**Reference:**

All the programs and scripts that were executed for this assignment are available on GitHub
**GitHub link**: https://github.com/saurabh-dixit-ds/Saurabh_Dixit_DA301_Assignment

**Background**:
Turtle Games, a game manufacturer and retailer sell their own products, as well as products manufactured by other companies. Their product range includes Lego board games, video games and toys. They have a global customer base and have a business objective of improving overall sales performance.

## Business Case 1:

What price should be set for the Lego sets that have 8,000 Lego pieces?

**Approach**:

Data gathered in **lego.csv** file was **loaded, cleaned, prepared, and analyzed** to derive insights and predict price using **Simple Linear Regression**. The csv file contained details such as the price, number of pieces, customer reviews and age, as well as number of countries in which the product is available.

Data was **loaded** into a data frame named **df_lego** and viewed to understand the dimensions (rows and columns), datatypes and the general values it contained.

```
df_lego.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 12261 entries, 0 to 12260
Data columns (total 7 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   ages               12261 non-null  int64  
 1   list_price         12261 non-null  float64
 2   num_reviews        12261 non-null  int64  
 3   piece_count        12261 non-null  int64  
 4   play_star_rating   12261 non-null  float64
 5   review_difficulty  12261 non-null  int64  
 6   country            12261 non-null  int64  
dtypes: float64(2), int64(5)
memory usage: 670.6 KB
```

```
df_lego.describe()
```

| | ages | list_price | num_reviews | piece_count | play_star_rating | review_difficulty | country |
|---|---|---|---|---|---|---|---|
| **count** | 12261.00000 | 12261.000000 | 12261.000000 | 12261.000000 | 12261.000000 | 12261.000000 | 12261.000000 |
| **mean** | 16.68828 | 65.141998 | 14.603050 | 493.405921 | 3.709689 | 1.988826 | 10.015333 |
| **std** | 8.21868 | 91.980429 | 34.356847 | 825.364580 | 1.641130 | 1.787565 | 6.185450 |
| **min** | 0.00000 | 2.272400 | 0.000000 | 1.000000 | 0.000000 | 0.000000 | 0.000000 |
| **25%** | 11.00000 | 19.990000 | 1.000000 | 97.000000 | 3.600000 | 0.000000 | 4.000000 |
| **50%** | 19.00000 | 36.587800 | 4.000000 | 216.000000 | 4.400000 | 2.000000 | 10.000000 |
| **75%** | 23.00000 | 70.192200 | 11.000000 | 544.000000 | 4.700000 | 4.000000 | 15.000000 |
| **max** | 30.00000 | 1104.870000 | 367.000000 | 7541.000000 | 5.000000 | 5.000000 | 20.000000 |

```
df_lego.shape
```

```
(12261, 7)
```

### Describing the data set

- **Num of Rows :** 12261
- **Num of Columns :** 7

As part of **data cleaning** process, the data set was examined to see if there are any missing values. As you will notice from the below screenshot, **no missing values were found**.

```
# Check for missing values
df_lego.isna().sum()
```

```
ages                  0
list_price            0
num_reviews           0
piece_count           0
play_star_rating      0
review_difficulty     0
country               0
dtype: int64
```

```
# Check for null values
df_lego.isnull().sum()
```

```
ages                  0
list_price            0
num_reviews           0
piece_count           0
play_star_rating      0
review_difficulty     0
country               0
dtype: int64
```

## Sense check the data

- **There are No missing values in any of the columns in the Lego data set**

## Min and Max values in lego data set

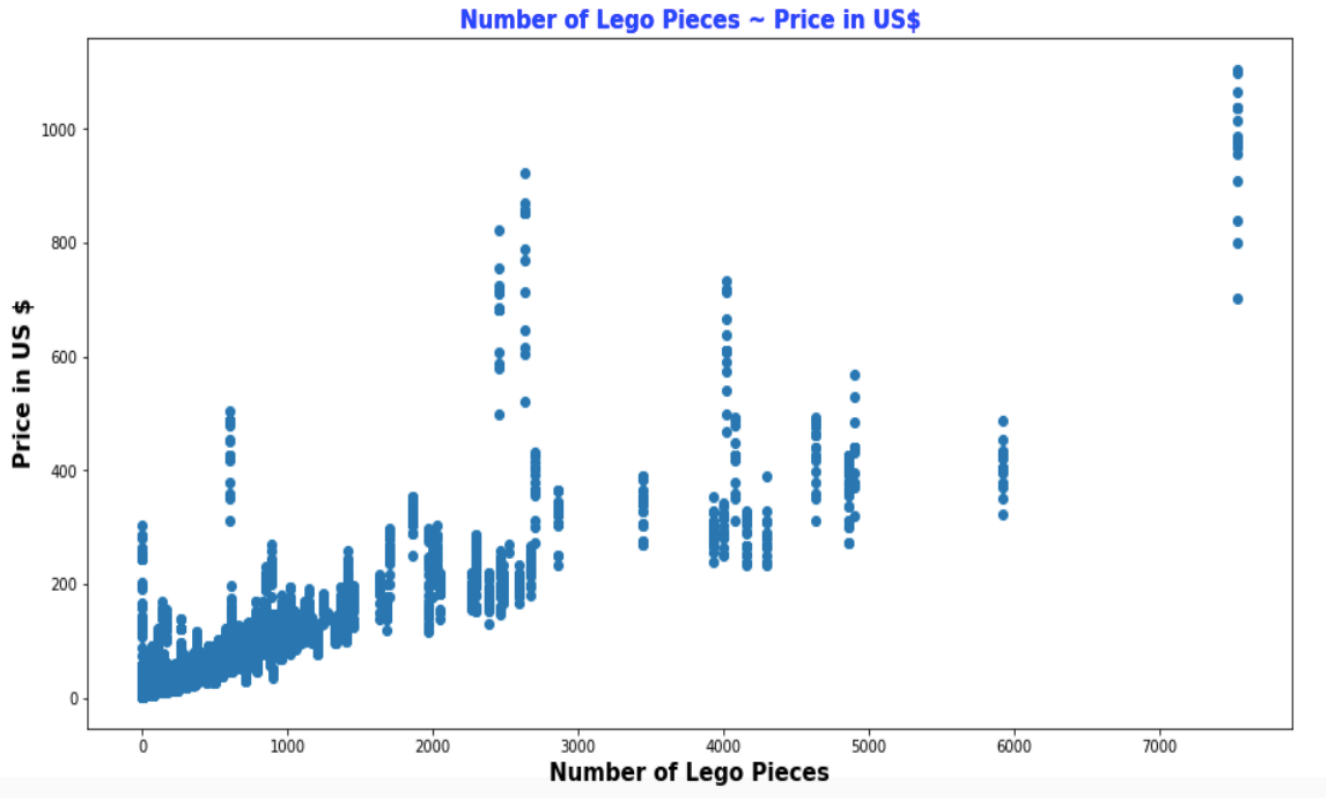
```
df_lego.min()
```

```
ages                  0.0000
list_price            2.2724
num_reviews           0.0000
piece_count           1.0000
play_star_rating      0.0000
review_difficulty     0.0000
country               0.0000
dtype: float64
```

```
df_lego.max()
```

```
ages                    30.00
list_price            1104.87
num_reviews            367.00
piece_count           7541.00
play_star_rating         5.00
review_difficulty        5.00
country                 20.00
dtype: float64
```

**Scatter plot** below shows how data is distributed across different price ranges based on the number of pieces in the Lego set.




## Key Observations

1. **Minimum Price** of Lego product is **2.2742 US$**
2. **Maximum Price** is **1104.87 US$**
3. **Majority** (count=**12075**) of the available Lego **products are in the price range of 3 to 400 US$**
4. **Very few** Lego products go **beyond the price of 400 US$**
5. Price of Lego products goes **beyond 600 US$ for the first time when the No. of Lego pieces is between 2500 and 2700 pieces**

## Check for Linear Relationship :

An OLS Regression Analysis test was run to see if there is a linear relationship between Number of Lego pieces and the price.

```
f = 'y ~ X'
ols_test = ols(f, data = df_lego).fit()

ols_test.summary()
```

OLS Regression Results

| | | | |
|---|---|---|---|
| **Dep. Variable:** | y | **R-squared:** | 0.756 |
| **Model:** | OLS | **Adj. R-squared:** | 0.756 |
| **Method:** | Least Squares | **F-statistic:** | 3.804e+04 |
| **Date:** | Mon, 04 Jul 2022 | **Prob (F-statistic):** | 0.00 |
| **Time:** | 01:28:15 | **Log-Likelihood:** | -64182. |
| **No. Observations:** | 12261 | **AIC:** | 1.284e+05 |
| **Df Residuals:** | 12259 | **BIC:** | 1.284e+05 |
| **Df Model:** | 1 | | |
| **Covariance Type:** | nonrobust | | |

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| **Intercept** | 17.3243 | 0.478 | 36.256 | 0.000 | 16.388 | 18.261 |
| **X** | 0.0969 | 0.000 | 195.027 | 0.000 | 0.096 | 0.098 |

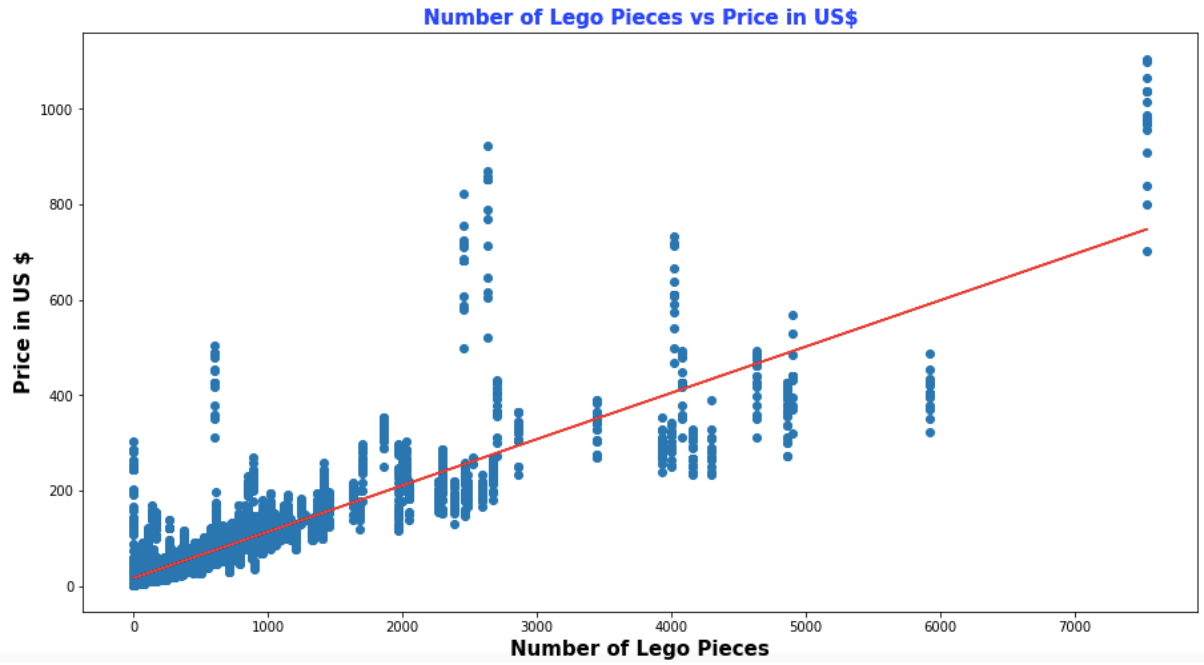
## Observations based on Simple Linear Regression Analysis

1. **R-squared (the coefficient of determination)** is **0.756**.

2. We have a **High** value of the **coefficient of determination**, which means:
   - There is a **Strong relationship** between the model and dependent variable **Price**
   - We can say that **75.6%** of the **Variation in the Price** is **explained by** the variation in the **Number of Pieces**

3. **Standard Error** is **0.478**

```
Text(0.5, 1.0, 'Number of Lego Pieces vs Price in US$')
```




## Conclusion

***Business Question 1*** *:* What price should be set for the Lego sets that have 8,000 Lego pieces?

***Answer*** **:** Based on the Regression Equation, **Predicted Price** for the Lego set having **8000 pieces** is : **792.5243 US $**

**Other considerations:**
The condition number is large, 1.12e+03. This might indicate that there are strong multicollinearity or other numerical problems.

## Business Case 2:

What price should be set for all the Lego sets that have 8,000 Lego pieces and are most likely to be purchased by customers who are 30 years old?

**Approach**:

Since there are two **independent** factors, **Lego pieces** and the **age** group that **influence the price,** a **Multiple Linear Regression** model was built and checked for its effectiveness.

```
# create train and test data sets
# training dataset is 70% of the total dataset
# testing dataset is 30% of the total dataset
x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.3, train_size=0.7)
```

```
multi = LinearRegression()
multi.fit(x_train.values, y_train.values)
```

```
▾ LinearRegression
LinearRegression()
```

```
multi.predict(x_train.values)
```

```
array([ 70.53380938,  53.74695744, 101.34393831, ...,  33.50291614,
        38.02457438,  36.76498915])
```

```
# Checking the value of R-squared, intercept and coefficients
print("R-squared: ", multi.score(x_train.values, y_train.values))
print("Intercept: ", multi.intercept_)
print("Coefficients:")
list(zip(x_train.values, multi.coef_))
```

```
R-squared:  0.7554519274419179
Intercept:  16.570832777690825
Coefficients:

[(array([544,  26]), 0.09594332369728356),
 (array([374,  19]), 0.06806955807883854)]
```

## Key Observations

High positive value of **R-squared 0.7554** indicates a **strong relationship** and a good model for prediction

```
# make predictions
New_Value1 = 8000
New_Value2 = 30
print ('Predicted Value: \n', multi.predict([[New_Value1 ,New_Value2]]))
```

```
Predicted Value:
 [786.1595091]
```

**Question 2 : What price should be set for all the Lego sets that have 8,000 Lego pieces and are most likely to be purchased by customers who are 30 years old?**

**Answer : Predicted Price : 786.1595 US Dollars**

## Business Case 3:

**What is the general sentiment of customers across all products?**

**Approach**:
Feedback collected in **games_reviews.csv file**, was systematically **loaded, sense checked, tokenized, and analyzed for sentiments and polarity**.

Step-by-step process undertaken.

**Load & Sense check:**

```
# import data into Python
df_game_rev = pd.read_csv('game_reviews.csv')
df_game_rev.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15000 entries, 0 to 14999
Data columns (total 9 columns):
 #   Column          Non-Null Count  Dtype 
---  ------          --------------  ----- 
 0   overall         15000 non-null  int64 
 1   verified        15000 non-null  bool  
 2   reviewTime      15000 non-null  object
 3   reviewerID      15000 non-null  object
 4   reviewerName    15000 non-null  object
 5   reviewText      14990 non-null  object
 6   summary         14998 non-null  object
 7   unixReviewTime  15000 non-null  int64 
 8   image           160 non-null    object
dtypes: bool(1), int64(2), object(6)
memory usage: 952.3+ KB
```

```
df_game_rev['reviewText']
```

```
0        When it comes to a DM's screen, the space on t...
1        An Open Letter to GaleForce9*:\n\nYour unpaint...
2        Nice art, nice printing.  Why two panels are f...
3        Amazing buy! Bought it as a gift for our new d...
4        As my review of GF9's previous screens these w...
                              ...
14995    Garbage.  Broke after 1 use.  Absolutely ridic...
14996    Our granddaughter loves these as part of her b...
14997    Got water in it after the first use. Shorted o...
14998                    I like print vs digital scheduling.
```

## Read > Pre-process > and Tokenize Text into Words:

```
# Look at one raw game review text and it's type
print(results_list_values[0])
type(results_list_values[0])
```

```
When it comes to a DM's screen, the space on the screen itself is at an absolute premium. The fact that 50% of this s
pace is wasted on art (and not terribly informative or needed art as well) makes it completely useless. The only reas
on that I gave it 2 stars and not 1 was that, technically speaking, it can at least still stand up to block your note
s and dice rolls. Other than that, it drops the ball completely.

str
```

```
# Split up each review into individual words
results_list_values_token = [word_tokenize(str(_)) for _ in results_list_values]
```

```
# Get a list of all english words so we can exclude anything that doesnt appear on the list
all_english_words = set(words.words())
```

```
# Some pre-processing:
#-- lets get every word
#-- lets convert it to lowercase
#-- only include if the word is alphanumeric and if it is in the list of English words.

results_list_values_token_nostop =\
[[y.lower() for y in x if y.lower() not in stop_words and y.isalpha() and y.lower() in all_english_words]\
 for x in results_list_values_token]
```

```
# Let's have a look at the same review as above
results_list_values_token_nostop[0]
```

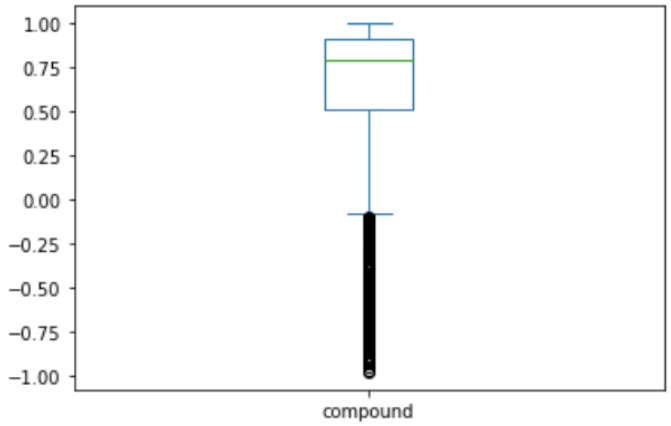
```
# Let's have a look at the same review as above
results_list_values_token_nostop[0]
```

```
['comes',
 'screen',
 'space',
 'screen',
 'absolute',
 'premium',
 'fact',
 'space',
 'wasted',
 'art',
 'terribly',
 'informative',
 'art',
 'well',
 'completely',
 'useless',
 'reason',
 'gave',
 'technically',
 'speaking',
 'least',
 'still',
 'stand',
 'block',
 'dice',
 'ball',
 'completely']
```

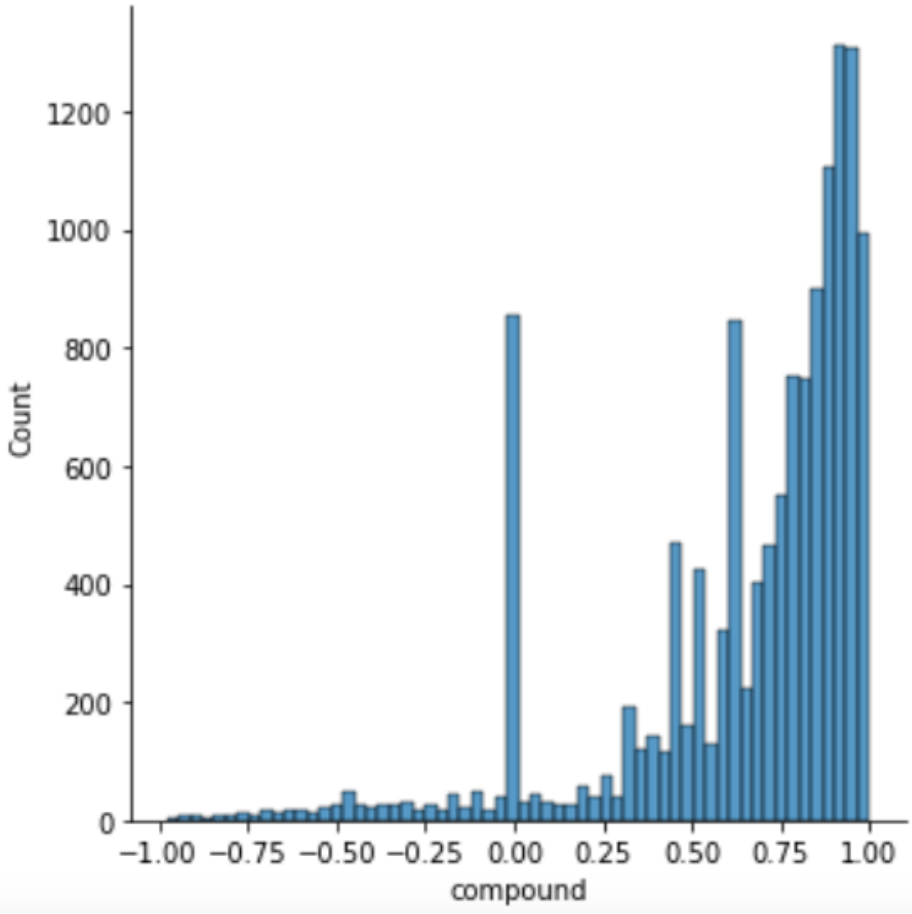
**Perform Sentiment Analysis:**

```
# The boxplot is a nice way to see how many values sit on the edges as outliers.
_plot = polarity_pd.reset_index()['compound'].sort_values()
_plot.plot(kind='box')
```

```
<AxesSubplot:>
```

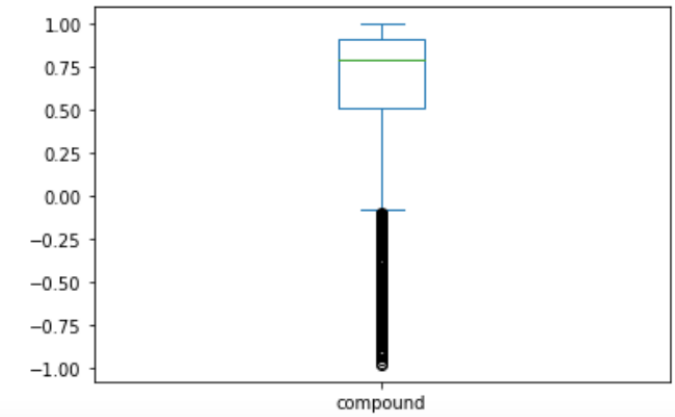



```
<seaborn.axisgrid.FacetGrid at 0x7faa750f3c40>
```

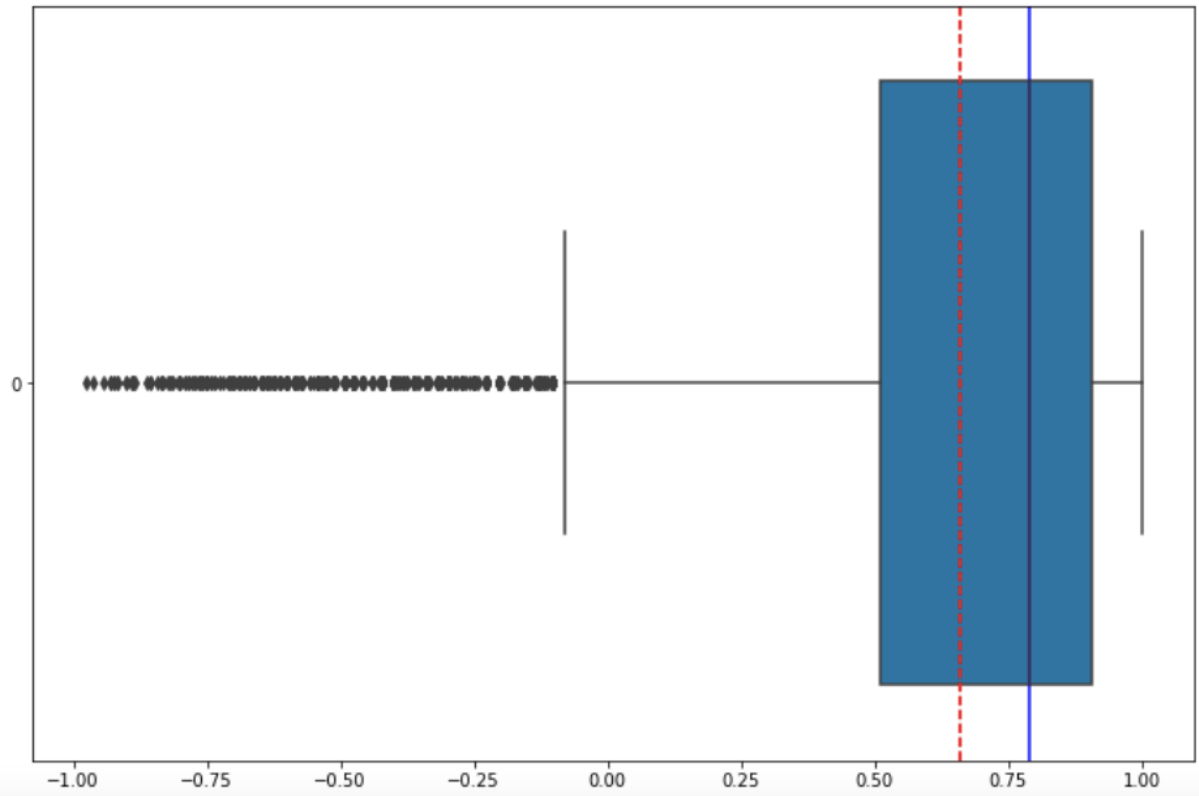


```
# The boxplot is a nice way to see how many values sit on the edges as outliers.
_plot = polarity_pd.reset_index()['compound'].sort_values()
_plot.plot(kind='box')
```

```
<AxesSubplot:>
```




```
<matplotlib.lines.Line2D at 0x7faa754339d0>
```



**Key observations from above distribution plot**

1. **Vast Majority** of the Reviews are **Positive** with the **Compound polarity scores** greater than **0.5**
2. **Left Skewed** distribution
3. **Lower/Negative Polarity score** values **on the left** and more **positive polarity scores** mostly on the **right end**

```
2]: mean=np.mean(_plot)
    print(mean)
```

```
0.659056308809365
```

```
3]:
    median=np.median(_plot)
    print(median)
```

```
0.7906
```

## Key Observations

General Sentiment of customers across all Products is: **Positive** with the mean polarity score of **+0.6590**

**Methodology and Analysis :**

**The Polarity scores** of customer reviews across all products was obtained using vaderSentiment Analysis. These scores were normalized to obtain compound scores for all the reviews.

- The average(mean) polarity score is: **0.6590**
- The median(central value) polarity score is : **0.7906**

## Business Case 4:

Based on the polarity of the sentiment, what are the top 20 positive and top 20 negative reviews?

### Top 20 Positive reviews (based on sentiment polarity)

```
pd.set_option('display.max_colwidth', 200)
df_text_pol.sort_values(by='comp_polarity', ascending=False).head(20)
```

| | comp_polarity | reviewtxt |
|---|---|---|
| **12032** | 0.9999 | Eminent Domain is a game by Seth Jaffee, published by Tasty Minstrel Games. It is for 2-4 players. In this game, players will be building an empire in space. They will be surveying new planets ... |
| **3619** | 0.9998 | When I first heard about Days of Wonder's newest game, Ticket to Ride (Days of Wonder, 2004 - Alan Moon), I was excited. But how could I not be - for all of Days of Wonders games so far have been ... |
| **1121** | 0.9995 | Disclaimer: Bought this from a local store. Paid list value, but supporting local game stores helps keep them in business, and it's a rough market to keep a gaming store running. Also, I do not ow... |
| **7643** | 0.9995 | The USA version of Ticket To Ride is fun but frustratingly cutthroat; I would not recommend getting the base set without the <a data-hook="product-link-linked" class="a-link-normal" href="/Da... |
| **879** | 0.9994 | Whenever I see this game on my shelf, I get a disturbing visual of Quark's big head from Star Trek: Deep Space Nine. I then picture him playing Tongo with a bunch of other Ferengi...a game that de... |
| **12040** | 0.9994 | So I went camping as kind of a chaperone with a youth group and learned to play this game at a picnic table. The occasional breeze made so many stacks of card perilous, but it would have been too... |
| **1666** | 0.9993 | If you only employ one creativity-enhancing resource for the rest of your life, make that resource the Ball of Whacks!\n\nBreakthroughs in effective creativity-inspiring methods seldom occur. Mos... |
| **13990** | 0.9992 | This is an in-depth review of the product "Robotech RPG Tactics Starter Board Game."\n\n1) OPENING THE BOX\n\nThe first thing you'll notice about Robotech: RPG Tactics is the sheer size of the box... |
| **11188** | 0.9992 | The game is easy to learn and explain. One person draws a card and selects a question from it to read out loud. Everyone else writes down an answer that they think the reader will think is the bes... |
| **6425** | 0.9992 | I needed that route! You just cut me off, now instead of destination cards giving me gobs of points, now they all count against me. Theres no way around! My nerves have never felt more vexed th... |
| **3571** | 0.9992 | Newest update: My daughter is now 6.5, and I still think this is one of the best things I've bought on Amazon. We recently saw one of those horrible ASPCA commercials, and she asked if we could s... |
| **358** | 0.9991 | This kit is AWESOME! My 5-year old daughter and I made the chihuahua dog first, and it came out looking exactly like the picture. Although I love crafts I'm not that great at them, so I was deligh... |
| **1570** | 0.9991 | As a dad of two boys Im always on the lookout for activities for us to do together. Something we can all enjoy and equally get into. We built a Da Vinci catapult, a siege tower, did some explori... |
| **6461** | 0.9991 | Originally posted at [...], a new idea everyday!\nGame- Ticket to Ride\nProducer-Days of Wonder\nPrice- $35-45\nTL;DR- Theme doesn't stop this train! 92.5%\n\nBasics- Around America in seven days!... |
| **7402** | 0.999 | This game is extremely elegant, making it easy for those new to gaming to get into, but it also provides great opportunities for strategy that game lovers can appreciate. Everyone I have played it... |
| **857** | 0.9989 | I grew up playing Monopoly. Lots of people did. It's unfortunate, because there was this gem just sitting there, begging to be played, but passed over. Here's what was missed:\n\nTHEME\nThe gam... |
| **2634** | 0.9988 | Publisher: Set Enterprises Inc.\n\nPlayers: 2 6 players\n\nAges: 5 + adult\n\nPlaying Time: 40 minutes\n\nGame Mechanics: Hand management and set collection\n\nContents: 103 unique playing c... |
| **12043** | 0.9987 | Originally posted at [...], a new idea everyday!\n\nGame-Eminent Domain\nPrice-$40\nProducer-Tasty Minstrel Games\nSet-Up/Play/Clean-Up-1 Hour\nTL;DR-Only a few faults make this game great instead... |
| **1295** | 0.9987 | Lords of Waterdeep was awesome, and Scoundrels of Skullport makes it even bigger, better, and crazier, like the original game on steroids. You get two expansions in one: Undermountain and Skullpor... |
| **5368** | 0.9986 | ... not because it's not a great gateway game, but because there's an even better version out there.\n\nThe beauty of vanilla Ticket to Ride is its simplicity and accessibility for players of all ... |

### Top 20 Negative reviews (based on sentiment polarity)

In [67]:
```
pd.set_option('display.max_colwidth', 200)
df_text_pol.sort_values(by='comp_polarity', ascending=False).tail(20)
```

Out[67]:

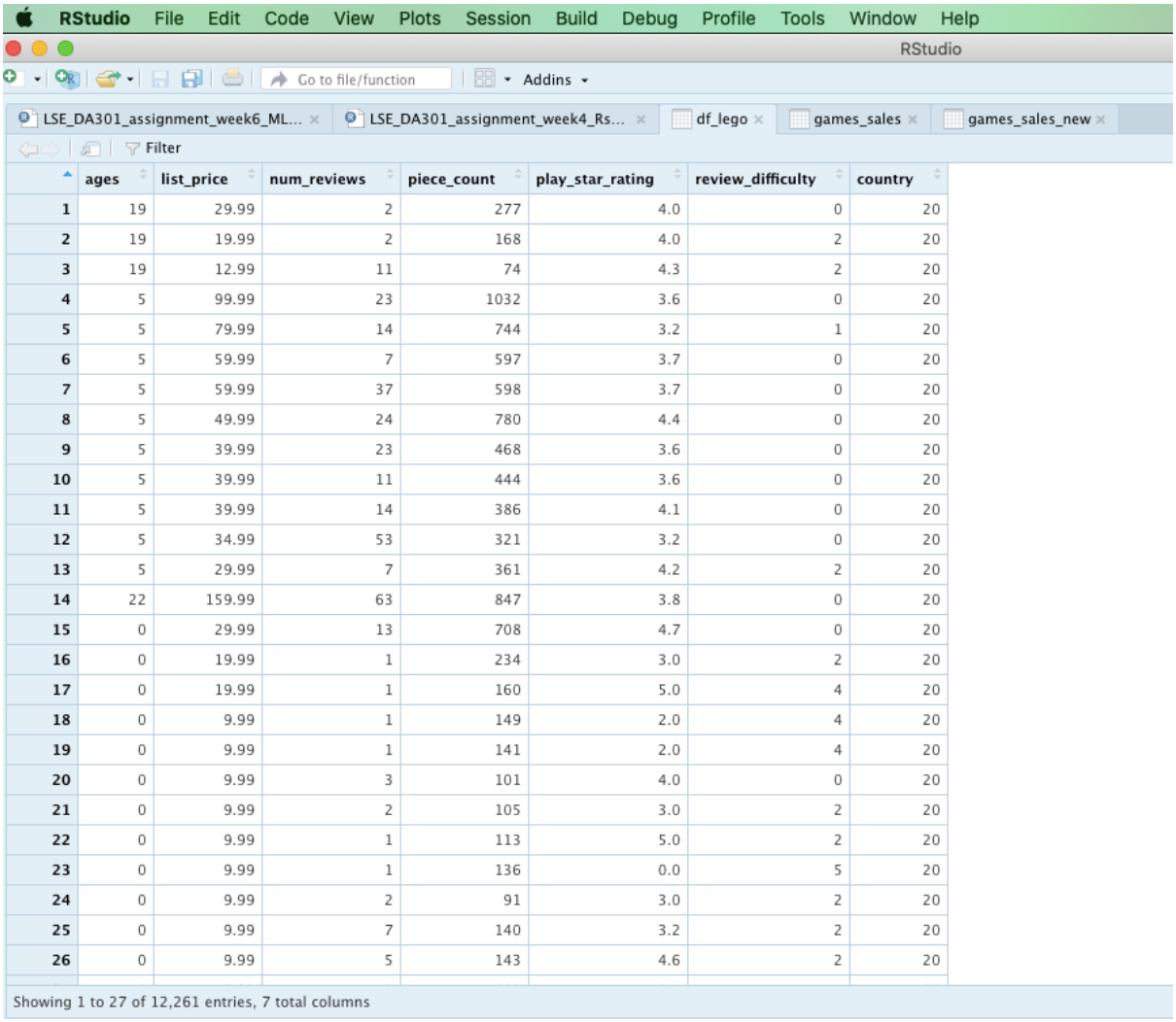
| | comp_polarity | reviewtxt |
|---|---|---|
| 1015 | -0.93 | I wish I'd watched some of the gameplay videos of Ashardalon before buying. As others have mentioned, it's not an RPG, it's a board game. But as a board game, it's a particularly bad boardgame. It... |
| 901 | -0.93 | Acquire is a great game of luck, strategy, and (like monopoly) can teach people about capitalism. This new updated version from Hasbro does just that. It is a sadly cheap and flimsy copy of the or... |
| 14977 | -0.9311 | This bath toy needs to taken off the market! Its worthless in every way! It never fit together. It began leaking immediately. Within 5 minutes it was a dead toy. My two little ones were so disappo... |
| 12203 | -0.9331 | For those who are fascinated by the Ray Kurzweil future of superintelligent machines and transhumanism, this RPG is the one for you. In the untold future, mankind has expanded out into the solar s... |
| 3628 | -0.9337 | Really excited to receive my game. But unfortunately the outside of the box was damaged when I received it. A corner is basically ripped off. Im sort of a board game freak so this made me sad. |
| 363 | -0.9349 | I found that this card game does the opposite of what it was intended for. It actually has the kids focusing on ways to get angry, etc. instead of teaching how to be calm and act better. It really... |
| 10755 | -0.9357 | We heard about Elf on a Shelf from some friends and loved this concept! I went to the Hallmark store and purchased one. We loved the book but were so disappointed with the quality of the Elf. I... |
| 3964 | -0.9366 | We opened this gift for Christmas today but had bought on Prime Day. The box was damaged to where it barely holds things together. They also failed to include all of the color cards, so we cant pl... |
| 11163 | -0.9441 | I have now use this deck a few times, and while I was saddened that all the pieces were card board and SMALLER the the regular sets, I love playing with Pooky. I have struggled finding the right c... |
| 10640 | -0.9484 | Okay, here is the real deal on this product... The story is cute, the website is also cute, the doll is not the cutest by today's standards but is very reminisent of vintage Christmas ornaments. T... |
| 12173 | -0.9493 | This is the book that introduced me to several futurist concepts, including transhumanism, sousveillance, and the idea of death itself being an inconvenience rather than a tragedy. For those alone... |
| 281 | -0.952 | I bought this thinking it would be really fun , but I was disappointed . It's really messy and it isn't nearly as easy as it seems. Also, the glue is useless.\nFor a 9 year old the instructions ar... |
| 12172 | -0.9587 | The quality of this game's mechanics vary wildly.\nIn a sci-fi game where people are programs uploaded into bio-mechanical brains, hacking is garbage. You would think you could hack a person's bra... |
| 14097 | -0.9606 | I was also disappointed with this puzzle, which my husband gave me for Christmas. While the puzzle-building itself was enjoyably challenging, I was fortunate to be finishing it in a bright room i... |
| 10591 | -0.9661 | Worst ever idea. I have no problem telling my kids that St. Nick visits every kid's house in just one night using slower-than-light even-toed ungulate technology, but the idea of Claus Inc. outsou... |
| 10428 | -0.9701 | Trust me, you can't win with this product. My son loved it at 6 & 7, but the last few days last year he started to get scared. Thankfully Christmas came around and Albert went home. Fast forwar... |
| 1559 | -0.973 | The One Ring is a very innovative RPG set in Middle Earth between the time of The Hobbit and The Lord of the Rings.\n\nIn order to play it you need occasional reference to die rolls. Specifically,... |
| 13637 | -0.9823 | If i could give this less than one star, i would. knowing that it was used, i had expected some wear and use, but this is ridiculous. some of the pages are missing, there is scribbling in crayon a... |
| 1119 | -0.9877 | Here is my review, cross-posted from boardgamegeek.com:\n\nI have fond memories of D&D from my youth, that I occasionally attempt to recapture. I remember the sense of vague foreboding conjured by... |
| 6613 | -0.9889 | It needs changes in four of its rules, and reminds me of Risk, where I could potentially lose friends. The game takes about 1 hour to play. The only good thing I can say is the artwork is beauti... |

## Business Case 5:

Which age group submits the most reviews?

**Approach:**
**Loaded, sense checked and analyzed the data to determine the age group that submits the most review and is most likely to submit the reviews.**

**Load and View:**



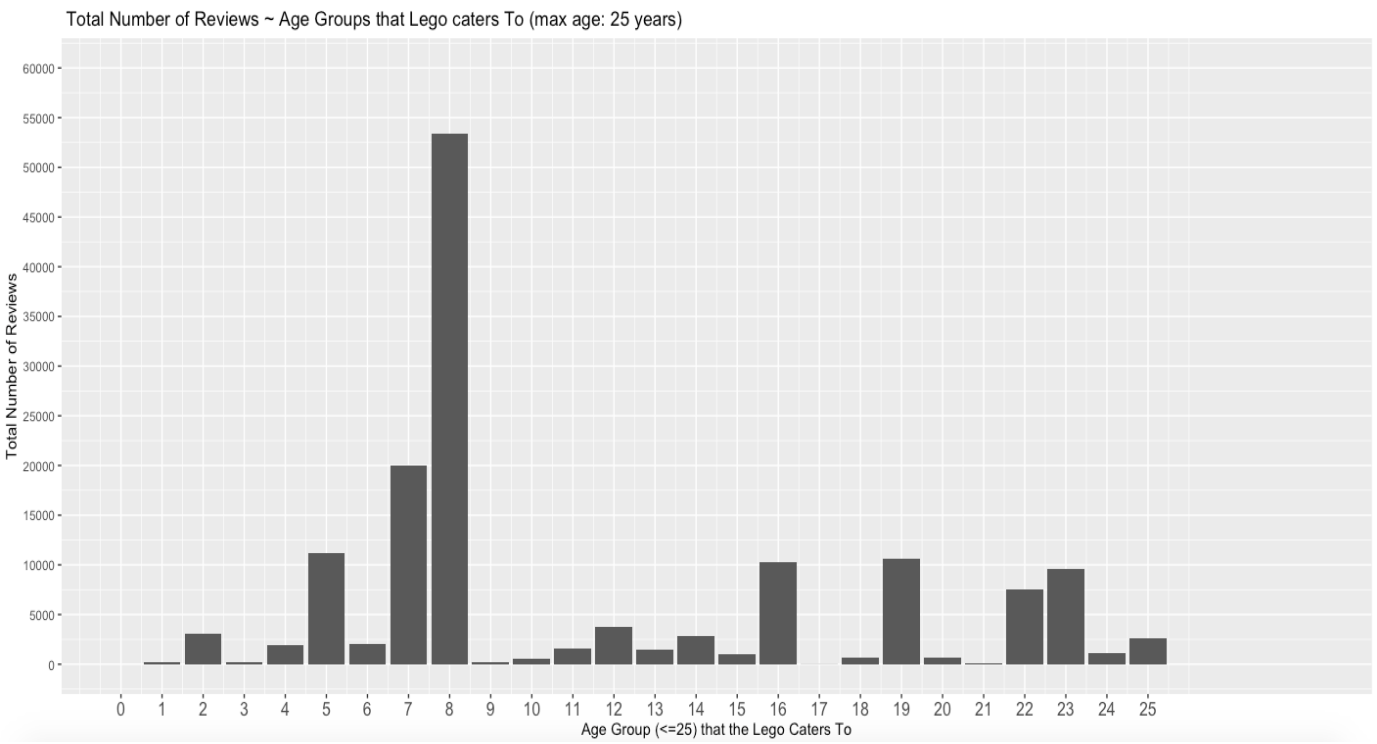

| | ages | list_price | num_reviews | piece_count | play_star_rating | review_difficulty | country |
|---|---|---|---|---|---|---|---|
| 1 | 19 | 29.99 | 2 | 277 | 4.0 | 0 | 20 |
| 2 | 19 | 19.99 | 2 | 168 | 4.0 | 2 | 20 |
| 3 | 19 | 12.99 | 11 | 74 | 4.3 | 2 | 20 |
| 4 | 5 | 99.99 | 23 | 1032 | 3.6 | 0 | 20 |
| 5 | 5 | 79.99 | 14 | 744 | 3.2 | 1 | 20 |
| 6 | 5 | 59.99 | 7 | 597 | 3.7 | 0 | 20 |
| 7 | 5 | 59.99 | 37 | 598 | 3.7 | 0 | 20 |
| 8 | 5 | 49.99 | 24 | 780 | 4.4 | 0 | 20 |
| 9 | 5 | 39.99 | 23 | 468 | 3.6 | 0 | 20 |
| 10 | 5 | 39.99 | 11 | 444 | 3.6 | 0 | 20 |
| 11 | 5 | 39.99 | 14 | 386 | 4.1 | 0 | 20 |
| 12 | 5 | 34.99 | 53 | 321 | 3.2 | 0 | 20 |
| 13 | 5 | 29.99 | 7 | 361 | 4.2 | 2 | 20 |
| 14 | 22 | 159.99 | 63 | 847 | 3.8 | 0 | 20 |
| 15 | 0 | 29.99 | 13 | 708 | 4.7 | 0 | 20 |
| 16 | 0 | 19.99 | 1 | 234 | 3.0 | 2 | 20 |
| 17 | 0 | 19.99 | 1 | 160 | 5.0 | 4 | 20 |
| 18 | 0 | 9.99 | 1 | 149 | 2.0 | 4 | 20 |
| 19 | 0 | 9.99 | 1 | 141 | 2.0 | 4 | 20 |
| 20 | 0 | 9.99 | 3 | 101 | 4.0 | 0 | 20 |
| 21 | 0 | 9.99 | 2 | 105 | 3.0 | 2 | 20 |
| 22 | 0 | 9.99 | 1 | 113 | 5.0 | 2 | 20 |
| 23 | 0 | 9.99 | 1 | 136 | 0.0 | 5 | 20 |
| 24 | 0 | 9.99 | 2 | 91 | 3.0 | 2 | 20 |
| 25 | 0 | 9.99 | 7 | 140 | 3.2 | 2 | 20 |
| 26 | 0 | 9.99 | 5 | 143 | 4.6 | 2 | 20 |

Showing 1 to 27 of 12,261 entries, 7 total columns

```
Console  Terminal  Jobs
R 4.1.2 · ~/
> #View the dataset in a tabular format
> View(df_lego)
> #Look up the overall Structure of the dataset
> str(df_lego)
'data.frame':   12261 obs. of  7 variables:
 $ ages            : int  19 19 19 5 5 5 5 5 5 ...
 $ list_price      : num  30 20 13 100 80 ...
 $ num_reviews     : int  2 2 11 23 14 7 37 24 23 11 ...
 $ piece_count     : int  277 168 74 1032 744 597 598 780 468 444 ...
 $ play_star_rating : num  4 4 4.3 3.6 3.2 3.7 3.7 4.4 3.6 3.6 ...
 $ review_difficulty: int  0 2 2 0 1 0 0 0 0 0 ...
 $ country         : int  20 20 20 20 20 20 20 20 20 20 ...
> # sum of missing values
> sum(is.na (df_lego))
[1] 0
> # delete all the records with missing values
> df_lego <-na.omit(df_lego)
> head(df_lego)
  ages list_price num_reviews piece_count play_star_rating review_difficulty country
1   19      29.99           2         277             4.0                 0      20
2   19      19.99           2         168             4.0                 2      20
3   19      12.99          11          74             4.3                 2      20
4    5      99.99          23        1032             3.6                 0      20
5    5      79.99          14         744             3.2                 1      20
6    5      59.99           7         597             3.7                 0      20
>
```

## Business case 6:

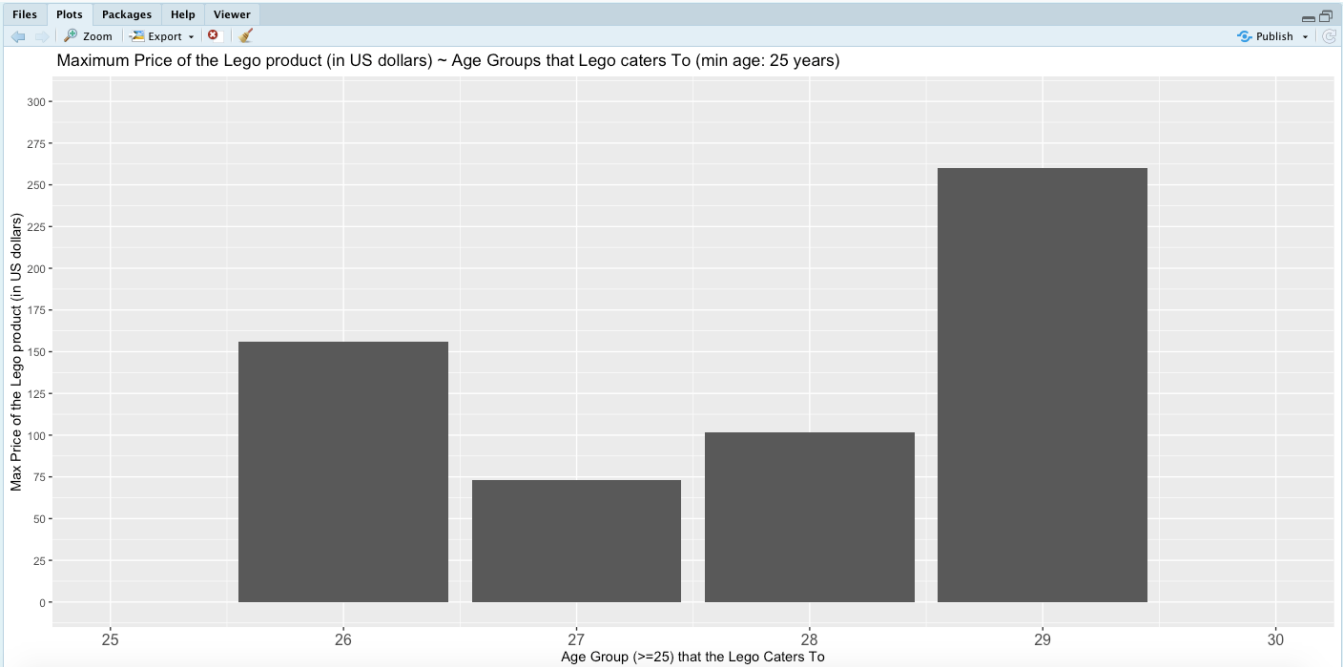
Which are the most popular (i.e. with the most number of reviews) Lego sets purchased by customers who are at the most 25 years old (<25 years)




```
# ANS :
# The customer group that will most likely leave a review on the products is in the Age Group: ** Age: 8 **
#Additional facts, this specific customer group
#     - Total 420 records of reviews for Age group 8
#     - Has bought Lego sets with wide range of Number of lego pieces
#     - Has bought Lego sets from many different countries
#     - Has mostly given play star rating of 4.0 or above
#     - Has review difficulty 0 or 1 (mostly 1)
```

## Business Case 7:

What is the most expensive Lego set purchased by customers who are at least 25 years old (>=25 years)?




```
# ANS : The most expensive Lego set purchased by customers who are at least 25 years old (>=25 years)
#       has the List price : 259.87 US$
#       Further details are as below:
#     ages list_price num_reviews piece_count play_star_rating review_difficulty country
#    ----- ---------- ----------- ----------- ---------------- ----------------- -------
#      29     259.87           6        1413              4.3                 0      16
```

## Business case 8:

Perform exploratory data analysis (EDA) of Games Sales Data set to derive Insights

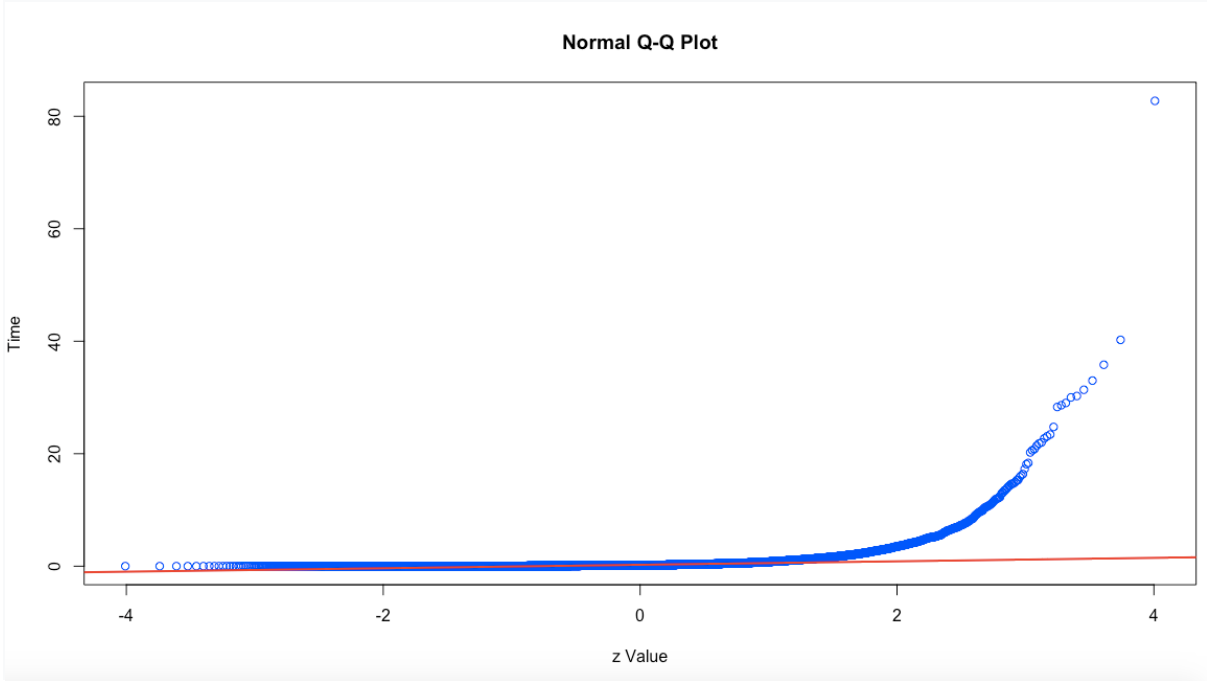
**Approach**:

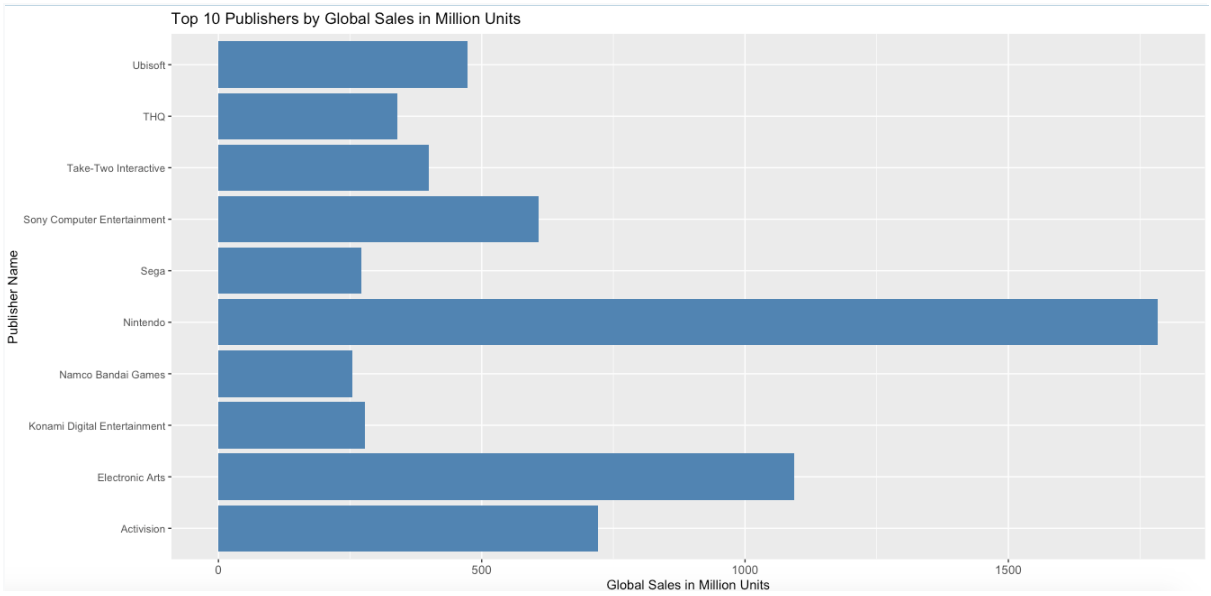
Loaded/Cleaned and analysed the data as below

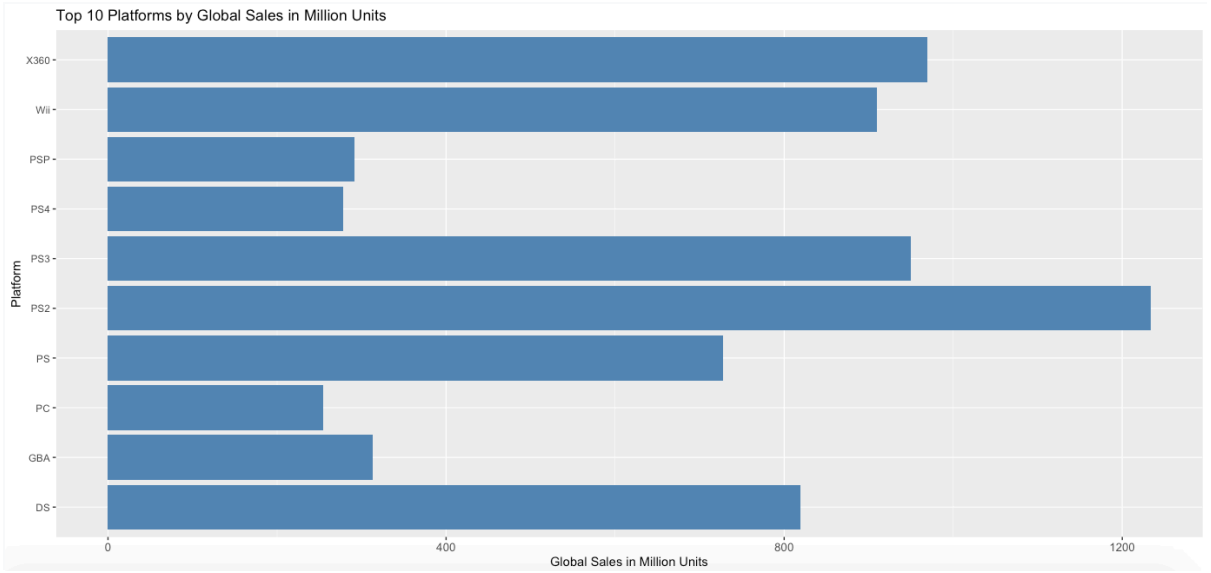
Filter

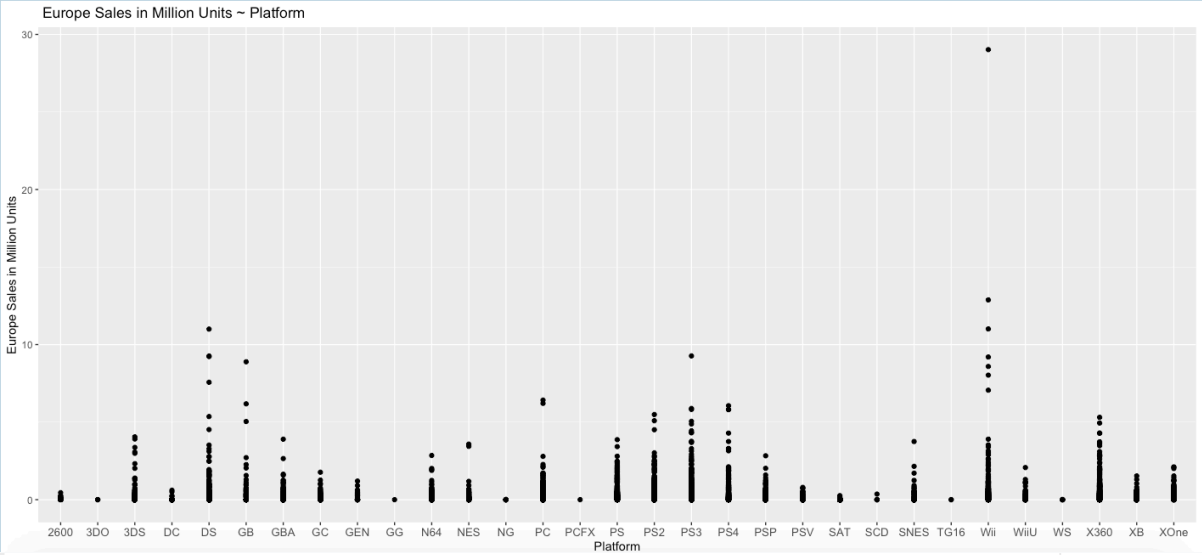
| | Rank | Name | Platform | Year | Genre | Publisher | NA_Sales | EU_Sales | Global_Sales |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Wii Sports | Wii | 2006 | Sports | Nintendo | 41.49 | 29.02 | 82.74 |
| 2 | 2 | Super Mario Bros. | NES | 1985 | Platform | Nintendo | 29.08 | 3.58 | 40.24 |
| 3 | 3 | Mario Kart Wii | Wii | 2008 | Racing | Nintendo | 15.85 | 12.88 | 35.82 |
| 4 | 4 | Wii Sports Resort | Wii | 2009 | Sports | Nintendo | 15.75 | 11.01 | 33.00 |
| 5 | 5 | Pokemon Red/Pokemon Blue | GB | 1996 | Role-Playing | Nintendo | 11.27 | 8.89 | 31.37 |
| 6 | 6 | Tetris | GB | 1989 | Puzzle | Nintendo | 23.20 | 2.26 | 30.26 |
| 7 | 7 | New Super Mario Bros. | DS | 2006 | Platform | Nintendo | 11.38 | 9.23 | 30.01 |
| 8 | 8 | Wii Play | Wii | 2006 | Misc | Nintendo | 14.03 | 9.20 | 29.02 |
| 9 | 9 | New Super Mario Bros. Wii | Wii | 2009 | Platform | Nintendo | 14.59 | 7.06 | 28.62 |
| 10 | 10 | Duck Hunt | NES | 1984 | Shooter | Nintendo | 26.93 | 0.63 | 28.31 |
| 11 | 11 | Nintendogs | DS | 2005 | Simulation | Nintendo | 9.07 | 11.00 | 24.76 |
| 12 | 12 | Mario Kart DS | DS | 2005 | Racing | Nintendo | 9.81 | 7.57 | 23.42 |
| 13 | 13 | Pokemon Gold/Pokemon Silver | GB | 1999 | Role-Playing | Nintendo | 9.00 | 6.18 | 23.10 |
| 14 | 14 | Wii Fit | Wii | 2007 | Sports | Nintendo | 8.94 | 8.03 | 22.72 |
| 15 | 15 | Wii Fit Plus | Wii | 2009 | Sports | Nintendo | 9.09 | 8.59 | 22.00 |

Showing 1 to 15 of 16,598 entries, 9 total columns




Top 10 Publishers by Global Sales in Million Units
Ubisoft
THQ
Take-Two Interactive
Sony Computer Entertainment
Sega
Nintendo
Namco Bandai Games
Konami Digital Entertainment
Electronic Arts
Activision
Publisher Name
0
500
1000
1500
Global Sales in Million Units


Top 10 Platforms by Global Sales in Million Units
X360
Wii
PSP
PS4
PS3
PS2
PS
PC
GBA
DS
Platform
0
400
800
1200
Global Sales in Million Units




```
###### *** ADDITIONAL INSIGHTS** ####
################################################################################
# Total 577 Publishers
# Top 5 Publishers in terms of Global Sales are:
#  1. Nintendo
#  2. Electronic Arts
#  3. Activision
#  4. Sony Computer Entertainment
#  5. Ubisoft
#-----------------------------------------------
# Top 5 Platforms in terms of Global Sales are:
#  1. PS2           1233.
#  2. X360           970.
#  3. PS3            949.
#  4. Wii            910.
#  5. DS             819.
# -----------------------------------------------
# Distinct Gaming Platforms : 31
# -----------------------------------------------

###### *** END OF PROGRAM - WEEK 5** ####
```

## Business case 9:

Determine the optimal global sales for all the video games

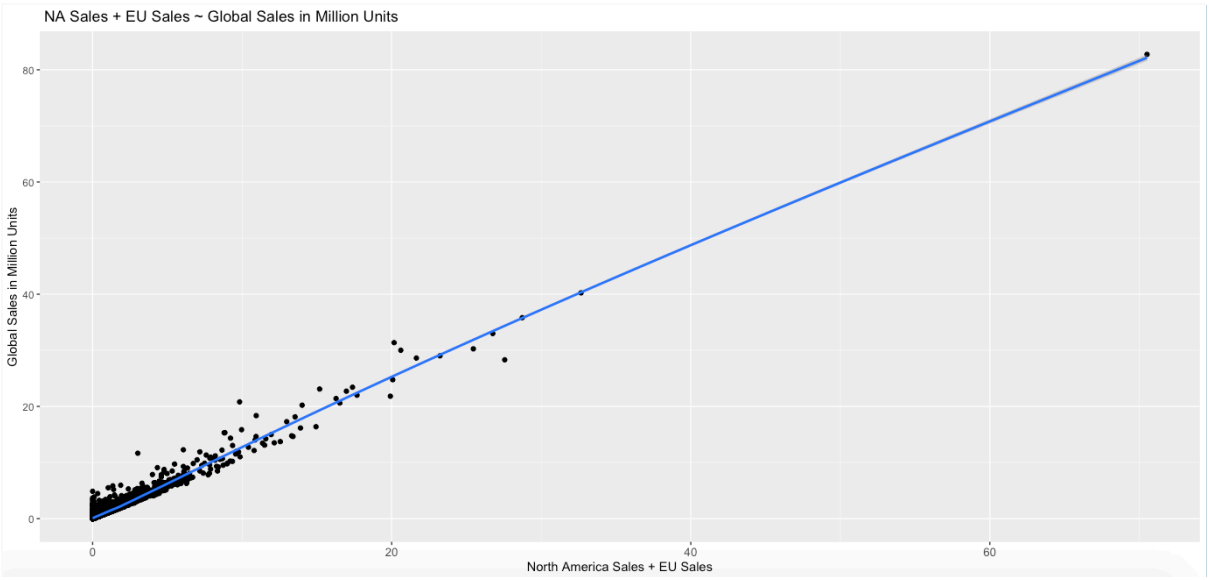
LSE_DA301_assignment_week6_ML... | LSE_DA301_assignment_week4_Rs... | df_lego | games_sales | games_sales_new

Filter

| | Rank | Name | Platform | Year | Genre | Publisher | NA_Sales | EU_Sales | Global_Sales |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Wii Sports | Wii | 2006 | Sports | Nintendo | 41.49 | 29.02 | 82.74 |
| 2 | 2 | Super Mario Bros. | NES | 1985 | Platform | Nintendo | 29.08 | 3.58 | 40.24 |
| 3 | 3 | Mario Kart Wii | Wii | 2008 | Racing | Nintendo | 15.85 | 12.88 | 35.82 |
| 4 | 4 | Wii Sports Resort | Wii | 2009 | Sports | Nintendo | 15.75 | 11.01 | 33.00 |
| 5 | 5 | Pokemon Red/Pokemon Blue | GB | 1996 | Role-Playing | Nintendo | 11.27 | 8.89 | 31.37 |
| 6 | 6 | Tetris | GB | 1989 | Puzzle | Nintendo | 23.20 | 2.26 | 30.26 |
| 7 | 7 | New Super Mario Bros. | DS | 2006 | Platform | Nintendo | 11.38 | 9.23 | 30.01 |
| 8 | 8 | Wii Play | Wii | 2006 | Misc | Nintendo | 14.03 | 9.20 | 29.02 |
| 9 | 9 | New Super Mario Bros. Wii | Wii | 2009 | Platform | Nintendo | 14.59 | 7.06 | 28.62 |
| 10 | 10 | Duck Hunt | NES | 1984 | Shooter | Nintendo | 26.93 | 0.63 | 28.31 |
| 11 | 11 | Nintendogs | DS | 2005 | Simulation | Nintendo | 9.07 | 11.00 | 24.76 |
| 12 | 12 | Mario Kart DS | DS | 2005 | Racing | Nintendo | 9.81 | 7.57 | 23.42 |
| 13 | 13 | Pokemon Gold/Pokemon Silver | GB | 1999 | Role-Playing | Nintendo | 9.00 | 6.18 | 23.10 |
| 14 | 14 | Wii Fit | Wii | 2007 | Sports | Nintendo | 8.94 | 8.03 | 22.72 |
| 15 | 15 | Wii Fit Plus | Wii | 2009 | Sports | Nintendo | 9.09 | 8.59 | 22.00 |

Showing 1 to 15 of 16,598 entries, 9 total columns

```
> # delete all the records with missing values
> games_sales_new <-na.omit(games_sales)
> head(games_sales_new)
  Rank                     Name Platform Year        Genre Publisher NA_Sales EU_Sales Global_Sales
1    1              Wii Sports      Wii 2006       Sports  Nintendo    41.49    29.02        82.74
2    2        Super Mario Bros.      NES 1985     Platform  Nintendo    29.08     3.58        40.24
3    3           Mario Kart Wii      Wii 2008       Racing  Nintendo    15.85    12.88        35.82
4    4        Wii Sports Resort      Wii 2009       Sports  Nintendo    15.75    11.01        33.00
5    5 Pokemon Red/Pokemon Blue       GB 1996 Role-Playing  Nintendo    11.27     8.89        31.37
6    6                   Tetris       GB 1989       Puzzle  Nintendo    23.20     2.26        30.26
> dim(games_sales_new)
[1] 16598     9
> sum(is.na (games_sales_new))
[1] 0
> # Still some N/A values in Year, filter those out and store only the records that Do NOT HAVE "N/A" in Year column
> games_sales_new <- games_sales_new[games_sales_new["Year"]!="N/A",]
> dim(games_sales_new)
[1] 16327     9
```



```
> cor(games_sales_new$NA_Sales, games_sales_new$Global_Sales)
[1] 0.9412677
> # Check correlation coefficient between Global Sales and European Sales
> cor(games_sales_new$EU_Sales, games_sales_new$Global_Sales)
[1] 0.903271
> # Check correlation coefficient between Global Sales and European Sales + N-America Sales
> cor(games_sales_new$NA_Sales + games_sales_new$EU_Sales, games_sales_new$Global_Sales)
[1] 0.9818667
```

```
summary(model1) # Print the summary statistics.
print(coefficients(model1)) # Look up coefficients from model 1
## Plot RESIDUALS for model1
hist(residuals(model1), col = 'steel blue')

### STATISTICAL OBSERVATIONS FROM MODEL-1 SUMMARY
## Coefficients:
#Estimate Std. Error t value Pr(>|t|)
#(Intercept) 0.035512   0.002420   14.67   <2e-16 ***
#  NA_Sales    1.150282   0.004377  262.83   <2e-16 ***
#  EU_Sales    1.351483   0.007068  191.22   <2e-16 ***
# Multiple R-squared:  0.9648,  Adjusted R-squared:  0.9648
# F-statistic: 2.238e+05 on 2 and 16324 DF,  p-value: < 2.2e-16

# OBSERVATIONS
# Multiple R-square: 0.9648 *** indicates a STRONG LINEAR RELATIONSHIP between NA_Sales, EU_Sales AND Global_Sales
# 96.48% of the variations in y (Global_Sales) can be explained by the predictor / independent variables NA_Sales and EU_Sales
# p-value < 0.05, which means the model is statistically significant
```

Filter

| | Rank | Game_Title | Platform | Year | Genre | Publisher | NA_Sales | EU_Sales | Global_Sales | Predicted_Global_Sales |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Wii Sports | Wii | 2006 | Sports | Nintendo | 41.49 | 29.02 | 82.74 | 86.9808 |
| 2 | 2 | Super Mario Bros. | NES | 1985 | Platform | Nintendo | 29.08 | 3.58 | 40.24 | 38.3240 |
| 3 | 3 | Mario Kart Wii | Wii | 2008 | Racing | Nintendo | 15.85 | 12.88 | 35.82 | 35.6746 |
| 4 | 4 | Wii Sports Resort | Wii | 2009 | Sports | Nintendo | 15.75 | 11.01 | 33.00 | 33.0323 |
| 5 | 5 | Pokemon Red/Pokemon Blue | GB | 1996 | Role-Playing | Nintendo | 11.27 | 8.89 | 31.37 | 25.0139 |
| 6 | 6 | Tetris | GB | 1989 | Puzzle | Nintendo | 23.20 | 2.26 | 30.26 | 29.7764 |
| 7 | 7 | New Super Mario Bros. | DS | 2006 | Platform | Nintendo | 11.38 | 9.23 | 30.01 | 25.5999 |
| 8 | 8 | Wii Play | Wii | 2006 | Misc | Nintendo | 14.03 | 9.20 | 29.02 | 28.6076 |
| 9 | 9 | New Super Mario Bros. Wii | Wii | 2009 | Platform | Nintendo | 14.59 | 7.06 | 28.62 | 26.3596 |
| 10 | 10 | Duck Hunt | NES | 1984 | Shooter | Nintendo | 26.93 | 0.63 | 28.31 | 31.8640 |
| 11 | 11 | Nintendogs | DS | 2005 | Simulation | Nintendo | 9.07 | 11.00 | 24.76 | 25.3349 |
| 12 | 12 | Mario Kart DS | DS | 2005 | Racing | Nintendo | 9.81 | 7.57 | 23.42 | 21.5505 |
| 13 | 13 | Pokemon Gold/Pokemon Silver | GB | 1999 | Role-Playing | Nintendo | 9.00 | 6.18 | 23.10 | 18.7402 |
| 14 | 14 | Wii Fit | Wii | 2007 | Sports | Nintendo | 8.94 | 8.03 | 22.72 | 21.1714 |
| 15 | 15 | Wii Fit Plus | Wii | 2009 | Sports | Nintendo | 9.09 | 8.59 | 22.00 | 22.1008 |
| 16 | 16 | Kinect Adventures! | X360 | 2010 | Misc | Microsoft Game Studios | 14.97 | 4.94 | 21.82 | 23.9316 |
| 17 | 17 | Grand Theft Auto V | PS3 | 2013 | Action | Take-Two Interactive | 7.01 | 9.27 | 21.40 | 20.6272 |
| 18 | 18 | Grand Theft Auto: San Andreas | PS2 | 2004 | Action | Take-Two Interactive | 9.43 | 0.40 | 20.81 | 11.4233 |
| 19 | 19 | Super Mario World | SNES | 1990 | Platform | Nintendo | 12.78 | 3.75 | 20.61 | 19.8042 |
| 20 | 20 | Brain Age: Train Your Brain in Minutes a Day | DS | 2005 | Misc | Nintendo | 4.75 | 9.26 | 20.22 | 18.0141 |
| 21 | 21 | Pokemon Diamond/Pokemon Pearl | DS | 2006 | Role-Playing | Nintendo | 6.42 | 4.52 | 18.36 | 13.5290 |
| 22 | 22 | Super Mario Land | GB | 1989 | Platform | Nintendo | 10.83 | 2.71 | 18.14 | 16.1556 |
| 23 | 23 | Super Mario Bros. 3 | NES | 1988 | Platform | Nintendo | 9.54 | 3.44 | 17.28 | 15.6583 |
| 24 | 24 | Grand Theft Auto V | X360 | 2013 | Action | Take-Two Interactive | 9.63 | 5.31 | 16.38 | 18.2891 |

Showing 1 to 24 of 16,327 entries, 10 total columns