Steam Games Library Analysis

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Data from Kaggle

additional data from Kaggle

Github

Outline

Descriptive Analysis Questions

1. What operating system has the most playable games?

2. What is the average price for games on steam?

3. Which games have been played/reviewed the most?

4. What type of games were released in 2020?

5. How have games in 2020 been rated/received?
   </ol>

Inferential Analysis

A. Did games from 2020 do better overall than other games from the between 2016 to 2023?

B. Did prices of games change compared to 2020?

C. Which year had the most expensive game releases overall?
   </ol>

Final Analysis

Recommendations

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Descriptive Analysis

</span>

Data intake and cleaning

</span>

In [ ]:

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
from scipy import stats
import seaborn as sns
```

In [ ]:

```
df = pd.read_csv('data/games.csv')
df_genres = pd.read_csv('data/games-genres.csv')

df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50872 entries, 0 to 50871
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   app_id          50872 non-null  int64  
 1   title           50872 non-null  object 
 2   date_release    50872 non-null  object 
 3   win             50872 non-null  bool   
 4   mac             50872 non-null  bool   
 5   linux           50872 non-null  bool   
 6   rating          50872 non-null  object 
 7   positive_ratio  50872 non-null  int64  
 8   user_reviews    50872 non-null  int64  
 9   price_final     50872 non-null  float64
 10  price_original  50872 non-null  float64
 11  discount        50872 non-null  float64
 12  steam_deck      50872 non-null  bool   
dtypes: bool(4), float64(3), int64(3), object(3)
memory usage: 3.7+ MB
```

In [ ]:

```
df.head()
```

Out[ ]:

	app_id	title	date_release	win	mac	linux	rating	positive_ratio	user_reviews	price_final
0	13500	Prince of Persia: Warrior Within™	2008-11-21	True	False	False	Very Positive	84	2199	9.99
1	22364	BRINK: Agents of Change	2011-08-03	True	False	False	Positive	85	21	2.99
2	113020	Monaco: What's Yours Is Mine	2013-04-24	True	True	True	Very Positive	92	3722	14.99
3	226560	Escape Dead Island	2014-11-18	True	False	False	Mixed	61	873	14.99
4	249050	Dungeon of the ENDLESS™	2014-10-27	True	True	False	Very Positive	88	8784	11.99

In [ ]:

```
#convert date_release to date_time

df['date_release'] = pd.to_datetime(df['date_release'])

df['date'] = df['date_release'].dt.date
df['month'] = df['date_release'].dt.to_period('M').astype(str)
```

In [ ]:

```
# Create a custom palette using steam's palette

custom_palette = sns.color_palette(['#c7d5e0','#66c0f4','#2a475e','#1b2838','#171a21'],
custom_palette_gradient = sns.color_palette('blend:#c7d5e0,#66c0f4,#2a475e,#1b2838,#171
```

What operating system has the most playable games?

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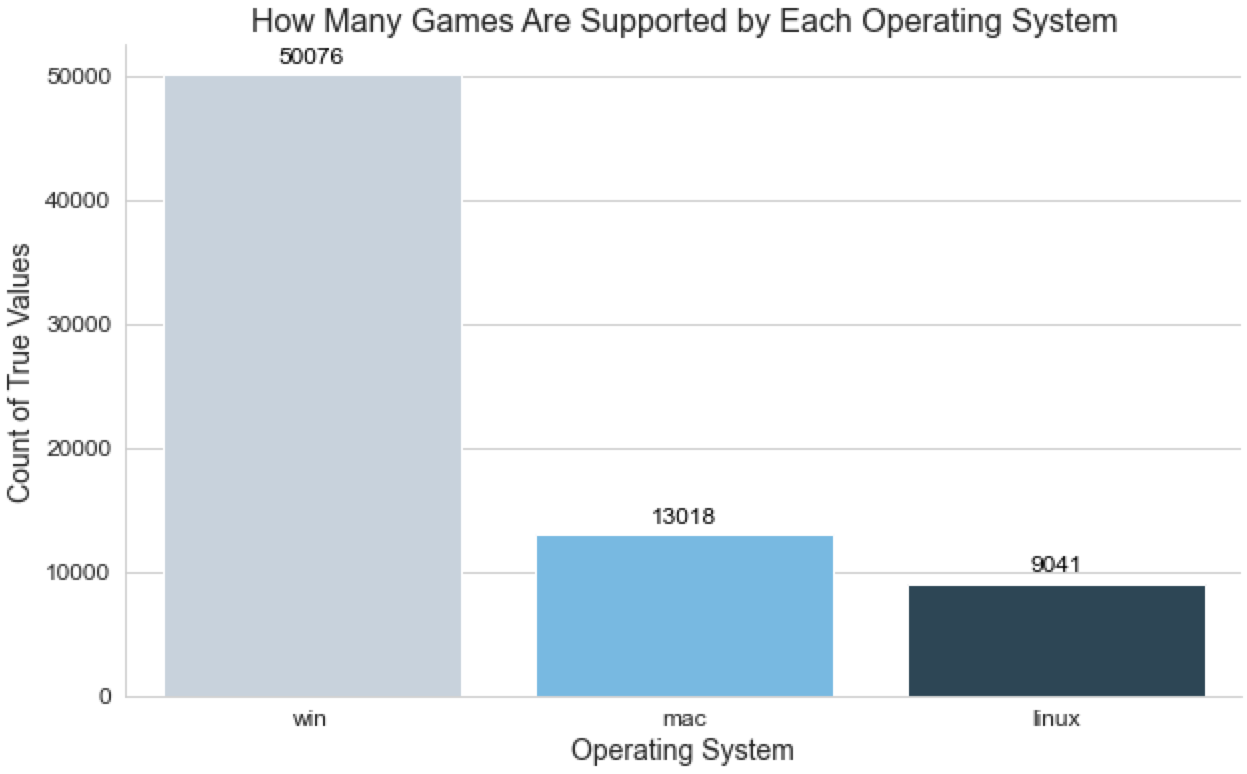
In [ ]:

```
# create a dateframe with just the operating systems
df_os = df[['win', 'mac', 'linux']]
```

In [ ]:

```
# Transform dataframe to long format
df_long = df_os.melt(var_name='os', value_name='count')

# Filter to include only True values
df_true = df_long[df_long['count'] == True]


sns.set_style(style="whitegrid")

plt.figure(figsize=(10,6))

ax = sns.countplot(data=df_true, x='os', palette=custom_palette)

ax.set_xlabel("Operating System", fontsize=14)
ax.set_ylabel("Count of True Values", fontsize=14)
ax.set_title("How Many Games Are Supported by Each Operating System", fontsize=16)

ax.tick_params(axis='x', labelsize=12)
ax.tick_params(axis='y', labelsize=12)

# Annotate each bar with the value count
for p in ax.patches:
    ax.annotate(format(p.get_height(), '.0f'),
                (p.get_x() + p.get_width() / 2., p.get_height()),
                ha = 'center', va = 'center',
                xytext = (0, 9), textcoords = 'offset points',
                fontsize=12, color='black')

sns.despine()

plt.show()
```



There's a pretty distinct difference in the amount of games supported by each operating system. Windows OS is the clear standout

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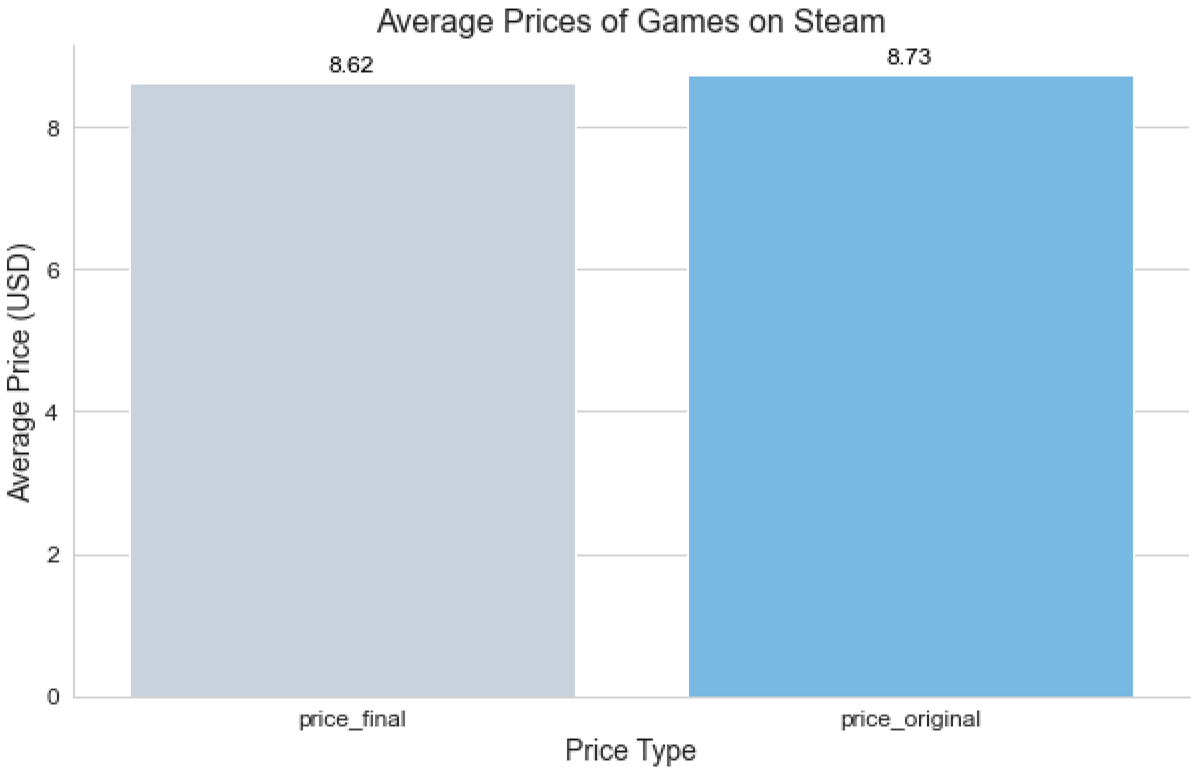
What is the average price for games on steam?

</span>

```
In [ ]: # create a dataframe with only prices and sale prices
        df_prices = df[['price_final', 'price_original']]
```

```
In [ ]: # Calculate average prices
        avg_prices = df_prices.mean().reset_index()
        avg_prices.columns = ['price_type', 'average_price']

        # Set the seaborn style
        sns.set_style(style="whitegrid")

        # Create the plot
        plt.figure(figsize=(10, 6))
        ax = sns.barplot(data=avg_prices, x='price_type', y='average_price', palette=custom_pal

        # Add labels and title
        ax.set_xlabel("Price Type", fontsize=14)
        ax.set_ylabel("Average Price (USD)", fontsize=14)
        ax.set_title("Average Prices of Games on Steam", fontsize=16)

        # Customize the tick parameters
        ax.tick_params(axis='x', labelsize=12)
        ax.tick_params(axis='y', labelsize=12)
```

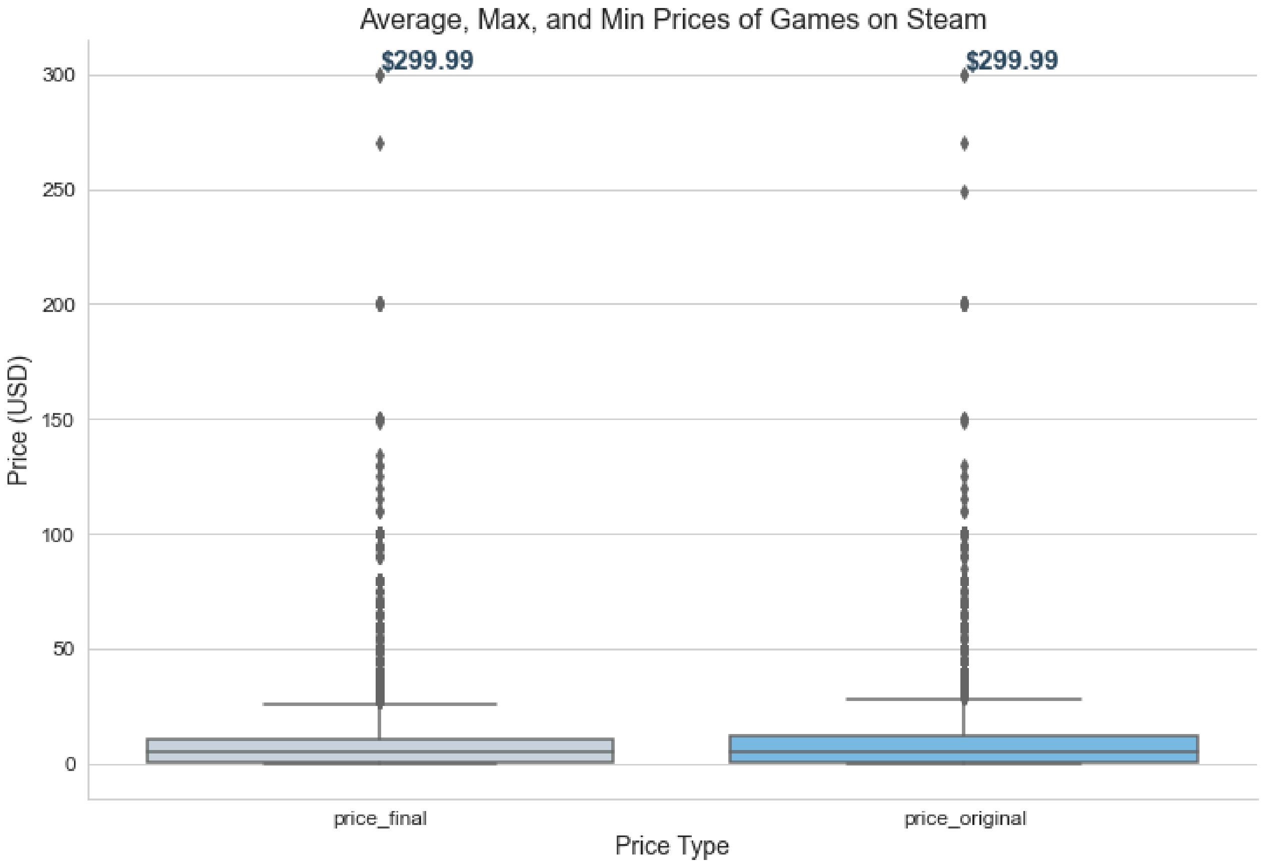
```
# Annotate each bar with the average price
for p in ax.patches:
    ax.annotate(format(p.get_height(), '.2f'),
                (p.get_x() + p.get_width() / 2., p.get_height()),
                ha = 'center', va = 'center',
                xytext = (0, 9), textcoords = 'offset points',
                fontsize=12, color='black')

# Remove the top and right spines for a cleaner look
sns.despine()

plt.savefig('graphs/average_price_games_on_steam.png', bbox_inches = 'tight', edgecolor

# Show the plot
plt.show()
```



In [ ]:

```
# Transform the DataFrame to long format
df_long = df_prices.melt(var_name='price_type', value_name='price')

# Set the seaborn style
sns.set_style(style="whitegrid")

# Create the plot
plt.figure(figsize=(12, 8))
ax = sns.boxplot(data=df_long, x='price_type', y='price', palette=custom_palette)

# Add labels and title
ax.set_xlabel("Price Type", fontsize=14)
ax.set_ylabel("Price (USD)", fontsize=14)
ax.set_title("Average, Max, and Min Prices of Games on Steam", fontsize=16)

# Customize the tick parameters
ax.tick_params(axis='x', labelsize=12)
ax.tick_params(axis='y', labelsize=12)
```

```
# Annotate the highest value
max_prices = df_long.groupby('price_type')['price'].max().reset_index()

for i, row in max_prices.iterrows():
    ax.text(i, row['price'], f'${row["price"]:.2f}',
            ha='left', va='bottom', fontsize=15, color='#2a475e', weight='bold')

# Remove the top and right spines for a cleaner look
sns.despine()

plt.savefig('graphs/max_min_price_games_on_steam.png', bbox_inches = 'tight', edgecolor

# Show the plot
plt.show()
```



It's pretty crazy how the average price for both original and sale price sits at ~8.60−8.70, whereas there are some insane outliers. A $299.99 game? Let's just pull up what game that is.

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In [ ]:

```
filtered_df = df[df['price_final'] == 299.99]

titles = filtered_df['title'].unique()
print(titles[0])
```

```
Clickteam Fusion 2.5 Developer Upgrade
```

Clickteam Fusion 2.5 Developer Upgrade. And this is the DLC

</span>

Which games have been played/reviewed the most?

Basing the played aspect as most reviewed, since the more people reviewing, the more the game should have been played. Barring any review bombs for outside reasons

</span>

In [ ]:

```
df_sorted = df.sort_values(by='user_reviews', ascending=False)

top_100_games = df_sorted.head(100)
top_100_games
```

Out[ ]:

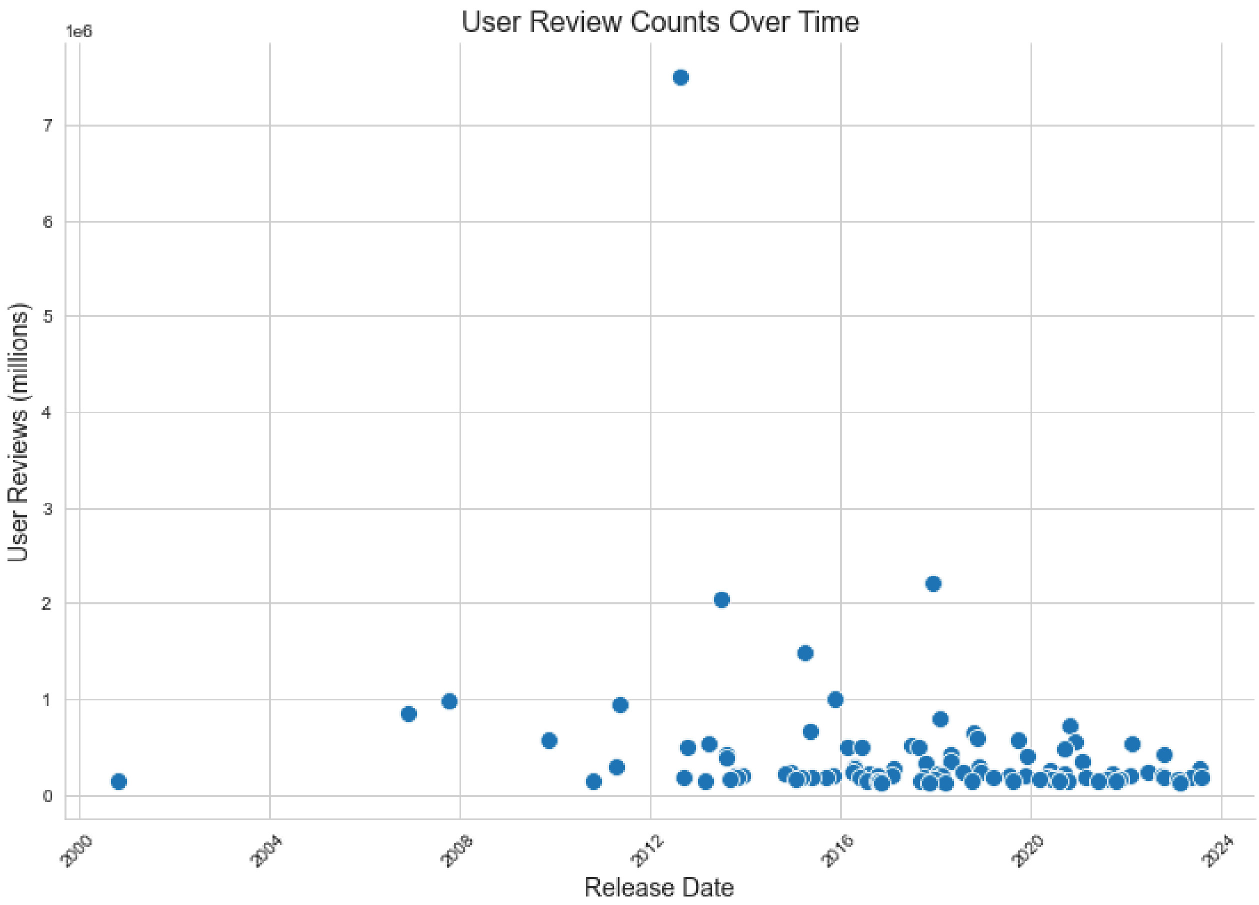
	app_id	title	date_release	win	mac	linux	rating	positive_ratio	user_re
14398	730	Counter-Strike: Global Offensive	2012-08-21	True	True	True	Very Positive	88	74
47770	578080	PUBG: BATTLEGROUNDS	2017-12-21	True	False	False	Mixed	57	22
13176	570	Dota 2	2013-07-09	True	True	True	Very Positive	82	20
12717	271590	Grand Theft Auto V	2015-04-13	True	False	False	Very Positive	86	14
14535	359550	Tom Clancy's Rainbow Six® Siege	2015-12-01	True	False	False	Very Positive	86	9
...	...	...	...	...	...	...	...	...	
47793	427520	Factorio	2020-08-14	True	True	True	Overwhelmingly Positive	96	1
11720	444200	World of Tanks Blitz	2016-11-09	True	True	False	Very Positive	80	1
480	552520	Far Cry® 5	2018-03-26	True	False	False	Very Positive	80	1
15926	552990	World of Warships	2017-11-15	True	False	False	Mostly Positive	76	1
48601	1326470	Sons Of The Forest	2023-02-23	True	False	False	Very Positive	83	1

100 rows × 15 columns

In [ ]:

```
# Set the seaborn style
sns.set_style(style="whitegrid")

# Create the plot
plt.figure(figsize=(12, 8))
ax = sns.scatterplot(data=top_100_games, x='date_release', y='user_reviews', s=100)
```

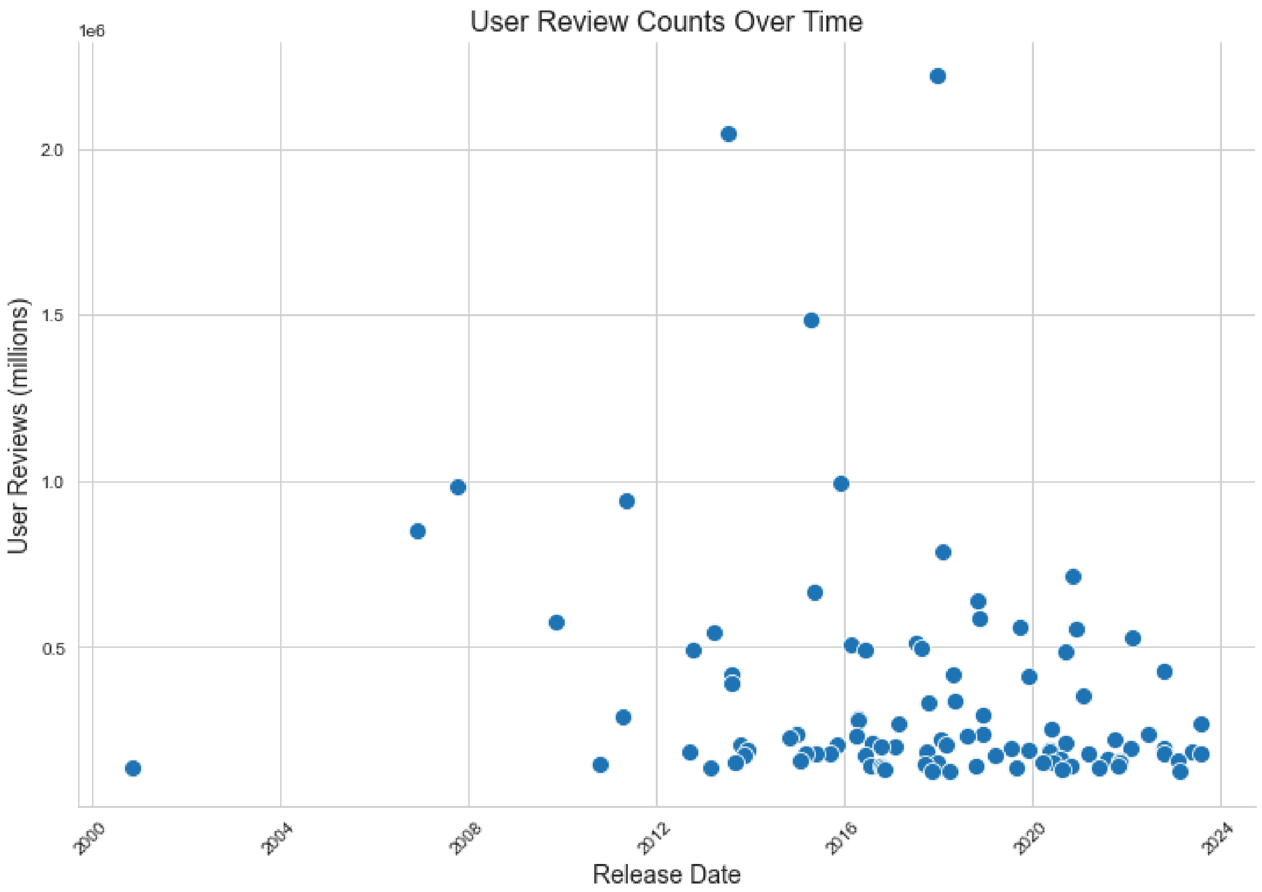
```
# Add labels and title
ax.set_xlabel("Release Date", fontsize=14)
ax.set_ylabel("User Reviews (millions)", fontsize=14)
ax.set_title("User Review Counts Over Time", fontsize=16)

# Rotate the x-axis labels for better readability
plt.xticks(rotation=45)

# Remove the top and right spines for a cleaner look
sns.despine()

plt.show()
```



In [ ]:

```
filtered_games = top_100_games[top_100_games['user_reviews'] <= 5_000_000]
most_reviews_for_game = top_100_games['user_reviews'].max()
top_reviewed_game = top_100_games.loc[top_100_games['user_reviews'].idxmax()]
game_title = top_reviewed_game['title']

# Set the seaborn style
sns.set_style(style="whitegrid")

# Create the plot
plt.figure(figsize=(12, 8))
ax = sns.scatterplot(data=filtered_games, x='date_release', y='user_reviews', s=100)

# Add labels and title
ax.set_xlabel("Release Date", fontsize=14)
ax.set_ylabel("User Reviews (millions)", fontsize=14)
ax.set_title("User Review Counts Over Time", fontsize=16)
```

```
# Rotate the x-axis labels for better readability
plt.xticks(rotation=45)

# Remove the top and right spines for a cleaner look
sns.despine()

plt.show()

print(f'The most reviews for a game is {most_reviews_for_game:,} and the game is: ')
print(game_title)
```



```
The most reviews for a game is 7,494,460 and the game is:
Counter-Strike: Global Offensive
```

What type of games were released in 2020?

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In [ ]:

```
# Merge the DataFrames on 'app_id'
merged_df = pd.merge(df, df_genres, on='app_id')

columns_to_keep = ['title_x', 'date_release', 'user_reviews', 'categories', 'genres', '
filtered_df = merged_df[columns_to_keep]

# Create 'month' column with abbreviated month names
filtered_df['month'] = filtered_df['date_release'].dt.strftime('%b')

# Create 'year' column with year
filtered_df['year'] = filtered_df['date_release'].dt.year
```

```
games_2020 = filtered_df[filtered_df['date_release'].dt.year == 2020]
```

```
<ipython-input-248-b9c2cebeeabe>:8: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  filtered_df['month'] = filtered_df['date_release'].dt.strftime('%b')
<ipython-input-248-b9c2cebeeabe>:11: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  filtered_df['year'] = filtered_df['date_release'].dt.year
```

In [ ]:

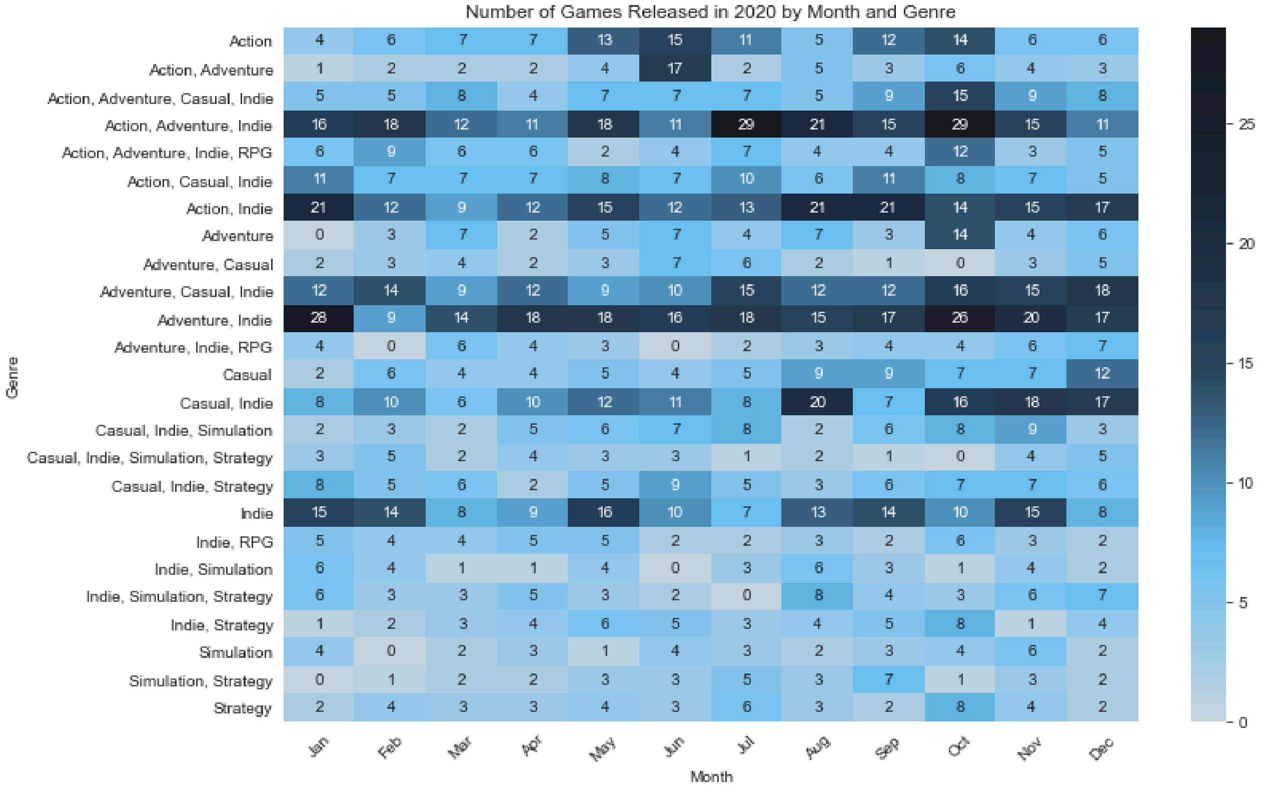
```
games_2020['genres'].value_counts().head(25)

genre_counts = games_2020['genres'].value_counts()

top_25_genres = genre_counts.head(25).index

filtered_games = games_2020[games_2020['genres'].isin(top_25_genres)]
```

In [ ]:

```
month_order = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'N

# Pivot the DataFrame to get counts of games by month and genre
heatmap_data = filtered_games.pivot_table(
    index='genres',    # Rows will be genres
    columns='month',   # Columns will be months
    aggfunc='size',    # Count occurrences
    fill_value=0       # Fill missing values with 0
)

heatmap_data = heatmap_data.reindex(columns=month_order)
```

In [ ]:

```
# Set the seaborn style
sns.set_style(style="whitegrid")

# Create the heatmap
plt.figure(figsize=(12, 8))

sns.heatmap(heatmap_data, cmap=custom_palette_gradient, annot=True, fmt='d')

plt.title('Number of Games Released in 2020 by Month and Genre')
plt.xlabel('Month')
plt.ylabel('Genre')
plt.xticks(rotation=45)
plt.yticks(rotation=0)

plt.savefig('graphs/2020_game_released_by_genre.png', bbox_inches = 'tight', edgecolor=

plt.show()
```

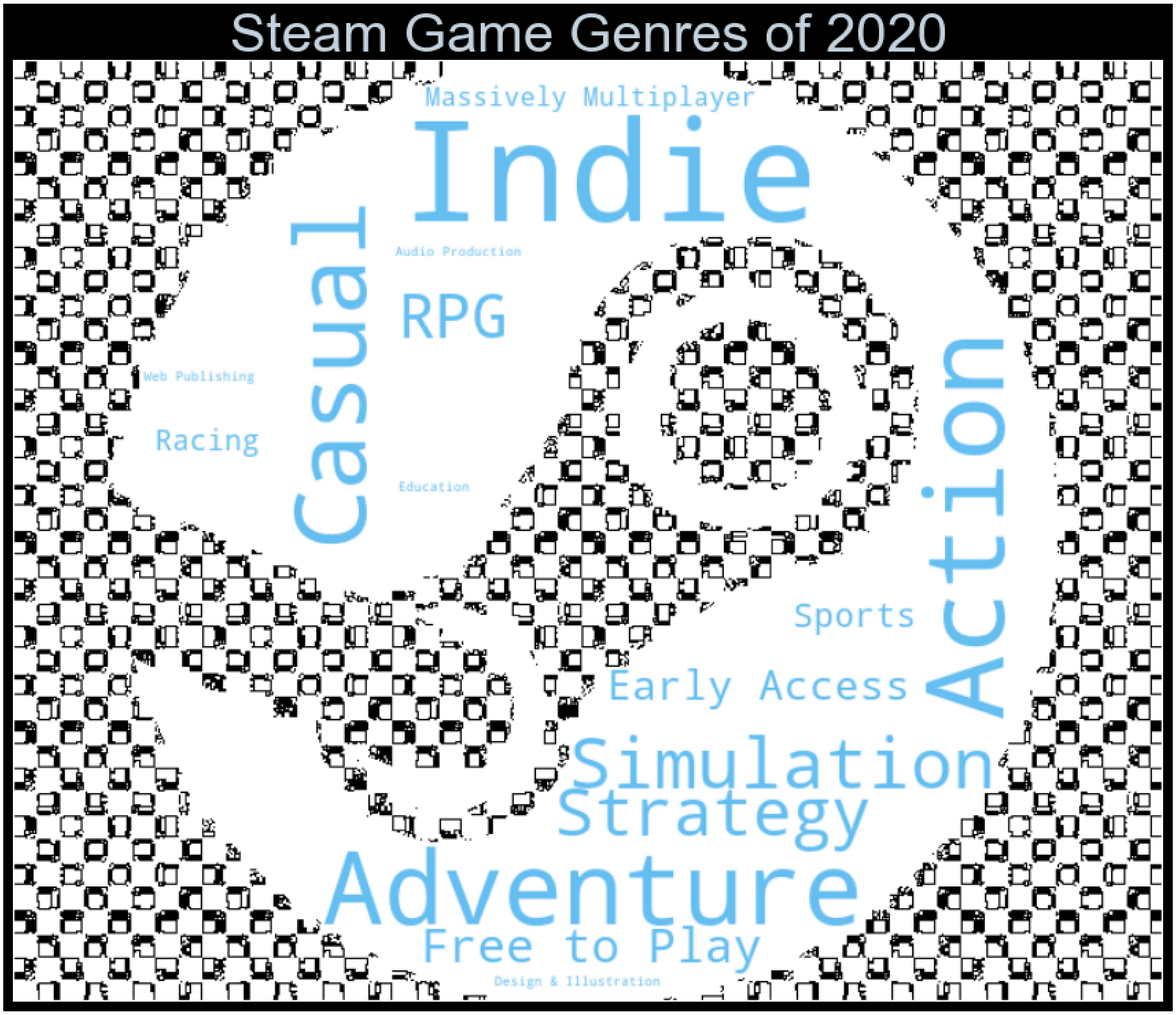


Genre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Action	4	6	7	7	13	15	11	5	12	14	6	6
Action, Adventure	1	2	2	2	4	17	2	5	3	6	4	3
Action, Adventure, Casual, Indie	5	5	8	4	7	7	7	5	9	15	9	8
Action, Adventure, Indie	16	18	12	11	18	11	29	21	15	29	15	11
Action, Adventure, Indie, RPG	6	9	6	6	2	4	7	4	4	12	3	5
Action, Casual, Indie	11	7	7	7	8	7	10	6	11	8	7	5
Action, Indie	21	12	9	12	15	12	13	21	21	14	15	17
Adventure	0	3	7	2	5	7	4	7	3	14	4	6
Adventure, Casual	2	3	4	2	3	7	6	2	1	0	3	5
Adventure, Casual, Indie	12	14	9	12	9	10	15	12	12	16	15	18
Adventure, Indie	28	9	14	18	18	16	18	15	17	26	20	17
Adventure, Indie, RPG	4	0	6	4	3	0	2	3	4	4	6	7
Casual	2	6	4	4	5	4	5	9	9	7	7	12
Casual, Indie	8	10	6	10	12	11	8	20	7	16	18	17
Casual, Indie, Simulation	2	3	2	5	6	7	8	2	6	8	9	3
Casual, Indie, Simulation, Strategy	3	5	2	4	3	3	1	2	1	0	4	5
Casual, Indie, Strategy	8	5	6	2	5	9	5	3	6	7	7	6
Indie	15	14	8	9	16	10	7	13	14	10	15	8
Indie, RPG	5	4	4	5	5	2	2	3	2	6	3	2
Indie, Simulation	6	4	1	1	4	0	3	6	3	1	4	2
Indie, Simulation, Strategy	6	3	3	5	3	2	0	8	4	3	6	7
Indie, Strategy	1	2	3	4	6	5	3	4	5	8	1	4
Simulation	4	0	2	3	1	4	3	2	3	4	6	2
Simulation, Strategy	0	1	2	2	3	3	5	3	7	1	3	2
Strategy	2	4	3	3	4	3	6	3	2	8	4	2

In [ ]:

```
from wordcloud import WordCloud, ImageColorGenerator
from collections import Counter
from PIL import Image

#Create the mask
steam_mask = np.array(Image.open('images/steam-logo.jfif'))

#Grab the mask colors
colors = ImageColorGenerator(steam_mask)

games_2020_copy = games_2020.copy()

games_2020_copy['genres'] = games_2020_copy['genres'].fillna('').astype(str)

# Combine all genre entries into a single string
all_genres = ','.join(games_2020_copy['genres'])

genres = [genre.strip() for genre in all_genres.split(',') if genre.strip()]

genre_counts = Counter(genres)
genre_counts_dict = dict(genre_counts)

def grey_color_func(word, font_size, position,orientation,random_state=None, **kwargs):
    return("hsl(202, 87%, 68%)")

font_path = None

# Create a word cloud
wordcloud = WordCloud(width=1600, height=800, background_color='white', color_func=colo
                      contour_color='black', contour_width=1, collocations=False,
                      font_path=font_path, mask=steam_mask).generate_from_frequencies(g
wordcloud.recolor(color_func = grey_color_func)

# Display the word cloud
```

```
plt.figure(figsize=(20, 10), facecolor='k')
plt.imshow(wordcloud)

plt.imshow(wordcloud, interpolation='bilinear')
plt.axis('off')  # Hide axes
plt.title('Steam Game Genres of 2020', color='#c7d5e0', fontsize=40)
plt.tight_layout(pad=0)
plt.savefig('graphs/2020_genre_wordcloud.png', bbox_inches = 'tight', edgecolor='w')

plt.show()
```



How have games in 2020 been rated/received?

</span>

```
In [ ]: genre_counts_dict
```

```
Out[ ]: {'Simulation': 941,
         'Strategy': 828,
         'Action': 1704,
         'Casual': 1553,
         'Indie': 2974,
         'RPG': 712,
         'Adventure': 1683,
         'Massively Multiplayer': 124,
         'Free to Play': 451,
         'Racing': 163,
         'Sports': 215,
         'Early Access': 340,
         'Audio Production': 1,
         'Design & Illustration': 1,
         'Education': 1,
         'Web Publishing': 1}
```

In [ ]:

```
games_2020['rating'].unique()
```

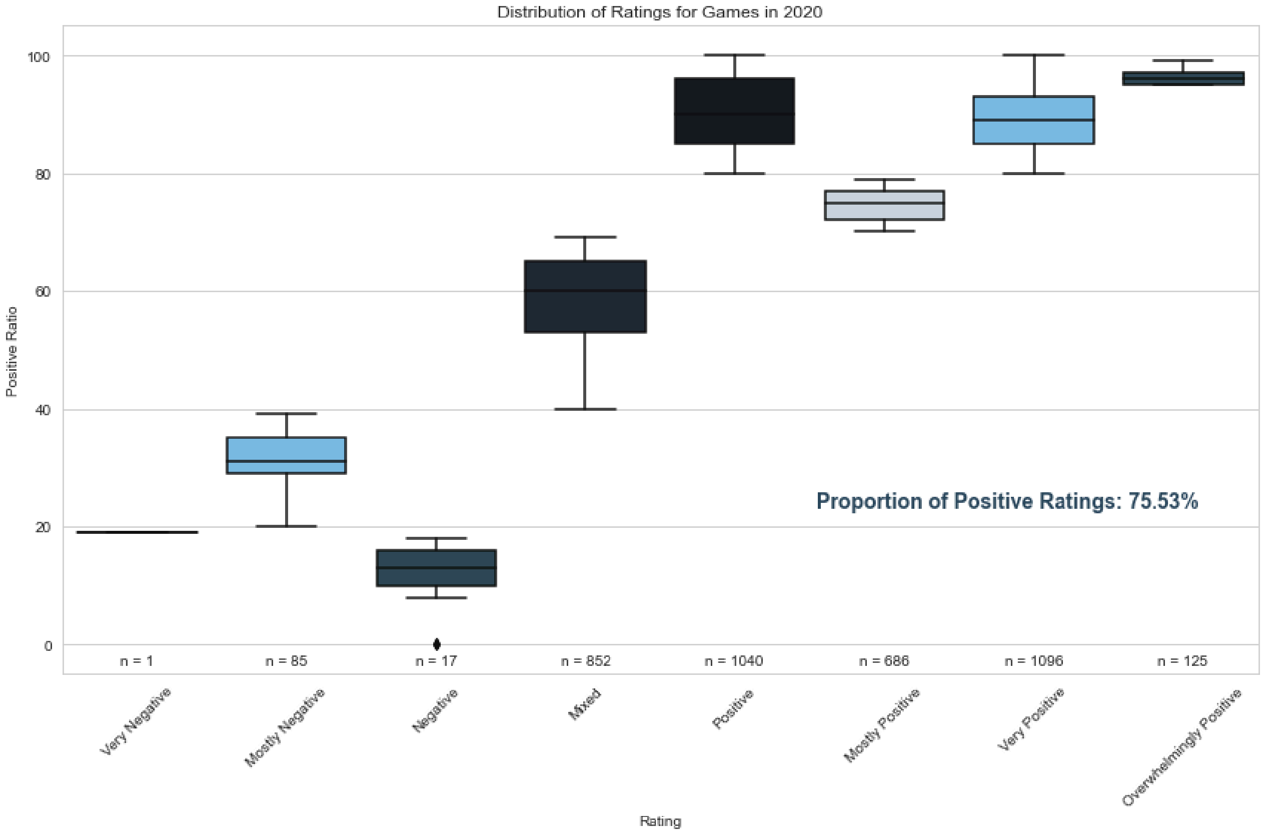
Out[ ]:

```
array(['Very Positive', 'Mostly Positive', 'Mixed',
       'Overwhelmingly Positive', 'Positive', 'Mostly Negative',
       'Negative', 'Very Negative'], dtype=object)
```

In [ ]:

```
rating_order = ['Very Negative', 'Mostly Negative', 'Negative', 'Mixed',
                'Positive', 'Mostly Positive', 'Very Positive', 'Overwhelmingly Positiv

rating_mapping = {rating: index for index, rating in enumerate(rating_order)}

# Map the 'rating' column to the numeric values based on the order
games_2020.loc[:, 'rating_order'] = games_2020['rating'].map(rating_mapping)

# Sort the DataFrame by the new 'rating_order' column
games_2020_sorted = games_2020.sort_values('rating_order')



# Filter for positive ratings
positive_ratings = ['Positive', 'Mostly Positive', 'Very Positive', 'Overwhelmingly Pos
positive_counts = games_2020_sorted[games_2020_sorted['rating'].isin(positive_ratings)]
total_counts = games_2020_sorted.shape[0]
positive_proportion = positive_counts / total_counts



# Set the seaborn style
sns.set_style(style="whitegrid")

plt.figure(figsize=(12, 8))
ax = sns.boxplot(x='rating', y='positive_ratio', data=games_2020_sorted, order=rating_o

plt.title('Distribution of Ratings for Games in 2020')
plt.ylabel('Positive Ratio')
plt.xlabel('Rating')
plt.xticks(rotation=45)

n_counts = games_2020_sorted['rating'].value_counts().reindex(rating_order)
for i, count in enumerate(n_counts):
    ax.text(i, 0.01, f'n = {count}', ha='center', va='bottom', transform=ax.get_xaxis_t

# Add text annotation for positive proportion
plt.text(0.95, 0.25, f'Proportion of Positive Ratings: {positive_proportion:.2%}',
         ha='right', va='bottom', fontsize=14, color='#2a475e', fontweight='bold', tran

plt.tight_layout()
plt.savefig('graphs/ratings_for_2020_games.png', bbox_inches = 'tight', edgecolor='w')

plt.show()
```

```
c:\Users\dmm46\anaconda3\envs\learn-env\lib\site-packages\pandas\core\indexing.py:1596:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  self.obj[key] = _infer_fill_value(value)
c:\Users\dmm46\anaconda3\envs\learn-env\lib\site-packages\pandas\core\indexing.py:1745:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  isetter(ilocs[0], value)
```



Based off this information, games did generally well in 2020 with a 75.53% proportion of positive or higher ratings

</span>

Inferential Analysis

Did games from 2020 do better overall than other games from the between 2016 to 2023?

</span>

In [ ]:

```
# Define the positive rating categories
positive_ratings = ['Positive', 'Mostly Positive', 'Very Positive', 'Overwhelmingly Pos

# Function to calculate positive rating proportion for a given year
def calculate_positive_proportion(df, year):
    year_data = df[df['year'] == year]
    positive_counts = year_data['rating'].isin(positive_ratings).sum()
    total_counts = year_data['rating'].shape[0]
    return positive_counts / total_counts if total_counts > 0 else 0

# Calculate proportions for each year
years = [2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023]
proportions = {year: calculate_positive_proportion(filtered_df, year) for year in years
```

H0: Games made outside of 2020 will not have a difference in positive rating proportion

HA: Games made outside of 2020 will have a major difference in positive rating proportion

A significance level of 80%

</span>

In [ ]:

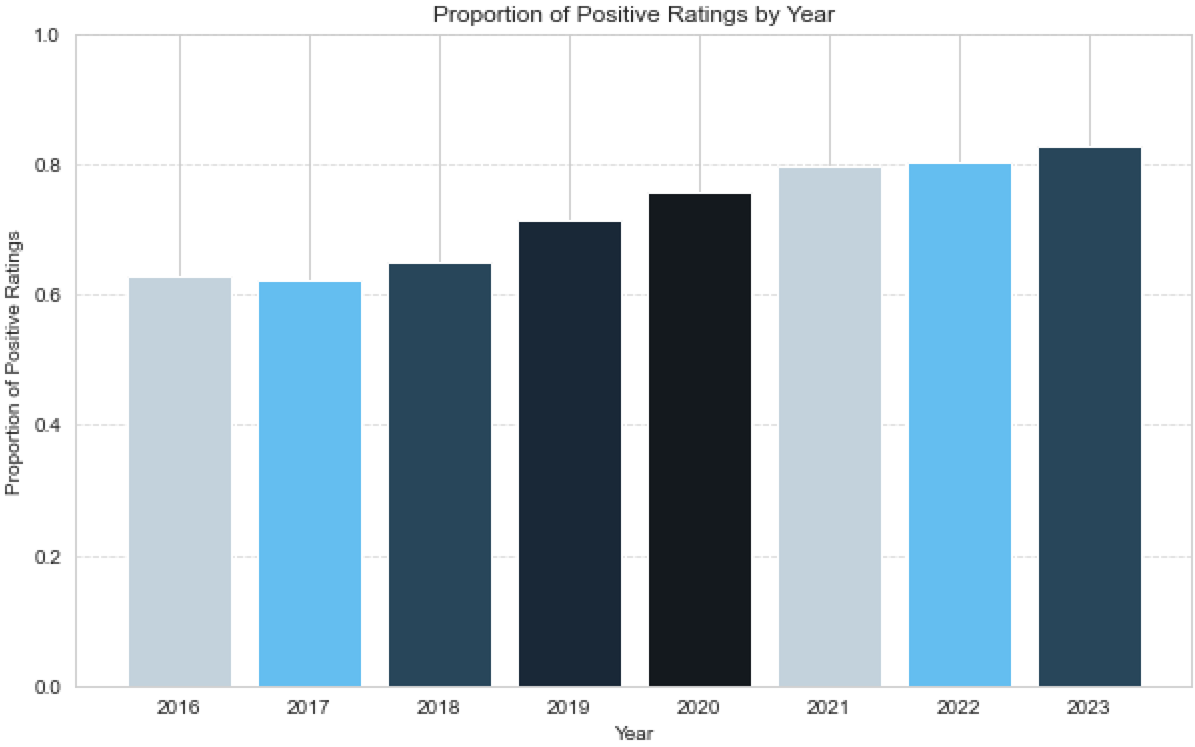
```
from scipy.stats import chi2_contingency

# Prepare the contingency table
# Separate data into two groups: 2020 and other years
games_2020 = filtered_df[filtered_df['year'] == 2020]
games_non_2020 = filtered_df[filtered_df['year'] != 2020]

# Count positive ratings
positive_2020 = games_2020['rating'].isin(positive_ratings).sum()
positive_non_2020 = games_non_2020['rating'].isin(positive_ratings).sum()

# Count total ratings
total_2020 = games_2020.shape[0]
total_non_2020 = games_non_2020.shape[0]

# Create the contingency table
contingency_table = pd.DataFrame({
    'Positive': [positive_2020, positive_non_2020],
    'Negative': [total_2020 - positive_2020, total_non_2020 - positive_non_2020]
})

# Perform the Chi-square test
chi2_stat, p_val, dof, expected = chi2_contingency(contingency_table)
print(f'Chi2 Stat: {chi2_stat}, p-value: {p_val}')

# Determine the alpha for a significance level of 80%
alpha = 1 - 0.80

# Compare the p-value to the significance level
if p_val < alpha:
    print('Reject the null hypothesis (H0): There is a significant difference in positi
else:
    print('Fail to reject the null hypothesis (H0): There is no significant difference
```

```
Chi2 Stat: 30.733051348541867, p-value: 2.960786585830045e-08
Reject the null hypothesis (H0): There is a significant difference in positive rating pr
```

oportions.

In [ ]:

```
plt.figure(figsize=(10, 6))
plt.bar(proportions.keys(), proportions.values(), color=custom_palette)

plt.xlabel('Year')
plt.ylabel('Proportion of Positive Ratings')
plt.title('Proportion of Positive Ratings by Year')
plt.ylim(0, 1)  # Adjust if needed
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



Did prices of games change compared to 2020?

H0: Games made outside of 2020 will not have a difference cost

HA: Games made outside of 2020 will cost more overall

A significance level of 90%

</span>

In [ ]:

```
# We will get smaller samples
np.random.seed(42)

# Sample 1000 games from each group
sample_2020 = games_2020.sample(n=1000, random_state=42)
sample_non_2020 = games_non_2020.sample(n=1000, random_state=42)

# Extract prices
prices_2020 = sample_2020['price_final'].dropna()
prices_non_2020 = sample_non_2020['price_final'].dropna()
```

```
# Determine the alpha for significance level of 90%
alpha = 1 - 0.90
```

In [ ]:

```
from scipy.stats import shapiro

# Normality test for 2020 prices
stat_2020, p_2020 = shapiro(prices_2020)
print(f'2020 Prices Normality Test: Statistic = {stat_2020}, p-value = {p_2020}')

# Normality test for other years prices
stat_non_2020, p_non_2020 = shapiro(prices_non_2020)
print(f'Non-2020 Prices Normality Test: Statistic = {stat_non_2020}, p-value = {p_non_2

# Compare the p-value to the significance level
if p_2020 < alpha:
    print('Reject the null hypothesis (H0): The data may be normally distributed')
else:
    print('Fail to reject the null hypothesis (H0): The data may be normally distribute
```

```
2020 Prices Normality Test: Statistic = 0.7999120354652405, p-value = 2.2492546246976986
e-33
Non-2020 Prices Normality Test: Statistic = 0.7559380531311035, p-value = 5.277719957436
8914e-36
Reject the null hypothesis (H0): The data may be normally distributed
```

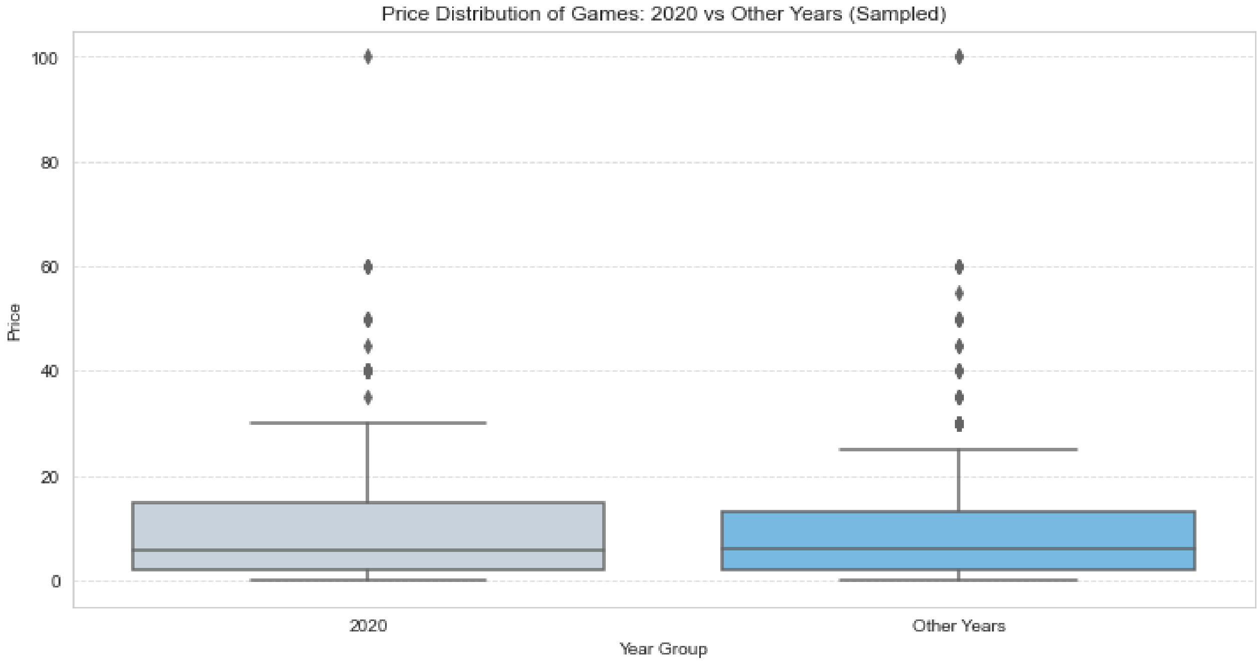
In [ ]:

```
from scipy.stats import ttest_ind

# t-test for independent samples
t_stat, p_value = ttest_ind(prices_2020, prices_non_2020, equal_var=True)
print(f't-Test: Statistic = {t_stat}, p-value = {p_value}')

if p_val < alpha:
    print('Reject the null hypothesis (H0): Games made outside of 2020 will cost more o
else:
    print('Fail to reject the null hypothesis (H0): Games made outside of 2020 will not
```

```
t-Test: Statistic = 0.57842749552097, p-value = 0.5630407261719227
Reject the null hypothesis (H0): Games made outside of 2020 will cost more overall.
```

In [ ]:

```
# Add a column for price group
sample_2020['price_group'] = '2020'
sample_non_2020['price_group'] = 'Other Years'

# Combine samples into a single DataFrame
combined_sample = pd.concat([sample_2020, sample_non_2020])

# Plot
plt.figure(figsize=(12, 6))
sns.boxplot(x='price_group', y='price_final', data=combined_sample, palette=custom_pale

plt.title('Price Distribution of Games: 2020 vs Other Years (Sampled)')
plt.ylabel('Price')
plt.xlabel('Year Group')
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



Which year had the most expensive game releases overall?

H0: Game prices have not significantly changed over the years

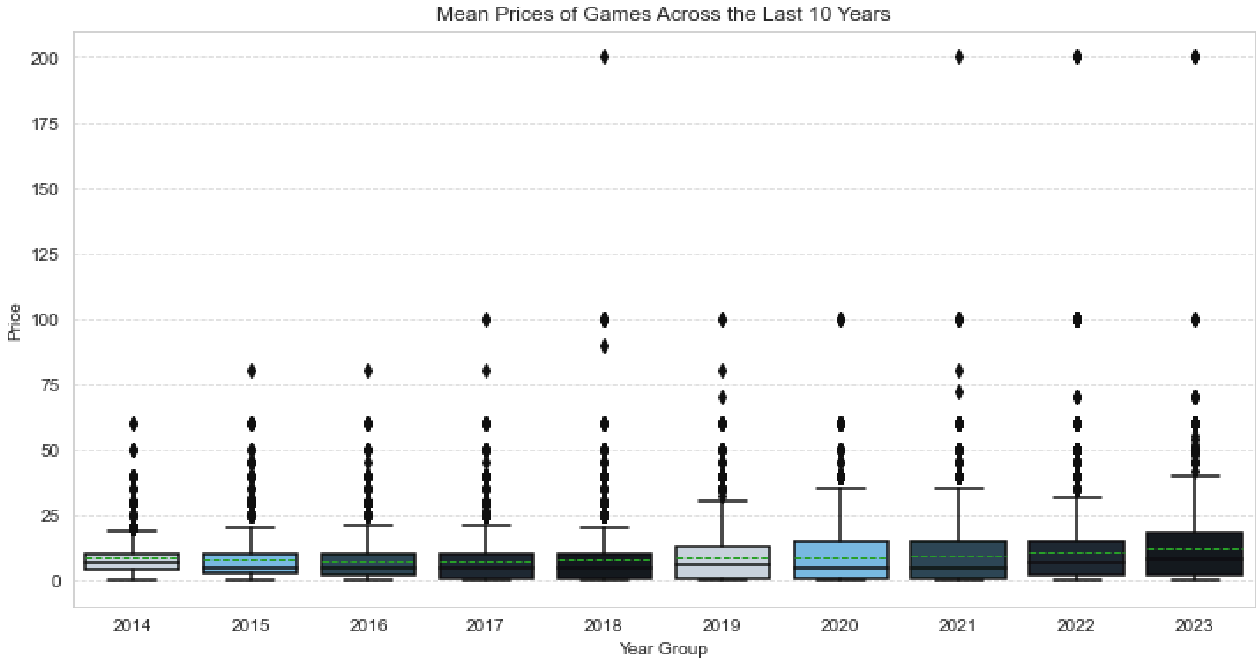
HA: Games prices have increased over the years

A significance level of 90%

</span>

In [ ]:

```
last_ten_years = filtered_df[~filtered_df['year'].between(1997, 2013)][['year','price_f

means_per_year = last_ten_years.groupby('year')['price_final'].mean()

sns.set_style(style="whitegrid")

plt.figure(figsize=(12, 6))

# Create the boxplot
sns.boxplot(x='year', y='price_final', data=last_ten_years, showmeans=True, meanline=Tr


plt.title('Mean Prices of Games Across the Last 10 Years')
plt.ylabel('Price')
plt.xlabel('Year Group')
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



In [ ]:

```
last_ten_years.groupby('year').describe()
```

Out[ ]:

	price_final							
	count	**mean**	**std**	**min**	**25%**	**50%**	**75%**	**max**
year								
2014	1338.0	8.874918	7.758010	0.0	3.99	6.99	9.99	59.99
2015	1994.0	7.859534	7.676566	0.0	2.99	4.99	9.99	79.99
2016	2942.0	7.428426	7.880083	0.0	1.99	4.99	9.99	79.99
2017	3473.0	7.657178	9.089136	0.0	0.99	4.99	9.99	99.99
2018	3694.0	8.038771	10.384270	0.0	0.99	4.99	9.99	199.99
2019	3193.0	9.044883	10.225926	0.0	0.99	5.99	12.99	99.99
2020	3902.0	8.985577	10.163902	0.0	0.99	4.99	14.99	99.99
2021	4471.0	9.181619	11.282049	0.0	0.99	4.99	14.99	199.99
2022	4769.0	10.754647	14.366454	0.0	1.99	6.99	14.99	199.99
2023	2300.0	12.218648	15.601864	0.0	1.99	8.09	17.99	199.99

It does seem as those prices are getting more expensive each year with the 2023 having the large mean of prices

In [ ]:

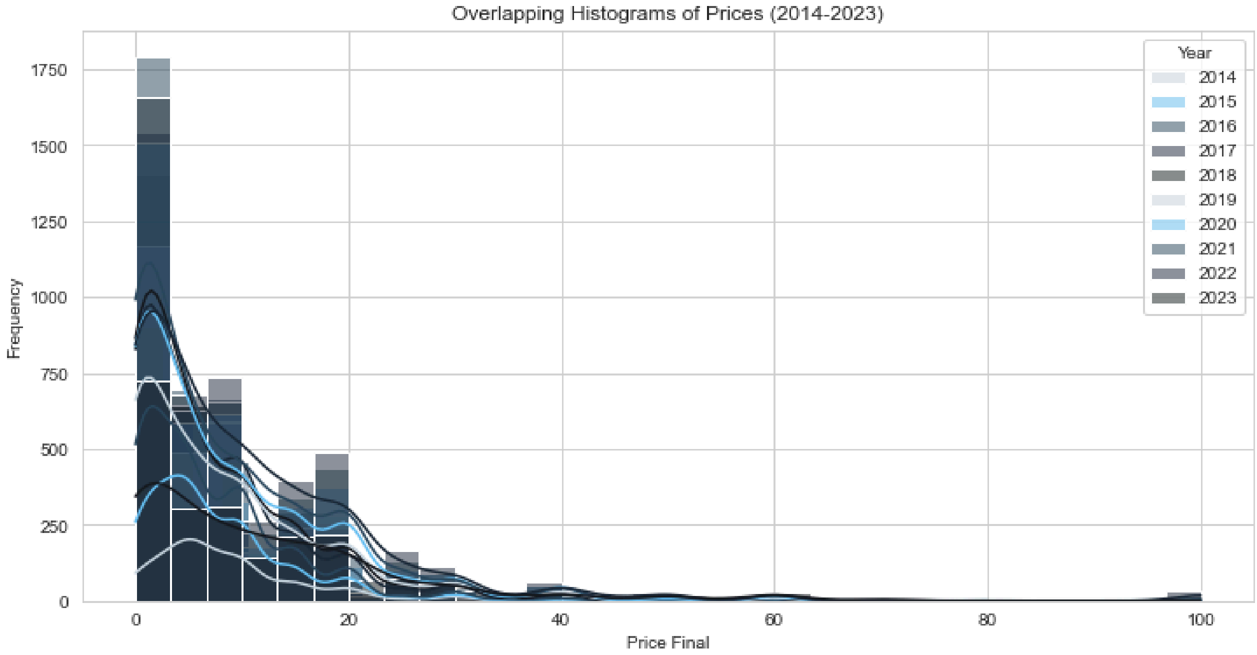
```
observed_variance = last_ten_years.groupby('year').mean().var()[0]
print('Observed means:', last_ten_years.groupby('year').mean().values.ravel())
print('Variance:',observed_variance)

def perm_test(df):
    df = df.copy()
    df['price_final'] = np.random.permutation(df['price_final'].values)
    return df.groupby('year').mean().var()[0]
```

```
perm_variance = [perm_test(last_ten_years) for _ in range(3000)]
p_val = np.mean([var > observed_variance for var in perm_variance])
print('Pr(Prob)', p_val)

# Determine the alpha for significance level of 90%
alpha = 1 - 0.90

# Compare the p-value to the significance level
if p_val < alpha:
    print('Reject the null hypothesis (H0): Games prices have increased over the years.
else:
    print('Fail to reject the null hypothesis (H0): Game prices have not significantly
```

```
Observed means: [ 8.87491779  7.8595336   7.42842624  7.65717823  8.03877098  9.04488256
  8.98557663  9.18161932 10.75464668 12.21864783]
Variance: 2.2207529177049437
Pr(Prob) 0.0
Reject the null hypothesis (H0): Games prices have increased over the years.
```

In [ ]:

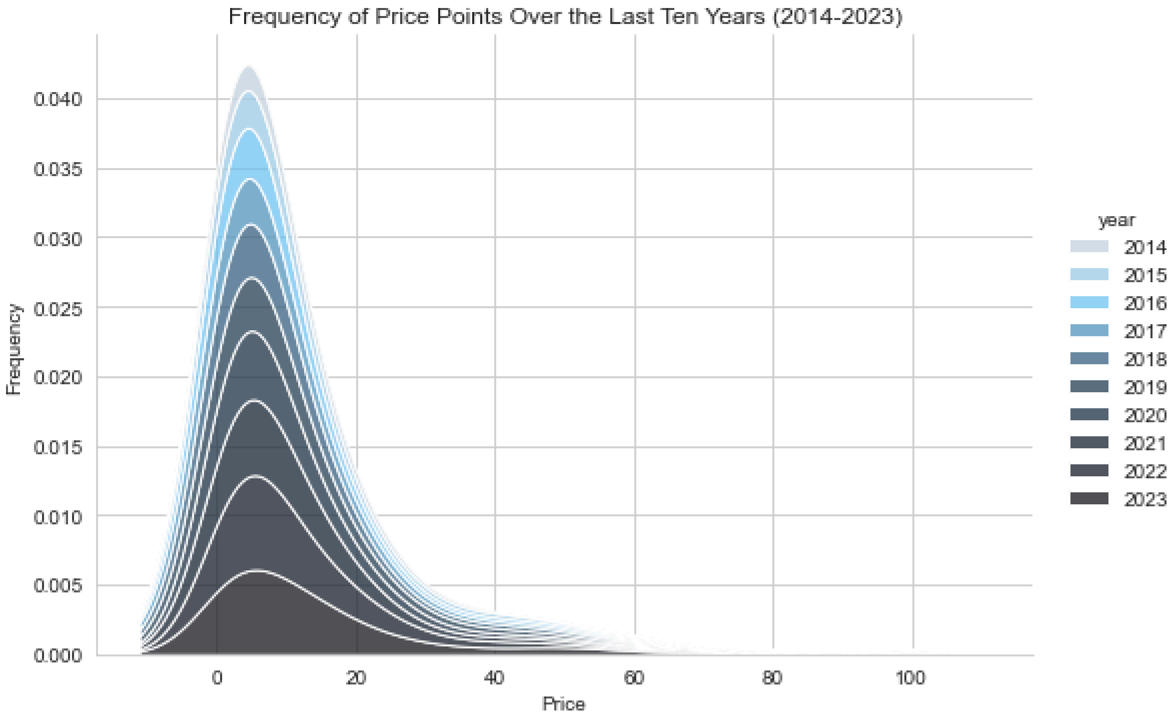
```
filtered_prices = last_ten_years[last_ten_years['price_final'] < 100.00]

sns.set_style(style="whitegrid")

plt.figure(figsize=(12, 6))

palette = custom_palette

# Loop through each year and plot a histogram for each
for i, year in enumerate(range(2014, 2024)):
    sns.histplot(data=filtered_prices[filtered_prices['year'] == year],
                 x='price_final',
                 color=palette[i],
                 kde=True,
                 bins=30,
                 label=str(year),
                 alpha=0.5)

# Customize the plot
plt.title('Overlapping Histograms of Prices (2014-2023)')
plt.xlabel('Price Final')
plt.ylabel('Frequency')
plt.legend(title='Year')

plt.show()
```



lineplot for above

In [ ]:
```
grouped_df = filtered_prices.groupby(['year', 'price_final']).size().reset_index(name='

plt.figure(figsize=(20, 10))

# sns.lineplot(data=grouped_df, x='price_final', y='frequency', hue='year', marker='o')
g = sns.displot(data=grouped_df, x='price_final', hue='year', kind='kde', multiple='sta

# Customize the plot
plt.title('Frequency of Price Points Over the Last Ten Years (2014-2023)')
plt.xlabel('Price')
plt.ylabel('Frequency')

plt.show()
```

```
<Figure size 1440x720 with 0 Axes>
```



Final Analysis

CLEANING this data was pretty straightforward. The first table was very clean and I only needed some of the rows for this analysis. The second table that was merged wasn't as clean, but I really only needed the app.id and genre. I changed the date_release column to datetime type. It helped with mapping the new columns for year and month later on. As for the second table, I separated the genre column into a separate dictionary that I used later on to understand how often those tags were represented.

I wanted to make sure that I was focused on particular elements of the total data so I did make a lot of smaller dataframes with only necessary columns.

DESCRIPTIVE ANALYSIS was focused with intention. After seeing this data, I knew that I wanted to explore the impacts of the COVID lockdown on steam sales. I started with a broad look at the games and slowly worked towarded a more narrowed view of the 2020 games in this dataset. As a gamer I was aware that Windows would be the king in terms of operating systems. This data doesn't looking why that is the reason, but outside research reveals that developers call the process expensive, when trying to make games for MacOS. It was interesting to note that the average cost of games fell below $9. I think this is in part to the excessive amount of 'free to play' games as well as indie developers that publish and market on Steam.

When it came time to look deeper in to 2020, it was interesting to see that 'Indie' games and 'Action' games were the big release genres for 2020. This would make sense, especially since indie teams are generally smaller, and during a lockdown it's probably easier to develop these types of games from home. Lastly, I noted that games received approximately 75% of positive or better ratings on Steam. It seems like games did pretty well in 2020

INFERENTIAL ANALYSIS allowed me to step back from 2020 and use that information to test how different games were during that time period and the rest of the past decade. There was a significant enough difference in the reviews provided for games outside of 2020. This might be in part to look at the rest of the decade, compared to 2020. I wondered if prices would significantly change outside of 2020, and there was an increase in that value. The numbers were definitely more varied between 2020 and 2023, but if you look at the yearly difference, it seems to follow closely to a normal inflation. I think a deeper look into these on a year vs. year basis might show more, but that is work to be done in the future.

</span>

Recommendations

Keep on track with your pricing model. There was an uptick in the mean price of games, but the increase looks steady enough and not dramatic.

Indie developers did work through 2020, and given their positive ratings, it would make sense to provide more support for more indie companies to get their foot into the game dev business.

Provide more stats to gamers beyond the end of year review. Gamers love stats

</span>