_temp
```

In [42]:
```
# make dataframe
df_genres = get_data_frame(df_popularity,'genres','popularity_levels')
```

In [43]:
```
# lets see the sample value of dataframe we make
df_genres.head(3)
```

Out[43]:
```
   animation war horror foreign crime drama fantasy adventure action history  \
0          0   0      0       0     0     0       1         0      1       0
1          0   0      0       0     0     0       1         1      1       0
2          1   0      0       0     0     0       0         1      0       0

   ... western family mystery documentary thriller movie fiction comedy music  \
0  ...       0      0       0           0        1     0       1      0     0
1  ...       0      0       0           0        0     0       0      0     0
2  ...       0      1       0           0        0     0       0      1     0

  popularity_levels
0         Very High
1         Very High
2         Very High

[3 rows x 21 columns]
```

In [44]:
```
# lets find the sum in each column so we know what the genre most often used in all mov
df_genres.sum()
```

Out[44]:
```
animation                                                               383
war                                                                     106
horror                                                                  884
foreign                                                                  91
crime                                                                   569
drama                                                                  2291
fantasy                                                                 398
adventure                                                               618
action                                                                 1052
history                                                                 141
romance                                                                 747
```

```
western                                                                   36
family                                                                   519
mystery                                                                  359
documentary                                                              363
thriller                                                                1482
movie                                                                     95
fiction                                                                  549
comedy                                                                  1690
music                                                                    195
popularity_levels    Very HighVery HighVery HighVery HighVery HighV...
dtype: object
```

In [45]:
```python
# let's count the genre alomst use group by metric we decide before
df_genre_rank = df_genres.groupby(['popularity_levels']).sum()
df_genre_rank.head(8)
```

Out[45]:

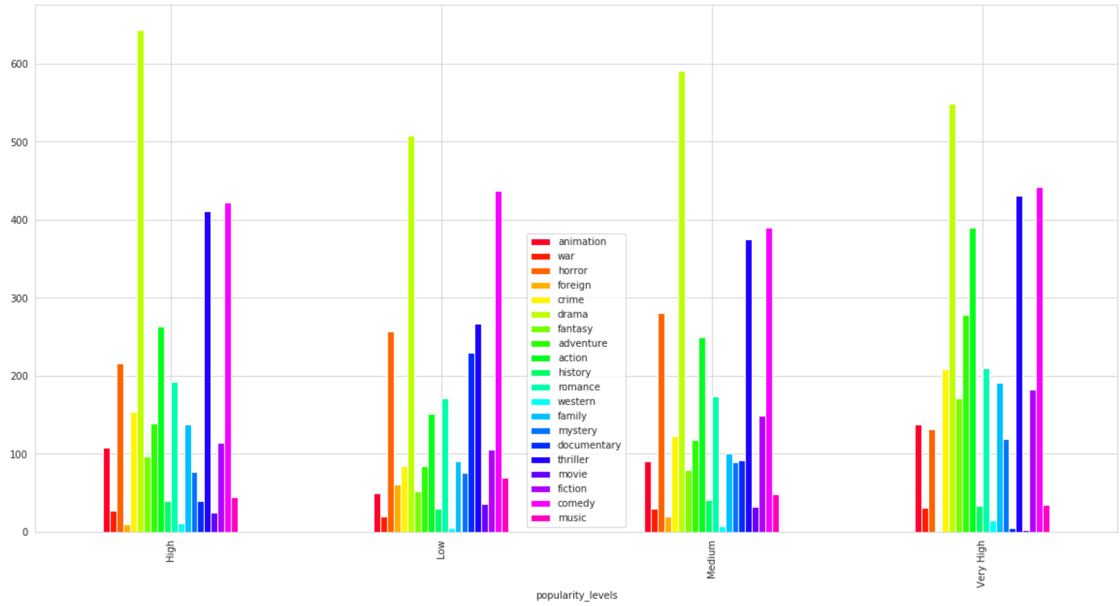
popularity_levels	animation	war	horror	foreign	crime	drama	fantasy
High	107	27	216	10	154	643	96
Low	49	19	257	60	84	508	52
Medium	90	29	280	20	123	591	79
Very High	137	31	131	1	208	549	171

popularity_levels	adventure	action	history	romance	western	family
High	139	263	39	192	11	138
Low	84	151	29	171	4	90
Medium	117	249	40	174	7	100
Very High	278	389	33	210	14	191

popularity_levels	mystery	documentary	thriller	movie	fiction	comedy
High	76	39	411	25	114	422
Low	75	229	266	36	105	437
Medium	89	91	375	32	148	389
Very High	119	4	430	2	182	442

popularity_levels	music
High	44
Low	69
Medium	48
Very High	34

In [46]:
```python
# plot sum of genre use in each level of popularity
df_genre_rank.plot(kind='bar',figsize=(20,10),colormap='gist_rainbow');
```



Answer Question Associate 1

from figure above we found that genre drama are high distributed in all popularity level movie which level "very high" popularity in genre movie, documentary, and foreign has the smallest amount. This means that not many movies have high popularity in that genres Go To List Question

2. What movie genre that associated with high revenue?

This calculation just like the answer before, so lets make function to make it simple and reusable

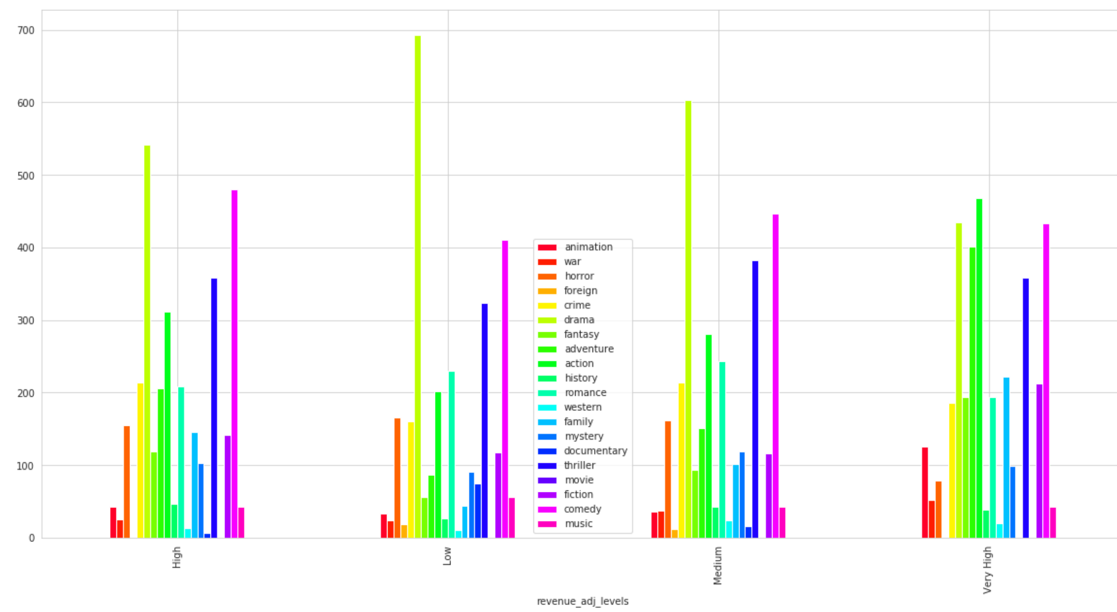
list used function: Function get_class Function get_data_frame list function name: Function get_df_rank

```
In [47]: def get_df_rank(df,column,metric):
             # make dataframe
             df_new = df.copy()
             df_new = get_class(df_new,metric)
             metric_name = '{}_levels'.format(metric)
             df_genre_new = get_data_frame(df_new.copy(),column,metric_name)

             # let's count the genre alomst use group by metric we decide before
             df_genre_new_rank = df_genre_new.groupby([metric_name]).sum()
             df_genre_new_rank.head(8)

             return df_genre_new_rank
```

In [48]:
```
# lets call the function to get the df we want
df_genre_revenue_rank = get_df_rank(df,'genres','revenue_adj')
df_genre_revenue_rank.head(8)
```

Out[48]:
```
                    animation  war  horror  foreign  crime  drama  fantasy  \
revenue_adj_levels
High                       43   25     155        1    214    541      118
Low                        33   23     166       18    160    693       56
Medium                     35   37     161       11    214    603       93
Very High                 126   52      79        0    185    434      194

                    adventure  action  history  romance  western  family  \
revenue_adj_levels
High                      205     311       47      209       13     146
Low                        86     201       26      230       10      44
Medium                    151     280       42      243       23     101
Very High                 401     468       38      194       19     222

                    mystery  documentary  thriller  movie  fiction  comedy  \
revenue_adj_levels
High                    102            6       358      1      141     480
Low                      91           74       324      0      117     411
Medium                  119           16       382      0      116     446
Very High                98            1       358      0      212     433

                    music
revenue_adj_levels
High                   42
Low                    56
Medium                 43
Very High              43
```

In [49]:
```
# plot sum of genre use in each level of revenue
df_genre_revenue_rank.plot(kind='bar',figsize=(20,10),colormap='gist_rainbow');
```



Answer Question Associate 2

from figure above we found that even always in all level o fpopularity (answer question associate 1) but in revenue genre that always appear in high distribution is horor. In very high revenue, genre documentary and foreign is not appear (or maybe too small) so its mean they dont have a big revenue. also in high level revenue, genre foreign is not appear but genre documentary is appear with small distribution. Go To List Question

3. What movie genre that associated with high vote average?
list used function: Function get_df_rank

In [50]:
```
# lets call the function to get the df we want
df_genre_vote_rank = get_df_rank(df,'genres','vote_average')
df_genre_vote_rank.head(8)
```

Out[50]:

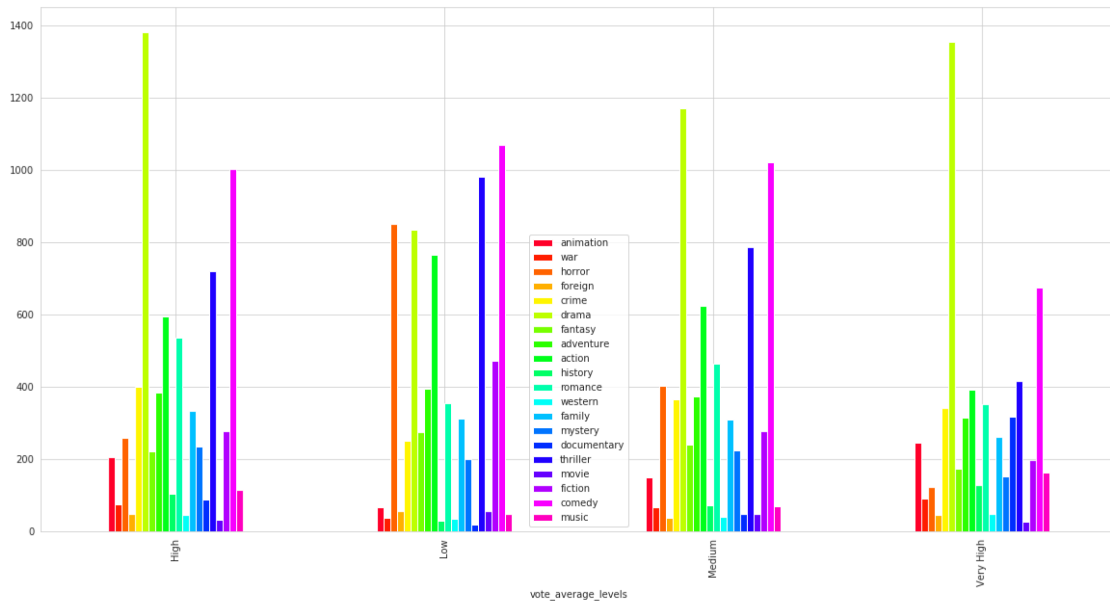
vote_average_levels	animation	war	horror	foreign	crime	drama	fantasy
High	204	75	257	47	398	1381	220
Low	67	37	849	54	249	833	275
Medium	149	65	401	37	364	1170	239
Very High	244	91	121	45	341	1354	173

vote_average_levels	adventure	action	history	romance	western	family
High	384	595	104	534	45	332
Low	393	765	28	354	35	311
Medium	373	622	71	463	38	308
Very High	314	392	127	352	46	261

vote_average_levels	mystery	documentary	thriller	movie	fiction	comedy
High	233	86	719	31	276	1001
Low	199	18	980	54	471	1070
Medium	223	47	787	47	277	1020
Very High	151	316	414	27	196	674

vote_average_levels	music
High	115
Low	48
Medium	68
Very High	163

In [51]:
```
# plot sum of genre use in each level of vote
df_genre_vote_rank.plot(kind='bar',figsize=(20,10),colormap='gist_rainbow');
```



Answer Question Associate 3

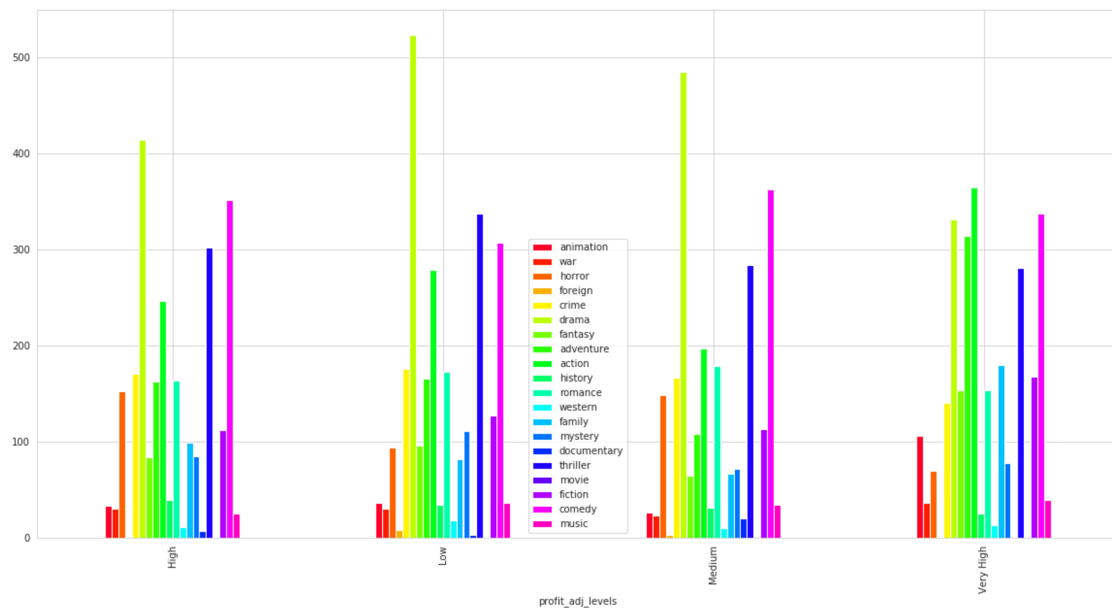
from figure above we found that just like popularity level, in vote level drama still appear in all distribution. All genre drama have higher distribution except in low level. So its mean more drama movie have high vote. Just like popularity and revenue, comedy is in second place distribution in each vote level. Go To List Question

4. What movie genre that associated with high profit?
list used function: Function get_df_rank

```
In [52]: # lets call the function to get the df we want
         df_genre_profit_rank = get_df_rank(df,'genres','profit_adj')
         df_genre_profit_rank.head(8)
```

```
Out[52]:                   animation  war  horror  foreign  crime  drama  fantasy  \
         profit_adj_levels
         High                     33   30     152        1    170    414       83
         Low                      36   30      94        8    175    523       96
         Medium                   26   23     148        3    166    485       64
         Very High               106   36      69        0    140    331      153

                           adventure  action  history  romance  western  family  \
         profit_adj_levels
         High                    162     246       39      163       11      99
         Low                     165     278       34      172       18      81
         Medium                  108     197       31      178       10      66
         Very High               314     364       25      153       13     179

                           mystery  documentary  thriller  movie  fiction  comedy  \
         profit_adj_levels
         High                   85            7       302      1      112     351
         Low                   111            3       337      0      127     307
         Medium                 71           20       284      0      113     362
         Very High              77            1       280      0      167     337

                           music
         profit_adj_levels
         High                 25
         Low                  36
         Medium               34
         Very High            39
```

```
In [53]: # plot sum of genre use in each level of vote
         df_genre_profit_rank.plot(kind='bar',figsize=(20,10),colormap='gist_rainbow');
```



Answer Question Associate 4

from figure above we found that just like the answer before, in profit level drama still appear in all distribution. All genre drama have higher distribution except in very high level. So its mean drama movie have good distribution in all profit level. Genre action have highest distribution in very high profit level, in another level that genre just in 4 positition from higher distribution. Go To List Question

Trend Question
1. What is the trend of the genre every 10 years

In [54]:
```
# sort the movie release year list.
df_sub_year= df.release_year.unique()
df_sub_year= np.sort(df_sub_year)
df_sub_year
```

Out[54]:
```
array([1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970,
       1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981,
       1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992,
       1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003,
       2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014,
       2015])
```

In [55]:
```
# year list of 1960s
y1960s =df_sub_year[:10]
# year list of 1970s
y1970s =df_sub_year[10:20]
# year list of 1980s
y1980s =df_sub_year[20:30]
```

```
# year list of 1990s
y1990s = df_sub_year[30:40]
# year list of afer 2000
y2000s = df_sub_year[40:50]
# year list of afer 2000
y2010 = df_sub_year[50:]
```

In [56]:
```
# year list devide by 10 years
times = [y1960s, y1970s, y1980s, y1990s, y2000s, y2010]
# timesline name
names = ['1960s', '1970s', '1980s', '1990s', '2000s','after2010']
df['decade'] = np.nan
for i in range(len(names)):
    index = df[df.release_year.isin(times[i])].index.values.tolist()
    for j in index:
        df.loc[j,'decade'] = names[i]
df.head()
```

Out[56]:
```
       id  popularity       budget       revenue  \
0  135397   32.985763  150000000.0  1.513529e+09
1   76341   28.419936  150000000.0  3.784364e+08
2  262500   13.112507  110000000.0  2.952382e+08
3  140607   11.173104  200000000.0  2.068178e+09
4  168259    9.335014  190000000.0  1.506249e+09

                 original_title  \
0                Jurassic World
1            Mad Max: Fury Road
2                     Insurgent
3  Star Wars: The Force Awakens
4                     Furious 7

                                                cast          director  \
0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...   Colin Trevorrow
1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...     George Miller
2  Shailene Woodley|Theo James|Kate Winslet|Ansel...  Robert Schwentke
3  Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...       J.J. Abrams
4  Vin Diesel|Paul Walker|Jason Statham|Michelle ...         James Wan

                                            keywords  runtime  \
0  monster|dna|tyrannosaurus rex|velociraptor|island    124.0
1   future|chase|post-apocalyptic|dystopia|australia    120.0
2  based on novel|revolution|dystopia|sequel|dyst...    119.0
3              android|spaceship|jedi|space opera|3d    136.0
4                car race|speed|revenge|suspense|car    137.0

                                       genres  \
0  Action|Adventure|Science Fiction|Thriller
```

```
1  Action|Adventure|Science Fiction|Thriller
2        Adventure|Science Fiction|Thriller
3   Action|Adventure|Science Fiction|Fantasy
4                     Action|Crime|Thriller

                              production_companies release_date  vote_count  \
0  Universal Studios|Amblin Entertainment|Legenda...   2015-06-09        5562
1  Village Roadshow Pictures|Kennedy Miller Produ...   2015-05-13        6185
2  Summit Entertainment|Mandeville Films|Red Wago...   2015-03-18        2480
3          Lucasfilm|Truenorth Productions|Bad Robot   2015-12-15        5292
4  Universal Pictures|Original Film|Media Rights ...   2015-04-01        2947

   vote_average  release_year    budget_adj   revenue_adj        profit  \
0           6.5          2015  1.379999e+08  1.392446e+09  1.363529e+09
1           7.1          2015  1.379999e+08  3.481613e+08  2.284364e+08
2           6.3          2015  1.012000e+08  2.716190e+08  1.852382e+08
3           7.5          2015  1.839999e+08  1.902723e+09  1.868178e+09
4           7.3          2015  1.747999e+08  1.385749e+09  1.316249e+09

     profit_adj     decade
0  1.254446e+09  after2010
1  2.101614e+08  after2010
2  1.704191e+08  after2010
3  1.718723e+09  after2010
4  1.210949e+09  after2010
```

list used function: Function get_data_frame

In [57]:

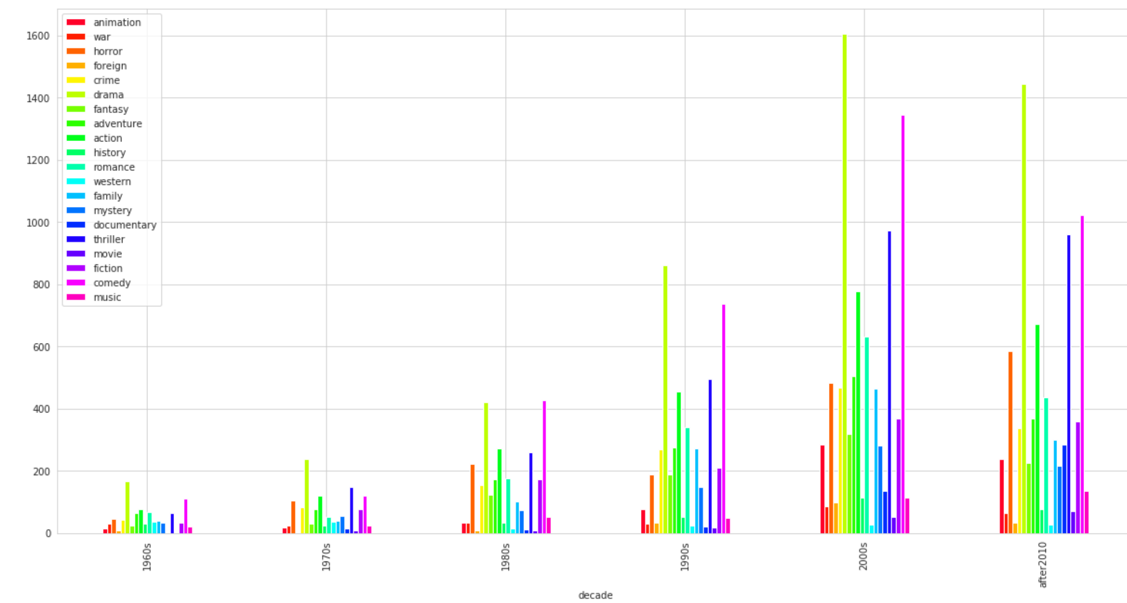
```
df_genre_decade = get_data_frame(df.copy(),'genres','decade')
# let's count the genre alomst use group by metric we decide before
df_genre_decade_rank = df_genre_decade.groupby(['decade']).sum()
df_genre_decade_rank.head(8)
```

Out[57]:

```
           animation  war  horror  foreign  crime  drama  fantasy  adventure  \
decade
1960s             14   31      47        9     43    167       23         64
1970s             17   25     104        3     83    238       30         77
1980s             32   32     221        8    153    421      122        174
1990s             78   29     189       32    270    862      188        275
2000s            285   87     483       99    466   1605      318        505
after2010        238   64     584       32    337   1445      226        369

           action  history  romance  western  family  mystery  documentary  \
decade
1960s          78       31       67       36      39       32            2
1970s         121       23       51       36      38       56           13
1980s         271       32      175       13     101       72           12
1990s         455       53      341       25     272      148           21
```

```
2000s        776    113    632     26    463    281        135
after2010    673     78    437     28    299    217        284

          thriller  movie  fiction  comedy  music
decade
1960s           64      2       34     112     20
1970s          148      8       77     121     25
1980s          260      9      172     428     51
1990s          495     19      211     736     49
2000s          972     52      367    1346    114
after2010      961     69      359    1022    135
```

In [58]:
```python
# plot sum of genre use in each decade
df_genre_decade_rank.plot(kind='bar',figsize=(20,10),colormap='gist_rainbow');
```



Answer Question Trend

from figure above we found that drama genre always have high distribution in every decade, genre western getting smaller in every decade. Genre foreign always have low distribution in every decade. Go To List Question

Conclusions
The purpose of this research is to answer 3 parts of the question:
Part 1: General From this part we found that number of movie increasing every year. Movie with the highest profit is Avatar(2009), but if we check the inflation over time so the highest profit movie is Star Wars(1977) and the lowest profit movie is The Warrior's Way(2010). The Warrior's Way maybe get the lowest profit because it is movie with the highest budget. The lowest budget movie so far is Fear Clinic(2014). In this data we found the highest revenue movie is Avatar(2009),

maybe it is reason that movie become the highest profit, but because the highest profit by inflation is Star Wars so we can conclude that budget Star Wars is bigger than Avatar (of course we assumed with inflation). The lowest revenue movie is Shattered Glass(2003). The longest runtime movie is The Story of Film: An Odyssey(2011) that is 900 minutes, its is make sense because it is documantary movie. The shortest runtime movie is Batman: Strange Days(2014) that is just run in 3 minutes. The highest popularity didn't mean the highest profit, but for level "very high" in popularity have highest profit. So if we want to make a highest profit movie we must make the movie get very high popularity levels, with minimum popularity is 0.710151. We also found that the highest level of vote average not always mean the movie get the highest profit, especially to 2010 which medium vote have higher profit than high and very high vote average.

Part 2: Find Associate Variable Movie Genre with Movie Metric From this part we found that genre drama are high distributed in all popularity level. Movies with genre "documentary", "movie", or "foreign" only few get "very high" popularity level. In revenue level, genre that always appear in high distribution is horor. In level very high revenue, genre documentary and foreign is not appear (or maybe too small) so its mean they don't have a big revenue. Also in high level revenue, genre foreign is not appear but genre documentary is appear with small distribution. In vote level, drama still appear in all distribution and have higher distribution except in low level vote. So its mean many drama movie have high vote. Just like popularity and revenue, comedy is in second place distribution in each vote level. In profit level, genre drama still appear in all distribution and also have higher distribution except in very high profit level. So its mean drama movie have good distribution in all profit level. Genre action have highest distribution in very high profit level, in another level that genre just in 4th positition from higher distribution.

Part 3: Find Some Trend From this part we found that drama genre always have high distribution in every decade, genre western getting smaller in every decade. Genre foreign always have low distribution in every decade.