```
import pandas as pd
import numpy as np
```

```
# Load dataset
df = pd.read_csv("/content/tmdb_5000_movies.csv")

# View first 5 rows
df.head()
```

	budget	genres	homepage	id	keywords	original_language	original_title	overview
0	237000000	[{"id": 28, "name": "Action"}, {"id": 12, "nam...	http://www.avatarmovie.com/	19995	[{"id": 1463, "name": "culture clash"}, {"id":...	en	Avatar	In the 22nd century, a paraplegic Marine is di...
1	300000000	[{"id": 12, "name": "Adventure"}, {"id": 14, "...	http://disney.go.com/disneypictures/pirates/	285	[{"id": 270, "name": "ocean"}, {"id": 726, "na...	en	Pirates of the Caribbean: At World's End	Captain Barbossa, long believed to be dead, ha...
2	245000000	[{"id": 28, "name": "Action"}, {"id": 12, "nam...	http://www.sonypictures.com/movies/spectre/	206647	[{"id": 470, "name": "spy"}, {"id": 818, "name...	en	Spectre	A cryptic message from Bond’s past sends him o...
3	250000000	[{"id": 28, "name": "Action"}, {"id": 80, "nam...	http://www.thedarkknightrises.com/	49026	[{"id": 849, "name": "dc comics"}, {"id": 853,...	en	The Dark Knight Rises	Following the death of District Attorney Harve...
4	260000000	[{"id": 28, "name": "Action"}, {"id": 12, "nam...	http://movies.disney.com/john-carter	49529	[{"id": 818, "name": "based on novel"}, {"id":...	en	John Carter	John Carter is a war-weary, former military ca...

```
# Shape of dataset
print("Shape:", df.shape)

# Column names
print("\nColumns:")
print(df.columns)

# Info about dataset
print("\nDataset Info:")
print(df.info())

# Statistical summary
print("\nStatistical Summary:")
print(df.describe())
```

```
Columns:
Index(['budget', 'genres', 'homepage', 'id', 'keywords', 'original_language',
       'original_title', 'overview', 'popularity', 'production_companies',
       'production_countries', 'release_date', 'revenue', 'runtime',
       'spoken_languages', 'status', 'tagline', 'title', 'vote_average',
       'vote_count'],
      dtype='object')

Dataset Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4803 entries, 0 to 4802
Data columns (total 20 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   budget                4803 non-null   int64
 1   genres                4803 non-null   object
 2   homepage              1712 non-null   object
 3   id                    4803 non-null   int64
 4   keywords              4803 non-null   object
 5   original_language     4803 non-null   object
 6   original_title        4803 non-null   object
 7   overview              4800 non-null   object
 8   popularity            4803 non-null   float64
 9   production_companies  4803 non-null   object
 10  production_countries  4803 non-null   object


 13  runtime               4801 non-null   float64
```

```
 13  runtime               4801 non-null   float64
 14  spoken_languages      4803 non-null   object
 15  status                4803 non-null   object
 16  tagline               3959 non-null   object
 17  title                 4803 non-null   object
 18  vote_average          4803 non-null   float64
 19  vote_count            4803 non-null   int64
dtypes: float64(3), int64(4), object(13)
memory usage: 750.6+ KB
None

Statistical Summary:
             budget             id   popularity       revenue      runtime  \
count  4.803000e+03    4803.000000  4803.000000  4.803000e+03  4801.000000
mean   2.904504e+07   57165.484281    21.492301  8.226064e+07   106.875859
std    4.072239e+07   88694.614033    31.816650  1.628571e+08    22.611935
min    0.000000e+00       5.000000     0.000000  0.000000e+00     0.000000
25%    7.900000e+05    9014.500000     4.668070  0.000000e+00    94.000000
50%    1.500000e+07   14629.000000    12.921594  1.917000e+07   103.000000
75%    4.000000e+07   58610.500000    28.313505  9.291719e+07   118.000000
max    3.800000e+08  459488.000000   875.581305  2.787965e+09   338.000000

       vote_average    vote_count
count   4803.000000   4803.000000
mean       6.092172    690.217989
std        1.194612   1234.585891
min        0.000000      0.000000
25%        5.600000     54.000000
50%        6.200000    235.000000
75%        6.800000    737.000000
max       10.000000  13752.000000
```

Inference:

shape → total rows & columns

info() → data types + null values

describe() → numerical statistics

This helps us understand what cleaning is required.

```
# Count missing values
print("\nMissing Values:")
print(df.isnull().sum())
```

```
Missing Values:
budget                     0
genres                     0
homepage                3091
id                         0
keywords                   0
original_language          0
original_title             0
overview                   3
popularity                 0
production_companies       0
production_countries       0
release_date               1
revenue                    0
runtime                    2
spoken_languages           0
status                     0
tagline                  844
title                      0
vote_average               0
vote_count                 0
dtype: int64
```

```
numeric_cols = ['budget', 'popularity', 'revenue',
                'runtime', 'vote_average', 'vote_count']

for col in numeric_cols:
    df[col] = pd.to_numeric(df[col], errors='coerce')
```

Inference:

Converts columns into numeric format

Invalid values become NaN

```
df['homepage'] = df['homepage'].fillna('')
df['tagline'] = df['tagline'].fillna('')
df['overview'] = df['overview'].fillna('')
```

Inference:

Text columns can remain empty instead of NaN.

```
df['runtime'] = df['runtime'].fillna(df['runtime'].median())
df['budget'] = df['budget'].fillna(0)
df['revenue'] = df['revenue'].fillna(0)
```

Inference:

Runtime → use median (better than mean)

Budget & revenue → 0 (unknown values)

```
df.drop_duplicates(inplace=True)

print("Shape after removing duplicates:", df.shape)
```

```
Shape after removing duplicates: (4803, 20)
```

```
df['release_date'] = pd.to_datetime(df['release_date'], errors='coerce')

# Extract release year
df['release_year'] = df['release_date'].dt.year
```

Inference:

Converts string date to datetime

Extracts year for analysis

```
df['profit'] = df['revenue'] - df['budget']
```

```
df['roi'] = 0
df.loc[df['budget'] > 0, 'roi'] = df['profit'] / df['budget']
```

```
/tmp/ipython-input-2493819983.py:2: FutureWarning: Setting an item of incompatible dtype is deprecated and will raise an error
 -1.        ]' has dtype incompatible with int64, please explicitly cast to a compatible dtype first.
  df.loc[df['budget'] > 0, 'roi'] = df['profit'] / df['budget']
```

Inference:

Profit ⟶ Revenue - Budget

ROI ⟶ Profit / Budget

Helps measure movie success

```
# Remove movies with negative values
df = df[(df['budget'] >= 0) & (df['revenue'] >= 0)]

# Remove very high revenue outliers
upper_limit = df['revenue'].quantile(0.99)
df = df[df['revenue'] <= upper_limit]
```

Inference:

Removes unrealistic data

Keeps dataset balanced

```
df.drop(['id', 'imdb_id'], axis=1, inplace=True, errors='ignore')
```

```
print("Final Shape:", df.shape)

print("\nFinal Missing Values:")
print(df.isnull().sum())
```

```
Final Shape: (4754, 22)

Final Missing Values:
budget                  0
genres                  0
homepage                0
keywords                0
original_language       0
original_title          0
overview                0
popularity              0
production_companies    0
production_countries    0
release_date            1
revenue                 0
runtime                 0
spoken_languages        0
status                  0
tagline                 0
title                   0
vote_average            0
vote_count              0
release_year            1
profit                  0
roi                     0
dtype: int64
```

OLAP Operations

```
import pandas as pd
import numpy as np

# Load cleaned dataset (or original if not saved)
df = pd.read_csv("/content/tmdb_5000_movies.csv")
```

```
# Convert numeric columns
numeric_cols = ['budget', 'popularity', 'revenue',
                'runtime', 'vote_average', 'vote_count']

for col in numeric_cols:
    df[col] = pd.to_numeric(df[col], errors='coerce')

# Convert release_date
df['release_date'] = pd.to_datetime(df['release_date'], errors='coerce')
df['release_year'] = df['release_date'].dt.year
df['release_month'] = df['release_date'].dt.month

# Fill missing values
df['budget'].fillna(0, inplace=True)
df['revenue'].fillna(0, inplace=True)
df['runtime'].fillna(df['runtime'].median(), inplace=True)
```

```
/tmp/ipython-input-1373664512.py:20: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through cha
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are se

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] =


  df['budget'].fillna(0, inplace=True)
/tmp/ipython-input-1373664512.py:21: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through cha
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are se

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] =


  df['revenue'].fillna(0, inplace=True)
/tmp/ipython-input-1373664512.py:22: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through cha
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are se

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] =


  df['runtime'].fillna(df['runtime'].median(), inplace=True)
```

Movies released in 2015

```
slice_2015 = df[df['release_year'] == 2015]

print("Movies in 2015:", slice_2015.shape)
slice_2015[['title', 'revenue', 'vote_average']].head()
```

```
Movies in 2015: (216, 22)
```

	title	revenue	vote_average
2	Spectre	880674609	6.3
7	Avengers: Age of Ultron	1405403694	7.3
28	Jurassic World	1513528810	6.5
44	Furious 7	1506249360	7.3
54	The Good Dinosaur	331926147	6.6

Released between 2010–2015

Revenue > 100M

Rating > 7

```
dice_movies = df[
    (df['release_year'] >= 2010) &
    (df['release_year'] <= 2015) &
    (df['revenue'] > 100000000) &
    (df['vote_average'] > 7)
]

print("Filtered Movies:", dice_movies.shape)
dice_movies[['title', 'release_year', 'revenue', 'vote_average']].head()
```

```
Filtered Movies: (75, 22)
```

	title	release_year	revenue	vote_average
3	The Dark Knight Rises	2012.0	1084939099	7.6
6	Tangled	2010.0	591794936	7.4
7	Avengers: Age of Ultron	2015.0	1405403694	7.3
16	The Avengers	2012.0	1519557910	7.4
19	The Hobbit: The Battle of the Five Armies	2014.0	956019788	7.1

Total Revenue Per Year

```
rollup_year = df.groupby('release_year')['revenue'].sum().reset_index()

rollup_year.head()
```

	release_year	revenue
0	1916.0	8394751
1	1925.0	22000000
2	1927.0	650422
3	1929.0	4358000
4	1930.0	8000000

```
rollup_year_month = df.groupby(
    ['release_year', 'release_month']
)['revenue'].sum().reset_index()

rollup_year_month.head()
```

	release_year	release_month	revenue
0	1916.0	9.0	8394751
1	1925.0	11.0	22000000
2	1927.0	1.0	650422
3	1929.0	1.0	0
4	1929.0	2.0	4358000

Drill Down into 2015 → Month level

```
df[df['release_year'] == 2015] \
    .groupby('release_month')['revenue'].sum()
```

release_month	revenue
1.0	233825738
2.0	1561333527
3.0	1523987541
4.0	3286982086
5.0	1424127021
6.0	4528977085
7.0	2144512007
8.0	781355731
9.0	2413958848
10.0	1414719138
11.0	1765289874
12.0	1695955625

dtype: int64

```
import pandas as pd
import numpy as np
from sklearn.preprocessing import MinMaxScaler, StandardScaler
from scipy.stats import chi2_contingency

# Load dataset
df = pd.read_csv("/content/tmdb_5000_movies.csv")

# Convert numeric columns
numeric_cols = ['budget', 'popularity', 'revenue',
                'runtime', 'vote_average', 'vote_count']

for col in numeric_cols:
```

```
for col in numeric_cols:
    df[col] = pd.to_numeric(df[col], errors='coerce')

# Handle missing values
df['budget'].fillna(0, inplace=True)
df['revenue'].fillna(0, inplace=True)
df['runtime'].fillna(df['runtime'].median(), inplace=True)
df['vote_average'].fillna(df['vote_average'].median(), inplace=True)

df.head()
```

Equal Width Binning

```
# Create 5 equal width bins
df['revenue_bin_equal_width'] = pd.cut(df['revenue'], bins=5)

df[['revenue', 'revenue_bin_equal_width']].head()
```

	revenue	revenue_bin_equal_width
0	2787965087	(2230372069.6, 2787965087.0]
1	961000000	(557593017.4, 1115186034.8]
2	880674609	(557593017.4, 1115186034.8]
3	1084939099	(557593017.4, 1115186034.8]
4	284139100	(-2787965.087, 557593017.4]

```
df['budget'].fillna(0, inplace=True)
eWarning: A value is trying to be set on a copy of a DataFrame or Series through cha
...is inplace method will never work because the intermediate object on which we are se
For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] =
df['revenue'].fillna(0, inplace=True)
eWarning: A value is trying to be set on a copy of a DataFrame or Series through cha
is inplace method will never work because the intermediate object on which we are se
```

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] =

Equal Frequency Binning

```
# Create 5 equal frequency bins
df['revenue_bin_equal_freq'] = pd.qcut(df['revenue'], q=5, duplicates='drop')

df[['revenue', 'revenue_bin_equal_freq']].head()
```

	revenue	revenue_bin_equal_freq
0	2787965087	(119742109.2, 2787965087.0]
1	961000000	(119742109.2, 2787965087.0]
2	880674609	(119742109.2, 2787965087.0]
3	1084939099	(119742109.2, 2787965087.0]
4	284139100	(119742109.2, 2787965087.0]

```
df['vote_average'].fillna(df['vote_average'].median(), inplace=True)
```

	homepage	id	keywords	original_language	original_title	overview
0	http://www.avatarmovie.com/	19995	[{"id": 1463, "name": "culture clash"}, {"id":...	en	Avatar	In the 22nd century, a paraplegic Marine is di...
1	http://disney.go.com/disneypictures/pirates/	285	[{"id": 270, "name": "ocean"},	en	Pirates of the Caribbean: At World's End	Captain Barbossa, long believed to be

[{"id": 28, {"id": 12, "nam [{"id": 12, "name": "Adventure"},

Custom Binning

```
bins = [0, 50000000, 200000000, 500000000, df['revenue'].max()]
labels = ['Low', 'Medium', 'High', 'Blockbuster']

df['revenue_custom_bin'] = pd.cut(df['revenue'], bins=bins, labels=labels)

df[['revenue', 'revenue_custom_bin']].head()
```

	revenue	revenue_custom_bin
0	2787965087	Blockbuster
1	961000000	Blockbuster
2	880674609	Blockbuster
3	1084939099	Blockbuster
4	284139100	High

Min-Max Normalization

```
min_max_scaler = MinMaxScaler()

df['budget_minmax'] = min_max_scaler.fit_transform(df[['budget']])

df[['budget', 'budget_minmax']].head()
```

	budget	budget_minmax
0	237000000	0.623684
1	300000000	0.789474
2	245000000	0.644737
3	250000000	0.657895
4	260000000	0.684211

Z-Score Normalization

```
standard_scaler = StandardScaler()

df['budget_zscore'] = standard_scaler.fit_transform(df[['budget']])

df[['budget', 'budget_zscore']].head()
```

	budget	budget_zscore
0	237000000	5.107181
1	300000000	6.654402
2	245000000	5.303653
3	250000000	5.426449
4	260000000	5.672039

CHI-SQUARE TEST

```
# Revenue Category
df['revenue_category'] = pd.cut(
    df['revenue'],
    bins=3,
    labels=['Low', 'Medium', 'High']
)

# Vote Category
df['vote_category'] = pd.cut(
    df['vote_average'],
    bins=3,
    labels=['Low Rating', 'Medium Rating', 'High Rating']
)
```

```
contingency_table = pd.crosstab(
```

```
    df['revenue_category'],
    df['vote_category']
)

print(contingency_table)
```

```
vote_category     Low Rating  Medium Rating  High Rating
revenue_category
Low                      121           3143         1509
Medium                     0              6           23
High                       0              0            1
```

```
chi2, p, dof, expected = chi2_contingency(contingency_table)

print("Chi-Square Value:", chi2)
print("P-Value:", p)
print("Degrees of Freedom:", dof)
```

```
Chi-Square Value: 32.379082433072554
P-Value: 1.600427004563815e-06
Degrees of Freedom: 4
```

p < 0.05 ⟶ Revenue and Rating are related

p > 0.05 ⟶ No significant relationship

```
!pip install mlxtend
```

```
Requirement already satisfied: mlxtend in /usr/local/lib/python3.12/dist-packages (0.23.4)
Requirement already satisfied: scipy>=1.2.1 in /usr/local/lib/python3.12/dist-packages (from mlxtend) (1.16.3)
Requirement already satisfied: numpy>=1.16.2 in /usr/local/lib/python3.12/dist-packages (from mlxtend) (2.0.2)
Requirement already satisfied: pandas>=0.24.2 in /usr/local/lib/python3.12/dist-packages (from mlxtend) (2.2.2)
Requirement already satisfied: scikit-learn>=1.3.1 in /usr/local/lib/python3.12/dist-packages (from mlxtend) (1.6.1)
Requirement already satisfied: matplotlib>=3.0.0 in /usr/local/lib/python3.12/dist-packages (from mlxtend) (3.10.0)
Requirement already satisfied: joblib>=0.13.2 in /usr/local/lib/python3.12/dist-packages (from mlxtend) (1.5.3)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib>=3.0.0->mlxtend) (
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.12/dist-packages (from matplotlib>=3.0.0->mlxtend) (0.12
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.12/dist-packages (from matplotlib>=3.0.0->mlxtend)
Requirement already satisfied: kiwisolver>=1.3.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib>=3.0.0->mlxtend)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.12/dist-packages (from matplotlib>=3.0.0->mlxtend) (2
```

```
Requirement already satisfied: pillow>=8 in /usr/local/lib/python3.12/dist-packages (from matplotlib>=3.0.0->mlxtend) (11.3.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib>=3.0.0->mlxtend) (
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.12/dist-packages (from matplotlib>=3.0.0->mlxten
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.12/dist-packages (from pandas>=0.24.2->mlxtend) (2025.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.12/dist-packages (from pandas>=0.24.2->mlxtend) (2025.
Requirement already satisfied: threadpoolctl>=3.1.0 in /usr/local/lib/python3.12/dist-packages (from scikit-learn>=1.3.1->mlxt
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.12/dist-packages (from python-dateutil>=2.7->matplotlib>=3.0
```

```
import pandas as pd
import numpy as np
from mlxtend.frequent_patterns import apriori, association_rules
from mlxtend.preprocessing import TransactionEncoder

# Load dataset
df = pd.read_csv("/content/tmdb_5000_movies.csv")

df.head()
```

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
```

```
      budget       genres                          homepage     id  keywords  original_language  original_title  overview

                                                                    [{"id":                                       In the
                [{"id": 28,                                          1463,                                         22nd
```

```python
import ast

# Function to extract genre names
def extract_names(text):
    try:
        data = ast.literal_eval(text)
        return [item['name'] for item in data]
    except:
        return []

# Apply extraction
df['genres_list'] = df['genres'].apply(extract_names)

df[['title', 'genres_list']].head()
```

```
                                                                      "spy"},
                {"id": 12,                                        {"id": 818,                                       past
                  "nam...                                           "name...                                   sends him
                                                                                                                     o...

                                                                    [{"id":
                [{"id": 28,                                            849,                                    Following
                  "name":                                           "name":                                    the death
  3  250000000  "Action"},  http://www.thedarkknightrises.com/  49026   "dc        en     The Dark Knight        of District
                {"id": 80,                                         comics"},                     Rises          Attorney
                  "nam...                                           {"id":                                       Harve...
                                                                     853,...

                                                                    [{"id":                                        John
                [{"id": 28,                                           818,                                     Carter is a
```

		name": "Action"},			name": "based on novel"},				war weary, former military ca...
4	260000000	{"id": 12, "nam...	http://movies.disney.com/john-carter	49529	{"id":...	en	John Carter		

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
```

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
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/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
```

```
transactions = df['genres_list'].tolist()


# Remove empty transactions
transactions = [t for t in transactions if len(t) > 0]


len(transactions)
```

```
  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
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  return datetime.utcnow().replace(tzinfo=utc)
```

	title	genres_list
0	Avatar	[Action, Adventure, Fantasy, Science Fiction]
1	Pirates of the Caribbean: At World's End	[Adventure, Fantasy, Action]
2	Spectre	[Action, Adventure, Crime]
3	The Dark Knight Rises	[Action, Crime, Drama, Thriller]

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
```

4 John Carter [Action, Adventure, Science Fiction]

```
te = TransactionEncoder()
te_array = te.fit(transactions).transform(transactions)

df_encoded = pd.DataFrame(te_array, columns=te.columns_)

df_encoded.head()
```

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
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  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
```

```python
frequent_itemsets = apriori(
    df_encoded,
    min_support=0.05,
    use_colnames=True
)

frequent_itemsets.sort_values(by='support', ascending=False).head()
```

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
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/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
```

	Action	Adventure	Animation	Comedy	Crime	Documentary	Drama	Family	Fantasy	Foreign	History	Horror	Music	Mystery
0	True	True	False	False	False	False	False	False	True	False	False	False	False	False
1	True	True	False	False	False	False	False	False	True	False	False	False	False	False
2	True	True	False	False	True	False	False	False	False	False	False	False	False	False
3	True	False	False	False	True	False	True	False	False	False	False	False	False	False
4	True	True	False	False	False	False	False	False	False	False	False	False	False	False

```
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```
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/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
```

	support	itemsets
4	0.481047	(Drama)
2	0.360628	(Comedy)
11	0.266806	(Thriller)
0	0.241675	(Action)
9	0.187225	(Romance)

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
```

Inference:

Finds frequently occurring genre combinations.

Support = percentage of movies containing that combination.

```
rules = association_rules(
    frequent_itemsets,
    metric="confidence",
    min_threshold=0.6
)

rules[['antecedents', 'consequents', 'support', 'confidence', 'lift']].head()
```

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
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/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
```

```
df['keywords_list'] = df['keywords'].apply(extract_names)

transactions_kw = [t for t in df['keywords_list'] if len(t) > 0]

te_kw = TransactionEncoder()
te_array_kw = te_kw.fit(transactions_kw).transform(transactions_kw)

df_encoded_kw = pd.DataFrame(te_array_kw, columns=te_kw.columns_)

frequent_kw = apriori(df_encoded_kw, min_support=0.03, use_colnames=True)

frequent_kw.head()
```

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
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  return datetime.utcnow().replace(tzinfo=utc)
```

	antecedents	consequents	support	confidence	lift
0	(Romance)	(Drama)	0.126283	0.674497	1.402143

1	(Mystery)	(Thriller)	0.050681	0.695402	2.606394

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
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```

We:

Extracted genres

Converted to transaction format

One-hot encoded data

Applied Apriori

Generated association rules

Interpreted support, confidence, lift

```
     support          itemsets
```

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA

# Load dataset
df = pd.read_csv("/content/tmdb_5000_movies.csv")

df.head()
```

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```

	budget	genres	homepage	id	keywords	original_language	original_title	overview
0	237000000	[{"id": 28, "name": "Action"},	http://www.avatarmovie.com/	19995	[{"id": 1463, "name": "culture	en	Avatar	In the 22nd century, a paraplegic

```
numeric_cols = ['budget', 'popularity', 'revenue',
                'runtime', 'vote_average', 'vote_count']

# Convert to numeric
for col in numeric_cols:
    df[col] = pd.to_numeric(df[col], errors='coerce')

# Fill missing values
df[numeric_cols] = df[numeric_cols].fillna(df[numeric_cols].median())

# Select features
X = df[numeric_cols]

X.head()
```

		nam...			"name...			sends him o...
3	250000000	[{"id": 28, "name": "Action"}, {"id": 80, "nam...	http://www.thedarkknightrises.com/	49026	[{"id": 849, "name": "dc comics"}, {"id": 853,...	en	The Dark Knight Rises	Following the death of District Attorney Harve...
4	260000000	[{"id": 28, "name": "Action"}, {"id": 12, "nam...	http://movies.disney.com/john-carter	49529	[{"id": 818, "name": "based on novel"}, {"id":...	en	John Carter	John Carter is a war-weary, former military ca...

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
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```

	budget	popularity	revenue	runtime	vote_average	vote_count
0	237000000	150.437577	2787965087	162.0	7.2	11800
1	300000000	139.082615	961000000	169.0	6.9	4500
2	245000000	107.376788	880674609	148.0	6.3	4466
3	250000000	112.312950	1084939099	165.0	7.6	9106
4	260000000	43.926995	284139100	132.0	6.1	2124

```
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
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```

PCA works only on numeric data. Missing values are replaced with median.

```
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
```

```
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```

```
pca = PCA()
X_pca = pca.fit_transform(X_scaled)
```

```
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```

```
  return datetime.utcnow().replace(tzinfo=utc)
```

```
explained_variance = pca.explained_variance_ratio_

print("Explained Variance Ratio:")
print(explained_variance)
```

```
Explained Variance Ratio:
[0.54420777 0.19138384 0.11902831 0.07573418 0.04299268 0.02665322]
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:203: DeprecationWarning: datetime.datetime.utcnow() is depre
  return datetime.utcnow().replace(tzinfo=utc)
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  return datetime.utcnow().replace(tzinfo=utc)
```

```
plt.figure()
plt.plot(np.cumsum(explained_variance))
plt.xlabel("Number of Components")
plt.ylabel("Cumulative Explained Variance")
plt.title("PCA Explained Variance")
plt.show()
```