IMDb Movies Dataset

1. How much money should be invested into production

2. How long the movie should be

3. Which genre should the movie be categorized as

4. Best time of year to release the mov

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

In [2]:
```python
# read in the csv file into a df
movies_df = pd.read_csv('zippedData/movies.csv')
movies_df.head()
```

Out[2]:

	name	rating	genre	year	released	score	votes	director	writer	star
0	The Shining	R	Drama	1980	June 13, 1980 (United States)	8.4	927000.0	Stanley Kubrick	Stephen King	Jack Nicholson
1	The Blue Lagoon	R	Adventure	1980	July 2, 1980 (United States)	5.8	65000.0	Randal Kleiser	Henry De Vere Stacpoole	Brooke Shields
2	Star Wars: Episode V - The Empire Strikes Back	PG	Action	1980	June 20, 1980 (United States)	8.7	1200000.0	Irvin Kershner	Leigh Brackett	Mark Hamill
3	Airplane!	PG	Comedy	1980	July 2, 1980 (United States)	7.7	221000.0	Jim Abrahams	Jim Abrahams	Robert Hays
4	Caddyshack	R	Comedy	1980	July 25, 1980 (United States)	7.3	108000.0	Harold Ramis	Brian Doyle-Murray	Chevy Chase

In [3]:
```
# general info on the data - check datatypes and columns with missing rows
movies_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7668 entries, 0 to 7667
Data columns (total 15 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   name      7668 non-null   object 
 1   rating    7591 non-null   object 
 2   genre     7668 non-null   object 
 3   year      7668 non-null   int64  
 4   released  7666 non-null   object 
 5   score     7665 non-null   float64
 6   votes     7665 non-null   float64
 7   director  7668 non-null   object 
 8   writer    7665 non-null   object 
 9   star      7667 non-null   object 
 10  country   7665 non-null   object 
 11  budget    5497 non-null   float64
 12  gross     7479 non-null   float64
 13  company   7651 non-null   object 
 14  runtime   7664 non-null   float64
dtypes: float64(5), int64(1), object(9)
memory usage: 898.7+ KB
```

In [4]:
```
# describe method for columns with numerical data
movies_df.describe()
```

Out[4]:

	year	score	votes	budget	gross	runtime
count	7668.000000	7665.000000	7.665000e+03	5.497000e+03	7.479000e+03	7664.000000
mean	2000.405451	6.390411	8.810850e+04	3.558988e+07	7.850054e+07	107.261613
std	11.153508	0.968842	1.633238e+05	4.145730e+07	1.657251e+08	18.581247
min	1980.000000	1.900000	7.000000e+00	3.000000e+03	3.090000e+02	55.000000
25%	1991.000000	5.800000	9.100000e+03	1.000000e+07	4.532056e+06	95.000000
50%	2000.000000	6.500000	3.300000e+04	2.050000e+07	2.020576e+07	104.000000
75%	2010.000000	7.100000	9.300000e+04	4.500000e+07	7.601669e+07	116.000000
max	2020.000000	9.300000	2.400000e+06	3.560000e+08	2.847246e+09	366.000000

Data-cleaning

In [5]:
```
# drop the missing values without a budget
movies_df.dropna(inplace=True)
```

In [6]:
```
# checking dataframe again to make sure there are no longer any missing val
# we lost about 2200 movies because they did not specify a production budge
movies_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 5421 entries, 0 to 7652
Data columns (total 15 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   name      5421 non-null   object
 1   rating    5421 non-null   object
 2   genre     5421 non-null   object
 3   year      5421 non-null   int64
 4   released  5421 non-null   object
 5   score     5421 non-null   float64
 6   votes     5421 non-null   float64
 7   director  5421 non-null   object
 8   writer    5421 non-null   object
 9   star      5421 non-null   object
 10  country   5421 non-null   object
 11  budget    5421 non-null   float64
 12  gross     5421 non-null   float64
 13  company   5421 non-null   object
 14  runtime   5421 non-null   float64
dtypes: float64(5), int64(1), object(9)
memory usage: 677.6+ KB
```

In [7]:
```
movies_df.describe()
```

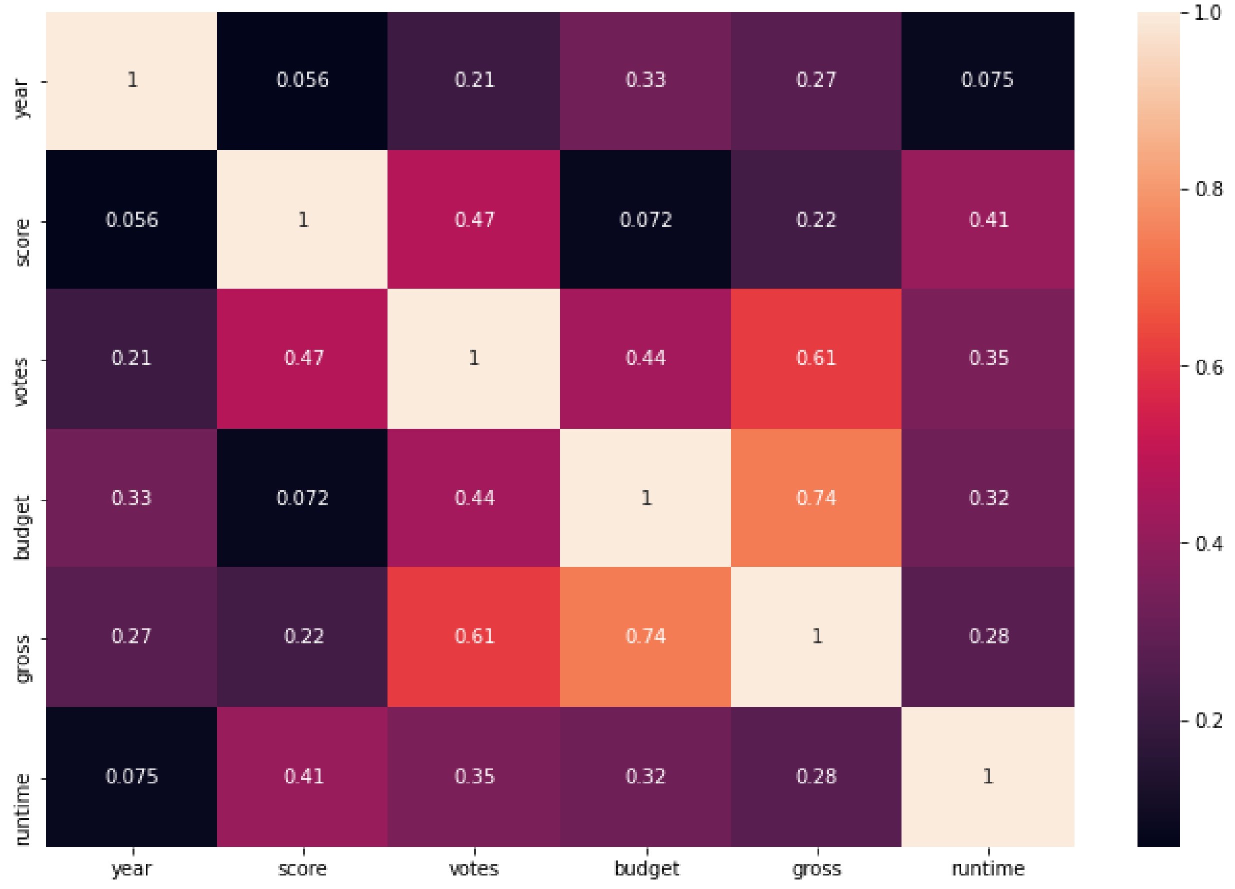
Out[7]:

	year	score	votes	budget	gross	runtime
count	5421.000000	5421.000000	5.421000e+03	5.421000e+03	5.421000e+03	5421.000000
mean	2001.661317	6.392455	1.150661e+05	3.600917e+07	1.032297e+08	108.152739
std	10.540908	0.962730	1.844073e+05	4.157337e+07	1.873027e+08	18.115698
min	1980.000000	1.900000	1.950000e+02	6.000000e+03	3.090000e+02	63.000000
25%	1993.000000	5.800000	1.900000e+04	1.000000e+07	1.073640e+07	95.000000
50%	2002.000000	6.500000	5.200000e+04	2.180000e+07	3.686941e+07	105.000000
75%	2011.000000	7.100000	1.290000e+05	4.500000e+07	1.124625e+08	118.000000
max	2020.000000	9.300000	2.400000e+06	3.560000e+08	2.847246e+09	271.000000

Correlation

In [8]:
```python
# visualize the correlation between columns with a heatmap using seaborn
plt.figure(figsize=(12,8))
sns.heatmap(movies_df.corr(), annot=True)
```

Out[8]:
```
<AxesSubplot:>
```



	year	score	votes	budget	gross	runtime
year	1	0.056	0.21	0.33	0.27	0.075
score	0.056	1	0.47	0.072	0.22	0.41
votes	0.21	0.47	1	0.44	0.61	0.35
budget	0.33	0.072	0.44	1	0.74	0.32
gross	0.27	0.22	0.61	0.74	1	0.28
runtime	0.075	0.41	0.35	0.32	0.28	1

Which month has the highest revenue?

In [9]:
```python
# get a look at the last 10 rows of the data
# all recent movies that released during 2020
movies_df.tail(5)
```

Out[9]:

	name	rating	genre	year	released	score	votes	director	writer	star	cc
7648	Bad Boys for Life	R	Action	2020	January 17, 2020 (United States)	6.6	140000.0	Adil El Arbi	Peter Craig	Will Smith	U S
7649	Sonic the Hedgehog	PG	Action	2020	February 14, 2020 (United States)	6.5	102000.0	Jeff Fowler	Pat Casey	Ben Schwartz	U S
7650	Dolittle	PG	Adventure	2020	January 17, 2020 (United States)	5.6	53000.0	Stephen Gaghan	Stephen Gaghan	Robert Downey Jr.	U S
7651	The Call of the Wild	PG	Adventure	2020	February 21, 2020 (United States)	6.8	42000.0	Chris Sanders	Michael Green	Harrison Ford	C
7652	The Eight Hundred	Not Rated	Action	2020	August 28, 2020 (United States)	6.8	3700.0	Hu Guan	Hu Guan	Zhi-zhong Huang	

The 'released' column is a string object containing parentheses with the country the film was released in

- Will perform data-cleaning to isolate the date on its own and convert to a pandas datetime object

In [10]:
```python
# new column to remove the country of origin from the release date
movies_df['release'] = movies_df['released'].str.split('(').str[0]
movies_df['release']
```

Out[10]:
```
0            June 13, 1980
1             July 2, 1980
2            June 20, 1980
3             July 2, 1980
4            July 25, 1980
                 ...
7648      January 17, 2020
7649     February 14, 2020
7650      January 17, 2020
7651     February 21, 2020
7652       August 28, 2020
Name: release, Length: 5421, dtype: object
```

In [11]:
```
# create a new column called 'release_date' that will be stored as a dateti
movies_df['release_date'] = pd.to_datetime(movies_df['release'])
```

In [12]:
```
# now drop the released and release columns since we have our release_date
movies_df.drop(['released', 'release'], axis=1, inplace=True)
```

In [13]:
```
# get a look at the movies_df now that we created a new release_date column
movies_df
```

Out[13]:

	name	rating	genre	year	score	votes	director	writer	star	coun
0	The Shining	R	Drama	1980	8.4	927000.0	Stanley Kubrick	Stephen King	Jack Nicholson	Uni Kingd
1	The Blue Lagoon	R	Adventure	1980	5.8	65000.0	Randal Kleiser	Henry De Vere Stacpoole	Brooke Shields	Uni Sta
2	Star Wars: Episode V - The Empire Strikes Back	PG	Action	1980	8.7	1200000.0	Irvin Kershner	Leigh Brackett	Mark Hamill	Uni Sta
3	Airplane!	PG	Comedy	1980	7.7	221000.0	Jim Abrahams	Jim Abrahams	Robert Hays	Uni Sta
4	Caddyshack	R	Comedy	1980	7.3	108000.0	Harold Ramis	Brian Doyle-Murray	Chevy Chase	Uni Sta
...	...	...	...	...	...	...	...	...	...	
7648	Bad Boys for Life	R	Action	2020	6.6	140000.0	Adil El Arbi	Peter Craig	Will Smith	Uni Sta
7649	Sonic the Hedgehog	PG	Action	2020	6.5	102000.0	Jeff Fowler	Pat Casey	Ben Schwartz	Uni Sta
7650	Dolittle	PG	Adventure	2020	5.6	53000.0	Stephen Gaghan	Stephen Gaghan	Robert Downey Jr.	Uni Sta
7651	The Call of the Wild	PG	Adventure	2020	6.8	42000.0	Chris Sanders	Michael Green	Harrison Ford	Cana
7652	The Eight Hundred	Not Rated	Action	2020	6.8	3700.0	Hu Guan	Hu Guan	Zhi-zhong Huang	Ch

5421 rows × 15 columns

To get a chart of the average movie gross by month, I first have to create a month column. This 'month' column will be extracted from the recently created release_date column

In [14]:
```python
# create a month column
movies_df['month'] = movies_df['release_date'].dt.month
movies_df
```

Out[14]:

	name	rating	genre	year	score	votes	director	writer	star	coun
0	The Shining	R	Drama	1980	8.4	927000.0	Stanley Kubrick	Stephen King	Jack Nicholson	Uni Kingd
1	The Blue Lagoon	R	Adventure	1980	5.8	65000.0	Randal Kleiser	Henry De Vere Stacpoole	Brooke Shields	Uni Sta
2	Star Wars: Episode V - The Empire Strikes Back	PG	Action	1980	8.7	1200000.0	Irvin Kershner	Leigh Brackett	Mark Hamill	Uni Sta
3	Airplane!	PG	Comedy	1980	7.7	221000.0	Jim Abrahams	Jim Abrahams	Robert Hays	Uni Sta
4	Caddyshack	R	Comedy	1980	7.3	108000.0	Harold Ramis	Brian Doyle-Murray	Chevy Chase	Uni Sta
...	...	...	...	...	...	...	...	...	...	
7648	Bad Boys for Life	R	Action	2020	6.6	140000.0	Adil El Arbi	Peter Craig	Will Smith	Uni Sta
7649	Sonic the Hedgehog	PG	Action	2020	6.5	102000.0	Jeff Fowler	Pat Casey	Ben Schwartz	Uni Sta
7650	Dolittle	PG	Adventure	2020	5.6	53000.0	Stephen Gaghan	Stephen Gaghan	Robert Downey Jr.	Uni Sta
7651	The Call of the Wild	PG	Adventure	2020	6.8	42000.0	Chris Sanders	Michael Green	Harrison Ford	Cana
7652	The Eight Hundred	Not Rated	Action	2020	6.8	3700.0	Hu Guan	Hu Guan	Zhi-zhong Huang	Ch

5421 rows × 16 columns

In [15]:
```python
# create a condensed dataframe that will be used to hold the release month
month_release = movies_df['release_date'].dt.month
month_release = pd.DataFrame(month_release)
```

In [16]:
```
month_release
```

Out[16]:

	release_date
0	6
1	7
2	6
3	7
4	7
...	...
7648	1
7649	2
7650	1
7651	2
7652	8

5421 rows × 1 columns

In [17]:
```
# create a 'gross' column in our condensed dataframe
# the 'gross' column will be the same as the original 'gross' column from t
month_release['gross'] = movies_df['gross']
month_release
```

Out[17]:

	release_date	gross
0	6	46998772.0
1	7	58853106.0
2	6	538375067.0
3	7	83453539.0
4	7	39846344.0
...	...	...
7648	1	426505244.0
7649	2	319715683.0
7650	1	245487753.0
7651	2	111105497.0
7652	8	461421559.0

5421 rows × 2 columns

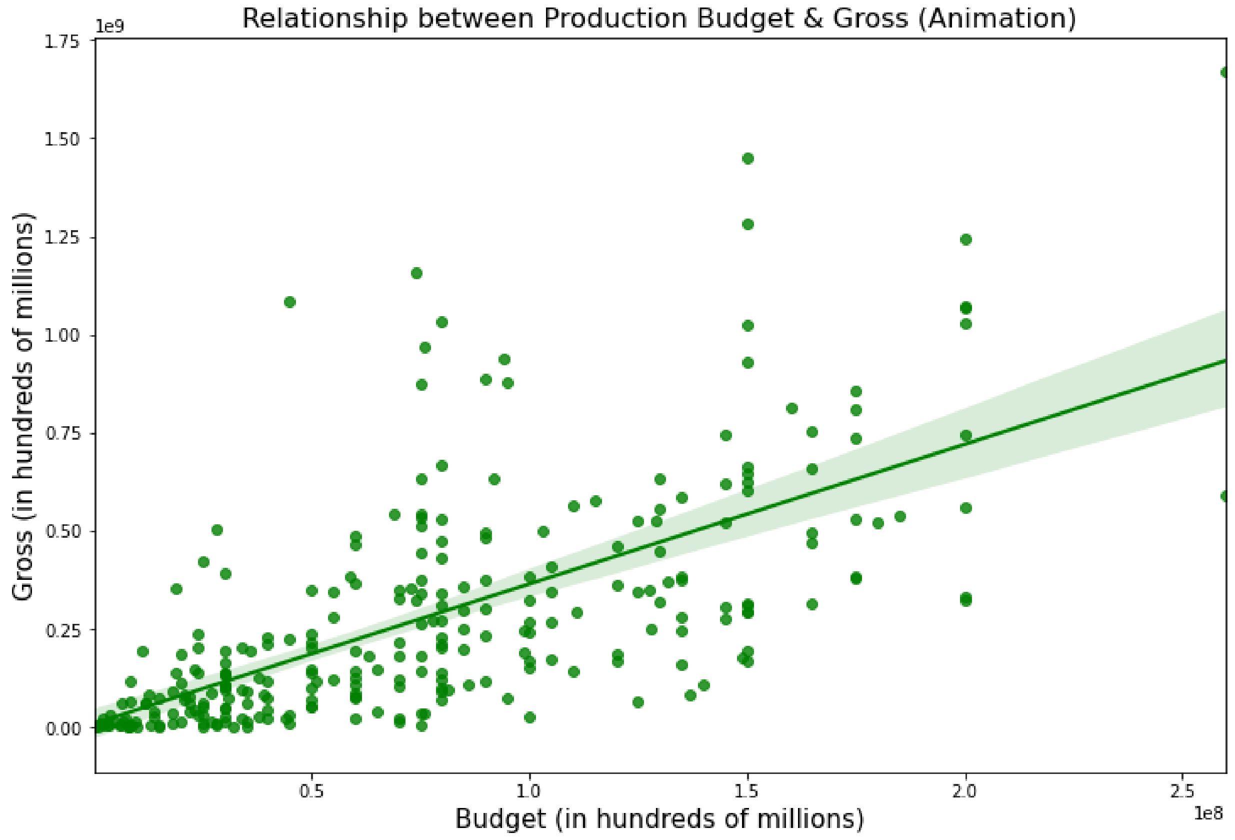
```
In [18]: # use groupby method to get the average 'gross' by each month
         mean_revenue = month_release.groupby('release_date').mean()
         mean_revenue
```

```
Out[18]:
                        gross
         release_date
                    1   6.263414e+07
                    2   7.407725e+07
                    3   8.771098e+07
                    4   7.240579e+07
                    5   1.697053e+08
                    6   1.672293e+08
                    7   1.519452e+08
                    8   6.736884e+07
                    9   5.390261e+07
                   10   5.996056e+07
                   11   1.333690e+08
                   12   1.544489e+08
```

Visualizations

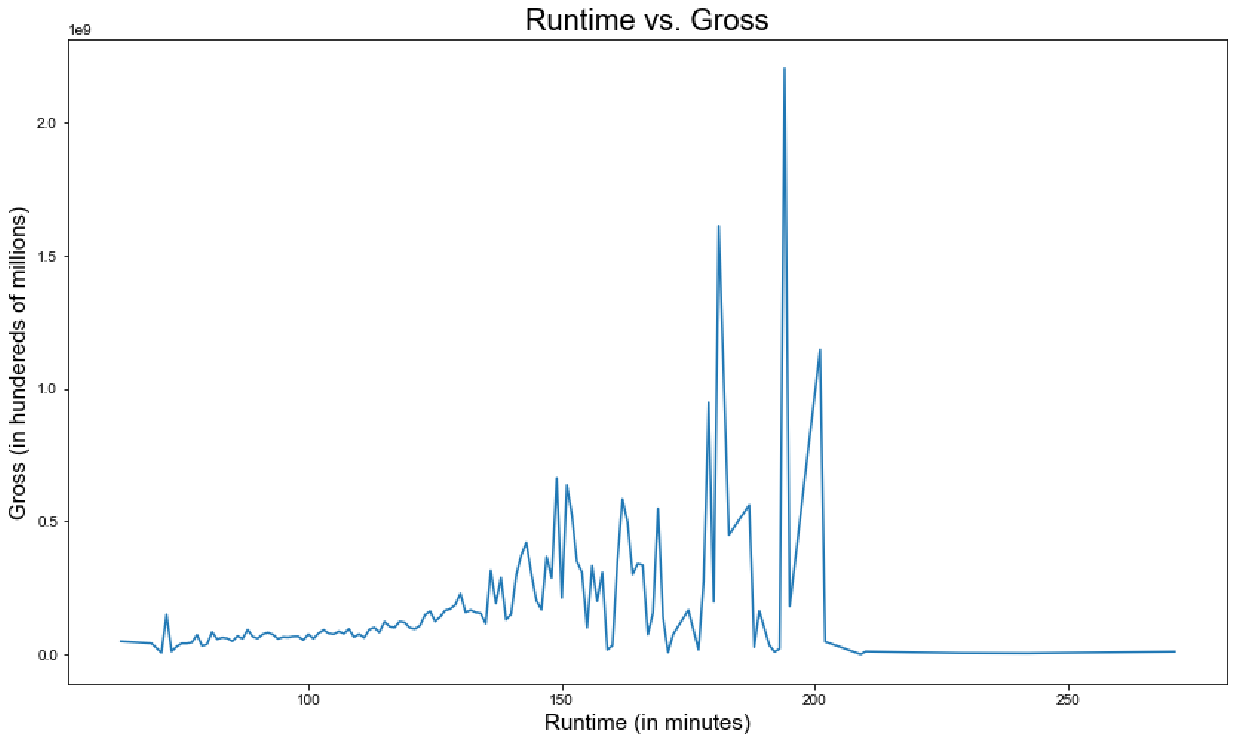
Production budget vs. Gross

In [19]:
```
# using a regression plot to analyze relationship between production budget
plt.figure(figsize=(12,8))

# use seaborn to create the regression plot
sns.regplot(x=movies_df[movies_df['genre']=='Animation']['budget'],y=movies

# add title and axes labels
plt.title('Relationship between Production Budget & Gross (Animation)', fon
plt.xlabel('Budget (in hundreds of millions)', fontsize=15)
plt.ylabel('Gross (in hundreds of millions)', fontsize=15)

plt.savefig('Graphs/Animation_regplot.png')
```



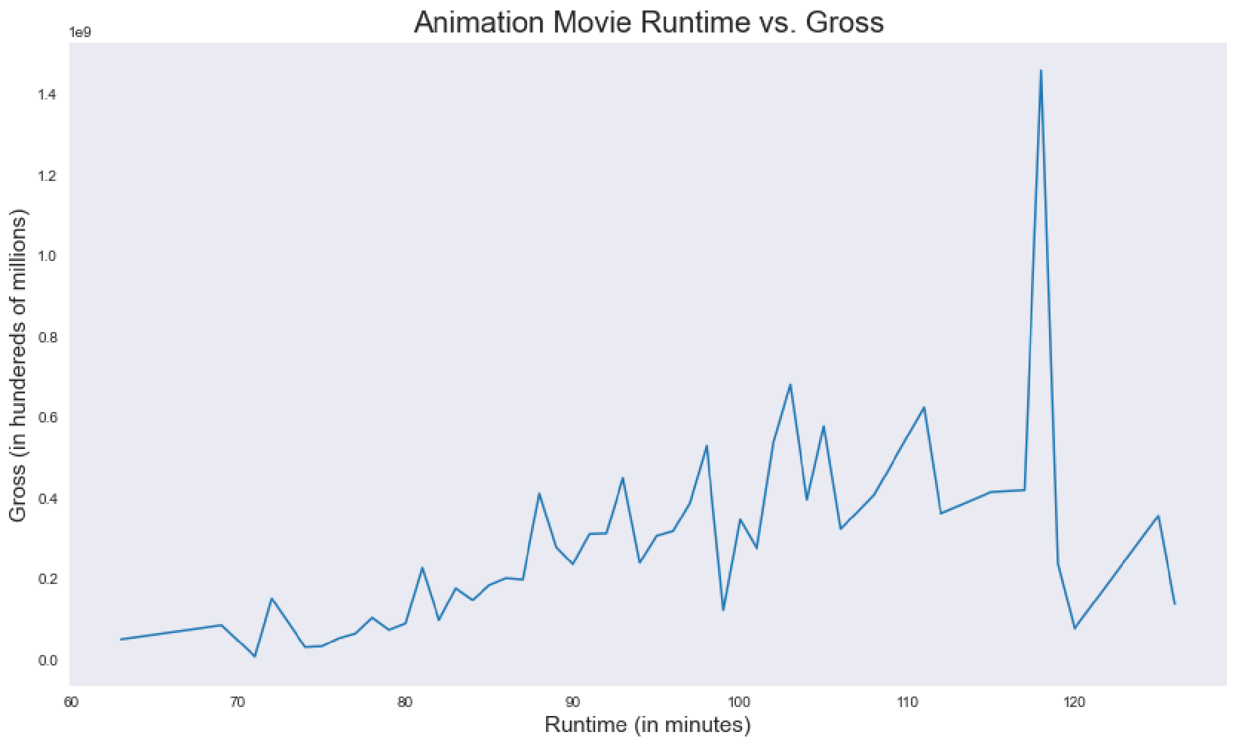
Runtime vs. Gross

```
In [20]: # create a lineplot using seaborn to visualize relationship between runtime
         plt.figure(figsize=(14, 8))
         sns.lineplot(x=movies_df['runtime'],y=movies_df['gross'], ci=None)

         # title and axes labels
         sns.set_style('dark')
         plt.title('Runtime vs. Gross', fontsize=20)
         plt.xlabel('Runtime (in minutes)', fontsize=15)
         plt.ylabel('Gross (in hundereds of millions)', fontsize=15)

         #plt.savefig('Runtime_Gross.png')
         plt.show()
```



Animation Runtime vs. Gross

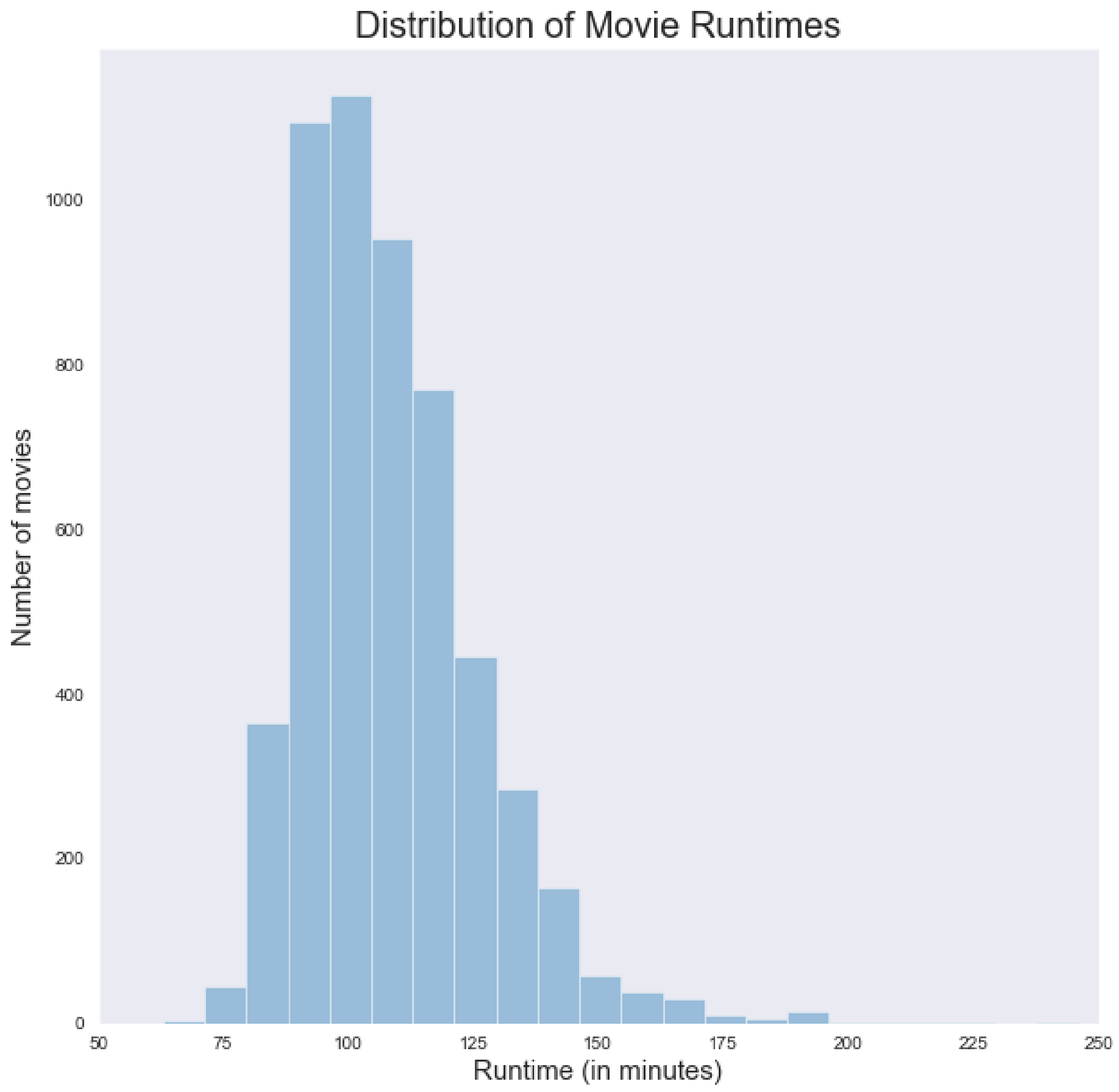
In [21]:
```
# create a lineplot using seaborn to visualize relationship between runtime
plt.figure(figsize=(14, 8))
sns.lineplot(x=movies_df[movies_df['genre']=='Animation']['runtime'],y=movi

# title and axes labels
sns.set_style('dark')
plt.title('Animation Movie Runtime vs. Gross', fontsize=20)
plt.xlabel('Runtime (in minutes)', fontsize=15)
plt.ylabel('Gross (in hundereds of millions)', fontsize=15)
plt.show()
```



Distribution of Runtime

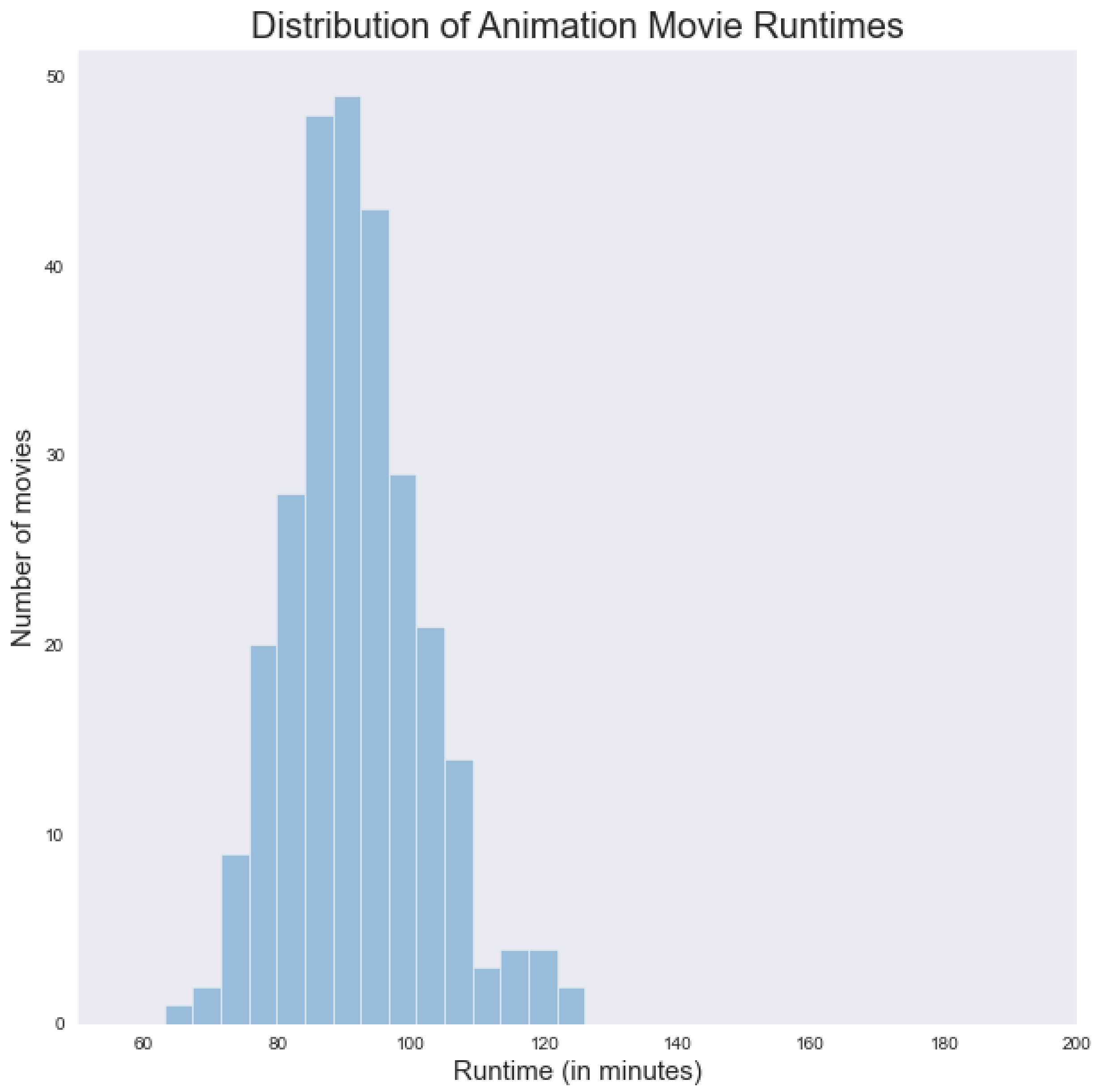
In [22]:
```
# distribution plot to visualize the movies by runtime (in minutes)
plt.figure(figsize=(10,10))
movie_runs = sns.distplot(movies_df['runtime'], kde=False, bins=25)

movie_runs.set_xlim(50, 250, 25)
# add title and axes labels
plt.title('Distribution of Movie Runtimes', fontsize=20)
plt.xlabel('Runtime (in minutes)', fontsize=15)
plt.ylabel('Number of movies', fontsize=15)

#plt.savefig('RuntimeDistribution.png')
plt.show()
```

```
/Users/nobletang/opt/anaconda3/envs/learn-env/lib/python3.8/site-package
s/seaborn/distributions.py:2551: FutureWarning: `distplot` is a deprecate
d function and will be removed in a future version. Please adapt your cod
e to use either `displot` (a figure-level function with similar flexibili
ty) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```



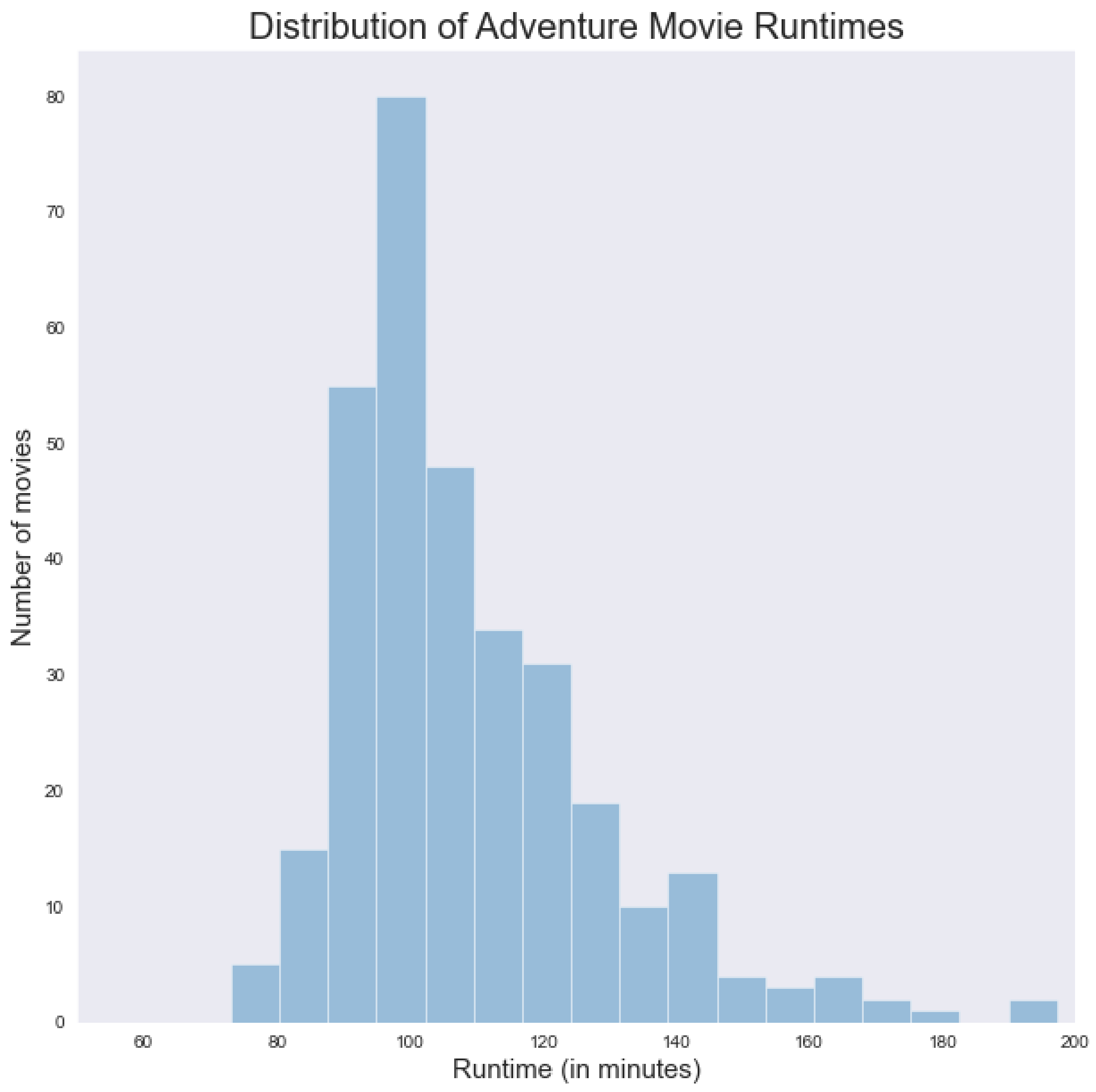
Distribution of Runtime for Animation Movies

In [23]:
```
# distribution plot to visualize the animation movies by runtime (in minute
plt.figure(figsize=(10,10))
animation = sns.distplot(movies_df[movies_df['genre']=='Animation']['runtim

animation.set_xlim(50, 200)
# add title and axes labels
plt.title('Distribution of Animation Movie Runtimes', fontsize=20)
plt.xlabel('Runtime (in minutes)', fontsize=15)
plt.ylabel('Number of movies', fontsize=15)

# save image
#plt.savefig('Graphs/animation_distribution.png')
plt.show()
```



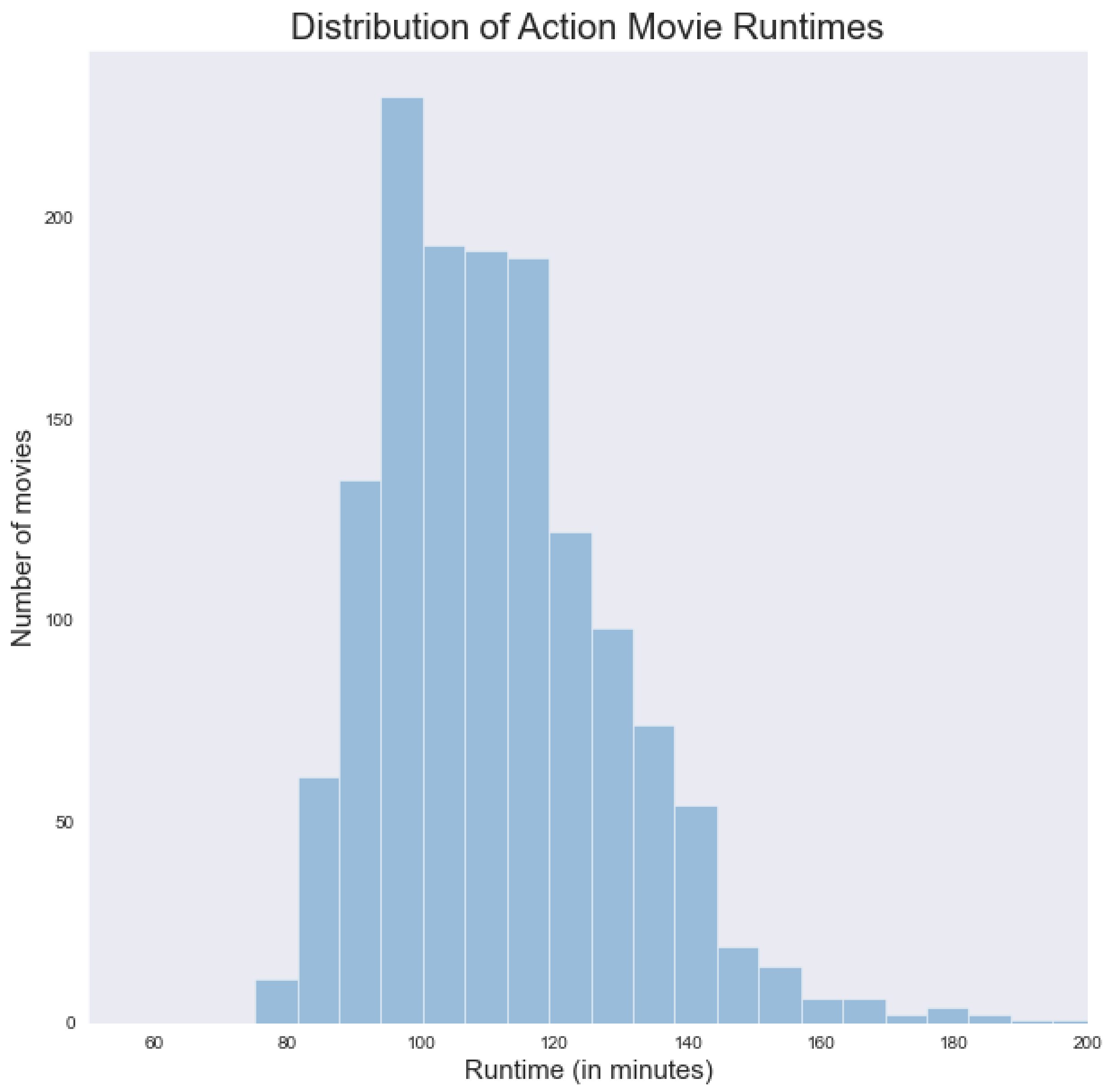
Distribution of Runtime for Adventure Movies

In [24]:
```
# distribution plot to visualize the adventure movies by runtime (in minute
plt.figure(figsize=(10,10))
adventure = sns.distplot(movies_df[movies_df['genre']=='Adventure']['runtim
adventure.set_xlim(50, 200)
# add title and axes labels
plt.title('Distribution of Adventure Movie Runtimes', fontsize=20)
plt.xlabel('Runtime (in minutes)', fontsize=15)
plt.ylabel('Number of movies', fontsize=15)

# save image
#plt.savefig('Graphs/adventure_distribution.png')
plt.show()
```



Distribution of Runtime for Action Movies

```
In [25]: # distribution plot to visualize the animation movies by runtime (in minute
         plt.figure(figsize=(10,10))
         action = sns.distplot(movies_df[movies_df['genre']=='Action']['runtime'], k
         action.set_xlim(50,200)
         # add title and axes labels
         plt.title('Distribution of Action Movie Runtimes', fontsize=20)
         plt.xlabel('Runtime (in minutes)', fontsize=15)
         plt.ylabel('Number of movies', fontsize=15)

         # save fig
         #plt.savefig('Graphs/action_distribution.png')
         plt.show()
```



Genres by Avg. Gross

In [26]:
```
# check the value counts of each genre
# genres with less than 10 movies may be misleading on a visualization
movies_df['genre'].value_counts()
```

Out[26]:
```
Comedy       1496
Action       1415
Drama         863
Crime         399
Adventure     327
Biography     311
Animation     277
Horror        251
Fantasy        41
Mystery        17
Thriller        7
Sci-Fi          6
Romance         5
Family          4
Western         2
Name: genre, dtype: int64
```

In [27]:
```
# group the dataset by genre and store into a separate variable
genre_groupby = movies_df.groupby('genre')
genre_groupby = genre_groupby.describe()['gross'].sort_values('mean', ascen
genre_groupby
```

Out[27]:
```
genre
Animation    2.811044e+08
Action       1.680232e+08
Adventure    1.332682e+08
Mystery      1.178877e+08
Biography    6.139527e+07
Drama        6.036914e+07
Comedy       5.916766e+07
Horror       5.681695e+07
Crime        5.016958e+07
Thriller     4.248814e+07
Fantasy      3.987870e+07
Sci-Fi       3.761010e+07
Romance      3.357538e+07
Western      1.001294e+07
Name: mean, dtype: float64
```

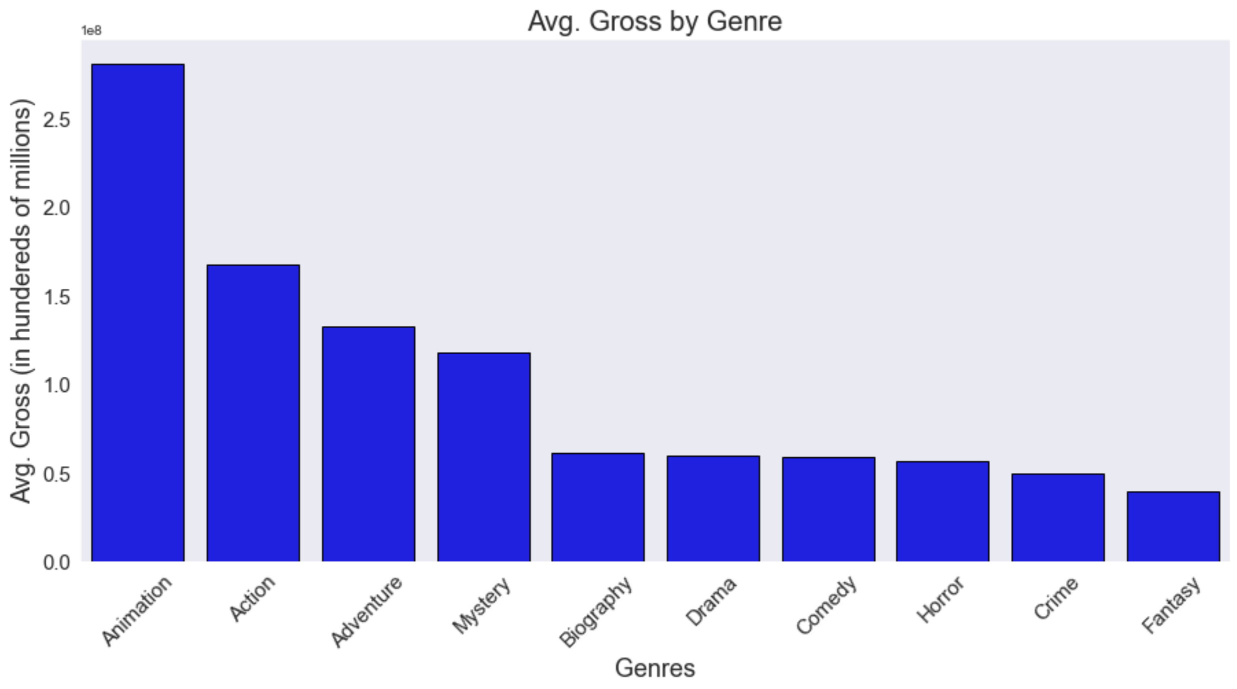
In [28]:
```
x = genre_groupby.index[:11]
x
```

Out[28]:
```
Index(['Animation', 'Action', 'Adventure', 'Mystery', 'Biography', 'Dram
a',
       'Comedy', 'Horror', 'Crime', 'Thriller', 'Fantasy'],
      dtype='object', name='genre')
```

```
In [29]: y = genre_groupby.values[:11]
         y

Out[29]: array([2.81104365e+08, 1.68023229e+08, 1.33268232e+08, 1.17887733e+08,
                6.13952743e+07, 6.03691365e+07, 5.91676588e+07, 5.68169523e+07,
                5.01695794e+07, 4.24881411e+07, 3.98786978e+07])

In [30]: # check the length of x to make sure they match for the barchart
         len(x)

Out[30]: 11

In [31]: # check the length of y to make sure they match the barchart
         len(y)

Out[31]: 11

In [32]: # delete the thriller and its value from both lists because it only has 7 m
         x = list(x)
         x.pop(-2)

Out[32]: 'Thriller'

In [33]: len(x)

Out[33]: 10

In [34]: # do the same for y
         y = list(y)
         y.pop(-2)

Out[34]: 42488141.14285714

In [35]: len(y)

Out[35]: 10
```

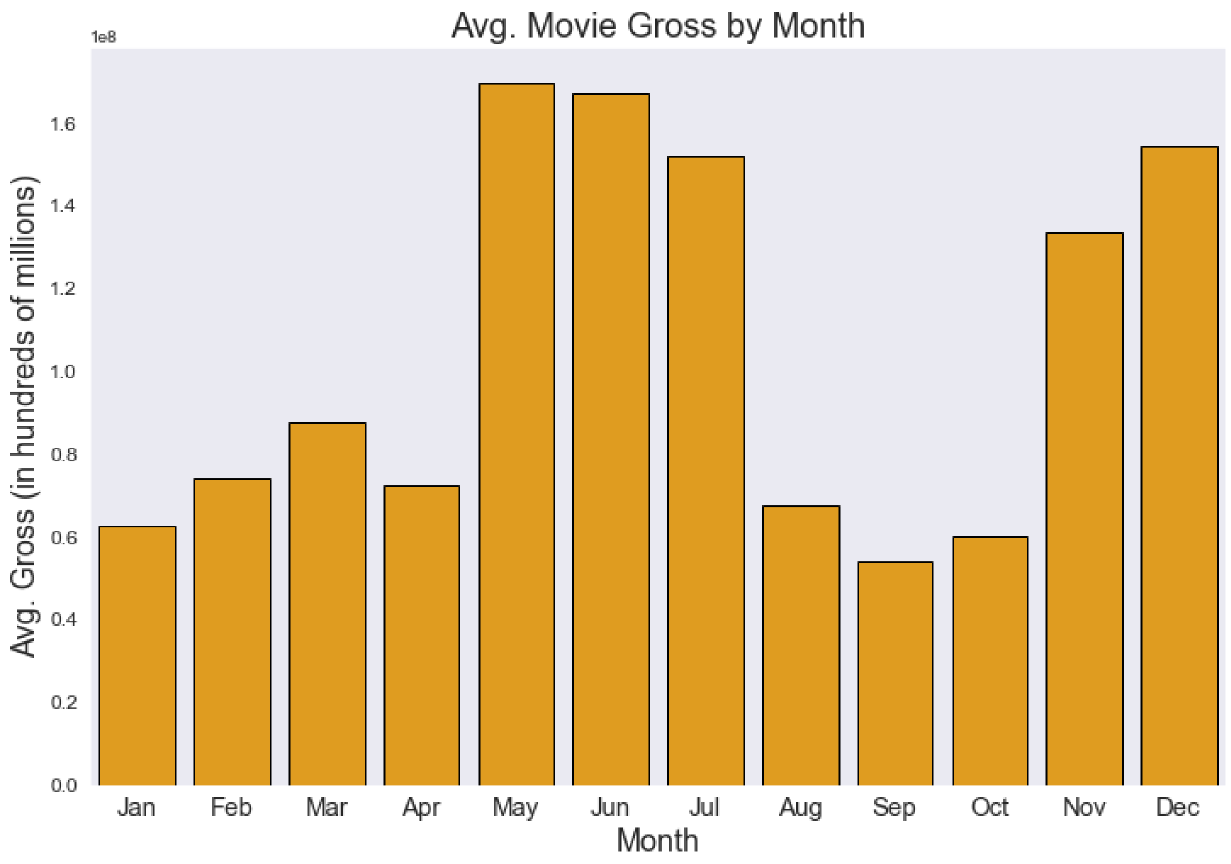
In [36]:
```python
# barchart to show avg. gross by genre
# using seaborn module
plt.figure(figsize=(15,7))
sns.barplot(x, y, color='blue', edgecolor='black')

# add title and axes labels
# rotating x-tick labels and editing fontsize so that is is readable
plt.title('Avg. Gross by Genre', fontsize=20)
plt.xlabel('Genres', fontsize=18)
plt.ylabel('Avg. Gross (in hundereds of millions)', fontsize=18)
plt.xticks(rotation=45, fontsize=15)
plt.yticks(fontsize=15)

plt.savefig('Graphs/Gross_by_Genre2.png')
plt.show()
```

```
/Users/nobletang/opt/anaconda3/envs/learn-env/lib/python3.8/site-package
s/seaborn/_decorators.py:36: FutureWarning: Pass the following variables
as keyword args: x, y. From version 0.12, the only valid positional argum
ent will be `data`, and passing other arguments without an explicit keywo
rd will result in an error or misinterpretation.
  warnings.warn(
```



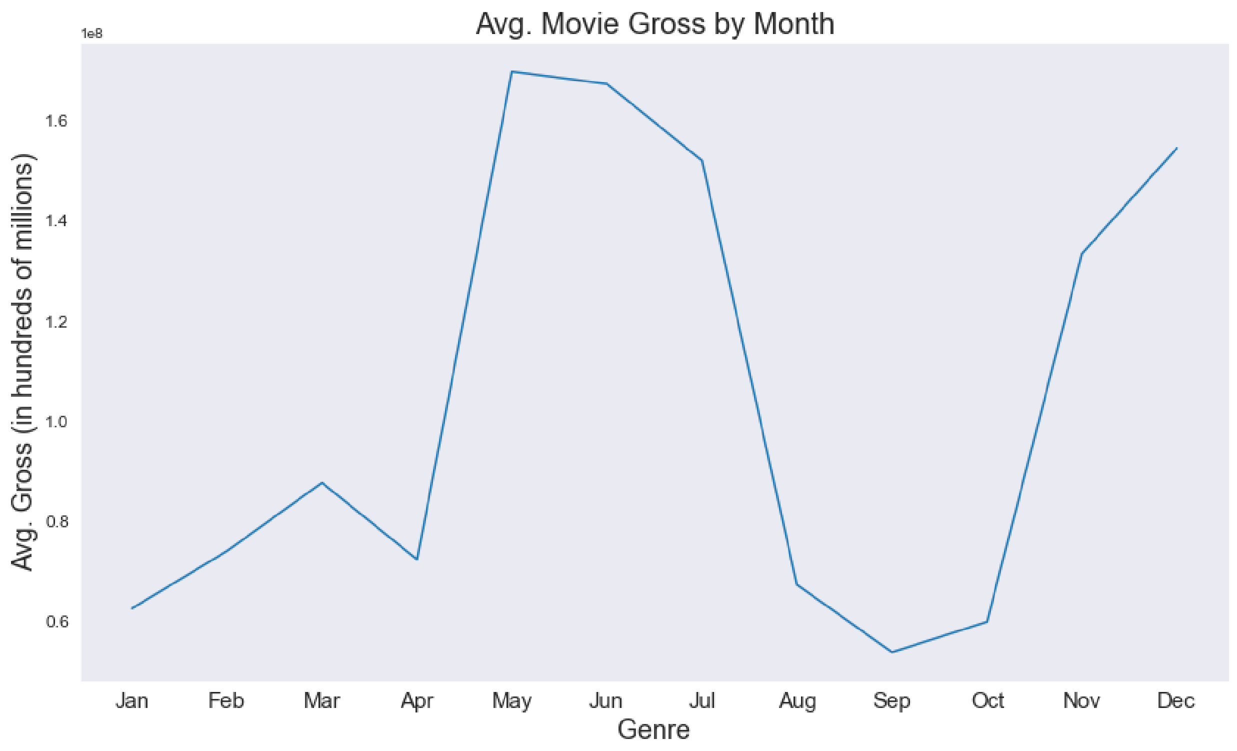
Mean Revenue by Month

In [37]:
```python
# month column is currently stored as numbers
# hard-coded labels to add as x-tick labels
x_tick_labels = ['Jan','Feb','Mar','Apr','May','Jun','Jul','Aug','Sep','Oct

# using seaborn library to create barchart of avg. gross by month
plt.figure(figsize=(12,8))
sns.barplot(x=x_tick_labels, y=mean_revenue['gross'], color='orange', edgec

# add title and axes labels
plt.title('Avg. Movie Gross by Month', fontsize=20)
plt.xlabel('Month', fontsize=18)
plt.ylabel('Avg. Gross (in hundreds of millions)',fontsize=18)
plt.xticks(fontsize=15)
plt.yticks(fontsize=12)

#plt.savefig('AvgGross_Month.png')
plt.show()
```



Alternative visualization to the barchart above. Instead, visualizing the same data using a lineplot with seaborn

In [38]:
```
# lineplot using seaborn
plt.figure(figsize=(14, 8))
sns.lineplot(x=x_tick_labels,y=mean_revenue['gross'], ci=None)

# title and axes labels
sns.set_style('darkgrid')
plt.title('Avg. Movie Gross by Month', fontsize=20)
plt.xlabel('Genre', fontsize=18)
plt.ylabel('Avg. Gross (in hundreds of millions)',fontsize=18)
plt.xticks(fontsize=15)
plt.yticks(fontsize=12)

#plt.savefig('AvgGross_Month_line.png')
plt.show()
```



In [39]:
```
movies_df[movies_df['genre']=='Animation']['runtime'].mean()
```

Out[39]:
```
91.57039711191335
```