In [1]:

```
import pandas as pd
import sqlite3
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:

```
df = pd.read_csv('bom.movie_gross.csv.')
df.head()
# df.shape
```

Out[2]:

	title	studio	domestic_gross	foreign_gross	year
0	Toy Story 3	BV	415000000.0	652000000	2010
1	Alice in Wonderland (2010)	BV	334200000.0	691300000	2010
2	Harry Potter and the Deathly Hallows Part 1	WB	296000000.0	664300000	2010
3	Inception	WB	292600000.0	535700000	2010
4	Shrek Forever After	P/DW	238700000.0	513900000	2010

In [3]:

```

titles = df.title.unique()
len(titles)
### There are no repeats
```

Out[3]:

```
3386
```

In [4]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3387 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3387 non-null   object 
 1   studio          3382 non-null   object 
 2   domestic_gross  3359 non-null   float64
 3   foreign_gross   2037 non-null   object 
 4   year            3387 non-null   int64  
dtypes: float64(1), int64(1), object(3)
memory usage: 132.4+ KB
```

In [5]:

```
df['foriegn_int'] = pd.to_numeric(df.foreign_gross.str.replace(',',''))

df['Total_Gross_Millions'] = (df.domestic_gross + df.foriegn_int) / 100000
df.head()
```

Out[5]:

	title	studio	domestic_gross	foreign_gross	year	foriegn_int	Total_Gross_Milli
0	Toy Story 3	BV	415000000.0	652000000	2010	652000000.0	106
1	Alice in Wonderland (2010)	BV	334200000.0	691300000	2010	691300000.0	102
2	Harry Potter and the Deathly Hallows Part 1	WB	296000000.0	664300000	2010	664300000.0	96
3	Inception	WB	292600000.0	535700000	2010	535700000.0	82
4	Shrek Forever After	P/DW	238700000.0	513900000	2010	513900000.0	75

In [6]:

```
df_moviebudgets = pd.read_csv('tn.movie_budgets.csv', index_col=0)
df_moviebudgets.head()
```

Out[6]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross
id					
1	Dec 18, 2009	Avatar	$425,000,000	$760,507,625	$2,776,345,279
2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	$410,600,000	$241,063,875	$1,045,663,875
3	Jun 7, 2019	Dark Phoenix	$350,000,000	$42,762,350	$149,762,350
4	May 1, 2015	Avengers: Age of Ultron	$330,600,000	$459,005,868	$1,403,013,963
5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	$317,000,000	$620,181,382	$1,316,721,747

In [7]:

```
df_moviebudgets.shape
```

Out[7]:

```
(5782, 5)
```

In [8]:

```
movie = df_moviebudgets.movie.unique()
len(movie)
### There are a few duplicates
```

Out[8]:

```
5698
```

In [9]:

```
# df_reviews = pd.read_csv('rt.reviews.tsv',sep = '\t')
df_movieinfo = pd.read_table('rt.movie_info.tsv', index_col=0)
df_movieinfo.head()
```

Out[9]:

	synopsis	rating	genre	director	writer	theater_date
id						
1	This gritty, fast-paced, and innovative police...	R	Action and Adventure|Classics|Drama	William Friedkin	Ernest Tidyman	Oct 9, 1971
3	New York City, not-too-distant-future: Eric Pa...	R	Drama|Science Fiction and Fantasy	David Cronenberg	David Cronenberg|Don DeLillo	Aug 17, 2012
5	Illeana Douglas delivers a superb performance ...	R	Drama|Musical and Performing Arts	Allison Anders	Allison Anders	Sep 13, 1996
6	Michael Douglas runs afoul of a treacherous su...	R	Drama|Mystery and Suspense	Barry Levinson	Paul Attanasio|Michael Crichton	Dec 9, 1994
7	NaN	NR	Drama|Romance	Rodney Bennett	Giles Cooper	NaN

In [10]:

```
### Connect to the IMDB Database
conn = sqlite3.connect('im.db')
```

In [11]:

```
q = """
SELECT *
FROM movie_basics
JOIN movie_ratings USING(movie_id)
;
"""
x = pd.read_sql(q, conn)
pd.read_sql(q, conn)
```

Out[11]:

	movie_id	primary_title	original_title	start_year	runtime_minutes	ge
0	tt0063540	Sunghursh	Sunghursh	2013	175.0	Action,Crime,Dr
1	tt0066787	One Day Before the Rainy Season	Ashad Ka Ek Din	2019	114.0	Biography,Dr
2	tt0069049	The Other Side of the Wind	The Other Side of the Wind	2018	122.0	Dr
3	tt0069204	Sabse Bada Sukh	Sabse Bada Sukh	2018	NaN	Comedy,Dr
4	tt0100275	The Wandering Soap Opera	La Telenovela Errante	2017	80.0	Comedy,Drama,Far
...	...	...	...	...	...	
73851	tt9913084	Diabolik sono io	Diabolik sono io	2019	75.0	Docume
73852	tt9914286	Sokagin Çocuklari	Sokagin Çocuklari	2019	98.0	Drama,Fa
73853	tt9914642	Albatross	Albatross	2017	NaN	Docume
73854	tt9914942	La vida sense la Sara Amat	La vida sense la Sara Amat	2019	NaN	I
73855	tt9916160	Drømmeland	Drømmeland	2019	72.0	Docume

73856 rows × 8 columns

In [12]:
```
df_budgets = pd.read_csv('tn.movie_budgets.csv',index_col=0)
df_budgets.head()
```

Out[12]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross
id					
1	Dec 18, 2009	Avatar	$425,000,000	$760,507,625	$2,776,345,279
2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	$410,600,000	$241,063,875	$1,045,663,875
3	Jun 7, 2019	Dark Phoenix	$350,000,000	$42,762,350	$149,762,350
4	May 1, 2015	Avengers: Age of Ultron	$330,600,000	$459,005,868	$1,403,013,963
5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	$317,000,000	$620,181,382	$1,316,721,747

In [13]:
```
df_budgets['budget_millions'] = df_budgets.production_budget.str.replace(
df_budgets['budget_millions'] = df_budgets.budget_millions.str.replace('$
df_budgets['budget_millions'] = pd.to_numeric(df_budgets.budget_millions)
df_budgets.head()
```

```
C:\Users\deapillai\AppData\Local\Temp\ipykernel_38760\2653470430.py:2: F
utureWarning: The default value of regex will change from True to False
in a future version. In addition, single character regular expressions w
ill *not* be treated as literal strings when regex=True.
  df_budgets['budget_millions'] = df_budgets.budget_millions.str.replace
('$','')
```

Out[13]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross	budget_
id						
1	Dec 18, 2009	Avatar	$425,000,000	$760,507,625	$2,776,345,279	
2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	$410,600,000	$241,063,875	$1,045,663,875	
3	Jun 7, 2019	Dark Phoenix	$350,000,000	$42,762,350	$149,762,350	
4	May 1, 2015	Avengers: Age of Ultron	$330,600,000	$459,005,868	$1,403,013,963	
5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	$317,000,000	$620,181,382	$1,316,721,747	

In [14]:

```
### Create Dataframe

df_runtime_minutes = pd.merge(x,df_budgets,how='inner',left_on = 'primary_
df_runtime_minutes.head()
```

Out[14]:

	movie_id	primary_title	original_title	start_year	runtime_minutes	gen
0	tt0249516	Foodfight!	Foodfight!	2012	91.0	Action,Animation,Com
1	tt0326592	The Overnight	The Overnight	2010	88.0	N
2	tt3844362	The Overnight	The Overnight	2015	79.0	Comedy,Myst
3	tt0337692	On the Road	On the Road	2012	124.0	Adventure,Drama,Roma
4	tt4339118	On the Road	On the Road	2014	89.0	Dra

In [15]:

```
df_runtime = df_runtime_minutes.drop_duplicates(subset=['movie'],
                                                  inplace=False)
df_runtime.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2126 entries, 0 to 2874
Data columns (total 14 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   movie_id           2126 non-null   object 
 1   primary_title      2126 non-null   object 
 2   original_title     2126 non-null   object 
 3   start_year         2126 non-null   int64  
 4   runtime_minutes    2072 non-null   float64
 5   genres             2124 non-null   object 
 6   averagerating      2126 non-null   float64
 7   numvotes           2126 non-null   int64  
 8   release_date       2126 non-null   object 
 9   movie              2126 non-null   object 
 10  production_budget  2126 non-null   object 
 11  domestic_gross     2126 non-null   object 
 12  worldwide_gross    2126 non-null   object 
 13  budget_millions    2126 non-null   float64
dtypes: float64(3), int64(2), object(9)
memory usage: 249.1+ KB
```

In [16]:

```
import seaborn as sns
import scipy.stats as stats
```

In [17]:

```
df_runtime.describe()
```

Out[17]:

	start_year	runtime_minutes	averagerating	numvotes	budget_millions
count	2126.000000	2072.000000	2126.000000	2.126000e+03	2126.000000
mean	2013.561148	103.881757	6.231232	8.212615e+04	37.163874
std	2.512421	18.760685	1.142910	1.465604e+05	51.129898
min	2010.000000	5.000000	1.600000	5.000000e+00	0.001400
25%	2011.000000	91.000000	5.600000	7.930000e+02	5.000000
50%	2013.000000	102.000000	6.300000	2.344900e+04	18.250000
75%	2015.000000	114.000000	7.000000	9.486275e+04	45.000000
max	2019.000000	180.000000	9.200000	1.841066e+06	425.000000

In [18]:

```
pd.options.mode.chained_assignment = None
```

In [19]:

```
#Domestic
df_runtime['domestic_millions'] = df_runtime.domestic_gross.str.replace('
df_runtime['domestic_millions'] = df_runtime.domestic_millions.str.replace
df_runtime['domestic_millions'] = pd.to_numeric(df_runtime.domestic_millio
# # #Worldwide
df_runtime['worldwide_millions'] = df_runtime.worldwide_gross.str.replace(
df_runtime['worldwide_millions'] = df_runtime.worldwide_millions.str.repla
df_runtime['worldwide_millions'] = pd.to_numeric(df_runtime.worldwide_mill
```

```
C:\Users\deapillai\AppData\Local\Temp\ipykernel_38760\2282399076.py:3: F
utureWarning: The default value of regex will change from True to False
in a future version. In addition, single character regular expressions w
ill *not* be treated as literal strings when regex=True.
  df_runtime['domestic_millions'] = df_runtime.domestic_millions.str.rep
lace('$','')
C:\Users\deapillai\AppData\Local\Temp\ipykernel_38760\2282399076.py:7: F
utureWarning: The default value of regex will change from True to False
in a future version. In addition, single character regular expressions w
ill *not* be treated as literal strings when regex=True.
  df_runtime['worldwide_millions'] = df_runtime.worldwide_millions.str.r
eplace('$','')
```

In [20]:

```
df_runtime['domestic_millions'] = pd.to_numeric(df_runtime.domestic_millio
df_runtime['worldwide_millions'] = pd.to_numeric(df_runtime.worldwide_mill
```

In [21]:

```
df_runtime['production_budget'] = df_runtime.production_budget.str.replace
df_runtime['production_budget'] = df_runtime.production_budget.str.replace
df_runtime['production_budget'] = pd.to_numeric(df_runtime.production_budg
```

```
C:\Users\deapillai\AppData\Local\Temp\ipykernel_38760\1529873331.py:2: F
utureWarning: The default value of regex will change from True to False
in a future version. In addition, single character regular expressions w
ill *not* be treated as literal strings when regex=True.
  df_runtime['production_budget'] = df_runtime.production_budget.str.rep
lace('$','')
```

In [22]:

```
df_runtime['production_budget'] = pd.to_numeric(df_runtime.production_budg
```

In [23]:

```
df_runtime['ROI'] = (df_runtime.worldwide_millions - df_runtime.productior
```

In [24]:

```
df_runtime.ROI.describe()
```

Out[24]:

```
count    2126.000000
mean        2.627956
std        13.627146
min        -1.000000
25%        -0.635096
50%         0.685090
75%         2.644018
max       415.564740
Name: ROI, dtype: float64
```

In [25]:

```
df_runtime.head()
```

Out[25]:

	movie_id	primary_title	original_title	start_year	runtime_minutes	gen
0	tt0249516	Foodfight!	Foodfight!	2012	91.0	Action,Animation,Com
1	tt0326592	The Overnight	The Overnight	2010	88.0	N
3	tt0337692	On the Road	On the Road	2012	124.0	Adventure,Drama,Roma
6	tt0359950	The Secret Life of Walter Mitty	The Secret Life of Walter Mitty	2013	114.0	Adventure,Comedy,Dra
7	tt0365907	A Walk Among the Tombstones	A Walk Among the Tombstones	2014	114.0	Action,Crime,Dra

In [26]:

```
df_runtime['runtime_minutes'].mean()
```

Out[26]:

```
103.88175675675676
```

In [27]:
```
import seaborn as sns
```

In [28]:
```
df_runtime.rename(columns={"production_budget":"budget_millions"})
```

Out[28]:

	movie_id	primary_title	original_title	start_year	runtime_minutes	
0	tt0249516	Foodfight!	Foodfight!	2012	91.0	Action,Animation,C
1	tt0326592	The Overnight	The Overnight	2010	88.0	
3	tt0337692	On the Road	On the Road	2012	124.0	Adventure,Drama,Rc
6	tt0359950	The Secret Life of Walter Mitty	The Secret Life of Walter Mitty	2013	114.0	Adventure,Comedy
7	tt0365907	A Walk Among the Tombstones	A Walk Among the Tombstones	2014	114.0	Action,Crime
...	...	...	...	...	...	
2870	tt8680254	Richard III	Richard III	2016	NaN	
2871	tt8824064	Heroes	Heroes	2019	88.0	Docun
2872	tt8976772	Push	Push	2019	92.0	Docun
2873	tt9024106	Unplanned	Unplanned	2019	106.0	Biography
2874	tt9248762	The Terrorist	The Terrorist	2018	NaN	

2126 rows × 17 columns

In [29]:
```
df_runtime.head()
```

Out[29]:

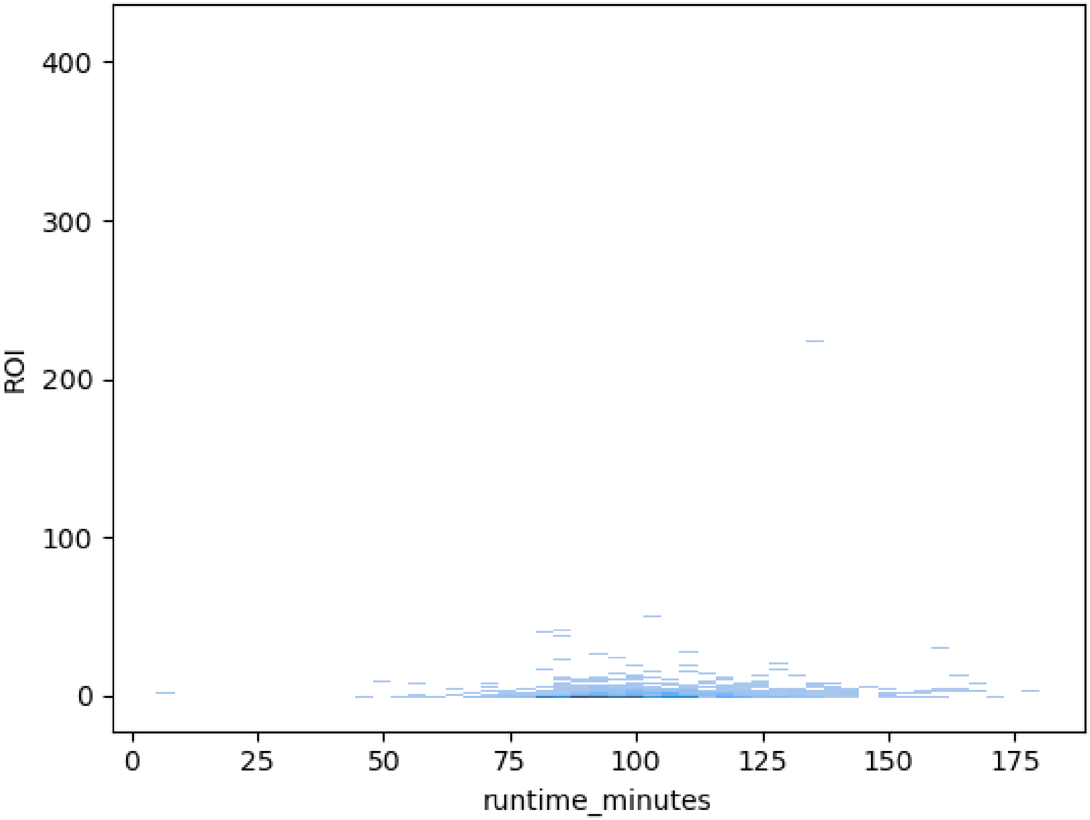
	movie_id	primary_title	original_title	start_year	runtime_minutes	gen
0	tt0249516	Foodfight!	Foodfight!	2012	91.0	Action,Animation,Com
1	tt0326592	The Overnight	The Overnight	2010	88.0	N
3	tt0337692	On the Road	On the Road	2012	124.0	Adventure,Drama,Roma
6	tt0359950	The Secret Life of Walter Mitty	The Secret Life of Walter Mitty	2013	114.0	Adventure,Comedy,Dra
7	tt0365907	A Walk Among the Tombstones	A Walk Among the Tombstones	2014	114.0	Action,Crime,Dra

In [30]:

```
sns.histplot(x=df_runtime.runtime_minutes,
             y=df_runtime.ROI)
```

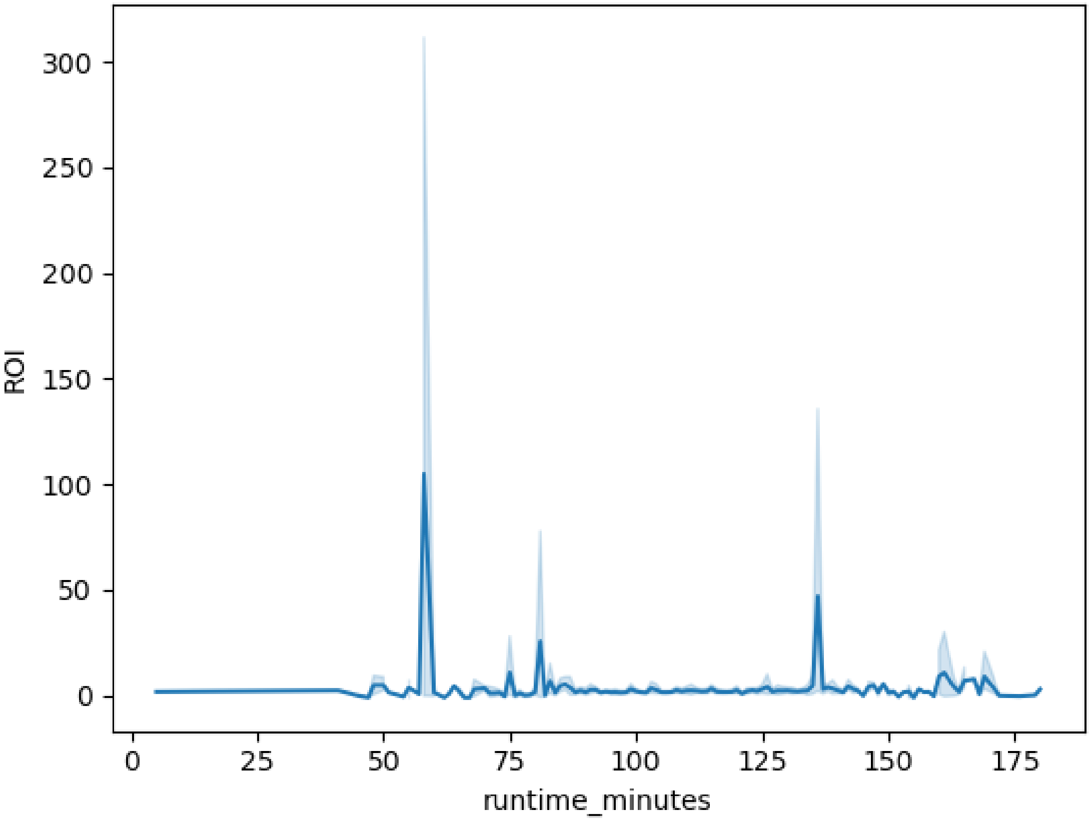
Out[30]:

```
<AxesSubplot:xlabel='runtime_minutes', ylabel='ROI'>
```



In [31]:
```
sns.lineplot(x=df_runtime.runtime_minutes,
             y=df_runtime.ROI)
```

Out[31]:
```
<AxesSubplot:xlabel='runtime_minutes', ylabel='ROI'>
```

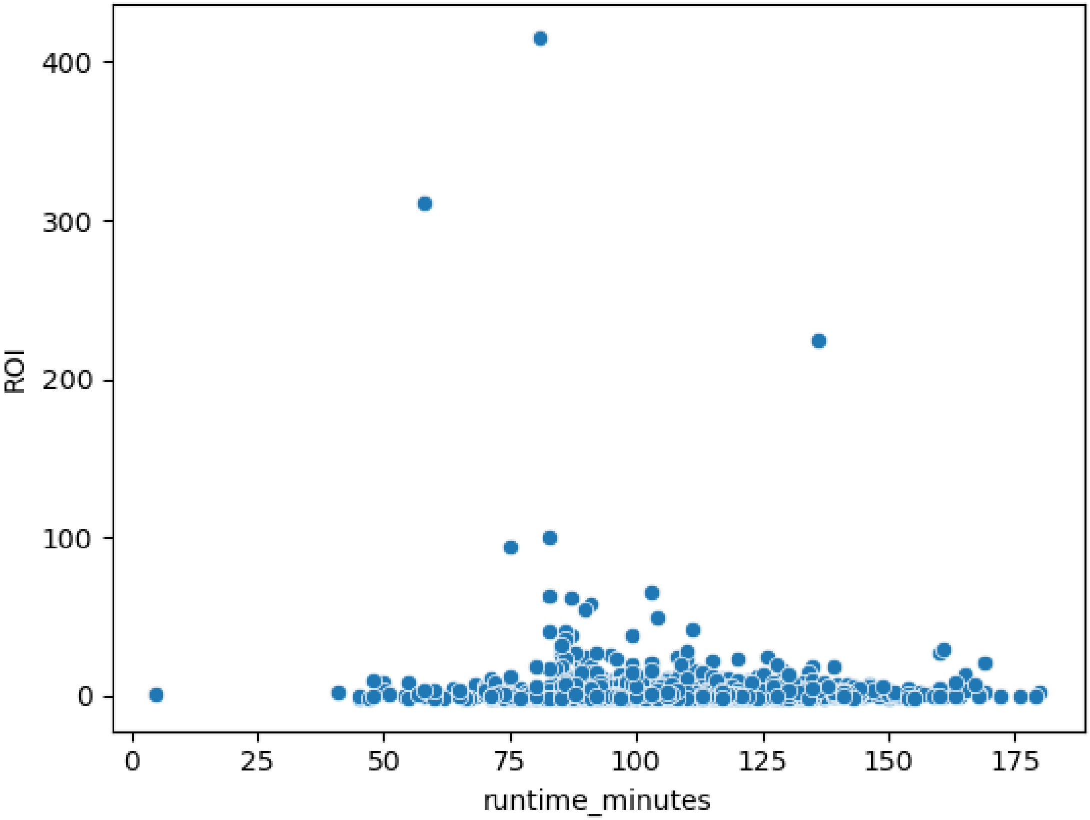


In [32]:

```
sns.scatterplot(x=df_runtime.runtime_minutes,
                y=df_runtime.ROI)
```

Out[32]:

```
<AxesSubplot:xlabel='runtime_minutes', ylabel='ROI'>
```



In [33]:

```
df = df_runtime.drop(df_runtime[df_runtime['averagerating'] < 7.1].index,
df.info()
```

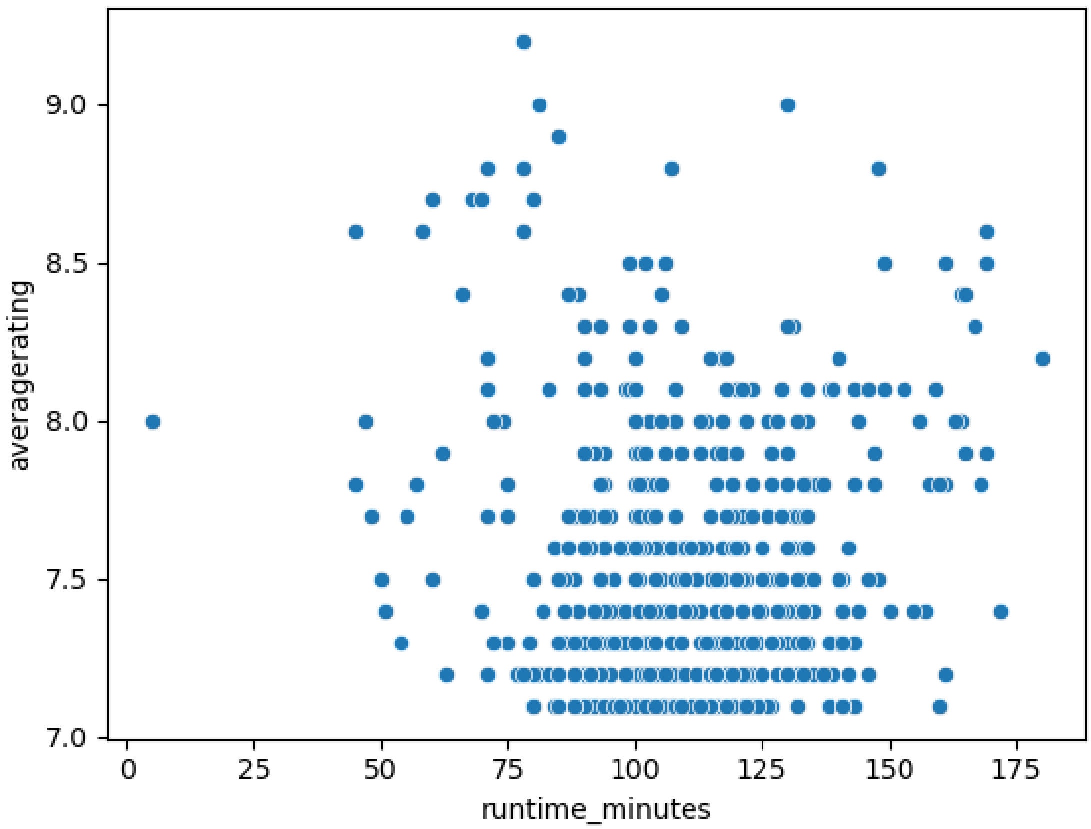
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 515 entries, 1 to 2872
Data columns (total 17 columns):
 #   Column              Non-Null Count  Dtype  
---  ------              --------------  -----  
 0   movie_id            515 non-null    object 
 1   primary_title       515 non-null    object 
 2   original_title      515 non-null    object 
 3   start_year          515 non-null    int64  
 4   runtime_minutes     496 non-null    float64
 5   genres              514 non-null    object 
 6   averagerating       515 non-null    float64
 7   numvotes            515 non-null    int64  
 8   release_date        515 non-null    object 
 9   movie               515 non-null    object 
 10  production_budget   515 non-null    float64
 11  domestic_gross      515 non-null    object 
 12  worldwide_gross     515 non-null    object 
 13  budget_millions     515 non-null    float64
 14  domestic_millions   515 non-null    float64
 15  worldwide_millions  515 non-null    float64
 16  ROI                 515 non-null    float64
dtypes: float64(7), int64(2), object(8)
memory usage: 72.4+ KB
```

In [34]:

```
sns.scatterplot(x=df.runtime_minutes,
                y=df.averagerating)
```

Out[34]:

```
<AxesSubplot:xlabel='runtime_minutes', ylabel='averagerating'>
```

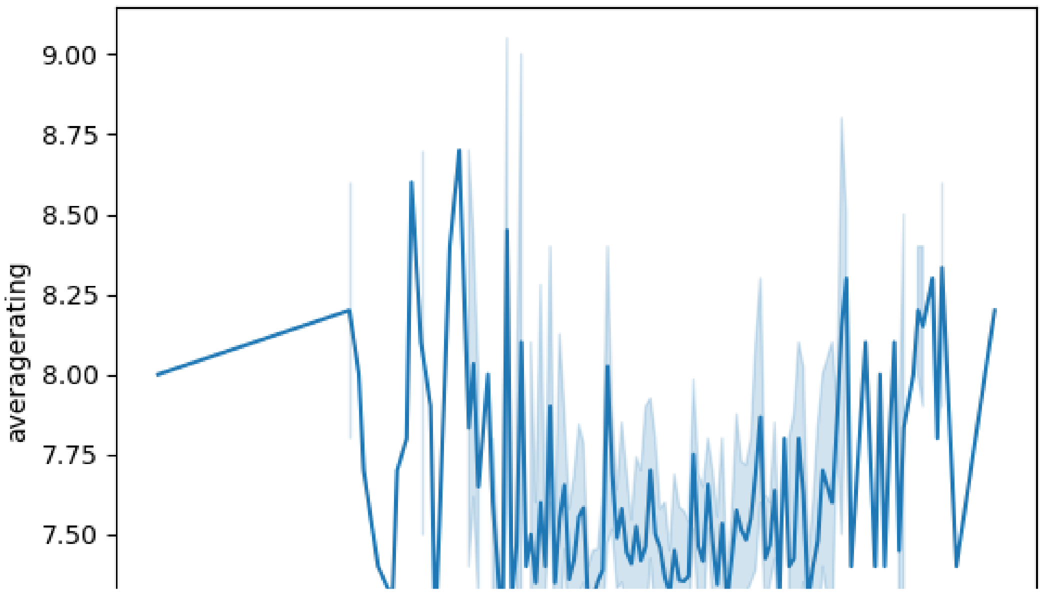


In [35]:

```
sns.lineplot(x=df.runtime_minutes,
             y=df.averagerating)
```

Out[35]:

```
<AxesSubplot:xlabel='runtime_minutes', ylabel='averagerating'>
```

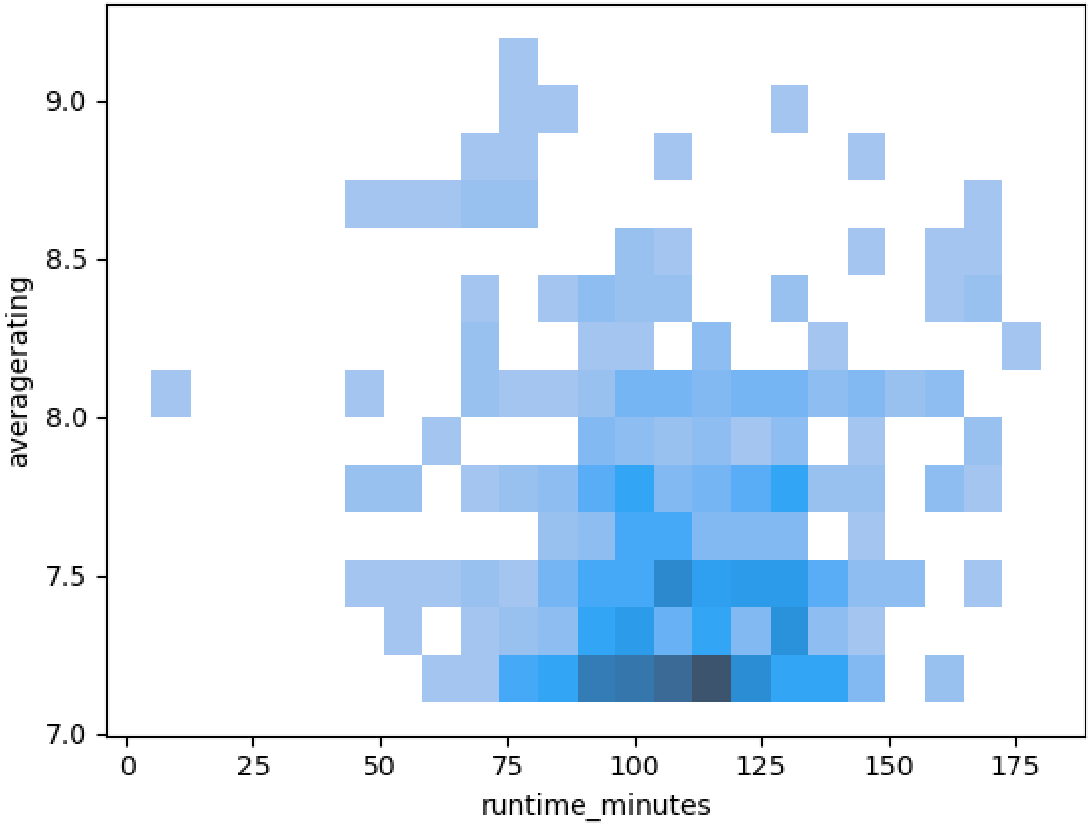


In [36]:

```
sns.histplot(x=df.runtime_minutes,
             y=df.averagerating)
```

Out[36]:

```
<AxesSubplot:xlabel='runtime_minutes', ylabel='averagerating'>
```

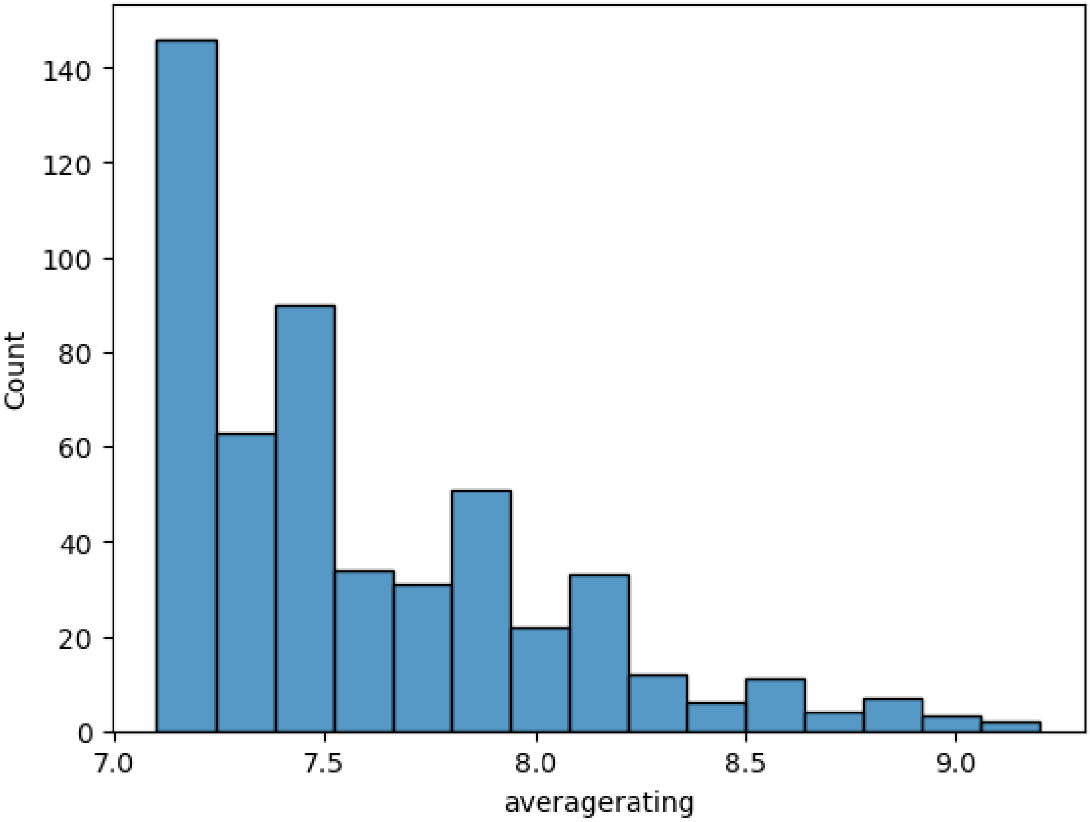


In [37]:

```
sns.histplot(x=df.averagerating
            )
```

Out[37]:

```
<AxesSubplot:xlabel='averagerating', ylabel='Count'>
```



In [38]:

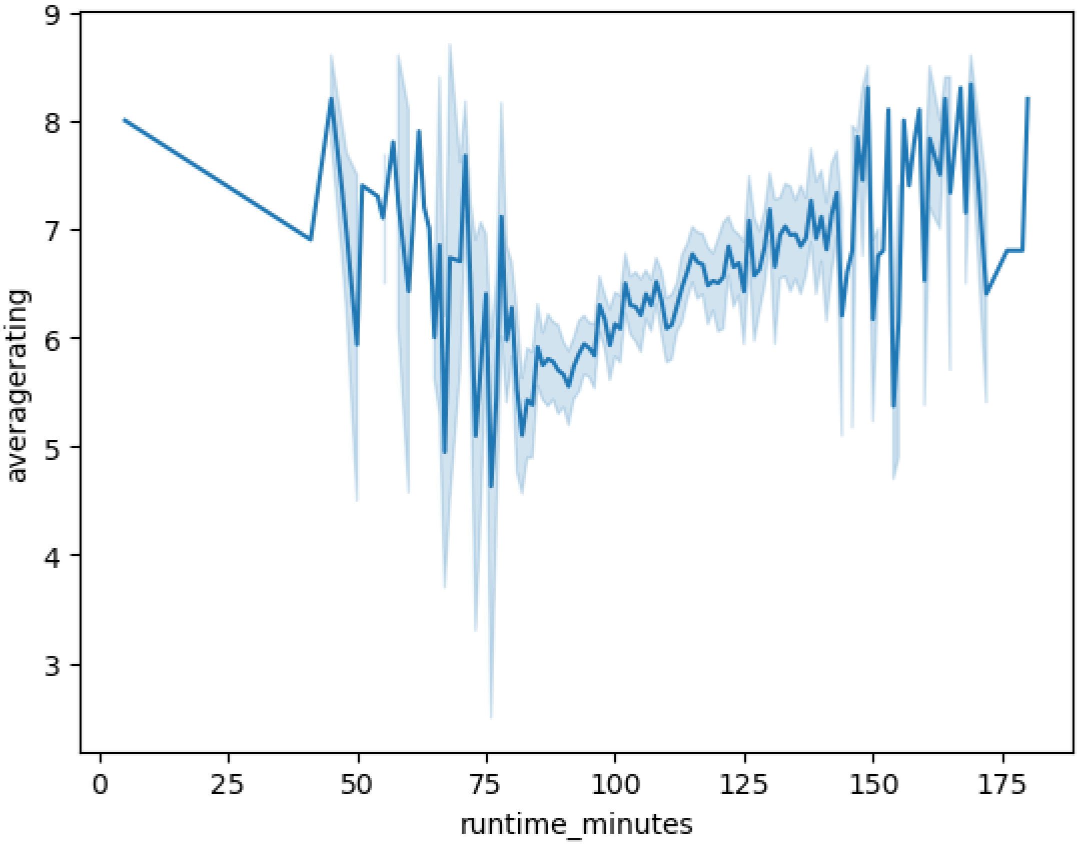
```
df.averagerating.describe()
```

Out[38]:

```
count    515.000000
mean       7.574951
std        0.438752
min        7.100000
25%        7.200000
50%        7.400000
75%        7.800000
max        9.200000
Name: averagerating, dtype: float64
```

```
In [39]:  sns.lineplot(x=df_runtime.runtime_minutes,
                       y=df_runtime.averagerating)
```

```
Out[39]: <AxesSubplot:xlabel='runtime_minutes', ylabel='averagerating'>
```

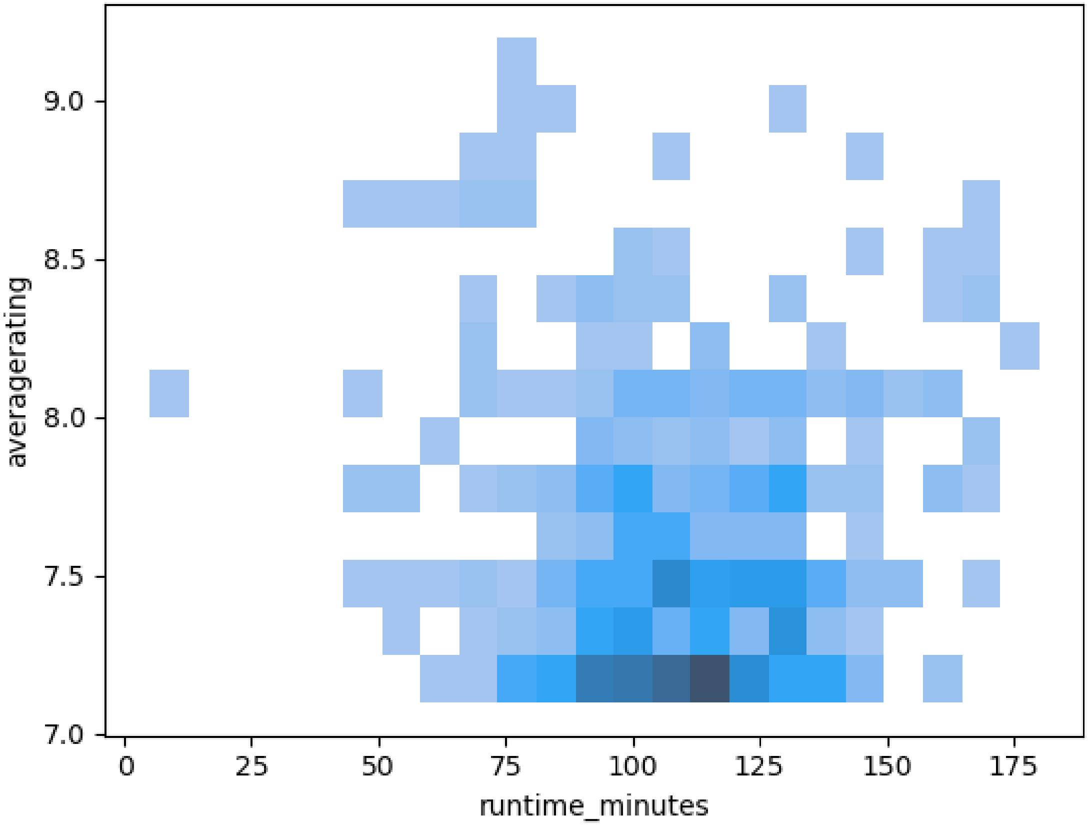


In [40]:

```
sns.histplot(x=df.runtime_minutes,
             y=df.averagerating)
```

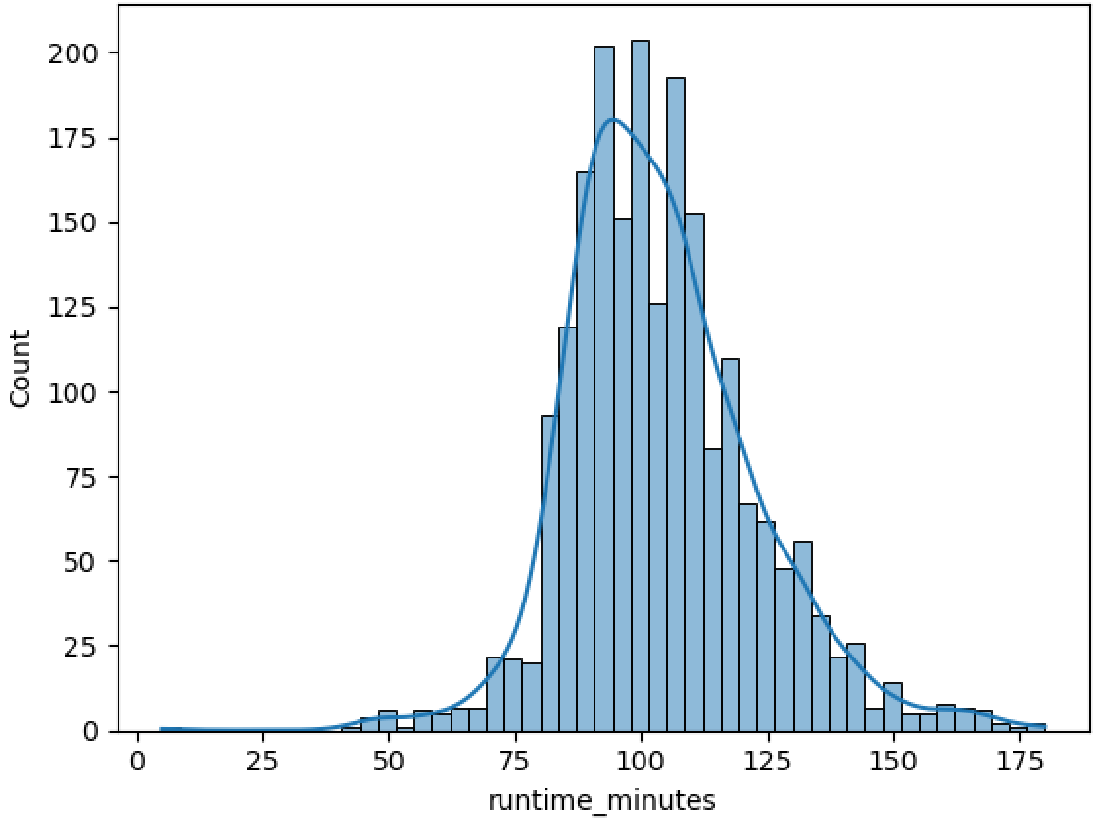
Out[40]:

```
<AxesSubplot:xlabel='runtime_minutes', ylabel='averagerating'>
```



In [41]:
```
sns.histplot(x=df_runtime.runtime_minutes, kde=True)
```

Out[41]:
```
<AxesSubplot:xlabel='runtime_minutes', ylabel='Count'>
```



In [42]:
```
df.describe()
```

Out[42]:

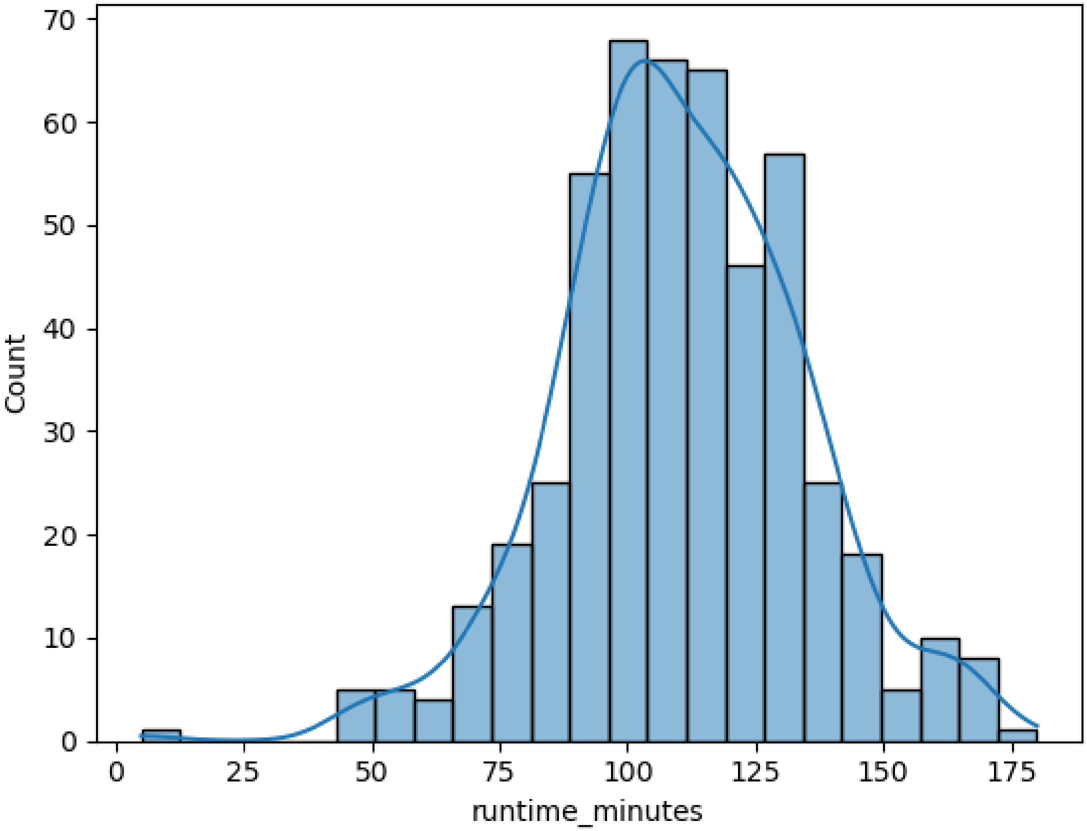
	start_year	runtime_minutes	averagerating	numvotes	production_budget	bud
count	515.000000	496.000000	515.000000	5.150000e+02	515.000000	
mean	2013.852427	110.516129	7.574951	1.729716e+05	45.053837	
std	2.537188	23.781831	0.438752	2.341522e+05	59.366843	
min	2010.000000	5.000000	7.100000	5.000000e+00	0.015000	
25%	2012.000000	96.000000	7.200000	9.765000e+02	8.000000	
50%	2014.000000	109.000000	7.400000	8.157500e+04	20.000000	
75%	2016.000000	126.250000	7.800000	2.630700e+05	51.350000	
max	2019.000000	180.000000	9.200000	1.841066e+06	330.600000	

In [43]:

```
sns.histplot(x=df.runtime_minutes, kde=True,)
```

Out[43]:

```
<AxesSubplot:xlabel='runtime_minutes', ylabel='Count'>
```



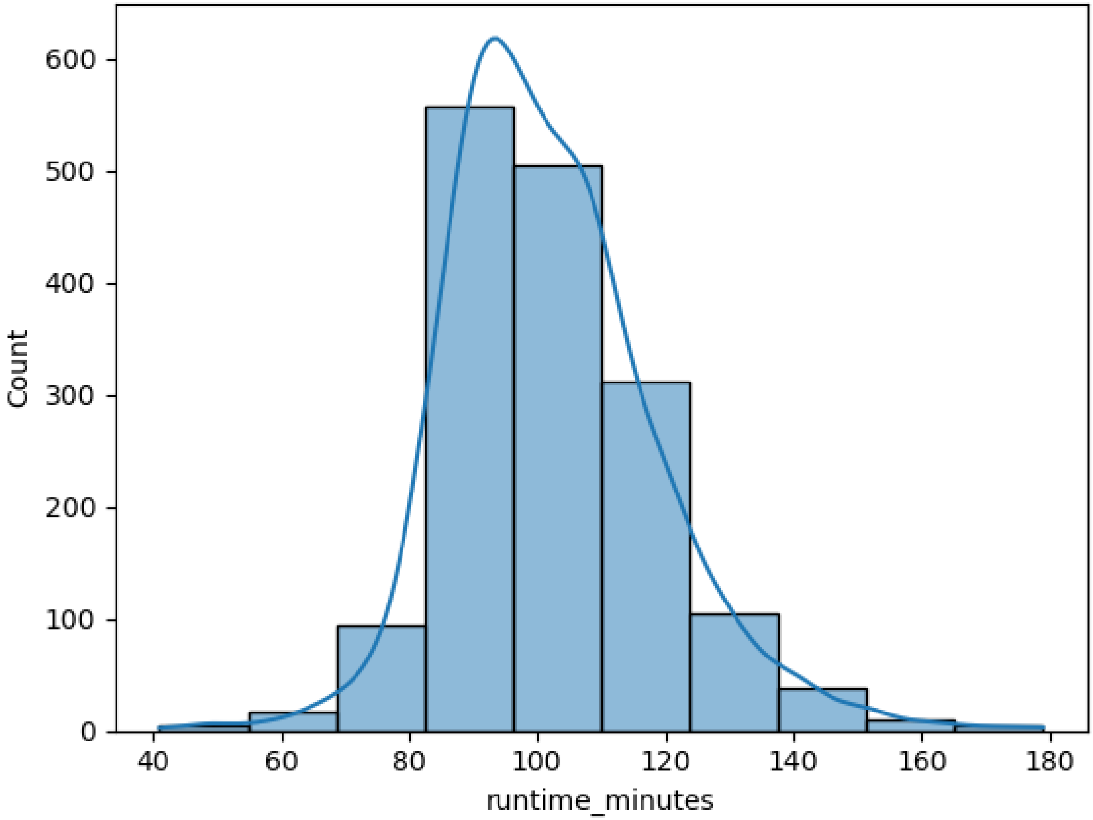
In [44]:

```
df2 = df_runtime.drop(df_runtime[df_runtime['averagerating'] > 7.1].index
df2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1680 entries, 0 to 2874
Data columns (total 17 columns):
 #   Column              Non-Null Count  Dtype  
---  ------              --------------  -----  
 0   movie_id            1680 non-null   object 
 1   primary_title       1680 non-null   object 
 2   original_title      1680 non-null   object 
 3   start_year          1680 non-null   int64  
 4   runtime_minutes     1645 non-null   float64
 5   genres              1679 non-null   object 
 6   averagerating       1680 non-null   float64
 7   numvotes            1680 non-null   int64  
 8   release_date        1680 non-null   object 
 9   movie               1680 non-null   object 
 10  production_budget   1680 non-null   float64
 11  domestic_gross      1680 non-null   object 
 12  worldwide_gross     1680 non-null   object 
 13  budget_millions     1680 non-null   float64
 14  domestic_millions   1680 non-null   float64
 15  worldwide_millions  1680 non-null   float64
 16  ROI                 1680 non-null   float64
dtypes: float64(7), int64(2), object(8)
memory usage: 236.2+ KB
```

In [46]:
```
sns.histplot(x=df2.runtime_minutes, bins = 10, kde=True,)
```

Out[46]:
```
<AxesSubplot:xlabel='runtime_minutes', ylabel='Count'>
```


Count
runtime_minutes