Project: Investigate a Dataset - [TMDB Movie Dataset]

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Introduction

Dataset Description

This is a dataset of more than 10000 movies

Question(s) for Analysis

- How did run time of movies changed over the years?
- Which genre had the most profit?
- Which genre is the most popular?
- Which production company made the most movies?
- Which actor performed the most?

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

%matplotlib inline
```

Data Wrangling

In [2]:
```
df = pd.read_csv('tmdb-movies.csv')
df.head(10)
```

Out[2]:

	id	imdb_id	popularity	budget	revenue	original_title	cast	
0	135397	tt0369610	32.985763	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	http
1	76341	tt1392190	28.419936	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	http:/

2	262500	tt2908446	13.112507	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	http://www.thediverge
3	140607	tt2488496	11.173104	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	http://www.sta
4	168259	tt2820852	9.335014	190000000	1506249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	
5	281957	tt1663202	9.110700	135000000	532950503	The Revenant	Leonardo DiCaprio|Tom Hardy|Will Poulter|Domhn...	http://www.foxmovies
6	87101	tt1340138	8.654359	155000000	440603537	Terminator Genisys	Arnold Schwarzenegger|Jason Clarke|Emilia Clar...	http://w
7	286217	tt3659388	7.667400	108000000	595380321	The Martian	Matt Damon|Jessica Chastain|Kristen Wiig|Jeff ...	http://www.foxmovie
8	211672	tt2293640	7.404165	74000000	1156730962	Minions	Sandra Bullock|Jon Hamm|Michael Keaton|Allison...	http:/
9	150540	tt2096673	6.326804	175000000	853708609	Inside Out	Amy Poehler|Phyllis Smith|Richard Kind|Bill Ha...	http://mo

10 rows × 21 columns

In [3]:
```
df.shape #checking number of rows and columns in the dataset
```

Out[3]:
```
(10866, 21)
```

the data has 10866 rows and 21 columns

In [4]:
```
df.dtypes #checking columns data types and
```

Out[4]:
```
id                      int64
imdb_id                object
popularity            float64
budget                  int64
```

```
revenue                 int64
original_title         object
cast                   object
homepage               object
director               object
tagline                object
keywords               object
overview               object
runtime                 int64
genres                 object
production_companies   object
release_date           object
vote_count              int64
vote_average          float64
release_year            int64
budget_adj            float64
revenue_adj           float64
dtype: object
```

In [5]:
```
df.describe()
```

Out[5]:

	id	popularity	budget	revenue	runtime	vote_count	vote_average	relea
count	10866.000000	10866.000000	1.086600e+04	1.086600e+04	10866.000000	10866.000000	10866.000000	10866
mean	66064.177434	0.646441	1.462570e+07	3.982332e+07	102.070863	217.389748	5.974922	200
std	92130.136561	1.000185	3.091321e+07	1.170035e+08	31.381405	575.619058	0.935142	12
min	5.000000	0.000065	0.000000e+00	0.000000e+00	0.000000	10.000000	1.500000	196
25%	10596.250000	0.207583	0.000000e+00	0.000000e+00	90.000000	17.000000	5.400000	199
50%	20669.000000	0.383856	0.000000e+00	0.000000e+00	99.000000	38.000000	6.000000	200
75%	75610.000000	0.713817	1.500000e+07	2.400000e+07	111.000000	145.750000	6.600000	201
max	417859.000000	32.985763	4.250000e+08	2.781506e+09	900.000000	9767.000000	9.200000	201

As we can the median of the budget and revenue is 0 there must be something wrong and the min runtime is 0 we need to check that also.

In [6]:
```
(df.runtime <= 0).sum()
```

Out[6]:
```
31
```

In [7]:
```
((df.revenue_adj == 0).sum()/df.revenue_adj.count())*100, ((df.budget_adj == 0).sum()/df
```

Out[7]:
```
(55.365359838026876, 52.42039388919566)
```

55% of the data have 0 budget and 52% of the data have 0 revenue there must be a problem when entering its values to the dataset

In [8]:
```
df.isnull().sum() #checking which variables has missing values and how much is it
```

Out[8]:
```
id                        0
imdb_id                  10
popularity                0
budget                    0
revenue                   0
original_title            0
cast                     76
homepage               7930
director                 44
```

```
tagline                2824
keywords               1493
overview                  4
runtime                   0
genres                   23
production_companies   1030
release_date              0
vote_count                0
vote_average              0
release_year              0
budget_adj                0
revenue_adj               0
dtype: int64
```

As we can see no numeric data is missing so we can fill the other missing data with a common value like unknown.

In [9]:
```
df.duplicated().sum()
```

Out[9]:
```
1
```

There is only 1 duplicated item in the datset

Data Cleaning

> **Tip**: Make sure that you keep your reader informed on the steps that you are taking in your investigation. Follow every code cell, or every set of related code cells, with a markdown cell to describe to the reader what was found in the preceding cell(s). Try to make it so that the reader can then understand what they will be seeing in the following cell(s).

In [10]:
```
# After discussing the structure of the data and any problems that need to be
#   cleaned, perform those cleaning steps in the second part of this section.
df.drop_duplicates(inplace=True) #removing duplicate values
```

In [11]:
```
df.drop(['imdb_id','homepage','tagline','overview','revenue','budget','keywords','id'],
```

In [12]:
```
df.fillna('unknown', inplace=True) #fillinf na values with unknown in the dataframe
```

In [13]:
```
df.isnull().sum()
```

Out[13]:
```
popularity             0
original_title         0
cast                   0
director               0
runtime                0
genres                 0
production_companies   0
release_date           0
vote_count             0
vote_average           0
release_year           0
budget_adj             0
revenue_adj            0
dtype: int64
```

There is no missing data in the dataset now

In [14]:
```
df['profit'] = df.revenue_adj - df.budget_adj #Calculating profit column
```

In [15]:
```
#splitting the different genres to different rows to have better analysis on individual
genre_df  =df.assign(genres=df.genres.str.split('|')).explode('genres')
genre_df.head()
```

Out[15]:

	popularity	original_title	cast	director	runtime	genres	production_companies	release_date	vc
0	32.985763	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Action	Universal Studios|Amblin Entertainment|Legenda...	6/9/15	
0	32.985763	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Adventure	Universal Studios|Amblin Entertainment|Legenda...	6/9/15	
0	32.985763	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Science Fiction	Universal Studios|Amblin Entertainment|Legenda...	6/9/15	
0	32.985763	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Thriller	Universal Studios|Amblin Entertainment|Legenda...	6/9/15	
1	28.419936	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller	120	Action	Village Roadshow Pictures|Kennedy Miller Produ...	5/13/15	

In [16]:
```
#splitting the different cast to different rows to have better analysis on individual ca
cast_df = df.assign(cast= df.cast.str.split('|')).explode('cast')
cast_df.head()
```

Out[16]:

	popularity	original_title	cast	director	runtime	genres	production_companies	release
0	32.985763	Jurassic World	Chris Pratt	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Universal Studios|Amblin Entertainment|Legenda...	6
0	32.985763	Jurassic World	Bryce Dallas Howard	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Universal Studios|Amblin Entertainment|Legenda...	6
0	32.985763	Jurassic World	Irrfan Khan	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Universal Studios|Amblin Entertainment|Legenda...	6
0	32.985763	Jurassic World	Vincent D'Onofrio	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Universal Studios|Amblin Entertainment|Legenda...	6
0	32.985763	Jurassic World	Nick Robinson	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Universal Studios|Amblin Entertainment|Legenda...	6

In [17]:
```
#splitting the different production companies to different rows to have better analysis
companies_df = df.assign(production_companies= df.production_companies.str.split('|')).e
companies_df.head()
```

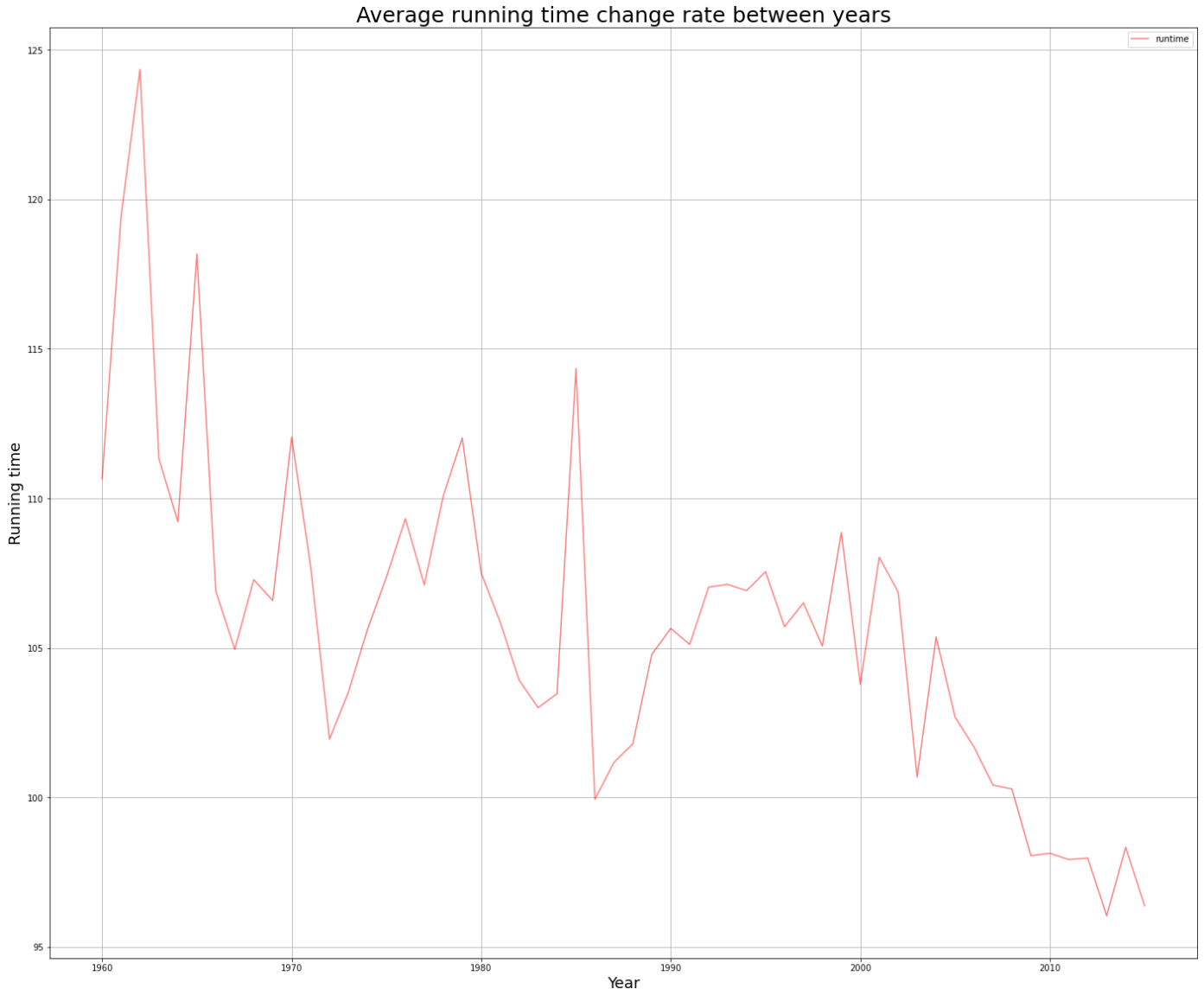
Out[17]:

	popularity	original_title	cast	director	runtime	genres	production_companies	rele
0	32.985763	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Universal Studios	
0	32.985763	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Amblin Entertainment	
0	32.985763	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Legendary Pictures	
0	32.985763	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Fuji Television Network	
0	32.985763	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Dentsu	

Exploratory Data Analysis

Research Question 1 (How did run time of movies changed over the years?)

In [18]:
```
plt.figure(figsize=(24,20))
df.groupby('release_year').mean().sort_values(by='release_year', ascending=False).runtim
plt.title('Average running time change rate between years',fontsize=25)
plt.xlabel('Year', fontsize=18)
plt.ylabel('Running time', fontsize=18)
plt.legend()
plt.grid(True)
plt.show();
```



It looks like the running time is **decreased significantly** over the years

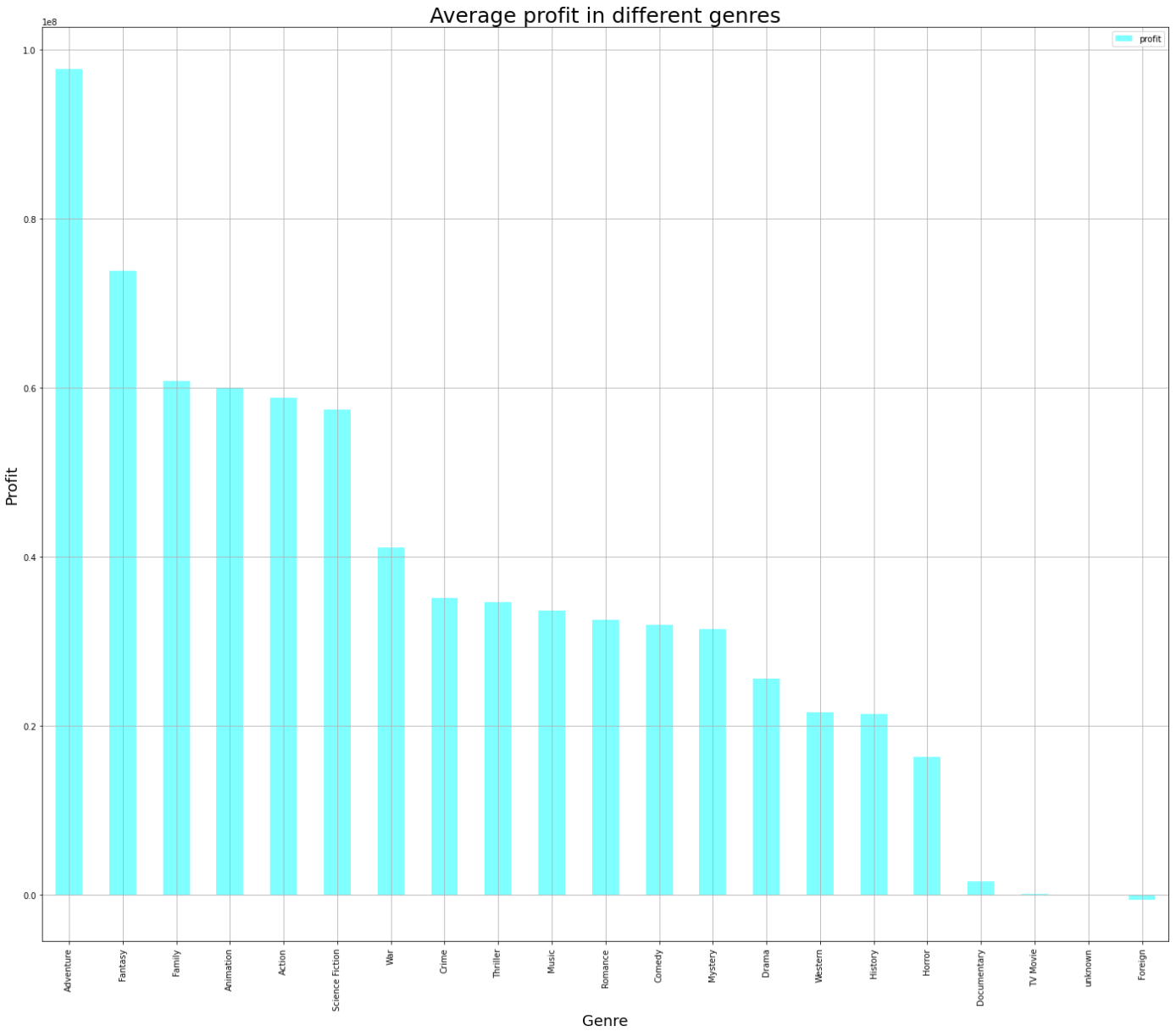
Research Question 2 (Which genre had the most profit?)

In [19]:
```
genre_df.genres.value_counts()#Number of each genre in the dataset
```

Out[19]:
```
Drama              4760
Comedy             3793
Thriller           2907
Action             2384
Romance            1712
Horror             1637
Adventure          1471
Crime              1354
Family             1231
Science Fiction    1229
Fantasy             916
Mystery             810
Animation           699
Documentary         520
Music               408
History             334
War                 270
Foreign             188
TV Movie            167
Western             165
```

```
unknown                23
Name: genres, dtype: int64
```

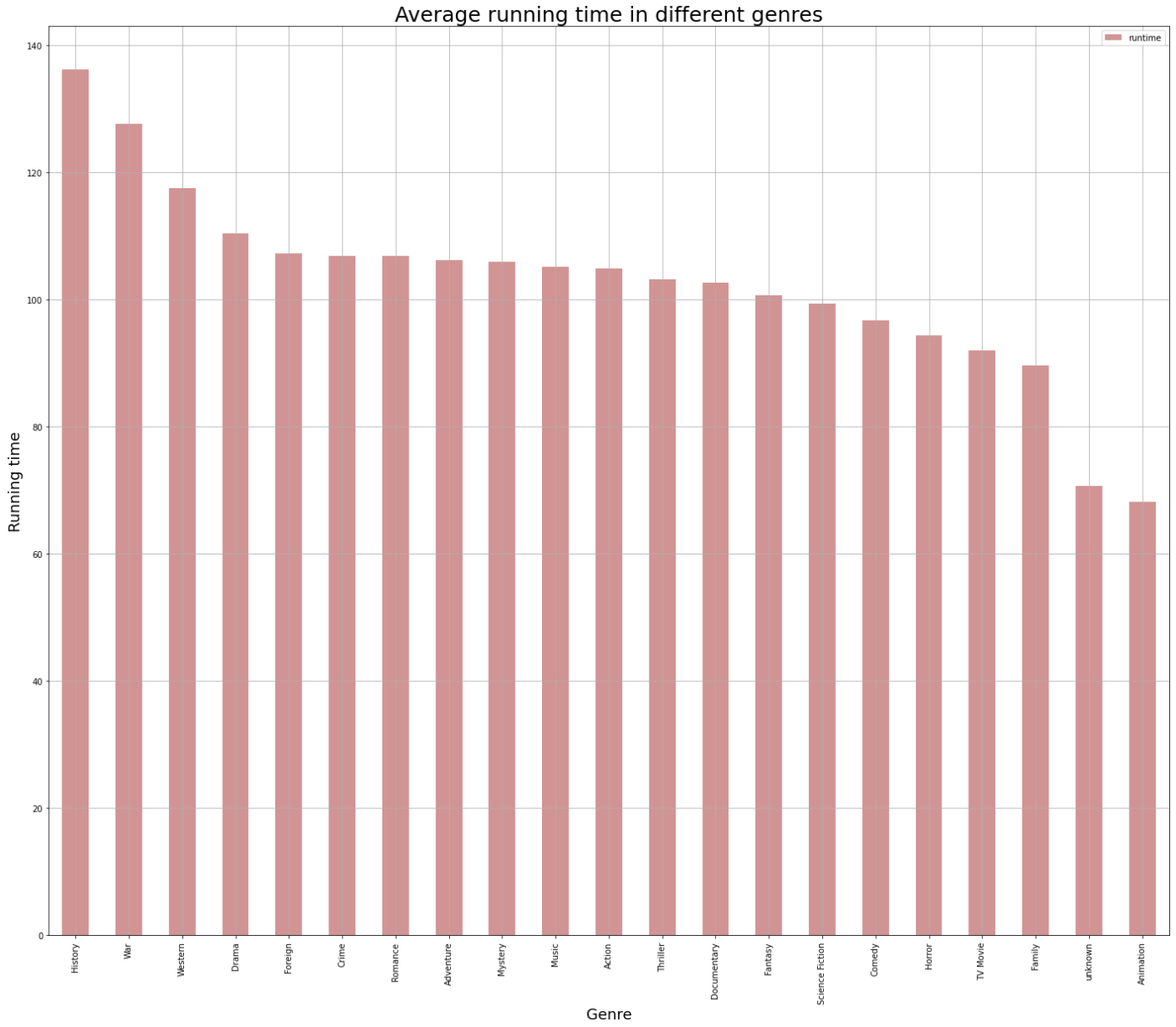
In [20]:
```
plt.figure(figsize=(24,20))
genre_df.groupby('genres').mean().sort_values(by='profit', ascending=False).profit.plot(
plt.title('Average profit in different genres', fontsize=25)
plt.xlabel('Genre', fontsize=18)
plt.ylabel('Profit', fontsize=18)
plt.legend()
plt.grid(True)
plt.show();
```



It seems like some genres had more profit than others the most profiable genre is **adventure** and the least is **TV Movie**

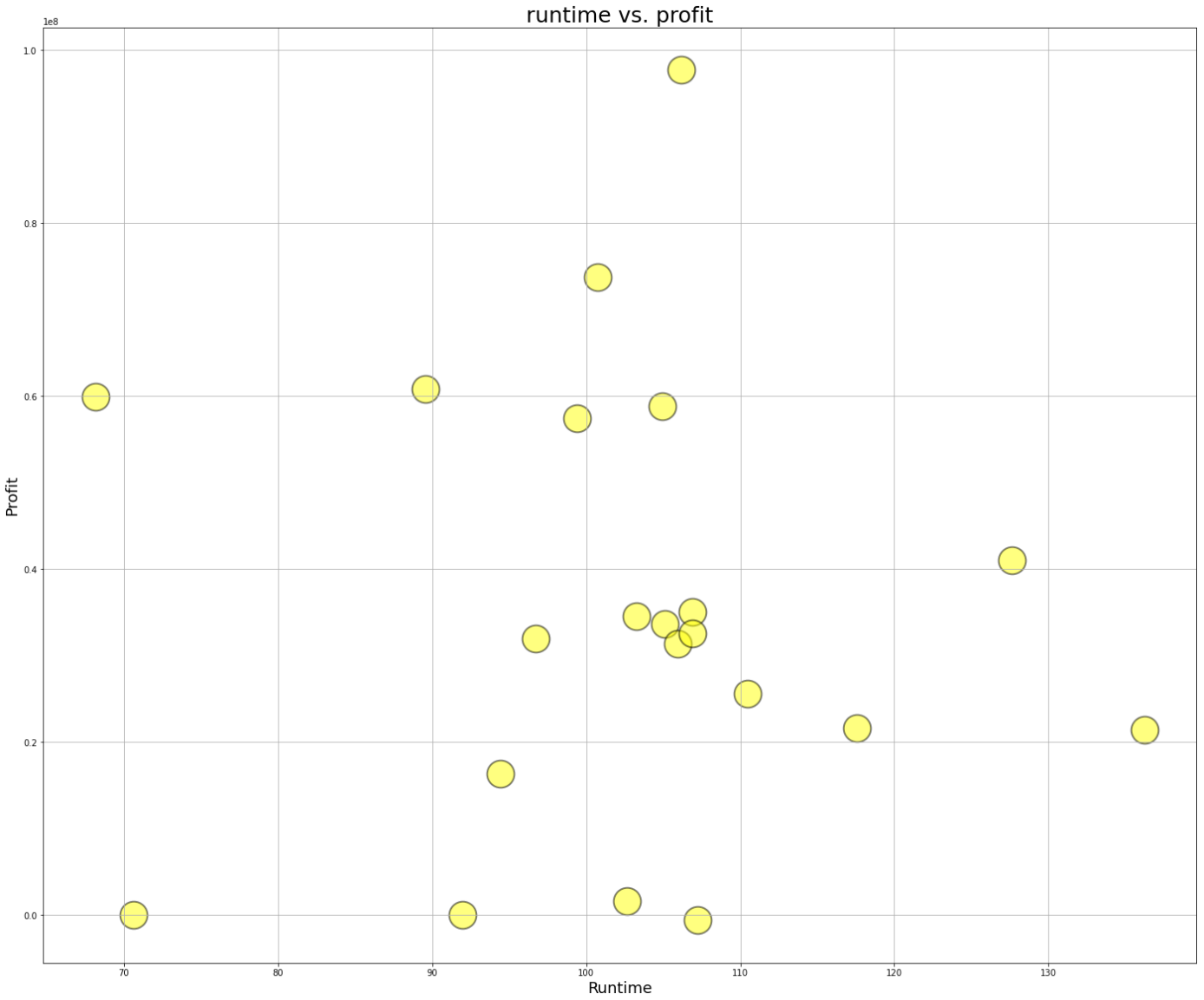
Movies average run time for each genre

In [21]:
```
plt.figure(figsize=(24,20))
genre_df.groupby('genres').mean().sort_values(by='runtime', ascending=False).runtime.plo
plt.title('Average running time in different genres', fontsize=25)
plt.xlabel('Genre', fontsize=18)
plt.ylabel('Running time', fontsize=18)
plt.legend()
plt.grid(True)
plt.show();
```



In [22]:

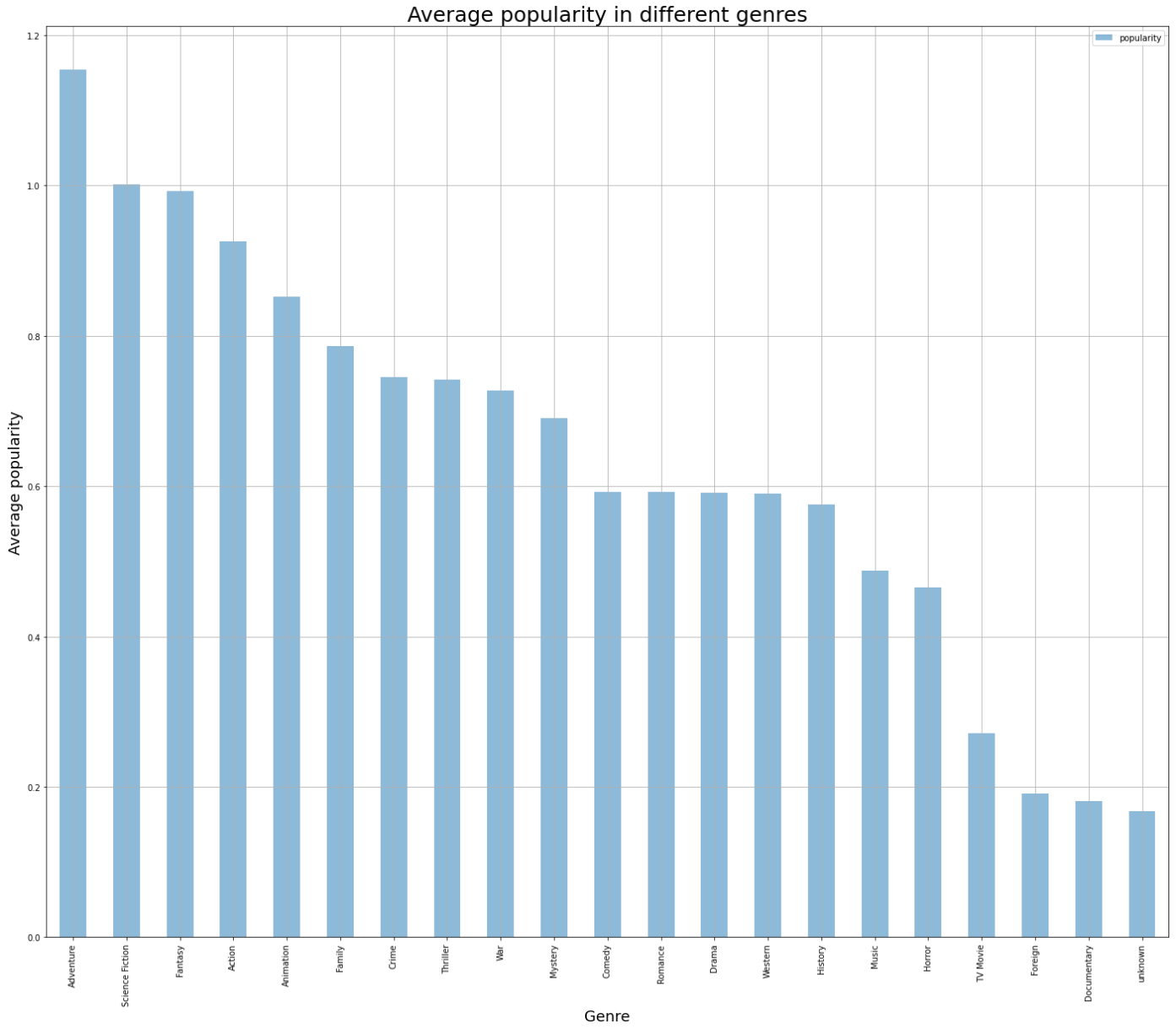
```
plt.figure(figsize=(24,20))
x1= genre_df.groupby('genres').mean().runtime
y1= genre_df.groupby('genres').mean().profit
plt.scatter(x=x1, y=y1, s=1000, c='yellow', edgecolor='black',linewidth=2, alpha=0.5)
plt.title('runtime vs. profit', fontsize=25)
plt.xlabel('Runtime', fontsize=18)
plt.ylabel('Profit', fontsize=18)
plt.grid(True)
plt.show();
```



It seems that median running time (100-110) movies have the best profit than the other movies

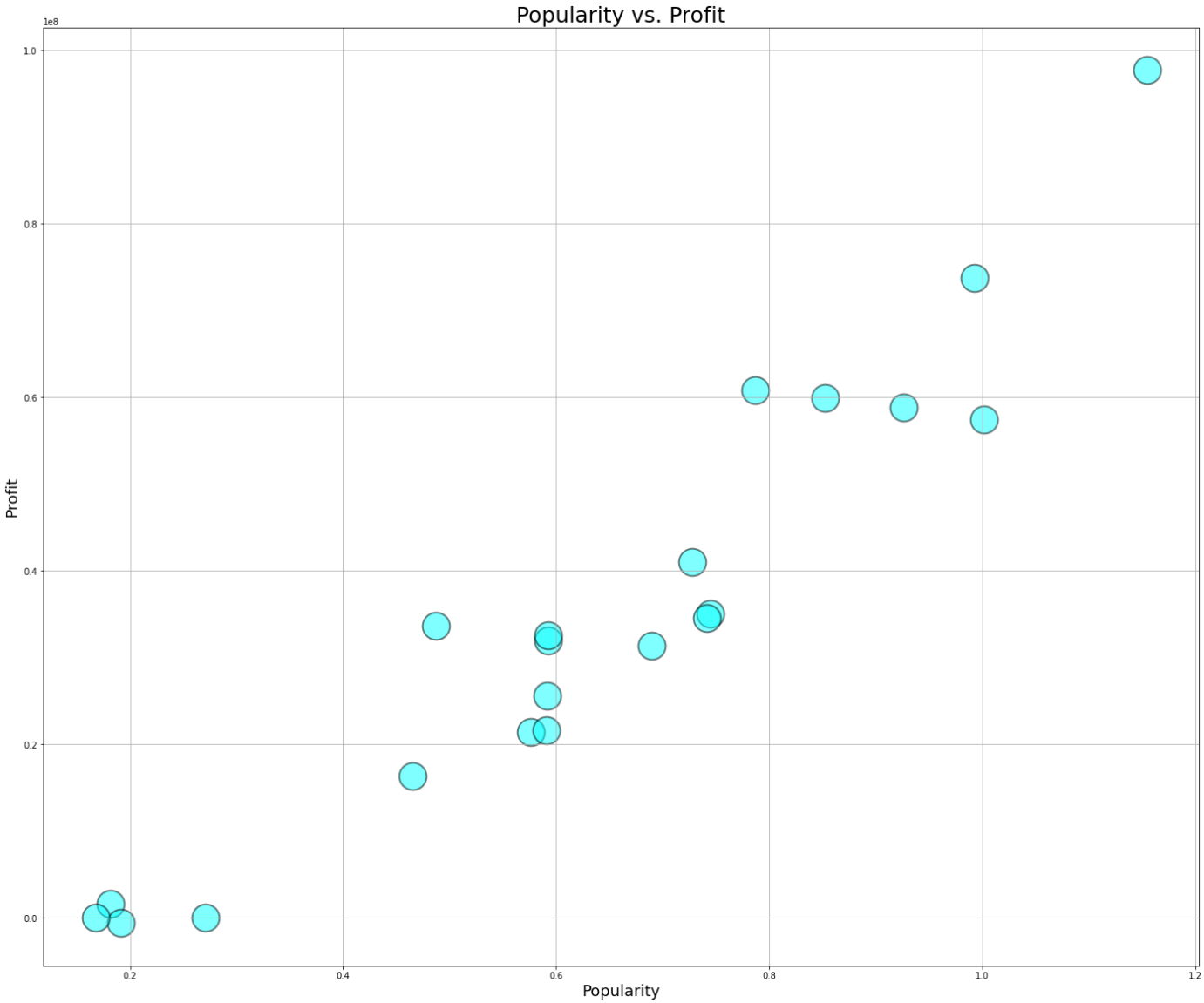
Research Question 3 (Which genre is the most popular?)

In [23]:
```
plt.figure(figsize=(24,20))
genre_df.groupby('genres').mean().sort_values(by='popularity', ascending=False).populari
plt.title('Average popularity in different genres', fontsize=25)
plt.xlabel('Genre', fontsize=18)
plt.ylabel('Average popularity', fontsize=18)
plt.legend()
plt.grid(True)
plt.show();
```



It seems that **adventure** genre is the most popular also maybe there is a correlation betweeen popularity and profit

In [24]:
```
plt.figure(figsize=(24,20))
x1= genre_df.groupby('genres').mean().popularity
y1= genre_df.groupby('genres').mean().profit
plt.scatter(x=x1, y=y1, s=1000, c='cyan', edgecolor='black',linewidth=2, alpha=0.5)
plt.title('Popularity vs. Profit', fontsize=25)
plt.xlabel('Popularity', fontsize=18)
plt.ylabel('Profit', fontsize=18)
plt.grid(True)
plt.show();
```



There is a **positive correlation** between **popularity** and **profit** so the more popular genres got more profit than the others

Research Question 4 (Which production company made the most movies?)

In [25]:
```
companies_df.production_companies.value_counts().to_frame()
```

Out[25]:

	production_companies
unknown	1030
Universal Pictures	522
Warner Bros.	509
Paramount Pictures	431
Twentieth Century Fox Film Corporation	282
...	...
CineEvelyn	1
Silver Sphere Corporation	1
MGM	1

Keystone Pictures	1
Norm-Iris	1

7880 rows × 1 columns

It seems that **Universal Pictures** made the most films

Research Question 5 (Which actor performed the most?)

In [26]:
```
cast_df.cast.value_counts().to_frame()
```

Out[26]:

	cast
unknown	76
Robert De Niro	72
Samuel L. Jackson	71
Bruce Willis	62
Nicolas Cage	61
...	...
Aran Bell	1
Rebecca Houseknecht	1
Joan Sebastian Zamora	1
Miko Fogarty	1
Stephanie Nielson	1

19027 rows × 1 columns

It seems that **Robert De Niro and Samuel L. Jackson** performed the most.

Conclusions

- The most profitable genre is **adventure** and it also were the most **popular**
- The movies who had a **higher popularity had more profit**
- It seems **longer** movies had **lower** profits **than shorter or median** running time movies
- The most movies made by a production company are **(Universal Pictures, Warner Bros., Paramount Pictures)**
- The most acted actors are **(Robert De Niro, Samuel L. Jackson,Bruce Willis ,Nicolas Cage)**

Limitations

Almost 52 % of budget data is zero which affects profit calculation greatly. also with zero revenue, s0 63% of profit is wrongly calculated

I could have dropped them but that will only let 37% of the data to work with which will make the results not accurate and will not be representative for the entire population