BoardGameML

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1 Beating the Game

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1.1 Introduction & Background

The board game industry has grown dramatically in the last ten years, with an estimated growth of 30% coming by 2021. This growth is not simply due to a resurgence of the classic games like Monopoly and Scrabble; rather, the very basis of board games is changing. In recent years, the target audience has shifted from children to adults, and new mechanics, goals, and styles have emerged. New genres such as cooperative games, multiday adventures, and puzzle quests have come about - and more are being designed all the time.

Many of these modern board games are getting their start through crowdfunding (for example, Kickstarter). This presents an interesting economic structure: public opinion really determines which games get the chance to come to market. Given only the basic information shared on a Kickstarter page, board game devotees are deciding which games they will support financially.

This model presents an interesting opportunity not previously available: rather than only seeing the most popular, financed games in big box stores, we have data on *all* size games - even those that failed to win the required funding to actually reach release.

This project uses that data to explore what exactly makes a board game successful. Our analysis focuses on games from the last ten years in an effort to capture the new trends that have emerged. We use various models to tease out the features that bring high player enjoyment ratings. At the end of our analysis, we apply our modeling theory to a set of games from 1980-1990, to characterize the important features of that era and potentially identify a concrete difference between games released in different decades.

1.2 Data Intake

The dataset for this project is taken from the kaggle "board games dataset" page (https://www.kaggle.com/gabrio/board-games-dataset/home). The sqlite database captures data combed from the widely-used board games rating site Board Game Geek (http://www.boardgamegeek.com).

(The sqlite file is submitted along with this notebook. It must be located in the same directory to read the data.)

```
In [1]: # Import packages necessary to read sqlite file

        import pandas as pd
        import sqlite3
        import matplotlib.pyplot as plt
        import numpy as np
        %matplotlib inline
        from scipy import stats
        import seaborn as sns
        sns.set()
        pd.set_option('display.max_columns', 100)
```

```
In [2]: #Connect to SQLite DB
        conn = sqlite3.connect("database.sqlite")
```

```
In [3]: #Create a cursor Object to allow us to execute SQL queries against the DB
        cur = conn.cursor()
```

```
In [4]: #Lets look into the different tables
        cur.execute("SELECT name FROM sqlite_master WHERE type='table';")
        print(cur.fetchall())
```

```
[('BoardGames',), ('bgg.ldaOut.topics',), ('bgg.ldaOut.top.terms',), ('bgg.ldaOut.top.documents
```

For this project, we will pull in only the raw data (the BoardGames table) and develop our own models. The raw data is stored in a dataframe called "df_bg".
(The sqlite database also includes some tables developed as part of the kaggle contest, named "lda_x". We will not use those tables here.)

```
In [5]: #Grab the data from the raw BoardGames table
        df_bg = pd.read_sql_query("select * from BoardGames", conn)
        print("Data loaded.")
```

```
Data loaded.
```

```
In [6]: #Close the connection:
        cur.close()
        conn.close()
```

1.3 Data Setup & Cleaning

The Board Games data frame consists of 81 columns (or features) and 90,400 entries. That's a lot of information!

This project hopes to direct board game designers towards qualities that will make their games more successful. In that spirit, we will focus here on features that are under the direct control of the game designer - play time, number of players, mechanics, theme, etc. Our analysis will *not* include input fields that are based on user ratings, since those are only available after a game is released (and therefore would not be available to the game designer during creation).

The output variable for our models will be "success" as measured by player enjoyment using the BoardGameGeek star rating system (a user-submitted 0-10 star rating). Later in this notebook, we will create multiple interpretations of that outcome varaible, including binary "success"/"failure", binned ratings, and the continuous 0-10 scale.

The sections below
(1) Filter the data to remove irrelevant entries
(2) Create variables where needed / translate categorical variables into binary fields
(3) Create a new dataframe containing only the data of interest to us

1.3.1 Data Filtering

```
In [7]: # print a bit of the table to visualize
        df_bg.head()
```

```
Out[7]:   row_names game.id  game.type  \
        0          1       1  boardgame
        1          2       2  boardgame
        2          3       3  boardgame
        3          4       4  boardgame
        4          5       5  boardgame

                                         details.description  \
        0  Die Macher is a game about seven sequential po...
        1  Dragonmaster is a trick-taking card game based...
        2  Part of the Knizia tile-laying trilogy, Samura...
        3  When you see the triangular box and the luxuri...
        4  In Acquire, each player strategically invests ...

                                          details.image  details.maxplayers  \
        0   //cf.geekdo-images.com/images/pic159509.jpg                 5.0
        1   //cf.geekdo-images.com/images/pic184174.jpg                 4.0
        2  //cf.geekdo-images.com/images/pic3211873.jpg                 4.0
        3   //cf.geekdo-images.com/images/pic285299.jpg                 4.0
        4   //cf.geekdo-images.com/images/pic342163.jpg                 6.0

           details.maxplaytime  details.minage  details.minplayers  \
        0                240.0            14.0                 3.0
        1                 30.0            12.0                 3.0
        2                 60.0            10.0                 2.0
        3                 60.0            12.0                 2.0
        4                 90.0            12.0                 3.0

           details.minplaytime    details.name  details.playingtime  \
        0                240.0      Die Macher                240.0
        1                 30.0    Dragonmaster                 30.0
        2                 30.0         Samurai                 60.0
        3                 60.0  Tal der Könige                 60.0
        4                 90.0         Acquire                 90.0
```

```
                                details.thumbnail  details.yearpublished  \
0   //cf.geekdo-images.com/images/pic159509_t.jpg                 1986.0
1   //cf.geekdo-images.com/images/pic184174_t.jpg                 1981.0
2  //cf.geekdo-images.com/images/pic3211873_t.jpg                 1998.0
3   //cf.geekdo-images.com/images/pic285299_t.jpg                 1992.0
4   //cf.geekdo-images.com/images/pic342163_t.jpg                 1964.0

    attributes.boardgameartist    attributes.boardgamecategory  \
0          Marcus Gschwendtner  Economic,Negotiation,Political
1                   Bob Pepper               Card Game,Fantasy
2              Franz Vohwinkel      Abstract Strategy,Medieval
3                         None                         Ancient
4  Scott Okumura,Peter Whitley                        Economic

  attributes.boardgamecompilation attributes.boardgamedesigner  \
0                            None           Karl-Heinz Schmiel
1                            None        G. W. "Jerry" D'Arcey
2                            None                Reiner Knizia
3                            None            Christian Beierer
4                            None                  Sid Sackson

  attributes.boardgameexpansion  \
0                          None
1                          None
2                          None
3                          None
4                          None

                         attributes.boardgamefamily  \
0        Country: Germany,Valley Games Classic Line
1                                  Animals: Dragons
2  Asian Theme,Country: Japan,Knizia tile-laying ...
3            Country: Egypt,Promotional Board Games
4                               3M Bookshelf Series

  attributes.boardgameimplementation attributes.boardgameintegration  \
0                               None                            None
1             Indulgence,Coup d'etat                            None
2                               None                            None
3                               None                            None
4                               None                            None

                       attributes.boardgamemechanic  \
0  Area Control / Area Influence,Auction/Bidding,...
1                                      Trick-taking
2  Area Control / Area Influence,Hand Management,...
3  Action Point Allowance System,Area Control / A...
```

```
4       Hand Management,Stock Holding,Tile Placement

                       attributes.boardgamepublisher  attributes.total  \
0  Hans im Glück Verlags-GmbH,Moskito Spiele,Vall...               6.0   
1                           E.S. Lowe,Milton Bradley               7.0   
2  999 Games,ABACUSSPIELE,Astrel Games,Ceilikan J...               6.0   
3                                             KOSMOS               5.0   
4  3M,Avalon Hill,Avalon Hill (Hasbro),Dujardin,G...               6.0   

   stats.average  stats.averageweight  stats.bayesaverage  \
0        7.66508               4.3477             7.29168   
1        6.60815               1.9423             5.87150   
2        7.44119               2.5085             7.28295   
3        6.60675               2.6667             5.76636   
4        7.35830               2.5089             7.21895   

   stats.family.abstracts.bayesaverage  stats.family.abstracts.pos  \
0                                  NaN                         NaN   
1                                  NaN                         NaN   
2                                  NaN                         NaN   
3                                  NaN                         NaN   
4                                  NaN                         NaN   

   stats.family.cgs.bayesaverage  stats.family.cgs.pos  \
0                            NaN                   NaN   
1                            NaN                   NaN   
2                            NaN                   NaN   
3                            NaN                   NaN   
4                            NaN                   NaN   

   stats.family.childrensgames.bayesaverage  stats.family.childrensgames.pos  \
0                                       NaN                              NaN   
1                                       NaN                              NaN   
2                                       NaN                              NaN   
3                                       NaN                              NaN   
4                                       NaN                              NaN   

   stats.family.familygames.bayesaverage  stats.family.familygames.pos  \
0                                    NaN                           NaN   
1                                    NaN                           NaN   
2                                    NaN                           NaN   
3                                    NaN                           NaN   
4                                    NaN                           NaN   

   stats.family.partygames.bayesaverage  stats.family.partygames.pos  \
0                                   NaN                          NaN   
1                                   NaN                          NaN   
2                                   NaN                          NaN   
```

```
3                                    NaN                          NaN
4                                    NaN                          NaN

   stats.family.strategygames.bayesaverage  stats.family.strategygames.pos  \
0                                  7.39570                            85.0
1                                  5.91318                          1066.0
2                                  7.30610                           112.0
3                                      NaN                             NaN
4                                  7.21696                           141.0

   stats.family.thematic.bayesaverage  stats.family.thematic.pos  \
0                                 NaN                        NaN
1                                 NaN                        NaN
2                                 NaN                        NaN
3                                 NaN                        NaN
4                                 NaN                        NaN

   stats.family.wargames.bayesaverage  stats.family.wargames.pos  \
0                                 NaN                        NaN
1                                 NaN                        NaN
2                                 NaN                        NaN
3                                 NaN                        NaN
4                                 NaN                        NaN

   stats.median  stats.numcomments  stats.numweights  stats.owned  \
0           0.0             1763.0             719.0       5251.0
1           0.0              273.0              52.0       1053.0
2           0.0             3281.0            1355.0      11870.0
3           0.0              111.0              30.0        523.0
4           0.0             5011.0            1515.0      18682.0

   stats.stddev  stats.subtype.boardgame.bayesaverage  \
0       1.59321                               7.29168
1       1.46282                               5.87150
2       1.18531                               7.28295
3       1.21028                               5.76636
4       1.33020                               7.21895

   stats.subtype.boardgame.pos  stats.trading  stats.usersrated  \
0                        147.0          170.0            4498.0
1                       2541.0           73.0             478.0
2                        150.0          234.0           12019.0
3                       3191.0           29.0             314.0
4                        181.0          823.0           15195.0

   stats.wanting  stats.wishing polls.language_dependence  \
0          505.0         1654.0                         No
1           67.0          161.0                       Some
```

```
2          707.0         2601.0                        No
3           61.0          112.0                        No
4          516.0         2219.0                        No

  polls.suggested_numplayers.1 polls.suggested_numplayers.10  \
0               NotRecommended                          None   
1               NotRecommended                          None   
2               NotRecommended                          None   
3               NotRecommended                          None   
4               NotRecommended                          None   

  polls.suggested_numplayers.2 polls.suggested_numplayers.3  \
0               NotRecommended               NotRecommended   
1               NotRecommended                  Recommended   
2                  Recommended                         Best   
3                  Recommended                         Best   
4               NotRecommended                  Recommended   

  polls.suggested_numplayers.4 polls.suggested_numplayers.5  \
0                  Recommended                         Best   
1                         Best                         None   
2                  Recommended                         None   
3                         Best                         None   
4                         Best                  Recommended   

  polls.suggested_numplayers.6 polls.suggested_numplayers.7  \
0                         None                         None   
1                         None                         None   
2                         None                         None   
3                         None                         None   
4                  Recommended                         None   

  polls.suggested_numplayers.8 polls.suggested_numplayers.9  \
0                         None                         None   
1                         None                         None   
2                         None                         None   
3                         None                         None   
4                         None                         None   

  polls.suggested_numplayers.Over polls.suggested_playerage  \
0                  NotRecommended                        14   
1                  NotRecommended                      None   
2                  NotRecommended                        10   
3                  NotRecommended                        14   
4                  NotRecommended                        12   

  attributes.t.links.concat.2...  stats.family.amiga.bayesaverage  \
0                            None                              NaN   
```

```
1                            None                              NaN
2                            None                              NaN
3                            None                              NaN
4                            None                              NaN

   stats.family.amiga.pos  stats.family.arcade.bayesaverage  \
0                     NaN                               NaN
1                     NaN                               NaN
2                     NaN                               NaN
3                     NaN                               NaN
4                     NaN                               NaN

   stats.family.arcade.pos  stats.family.atarist.bayesaverage  \
0                      NaN                                NaN
1                      NaN                                NaN
2                      NaN                                NaN
3                      NaN                                NaN
4                      NaN                                NaN

   stats.family.atarist.pos  stats.family.commodore64.bayesaverage  \
0                       NaN                                    NaN
1                       NaN                                    NaN
2                       NaN                                    NaN
3                       NaN                                    NaN
4                       NaN                                    NaN

   stats.family.commodore64.pos  stats.subtype.rpgitem.bayesaverage  \
0                           NaN                                 NaN
1                           NaN                                 NaN
2                           NaN                                 NaN
3                           NaN                                 NaN
4                           NaN                                 NaN

   stats.subtype.rpgitem.pos  stats.subtype.videogame.bayesaverage  \
0                        NaN                                   NaN
1                        NaN                                   NaN
2                        NaN                                   NaN
3                        NaN                                   NaN
4                        NaN                                   NaN

   stats.subtype.videogame.pos
0                          NaN
1                          NaN
2                          NaN
3                          NaN
4                          NaN
```

```
In [8]: # Describe the data frame fields and contents
```

```
        df_bg.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 90400 entries, 0 to 90399
Data columns (total 81 columns):
row_names                                   90400 non-null object
game.id                                     90400 non-null object
game.type                                   90400 non-null object
details.description                         90400 non-null object
details.image                               83508 non-null object
details.maxplayers                          90397 non-null float64
details.maxplaytime                         90397 non-null float64
details.minage                              90397 non-null float64
details.minplayers                          90397 non-null float64
details.minplaytime                         90397 non-null float64
details.name                                90400 non-null object
details.playingtime                         90397 non-null float64
details.thumbnail                           83508 non-null object
details.yearpublished                       90397 non-null float64
attributes.boardgameartist                  34665 non-null object
attributes.boardgamecategory                88869 non-null object
attributes.boardgamecompilation             2295 non-null object
attributes.boardgamedesigner                78517 non-null object
attributes.boardgameexpansion               17787 non-null object
attributes.boardgamefamily                  50168 non-null object
attributes.boardgameimplementation          4688 non-null object
attributes.boardgameintegration             1284 non-null object
attributes.boardgamemechanic                75163 non-null object
attributes.boardgamepublisher               90305 non-null object
attributes.total                            90400 non-null float64
stats.average                               90400 non-null float64
stats.averageweight                         90400 non-null float64
stats.bayesaverage                          90400 non-null float64
stats.family.abstracts.bayesaverage         897 non-null float64
stats.family.abstracts.pos                  858 non-null float64
stats.family.cgs.bayesaverage               342 non-null float64
stats.family.cgs.pos                        264 non-null float64
stats.family.childrensgames.bayesaverage    679 non-null float64
stats.family.childrensgames.pos             670 non-null float64
stats.family.familygames.bayesaverage       1712 non-null float64
stats.family.familygames.pos                1558 non-null float64
stats.family.partygames.bayesaverage        476 non-null float64
stats.family.partygames.pos                 436 non-null float64
stats.family.strategygames.bayesaverage     2002 non-null float64
stats.family.strategygames.pos              1631 non-null float64
stats.family.thematic.bayesaverage          1127 non-null float64
stats.family.thematic.pos                   870 non-null float64
stats.family.wargames.bayesaverage          3036 non-null float64
stats.family.wargames.pos                   2530 non-null float64
stats.median                                90400 non-null float64
stats.numcomments                           90400 non-null float64
stats.numweights                            90400 non-null float64
stats.owned                                 90400 non-null float64
stats.stddev                                90400 non-null float64
stats.subtype.boardgame.bayesaverage        18064 non-null float64
stats.subtype.boardgame.pos                 13693 non-null float64
stats.trading                               90400 non-null float64
stats.usersrated                            90400 non-null float64
stats.wanting                               90400 non-null float64
stats.wishing                               90400 non-null float64
polls.language_dependence                   20728 non-null object
polls.suggested_numplayers.1                17478 non-null object
polls.suggested_numplayers.10               866 non-null object
polls.suggested_numplayers.2                20381 non-null object
polls.suggested_numplayers.3                14809 non-null object
polls.suggested_numplayers.4                15102 non-null object
polls.suggested_numplayers.5                8522 non-null object
polls.suggested_numplayers.6                5984 non-null object
polls.suggested_numplayers.7                2264 non-null object
polls.suggested_numplayers.8                1982 non-null object
polls.suggested_numplayers.9                920 non-null object
polls.suggested_numplayers.Over             16175 non-null object
polls.suggested_playerage                   18205 non-null object
attributes.t.links.concat.2...             65 non-null object
stats.family.amiga.bayesaverage             1 non-null float64
stats.family.amiga.pos                      1 non-null float64
stats.family.arcade.bayesaverage            1 non-null float64
stats.family.arcade.pos                     1 non-null float64
stats.family.atarist.bayesaverage           1 non-null float64
stats.family.atarist.pos                    1 non-null float64
stats.family.commodore64.bayesaverage       1 non-null float64
stats.family.commodore64.pos                1 non-null float64
stats.subtype.rpgitem.bayesaverage          4 non-null float64
stats.subtype.rpgitem.pos                   2 non-null float64
stats.subtype.videogame.bayesaverage        1 non-null float64
stats.subtype.videogame.pos                 1 non-null float64
dtypes: float64(50), object(31)
memory usage: 55.9+ MB
```

We want to filter out a few types of entries:
(1) Those with fewer than 10 rating entries [where the results may be biased by a few users]
(2) Board Game expansions [we will only consider base games here]
(3) Video games & role-playing books [this analysis focuses on table-top board games]

We can accomplish this by filtering on the following variables:
- game.type (filter out non-Board Games to remove expansions) - stats.usersrated (Filter out less

than 10) - stats.subtype.rpgitem.pos (Filter out) - stats.subtype.videogame.pos (Filter out)

```
In [9]: # Filter out games with fewer than 10 rating entries
        # (also filter for published year > 1900 to remove irrelevant data)
        df_filter = df_bg[(df_bg['stats.usersrated'] > 10) &
                            (df_bg['details.yearpublished'] > 1900)]

        # Filter out expansions
        df_filter = df_filter[(df_filter['game.type']) == "boardgame"]
        # NOTE: expansions have game.type "boardgameexpansion"

        # Filter out video games and role-playing books
        df_filter = df_filter[(df_filter['stats.subtype.rpgitem.pos'].isnull()) &
                                    (df_filter['stats.subtype.videogame.pos'].isnull())]

        # Final filtered data frame:
        df_filter.describe()
```

```
Out[9]:        details.maxplayers  details.maxplaytime  details.minage  \
        count        20842.000000         20842.000000    20842.000000
        mean             5.341618            76.394828        8.960608
        std             14.373976           488.914626        3.997340
        min              0.000000             0.000000        0.000000
        25%              2.000000            20.000000        8.000000
        50%              4.000000            40.000000       10.000000
        75%              6.000000            90.000000       12.000000
        max            999.000000         60000.000000       42.000000

               details.minplayers  details.minplaytime  details.playingtime  \
        count        20842.000000         20842.000000         20842.000000
        mean             2.054937            67.869590            76.394828
        std              0.688318           461.959652           488.914626
        min              0.000000             0.000000             0.000000
        25%              2.000000            20.000000            20.000000
        50%              2.000000            30.000000            40.000000
        75%              2.000000            60.000000            90.000000
        max             10.000000         60000.000000         60000.000000

               details.yearpublished  attributes.total  stats.average  \
        count           20842.000000      20842.000000   20842.000000
        mean             2002.278860          5.483351       6.177499
        std                13.800454          1.205738       1.008343
        min              1901.000000          1.000000       1.226530
        25%              1996.000000          5.000000       5.556000
        50%              2007.000000          5.000000       6.219970
        75%              2012.000000          6.000000       6.861903
        max              2018.000000         10.000000       9.411770
```

```
       stats.averageweight  stats.bayesaverage  \
count         20842.000000        20842.000000  
mean              1.869084            3.747665  
std               0.924572            2.737987  
min               0.000000            0.000000  
25%               1.181800            0.000000  
50%               1.833300            5.510885  
75%               2.500000            5.617965  
max               5.000000            8.489660  

       stats.family.abstracts.bayesaverage  stats.family.abstracts.pos  \
count                           806.000000                  798.000000  
mean                              5.829950                  425.190476  
std                               0.439721                  245.290075  
min                               4.698510                    1.000000  
25%                               5.538267                  212.500000  
50%                               5.729110                  422.500000  
75%                               6.046375                  637.750000  
max                               7.649620                  855.000000  

       stats.family.cgs.bayesaverage  stats.family.cgs.pos  \
count                     266.000000            264.000000  
mean                        5.963841            132.500000  
std                         0.749003             76.354437  
min                         3.627810              1.000000  
25%                         5.463457             66.750000  
50%                         5.823545            132.500000  
75%                         6.366967            198.250000  
max                         8.040870            264.000000  

       stats.family.childrensgames.bayesaverage  \
count                                650.000000  
mean                                   5.490099  
std                                    0.560599  
min                                    2.871180  
25%                                    5.188495  
50%                                    5.490630  
75%                                    5.832482  
max                                    6.951310  

       stats.family.childrensgames.pos  stats.family.familygames.bayesaverage  \
count                       650.000000                            1547.000000  
mean                        327.836923                               5.986206  
std                         190.252685                               0.484513  
min                           1.000000                               4.093260  
25%                         163.250000                               5.631495  
50%                         326.500000                               5.892270  
75%                         491.750000                               6.266205  
```

```
max                         667.000000                               7.863330

       stats.family.familygames.pos  stats.family.partygames.bayesaverage  \
count                   1532.000000                            431.000000   
mean                     777.039817                              5.955147   
std                      447.814427                              0.580266   
min                        1.000000                              3.383350   
25%                      389.750000                              5.586265   
50%                      778.500000                              5.886040   
75%                     1163.250000                              6.249760   
max                     1556.000000                              7.827470   

       stats.family.partygames.pos  stats.family.strategygames.bayesaverage  \
count                   426.000000                              1645.000000   
mean                    215.969484                                 6.299888   
std                     124.543124                                 0.602057   
min                       1.000000                                 4.915410   
25%                     109.250000                                 5.795290   
50%                     215.500000                                 6.184040   
75%                     322.750000                                 6.694980   
max                     435.000000                                 8.479230   

       stats.family.strategygames.pos  stats.family.thematic.bayesaverage  \
count                     1625.000000                          879.000000   
mean                       815.225846                            6.156519   
std                        471.140369                            0.610644   
min                          1.000000                            4.850390   
25%                        407.000000                            5.677385   
50%                        815.000000                            5.989790   
75%                       1223.000000                            6.521710   
max                       1630.000000                            8.494430   

       stats.family.thematic.pos  stats.family.wargames.bayesaverage  \
count                 870.000000                         2555.000000   
mean                  435.301149                            6.017413   
std                   251.027497                            0.494920   
min                     1.000000                            4.494430   
25%                   218.250000                            5.670540   
50%                   435.500000                            5.900000   
75%                   652.750000                            6.248730   
max                   869.000000                            8.305610   

       stats.family.wargames.pos  stats.median  stats.numcomments  \
count                2523.000000       20842.0       20842.000000   
mean                 1263.164487           0.0         131.236829   
std                   730.036972           0.0         464.393914   
min                     1.000000           0.0           0.000000   
25%                   631.500000           0.0          10.000000   
```

```
50%                  1262.000000           0.0          25.000000
75%                  1893.500000           0.0          74.000000
max                  2530.000000           0.0       13841.000000

       stats.numweights   stats.owned  stats.stddev  \
count      20842.000000  20842.000000  20842.000000
mean          38.892429    729.420257      1.518226
std          173.669855   2842.386204      0.343919
min            0.000000      0.000000      0.369966
25%            2.000000     54.000000      1.296360
50%            6.000000    136.000000      1.470660
75%           18.000000    417.750000      1.684810
max         6448.000000  95401.000000      3.968040

       stats.subtype.boardgame.bayesaverage  stats.subtype.boardgame.pos  \
count                          13656.000000                 13483.000000
mean                               5.720150                  6814.585552
std                                0.398324                  3940.078844
min                                3.713330                     1.000000
25%                                5.513438                  3401.000000
50%                                5.569265                  6811.000000
75%                                5.743003                 10220.500000
max                                8.489660                 13680.000000

       stats.trading  stats.usersrated  stats.wanting  stats.wishing  \
count   20842.000000      20842.000000   20842.000000   20842.000000
mean       27.322954        457.413588      30.181077     117.509116
std        70.036042       2102.773633      98.820719     447.580727
min         0.000000         11.000000       0.000000       0.000000
25%         2.000000         21.000000       1.000000       5.000000
50%         7.000000         52.000000       5.000000      14.000000
75%        22.000000        182.000000      17.000000      53.000000
max      1858.000000      67655.000000    1838.000000    9082.000000

       stats.family.amiga.bayesaverage  stats.family.amiga.pos  \
count                              0.0                     0.0
mean                               NaN                     NaN
std                                NaN                     NaN
min                                NaN                     NaN
25%                                NaN                     NaN
50%                                NaN                     NaN
75%                                NaN                     NaN
max                                NaN                     NaN

       stats.family.arcade.bayesaverage  stats.family.arcade.pos  \
count                               0.0                      0.0
mean                                NaN                      NaN
std                                 NaN                      NaN
```

```
min                                 NaN                      NaN
25%                                 NaN                      NaN
50%                                 NaN                      NaN
75%                                 NaN                      NaN
max                                 NaN                      NaN

       stats.family.atarist.bayesaverage  stats.family.atarist.pos  \
count                                0.0                       0.0
mean                                 NaN                       NaN
std                                  NaN                       NaN
min                                  NaN                       NaN
25%                                  NaN                       NaN
50%                                  NaN                       NaN
75%                                  NaN                       NaN
max                                  NaN                       NaN

       stats.family.commodore64.bayesaverage  stats.family.commodore64.pos  \
count                                    0.0                           0.0
mean                                     NaN                           NaN
std                                      NaN                           NaN
min                                      NaN                           NaN
25%                                      NaN                           NaN
50%                                      NaN                           NaN
75%                                      NaN                           NaN
max                                      NaN                           NaN

       stats.subtype.rpgitem.bayesaverage  stats.subtype.rpgitem.pos  \
count                                 0.0                        0.0
mean                                  NaN                        NaN
std                                   NaN                        NaN
min                                   NaN                        NaN
25%                                   NaN                        NaN
50%                                   NaN                        NaN
75%                                   NaN                        NaN
max                                   NaN                        NaN

       stats.subtype.videogame.bayesaverage  stats.subtype.videogame.pos
count                                   0.0                          0.0
mean                                    NaN                          NaN
std                                     NaN                          NaN
min                                     NaN                          NaN
25%                                     NaN                          NaN
50%                                     NaN                          NaN
75%                                     NaN                          NaN
max                                     NaN                          NaN
```

1.3.2 Processing Feature Variables

As discussed above, this analysis focuses on the aspects of a board game that designers can directly control. Those features are given in the variables below:

Features

- details.maxplayers
- details.minage
- details.minplayers
- details.playingtime
- details.yearpublished
- attributes.boardgamecategory (will require pre-processing)
- attributes.boardgamemechanic (will require pre-processing)
- stats.averageweight (NOTE: this is a sort of complexity rating for gameplay)

Other Fields

- We'll keep details.name to be able to refer to specific games

A bit of pre-processing is required to make the Category and Mechanic fields more usable. The given database records these things in comma-separated lists, whereas we need a set of binary fields (one per category and mechanic). The cells below perform the preprocessing on the boardgamecategory and boardgamemechanic variables.

```
In [10]: # Next we'll try to pre-process attributes.boardgamemechanic

         df_mechs = df_filter['attributes.boardgamemechanic'].str.get_dummies(sep=',')
```

```
In [11]: df_mechs.head()
```

```
Out[11]:    Acting  Action / Movement Programming  Action Point Allowance System  \
         0       0                              0                              0
         1       0                              0                              0
         2       0                              0                              0
         3       0                              0                              1
         4       0                              0                              0

            Area Control / Area Influence  Area Enclosure  Area Movement  Area-Impulse  \
         0                              1               0              0             0
         1                              0               0              0             0
         2                              1               0              0             0
         3                              1               0              0             0
         4                              0               0              0             0

            Auction/Bidding  Betting/Wagering  Campaign / Battle Card Driven  \
         0                1                 0                              0
         1                0                 0                              0
         2                0                 0                              0
         3                1                 0                              0
```

```
4                0                 0                              0

   Card Drafting  Chit-Pull System  Co-operative Play  Commodity Speculation  \
0              0                 0                  0                      0
1              0                 0                  0                      0
2              0                 0                  0                      0
3              0                 0                  0                      0
4              0                 0                  0                      0

   Crayon Rail System  Deck / Pool Building  Dice Rolling  Grid Movement  \
0                   0                     0             1              0
1                   0                     0             0              0
2                   0                     0             0              0
3                   0                     0             0              0
4                   0                     0             0              0

   Hand Management  Hex-and-Counter  Line Drawing  Memory  Modular Board  \
0                1                0             0       0              0
1                0                0             0       0              0
2                1                0             0       0              0
3                0                0             0       0              0
4                1                0             0       0              0

   Paper-and-Pencil  Partnerships  Pattern Building  Pattern Recognition  \
0                 0             0                 0                    0
1                 0             0                 0                    0
2                 0             0                 0                    0
3                 0             0                 0                    0
4                 0             0                 0                    0

   Pick-up and Deliver  Player Elimination  Point to Point Movement  \
0                    0                   0                        0
1                    0                   0                        0
2                    0                   0                        0
3                    0                   0                        0
4                    0                   0                        0

   Press Your Luck  Rock-Paper-Scissors  Role Playing  Roll / Spin and Move  \
0                0                    0             0                     0
1                0                    0             0                     0
2                0                    0             0                     0
3                0                    0             0                     0
4                0                    0             0                     0

   Route/Network Building  Secret Unit Deployment  Set Collection  Simulation  \
0                       0                       0               0           0
1                       0                       0               0           0
2                       0                       0               1           0
```

```
3                       0                       0               1           0
4                       0                       0               0           0

   Simultaneous Action Selection  Singing  Stock Holding  Storytelling  \
0                              1        0              0             0
1                              0        0              0             0
2                              0        0              0             0
3                              0        0              0             0
4                              0        0              1             0

   Take That  Tile Placement  Time Track  Trading  Trick-taking  \
0          0               0           0        0             0
1          0               0           0        0             1
2          0               1           0        0             0
3          0               0           0        0             0
4          0               1           0        0             0

   Variable Phase Order  Variable Player Powers  Voting  Worker Placement
0                     0                       0       0                 0
1                     0                       0       0                 0
2                     0                       0       0                 0
3                     0                       0       0                 0
4                     0                       0       0                 0
```

```
In [12]: df_mechs.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 20842 entries, 0 to 90327
Data columns (total 51 columns):
Acting                           20842 non-null int64
Action / Movement Programming    20842 non-null int64
Action Point Allowance System    20842 non-null int64
Area Control / Area Influence    20842 non-null int64
Area Enclosure                   20842 non-null int64
Area Movement                    20842 non-null int64
Area-Impulse                     20842 non-null int64
Auction/Bidding                  20842 non-null int64
Betting/Wagering                 20842 non-null int64
Campaign / Battle Card Driven    20842 non-null int64
Card Drafting                    20842 non-null int64
Chit-Pull System                 20842 non-null int64
Co-operative Play                20842 non-null int64
Commodity Speculation            20842 non-null int64
Crayon Rail System               20842 non-null int64
Deck / Pool Building             20842 non-null int64
Dice Rolling                     20842 non-null int64
Grid Movement                    20842 non-null int64
Hand Management                  20842 non-null int64
```

```
Hex-and-Counter                  20842 non-null int64
Line Drawing                     20842 non-null int64
Memory                           20842 non-null int64
Modular Board                    20842 non-null int64
Paper-and-Pencil                 20842 non-null int64
Partnerships                     20842 non-null int64
Pattern Building                 20842 non-null int64
Pattern Recognition              20842 non-null int64
Pick-up and Deliver              20842 non-null int64
Player Elimination               20842 non-null int64
Point to Point Movement          20842 non-null int64
Press Your Luck                  20842 non-null int64
Rock-Paper-Scissors              20842 non-null int64
Role Playing                     20842 non-null int64
Roll / Spin and Move             20842 non-null int64
Route/Network Building           20842 non-null int64
Secret Unit Deployment           20842 non-null int64
Set Collection                   20842 non-null int64
Simulation                       20842 non-null int64
Simultaneous Action Selection    20842 non-null int64
Singing                          20842 non-null int64
Stock Holding                    20842 non-null int64
Storytelling                     20842 non-null int64
Take That                        20842 non-null int64
Tile Placement                   20842 non-null int64
Time Track                       20842 non-null int64
Trading                          20842 non-null int64
Trick-taking                     20842 non-null int64
Variable Phase Order             20842 non-null int64
Variable Player Powers           20842 non-null int64
Voting                           20842 non-null int64
Worker Placement                 20842 non-null int64
dtypes: int64(51)
memory usage: 8.3 MB
```

```
In [13]: mechs_selector = list(df_mechs)
```

```
In [14]: df_cats = df_filter['attributes.boardgamecategory'].str.get_dummies(sep=',')
```

```
In [15]: df_cats.head()
```

```
Out[15]:    Abstract Strategy  Action / Dexterity  Adventure  Age of Reason  \
         0                  0                   0          0              0
         1                  0                   0          0              0
         2                  1                   0          0              0
         3                  0                   0          0              0
         4                  0                   0          0              0
```

```
   American Civil War  American Indian Wars  American Revolutionary War  \
0                   0                     0                           0
1                   0                     0                           0
2                   0                     0                           0
3                   0                     0                           0
4                   0                     0                           0

   American West  Ancient  Animals  Arabian  Aviation / Flight  Bluffing  \
0              0        0        0        0                  0         0
1              0        0        0        0                  0         0
2              0        0        0        0                  0         0
3              0        1        0        0                  0         0
4              0        0        0        0                  0         0

   Book  Card Game  Children's Game  City Building  Civil War  Civilization  \
0     0          0                0              0          0             0
1     0          1                0              0          0             0
2     0          0                0              0          0             0
3     0          0                0              0          0             0
4     0          0                0              0          0             0

   Collectible Components  Comic Book / Strip  Deduction  Dice  Economic  \
0                       0                   0          0     0         1
1                       0                   0          0     0         0
2                       0                   0          0     0         0
3                       0                   0          0     0         0
4                       0                   0          0     0         1

   Educational  Electronic  Environmental  Expansion for Base-game  \
0            0           0              0                        0
1            0           0              0                        0
2            0           0              0                        0
3            0           0              0                        0
4            0           0              0                        0

   Exploration  Fan Expansion  Fantasy  Farming  Fighting  Game System  \
0            0              0        0        0         0            0
1            0              0        1        0         0            0
2            0              0        0        0         0            0
3            0              0        0        0         0            0
4            0              0        0        0         0            0

   Horror  Humor  Industry / Manufacturing  Korean War  Mafia  Math  \
0       0      0                         0           0      0     0
1       0      0                         0           0      0     0
2       0      0                         0           0      0     0
3       0      0                         0           0      0     0
4       0      0                         0           0      0     0
```

```
   Mature / Adult  Maze  Medical  Medieval  Memory  Miniatures  \
0               0     0        0         0       0           0
1               0     0        0         0       0           0
2               0     0        0         1       0           0
3               0     0        0         0       0           0
4               0     0        0         0       0           0

   Modern Warfare  Movies / TV / Radio theme  Murder/Mystery  Music  \
0               0                          0               0      0
1               0                          0               0      0
2               0                          0               0      0
3               0                          0               0      0
4               0                          0               0      0

   Mythology  Napoleonic  Nautical  Negotiation  Novel-based  Number  \
0          0           0         0            1            0       0
1          0           0         0            0            0       0
2          0           0         0            0            0       0
3          0           0         0            0            0       0
4          0           0         0            0            0       0

   Party Game  Pike and Shot  Pirates  Political  Post-Napoleonic  \
0           0              0        0          1                0
1           0              0        0          0                0
2           0              0        0          0                0
3           0              0        0          0                0
4           0              0        0          0                0

   Prehistoric  Print & Play  Puzzle  Racing  Real-time  Religious  \
0            0             0       0       0          0          0
1            0             0       0       0          0          0
2            0             0       0       0          0          0
3            0             0       0       0          0          0
4            0             0       0       0          0          0

   Renaissance  Science Fiction  Space Exploration  Spies/Secret Agents  \
0            0                0                  0                    0
1            0                0                  0                    0
2            0                0                  0                    0
3            0                0                  0                    0
4            0                0                  0                    0

   Sports  Territory Building  Trains  Transportation  Travel  Trivia  \
0       0                   0       0               0       0       0
1       0                   0       0               0       0       0
2       0                   0       0               0       0       0
3       0                   0       0               0       0       0
```

```
4       0                   0       0               0       0       0

   Video Game Theme  Vietnam War  Wargame  Word Game  World War I  \
0                 0            0        0          0            0
1                 0            0        0          0            0
2                 0            0        0          0            0
3                 0            0        0          0            0
4                 0            0        0          0            0

   World War II  Zombies
0             0        0
1             0        0
2             0        0
3             0        0
4             0        0
```

```
In [16]: df_cats.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 20842 entries, 0 to 90327
Data columns (total 84 columns):
Abstract Strategy             20842 non-null int64
Action / Dexterity            20842 non-null int64
Adventure                     20842 non-null int64
Age of Reason                 20842 non-null int64
American Civil War            20842 non-null int64
American Indian Wars          20842 non-null int64
American Revolutionary War    20842 non-null int64
American West                 20842 non-null int64
Ancient                       20842 non-null int64
Animals                       20842 non-null int64
Arabian                       20842 non-null int64
Aviation / Flight             20842 non-null int64
Bluffing                      20842 non-null int64
Book                          20842 non-null int64
Card Game                     20842 non-null int64
Children's Game               20842 non-null int64
City Building                 20842 non-null int64
Civil War                     20842 non-null int64
Civilization                  20842 non-null int64
Collectible Components        20842 non-null int64
Comic Book / Strip            20842 non-null int64
Deduction                     20842 non-null int64
Dice                          20842 non-null int64
Economic                      20842 non-null int64
Educational                   20842 non-null int64
Electronic                    20842 non-null int64
Environmental                 20842 non-null int64
```

```
Expansion for Base-game       20842 non-null int64
Exploration                   20842 non-null int64
Fan Expansion                 20842 non-null int64
Fantasy                       20842 non-null int64
Farming                       20842 non-null int64
Fighting                      20842 non-null int64
Game System                   20842 non-null int64
Horror                        20842 non-null int64
Humor                         20842 non-null int64
Industry / Manufacturing      20842 non-null int64
Korean War                    20842 non-null int64
Mafia                         20842 non-null int64
Math                          20842 non-null int64
Mature / Adult                20842 non-null int64
Maze                          20842 non-null int64
Medical                       20842 non-null int64
Medieval                      20842 non-null int64
Memory                        20842 non-null int64
Miniatures                    20842 non-null int64
Modern Warfare                20842 non-null int64
Movies / TV / Radio theme     20842 non-null int64
Murder/Mystery                20842 non-null int64
Music                         20842 non-null int64
Mythology                     20842 non-null int64
Napoleonic                    20842 non-null int64
Nautical                      20842 non-null int64
Negotiation                   20842 non-null int64
Novel-based                   20842 non-null int64
Number                        20842 non-null int64
Party Game                    20842 non-null int64
Pike and Shot                 20842 non-null int64
Pirates                       20842 non-null int64
Political                     20842 non-null int64
Post-Napoleonic               20842 non-null int64
Prehistoric                   20842 non-null int64
Print & Play                  20842 non-null int64
Puzzle                        20842 non-null int64
Racing                        20842 non-null int64
Real-time                     20842 non-null int64
Religious                     20842 non-null int64
Renaissance                   20842 non-null int64
Science Fiction               20842 non-null int64
Space Exploration             20842 non-null int64
Spies/Secret Agents           20842 non-null int64
Sports                        20842 non-null int64
Territory Building            20842 non-null int64
Trains                        20842 non-null int64
Transportation                20842 non-null int64
```

```
Travel                        20842 non-null int64
Trivia                        20842 non-null int64
Video Game Theme              20842 non-null int64
Vietnam War                   20842 non-null int64
Wargame                       20842 non-null int64
Word Game                     20842 non-null int64
World War I                   20842 non-null int64
World War II                  20842 non-null int64
Zombies                       20842 non-null int64
dtypes: int64(84)
memory usage: 13.5 MB
```

```
In [17]: cats_selector = list(df_cats)
```

```
In [18]: #Now let's create a new Dataframe with only the features we want to keep
         df_limit = df_filter[['details.name','details.maxplayers', 'details.minage', 'details
```

```
In [19]: df_limit.head(10)
```

```
Out[19]:          details.name  details.maxplayers  details.minage  details.minplayers  \
         0          Die Macher                 5.0            14.0                 3.0
         1        Dragonmaster                 4.0            12.0                 3.0
         2             Samurai                 4.0            10.0                 2.0
         3      Tal der Könige                 4.0            12.0                 2.0
         4             Acquire                 6.0            12.0                 3.0
         5  Mare Mediterraneum                 6.0            12.0                 2.0
         6           Cathedral                 2.0             8.0                 2.0
         7   Lords of Creation                 5.0            12.0                 2.0
         8        El Caballero                 4.0            13.0                 2.0
         9           Elfenland                 6.0            10.0                 2.0

            details.playingtime  details.yearpublished  stats.averageweight  \
         0                240.0                 1986.0               4.3477
         1                 30.0                 1981.0               1.9423
         2                 60.0                 1998.0               2.5085
         3                 60.0                 1992.0               2.6667
         4                 90.0                 1964.0               2.5089
         5                240.0                 1989.0               3.0000
         6                 20.0                 1978.0               1.8217
         7                120.0                 1993.0               2.4000
         8                 90.0                 1998.0               3.1958
         9                 60.0                 1998.0               2.1649

            stats.average  stats.owned  stats.stddev
         0        7.66508       5251.0       1.59321
         1        6.60815       1053.0       1.46282
         2        7.44119      11870.0       1.18531
         3        6.60675        523.0       1.21028
         4        7.35830      18682.0       1.33020
         5        6.52534        106.0       1.65064
         6        6.50534       4561.0       1.31078
         7        6.14538        460.0       1.25508
         8        6.51776       2263.0       1.40413
         9        6.74996       7792.0       1.24616
```

```
In [20]: df_interim = df_cats.join(df_mechs, lsuffix='_category', rsuffix='_mechanics')
```

```
In [21]: df_interim.head()
```

```
Out[21]:    Abstract Strategy  Action / Dexterity  Adventure  Age of Reason  \
         0                  0                   0          0              0
         1                  0                   0          0              0
         2                  1                   0          0              0
         3                  0                   0          0              0
         4                  0                   0          0              0

            American Civil War  American Indian Wars  American Revolutionary War  \
         0                   0                     0                           0
         1                   0                     0                           0
         2                   0                     0                           0
         3                   0                     0                           0
         4                   0                     0                           0

            American West  Ancient  Animals  Arabian  Aviation / Flight  Bluffing  \
         0              0        0        0        0                  0         0
         1              0        0        0        0                  0         0
         2              0        0        0        0                  0         0
         3              0        1        0        0                  0         0
         4              0        0        0        0                  0         0

            Book  Card Game  Children's Game  City Building  Civil War  Civilization  \
         0     0          0                0              0          0             0
         1     0          1                0              0          0             0
         2     0          0                0              0          0             0
         3     0          0                0              0          0             0
         4     0          0                0              0          0             0

            Collectible Components  Comic Book / Strip  Deduction  Dice  Economic  \
         0                       0                   0          0     0         1
         1                       0                   0          0     0         0
         2                       0                   0          0     0         0
         3                       0                   0          0     0         0
         4                       0                   0          0     0         1

            Educational  Electronic  Environmental  Expansion for Base-game  \
         0            0           0              0                        0
```

```
1            0           0              0                        0
2            0           0              0                        0
3            0           0              0                        0
4            0           0              0                        0

   Exploration  Fan Expansion  Fantasy  Farming  Fighting  Game System  \
0            0              0        0        0         0            0
1            0              0        1        0         0            0
2            0              0        0        0         0            0
3            0              0        0        0         0            0
4            0              0        0        0         0            0

   Horror  Humor  Industry / Manufacturing  Korean War  Mafia  Math  \
0       0      0                         0           0      0     0
1       0      0                         0           0      0     0
2       0      0                         0           0      0     0
3       0      0                         0           0      0     0
4       0      0                         0           0      0     0

   Mature / Adult  Maze  Medical  Medieval  Memory_category  Miniatures  \
0               0     0        0         0                0           0
1               0     0        0         0                0           0
2               0     0        0         1                0           0
3               0     0        0         0                0           0
4               0     0        0         0                0           0

   Modern Warfare  Movies / TV / Radio theme  Murder/Mystery  Music  \
0               0                          0               0      0
1               0                          0               0      0
2               0                          0               0      0
3               0                          0               0      0
4               0                          0               0      0

         ...         Action / Movement Programming  \
0        ...                                     0
1        ...                                     0
2        ...                                     0
3        ...                                     0
4        ...                                     0

   Action Point Allowance System  Area Control / Area Influence  \
0                              0                              1
1                              0                              0
2                              0                              1
3                              1                              1
4                              0                              0

   Area Enclosure  Area Movement  Area-Impulse  Auction/Bidding  \
0               0              0             0                1
1               0              0             0                0
2               0              0             0                0
3               0              0             0                1
4               0              0             0                0

   Betting/Wagering  Campaign / Battle Card Driven  Card Drafting  \
0                 0                              0              0
1                 0                              0              0
2                 0                              0              0
3                 0                              0              0
4                 0                              0              0

   Chit-Pull System  Co-operative Play  Commodity Speculation  \
0                 0                  0                      0
1                 0                  0                      0
2                 0                  0                      0
3                 0                  0                      0
4                 0                  0                      0

   Crayon Rail System  Deck / Pool Building  Dice Rolling  Grid Movement  \
0                   0                     0             1              0
1                   0                     0             0              0
2                   0                     0             0              0
3                   0                     0             0              0
4                   0                     0             0              0

   Hand Management  Hex-and-Counter  Line Drawing  Memory_mechanics  \
0                1                0             0                 0
1                0                0             0                 0
2                1                0             0                 0
3                0                0             0                 0
4                1                0             0                 0

   Modular Board  Paper-and-Pencil  Partnerships  Pattern Building  \
0              0                 0             0                 0
1              0                 0             0                 0
2              0                 0             0                 0
3              0                 0             0                 0
4              0                 0             0                 0

   Pattern Recognition  Pick-up and Deliver  Player Elimination  \
0                    0                    0                   0
1                    0                    0                   0
2                    0                    0                   0
3                    0                    0                   0
4                    0                    0                   0
```

```
   Point to Point Movement  Press Your Luck  Rock-Paper-Scissors  \
0                        0                0                    0
1                        0                0                    0
2                        0                0                    0
3                        0                0                    0
4                        0                0                    0

   Role Playing  Roll / Spin and Move  Route/Network Building  \
0             0                     0                       0
1             0                     0                       0
2             0                     0                       0
3             0                     0                       0
4             0                     0                       0

   Secret Unit Deployment  Set Collection  Simulation  \
0                       0               0           0
1                       0               0           0
2                       0               1           0
3                       0               1           0
4                       0               0           0

   Simultaneous Action Selection  Singing  Stock Holding  Storytelling  \
0                              1        0              0             0
1                              0        0              0             0
2                              0        0              0             0
3                              0        0              0             0
4                              0        0              1             0

   Take That  Tile Placement  Time Track  Trading  Trick-taking  \
0          0               0           0        0             0
1          0               0           0        0             1
2          0               1           0        0             0
3          0               0           0        0             0
4          0               1           0        0             0

   Variable Phase Order  Variable Player Powers  Voting  Worker Placement
0                     0                       0       0                 0
1                     0                       0       0                 0
2                     0                       0       0                 0
3                     0                       0       0                 0
4                     0                       0       0                 0

[5 rows x 135 columns]
```

```
In [22]: df_data = df_limit.join(df_interim)
```

```
In [23]: df_data
```

```
Out[23]:                                             details.name  details.maxplayers  \
0                                                Die Macher                  5.0
1                                              Dragonmaster                  4.0
2                                                   Samurai                  4.0
3                                            Tal der Könige                  4.0
4                                                   Acquire                  6.0
5                                        Mare Mediterraneum                  6.0
6                                                 Cathedral                  2.0
7                                         Lords of Creation                  5.0
8                                              El Caballero                  4.0
9                                                 Elfenland                  6.0
10                                                 Bohnanza                  7.0
11                                                       Ra                  5.0
12                                                    Catan                  4.0
13                                                   Basari                  4.0
14                                         Cosmic Encounter                  6.0
15                                                MarraCash                  4.0
16                                               Button Men                  2.0
17                                                RoboRally                  8.0
18                                         Wacky Wacky West                  4.0
19                                       Full Metal Planète                  4.0
20                                     Gateway to the Stars                  7.0
21                                              Magic Realm                 16.0
22                                             Divine Right                  6.0
23                                        Twilight Imperium                  6.0
24                                               Battlemist                  6.0
25                                       Age of Renaissance                  6.0
26                                                Supremacy                  6.0
27                              Illuminati:  Deluxe Edition                  8.0
28                                            Terrain Vague                  4.0
29                                               Dark Tower                  4.0
...                                                     ...                  ...
89526                                                 Tenno                  7.0
89536                                                 Tembo                  4.0
89537                                                NMBR 9                  4.0
89546                               Qwinto: Das Kartenspiel                  4.0
89547  Teenage Mutant Ninja Turtles Dice Masters: Her...                  4.0
89549                                            Twenty One                  6.0
89570                                       Vanguard of War                  4.0
89574                                         Go Go Gelato!                  4.0
89621                   Carry On: Gear Collecting Card Game                  4.0
89630                                       Import / Export                  6.0
89668                                                 Delve                  4.0
89697                                   Napoleons Quagmire                  2.0
89727                                              Profiler                  8.0
89778                                      Rise to Nobility                  6.0
89786                                  Deckscape: Test Time                  6.0
89788                                             3 Secrets                  8.0
89821                               Aeon's End: War Eternal                  4.0
```

```
89852                             Empires of the Void II                 5.0
89856                                       Tortuga 1667                 9.0
89881                                     Divinity Derby                 6.0
89962                  Game of Quotes  Verrückte Zitate                 6.0 
89969                                        Yukon Salon                 4.0
90001                                           Valletta                 4.0
90006            Warhammer Quest: Shadows Over Hammerhal                 5.0
90031                                      Santo Domingo                 6.0
90065                                   National Economy                 4.0
90167                                            Solaris                 5.0
90206                                         Math Fluxx                 6.0
90239                                          Bärenpark                 4.0
90327                     Vikings Gone Wild Ultimate Set                 5.0

       details.minage  details.minplayers  details.playingtime  \
0                14.0                 3.0                240.0   
1                12.0                 3.0                 30.0   
2                10.0                 2.0                 60.0   
3                12.0                 2.0                 60.0   
4                12.0                 3.0                 90.0   
5                12.0                 2.0                240.0   
6                 8.0                 2.0                 20.0   
7                12.0                 2.0                120.0   
8                13.0                 2.0                 90.0   
9                10.0                 2.0                 60.0   
10               13.0                 2.0                 45.0   
11               12.0                 2.0                 60.0   
12               10.0                 3.0                120.0   
13               10.0                 3.0                 25.0   
14               12.0                 2.0                 90.0   
15               12.0                 3.0                 60.0   
16               10.0                 2.0                  5.0   
17               12.0                 2.0                120.0   
18                9.0                 2.0                 45.0   
19               12.0                 2.0                 90.0   
20               12.0                 1.0                  0.0   
21               12.0                 1.0                240.0   
22               12.0                 2.0                360.0   
23               12.0                 2.0                240.0   
24               12.0                 2.0                200.0   
25               12.0                 3.0                360.0   
26               12.0                 2.0                340.0   
27               12.0                 2.0                180.0   
28               10.0                 2.0                120.0   
29               10.0                 1.0                 90.0   
...               ...                 ...                  ...   
89526             8.0                 2.0                 30.0   
89536             8.0                 2.0                 20.0   
```

```
89537             8.0                 1.0                20.0
89546             8.0                 1.0                 0.0
89547            14.0                 2.0                60.0
89549             8.0                 2.0                 0.0
89570            13.0                 1.0                60.0
89574             6.0                 2.0                15.0
89621            10.0                 2.0                30.0
89630             8.0                 2.0                90.0
89668            14.0                 2.0                60.0
89697             0.0                 2.0                 0.0
89727            12.0                 3.0                30.0
89778            13.0                 1.0               100.0
89786            12.0                 1.0                 0.0
89788            14.0                 2.0                 0.0
89821            14.0                 1.0                 0.0
89852            13.0                 2.0               180.0
89856            12.0                 2.0                40.0
89881            10.0                 3.0                90.0
89962            12.0                 3.0                30.0
89969             4.0                 2.0                15.0
90001            10.0                 2.0                80.0
90006             0.0                 2.0               120.0
90031             8.0                 2.0                30.0
90065            12.0                 1.0                45.0
90167            12.0                 3.0                60.0
90206             8.0                 2.0                30.0
90239             8.0                 2.0                45.0
90327            10.0                 2.0                70.0

       details.yearpublished  stats.averageweight  stats.average  stats.owned  \
0                     1986.0               4.3477        7.66508       5251.0
1                     1981.0               1.9423        6.60815       1053.0
2                     1998.0               2.5085        7.44119      11870.0
3                     1992.0               2.6667        6.60675        523.0
4                     1964.0               2.5089        7.35830      18682.0
5                     1989.0               3.0000        6.52534        106.0
6                     1978.0               1.8217        6.50534       4561.0
7                     1993.0               2.4000        6.14538        460.0
8                     1998.0               3.1958        6.51776       2263.0
9                     1998.0               2.1649        6.74996       7792.0
10                    1997.0               1.6777        7.06751      39474.0
11                    1999.0               2.3560        7.47505      14413.0
12                    1995.0               2.3603        7.26569      95401.0
13                    1998.0               1.8588        6.78156       1609.0
14                    1977.0               2.3708        6.93470       3991.0
15                    1996.0               2.1538        6.84341       1027.0
16                    1999.0               1.5493        6.30870       1123.0
17                    1994.0               2.4340        7.15355      22500.0
```

```
18                    1991.0               1.8467        6.31166       2402.0
19                    1988.0               3.1636        7.43592        794.0
20                    1981.0               3.0000        5.35714         80.0
21                    1979.0               4.4985        7.14384       3197.0
22                    1979.0               3.1324        6.95654        922.0
23                    1997.0               3.4902        6.66812        789.0
24                    1998.0               3.2105        5.93231        622.0
25                    1996.0               3.8511        7.09930       2491.0
26                    1984.0               3.1404        5.57724       1941.0
27                    1987.0               2.6489        6.52890       7170.0
28                    1993.0               3.2857        6.66639        187.0
29                    1981.0               1.8182        6.64350       1276.0
...                      ...                  ...            ...          ...
89526                 2017.0               0.0000        6.04167         35.0
89536                 2017.0               0.0000        5.69185         47.0
89537                 2017.0               1.0000        6.91718        154.0
89546                 2017.0               0.0000        6.74375         31.0
89547                 2017.0               0.0000        7.82960        102.0
89549                 2017.0               1.0000        6.37356        126.0
89570                 2017.0               0.0000        7.71429         11.0
89574                 2017.0               1.0000        7.15000         22.0
89621                 2016.0               2.0000        7.18182         21.0
89630                 2017.0               0.0000        6.78667         33.0
89668                 2017.0               0.0000        8.50667         44.0
89697                 2017.0               0.0000        8.45833         60.0
89727                 2017.0               1.0000        7.33939         53.0
89778                 2017.0               2.6667        8.21429         53.0
89786                 2017.0               1.0000        7.32069         70.0
89788                 2017.0               2.0000        6.46364         38.0
89821                 2017.0               0.0000        9.28333         56.0
89852                 2017.0               3.0000        7.53037         90.0
89856                 2017.0               0.0000        8.37522        185.0
89881                 2017.0               0.0000        8.45455         15.0
89962                 2017.0               1.5000        6.24000         58.0
89969                 2017.0               2.0000        8.67647         22.0
90001                 2017.0               2.3333        6.90270         33.0
90006                 2017.0               2.0000        8.09000        207.0
90031                 2017.0               0.0000        6.30690         46.0
90065                 2015.0               3.0000        7.59167         27.0
90167                 2017.0               3.7500        5.53571         11.0
90206                 2017.0               0.0000        6.30714        126.0
90239                 2017.0               2.2000        7.09487         85.0
90327                 2017.0               0.0000        8.26829        208.0

       stats.stddev  Abstract Strategy  Action / Dexterity  Adventure  \
0          1.593210                  0                   0          0
1          1.462820                  0                   0          0
2          1.185310                  1                   0          0
```

```
3          1.210280                  0                    0          0
4          1.330200                  0                    0          0
5          1.650640                  0                    0          0
6          1.310780                  1                    0          0
7          1.255080                  0                    0          0
8          1.404130                  0                    0          0
9          1.246160                  0                    0          0
10         1.276770                  0                    0          0
11         1.339560                  0                    0          0
12         1.448420                  0                    0          0
13         1.209930                  0                    0          0
14         1.795740                  0                    0          0
15         1.187540                  0                    0          0
16         1.512460                  0                    0          0
17         1.516010                  0                    0          0
18         1.206600                  0                    0          0
19         1.544890                  0                    0          0
20         1.673620                  0                    0          0
21         1.958700                  0                    0          1
22         1.564710                  0                    0          0
23         1.643250                  0                    0          0
24         1.487550                  0                    0          0
25         1.750650                  0                    0          0
26         2.017120                  0                    0          0
27         1.567170                  0                    0          0
28         1.428250                  0                    0          0
29         1.790150                  0                    0          1
...             ...                ...                  ...        ...
89526      1.540540                  0                    0          0
89536      1.655460                  0                    0          0
89537      1.166520                  0                    0          0
89546      1.669190                  0                    0          0
89547      1.283350                  0                    0          0
89549      1.381530                  0                    0          0
89570      2.736750                  0                    0          0
89574      0.788987                  0                    1          0
89621      1.748670                  0                    0          0
89630      1.523970                  1                    0          0
89668      2.165010                  0                    0          0
89697      1.029930                  0                    0          0
89727      1.483640                  0                    0          0
89778      2.114700                  0                    0          0
89786      0.882934                  0                    0          0
89788      1.270490                  0                    0          0
89821      1.737020                  0                    0          0
89852      3.565730                  0                    0          0
89856      2.084090                  0                    0          0
89881      1.075650                  0                    0          0
```

```
89962      1.443050                  0                   0          0
89969      1.542930                  0                   0          0
90001      1.112940                  0                   0          0
90006      1.654360                  0                   0          1
90031      1.010270                  0                   0          0
90065      0.683689                  0                   0          0
90167      1.505520                  0                   0          0
90206      1.213300                  0                   0          0
90239      1.115120                  0                   0          0
90327      1.126710                  0                   0          0

       Age of Reason  American Civil War  American Indian Wars  \
0                  0                   0                     0
1                  0                   0                     0
2                  0                   0                     0
3                  0                   0                     0
4                  0                   0                     0
5                  0                   0                     0
6                  0                   0                     0
7                  0                   0                     0
8                  0                   0                     0
9                  0                   0                     0
10                 0                   0                     0
11                 0                   0                     0
12                 0                   0                     0
13                 0                   0                     0
14                 0                   0                     0
15                 0                   0                     0
16                 0                   0                     0
17                 0                   0                     0
18                 0                   0                     0
19                 0                   0                     0
20                 0                   0                     0
21                 0                   0                     0
22                 0                   0                     0
23                 0                   0                     0
24                 0                   0                     0
25                 0                   0                     0
26                 0                   0                     0
27                 0                   0                     0
28                 0                   0                     0
29                 0                   0                     0
...              ...                 ...                   ...
89526              0                   0                     0
89536              0                   0                     0
89537              0                   0                     0
89546              0                   0                     0
89547              0                   0                     0
```

```
89549              0                   0                     0
89570              0                   0                     0
89574              0                   0                     0
89621              0                   0                     0
89630              0                   0                     0
89668              0                   0                     0
89697              0                   0                     0
89727              0                   0                     0
89778              0                   0                     0
89786              0                   0                     0
89788              0                   0                     0
89821              0                   0                     0
89852              0                   0                     0
89856              0                   0                     0
89881              0                   0                     0
89962              0                   0                     0
89969              0                   0                     0
90001              0                   0                     0
90006              0                   0                     0
90031              0                   0                     0
90065              0                   0                     0
90167              0                   0                     0
90206              0                   0                     0
90239              0                   0                     0
90327              0                   0                     0

       American Revolutionary War  American West  Ancient  Animals  Arabian  \
0                               0              0        0        0        0
1                               0              0        0        0        0
2                               0              0        0        0        0
3                               0              0        1        0        0
4                               0              0        0        0        0
5                               0              0        0        0        0
6                               0              0        0        0        0
7                               0              0        0        0        0
8                               0              0        0        0        0
9                               0              0        0        0        0
10                              0              0        0        0        0
11                              0              0        1        0        0
12                              0              0        0        0        0
13                              0              0        0        0        0
14                              0              0        0        0        0
15                              0              0        0        0        0
16                              0              0        0        0        0
17                              0              0        0        0        0
18                              0              1        0        0        0
19                              0              0        0        0        0
20                              0              0        0        0        0
```

```
21                              0              0        0        0        0
22                              0              0        0        0        0
23                              0              0        0        0        0
24                              0              0        0        0        0
25                              0              0        0        0        0
26                              0              0        0        0        0
27                              0              0        0        0        0
28                              0              0        0        0        0
29                              0              0        0        0        0
...                           ...            ...      ...      ...      ...
89526                           0              0        0        0        0
89536                           0              0        0        1        0
89537                           0              0        0        0        0
89546                           0              0        0        0        0
89547                           0              0        0        0        0
89549                           0              0        0        0        0
89570                           0              0        0        0        0
89574                           0              0        0        0        0
89621                           0              0        0        0        0
89630                           0              0        0        0        0
89668                           0              0        0        0        0
89697                           0              0        0        0        0
89727                           0              0        0        0        0
89778                           0              0        0        0        0
89786                           0              0        0        0        0
89788                           0              0        0        0        0
89821                           0              0        0        0        0
89852                           0              0        0        0        0
89856                           0              0        0        0        0
89881                           0              0        0        0        0
89962                           0              0        0        0        0
89969                           0              0        0        0        0
90001                           0              0        0        0        0
90006                           0              0        0        0        0
90031                           0              0        0        0        0
90065                           0              0        0        0        0
90167                           0              0        0        0        0
90206                           0              0        0        0        0
90239                           0              0        0        1        0
90327                           0              0        0        0        0

       Aviation / Flight  Bluffing  Book  Card Game  Children's Game  \
0                      0         0     0          0                0
1                      0         0     0          1                0
2                      0         0     0          0                0
3                      0         0     0          0                0
4                      0         0     0          0                0
5                      0         0     0          0                0
```

6	0	0	0	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0
10	0	0	0	1	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	1	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	1	0	0	0
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	1	0
28	0	0	0	0	0
29	0	0	0	0	0
...	...	...	...	...	...
89526	0	1	0	1	0
89536	0	0	0	1	0
89537	0	0	0	0	0
89546	0	0	0	1	0
89547	0	0	0	0	0
89549	0	0	0	0	0
89570	0	0	0	0	0
89574	0	0	0	0	1
89621	0	0	0	1	0
89630	0	1	0	1	0
89668	0	0	0	0	0
89697	0	0	0	0	0
89727	0	0	0	0	0
89778	0	0	0	0	0
89786	0	0	0	0	0
89788	0	0	0	0	0
89821	0	0	0	1	0
89852	0	0	0	0	0
89856	0	0	0	1	0
89881	0	0	0	0	0
89962	0	0	0	0	0
89969	0	0	0	1	0
90001	0	0	0	0	0

```
90006                  0         0     0          0                0
90031                  0         1     0          1                0
90065                  0         0     0          1                0
90167                  0         0     0          0                0
90206                  0         0     0          1                0
90239                  0         0     0          0                0
90327                  0         0     0          1                0

       City Building  Civil War  Civilization  Collectible Components  \
0                  0          0             0                       0
1                  0          0             0                       0
2                  0          0             0                       0
3                  0          0             0                       0
4                  0          0             0                       0
5                  0          0             1                       0
6                  0          0             0                       0
7                  0          0             1                       0
8                  0          0             0                       0
9                  0          0             0                       0
10                 0          0             0                       0
11                 0          0             0                       0
12                 0          0             0                       0
13                 0          0             0                       0
14                 0          0             0                       0
15                 0          0             0                       0
16                 0          0             0                       1
17                 0          0             0                       0
18                 1          0             0                       0
19                 0          0             0                       0
20                 0          0             1                       0
21                 0          0             0                       0
22                 0          0             0                       0
23                 0          0             1                       0
24                 0          0             0                       0
25                 0          0             1                       0
26                 0          0             0                       0
27                 0          0             0                       0
28                 0          0             0                       0
29                 0          0             0                       0
...              ...        ...           ...                     ...
89526              0          0             0                       0
89536              0          0             0                       0
89537              0          0             0                       0
89546              0          0             0                       0
89547              0          0             0                       0
89549              0          0             0                       0
89570              0          0             0                       0
89574              0          0             0                       0
```

```
89621              0          0             0                       0
89630              0          0             0                       0
89668              0          0             0                       0
89697              0          0             0                       0
89727              0          0             0                       0
89778              1          0             0                       0
89786              0          0             0                       0
89788              0          0             0                       0
89821              0          0             0                       0
89852              0          0             1                       0
89856              0          0             0                       0
89881              0          0             0                       0
89962              0          0             0                       0
89969              0          0             0                       0
90001              1          0             0                       0
90006              0          0             0                       0
90031              0          0             0                       0
90065              1          0             0                       0
90167              0          0             0                       0
90206              0          0             0                       0
90239              0          0             0                       0
90327              0          0             0                       0

       Comic Book / Strip  Deduction  Dice  Economic  Educational  Electronic  \
0                       0          0     0         1            0           0
1                       0          0     0         0            0           0
2                       0          0     0         0            0           0
3                       0          0     0         0            0           0
4                       0          0     0         1            0           0
5                       0          0     0         0            0           0
6                       0          0     0         0            0           0
7                       0          0     0         0            0           0
8                       0          0     0         0            0           0
9                       0          0     0         0            0           0
10                      0          0     0         0            0           0
11                      0          0     0         0            0           0
12                      0          0     0         0            0           0
13                      0          0     0         0            0           0
14                      0          0     0         0            0           0
15                      0          0     0         1            0           0
16                      0          0     1         0            0           0
17                      0          0     0         0            0           0
18                      0          0     0         0            0           0
19                      0          0     0         0            0           0
20                      0          0     0         0            0           0
21                      0          0     0         0            0           0
22                      0          0     0         0            0           0
23                      0          0     0         0            0           0
```

```
24                      0          0     0         0            0           0
25                      0          0     0         1            0           0
26                      0          0     0         1            0           0
27                      0          0     0         0            0           0
28                      0          0     0         0            0           0
29                      0          0     0         0            0           1
...                   ...        ...   ...       ...          ...         ...
89526                   0          0     0         0            0           0
89536                   0          0     0         0            0           0
89537                   0          0     0         0            0           0
89546                   0          0     0         0            0           0
89547                   1          0     1         0            0           0
89549                   0          0     1         0            0           0
89570                   0          0     0         0            0           0
89574                   0          0     0         0            0           0
89621                   0          0     0         0            0           0
89630                   0          0     0         1            0           0
89668                   0          0     0         0            0           0
89697                   0          0     0         0            0           0
89727                   0          1     0         0            0           0
89778                   0          0     1         1            0           0
89786                   0          0     0         0            0           0
89788                   0          1     0         0            0           0
89821                   0          0     0         0            0           0
89852                   0          0     0         1            0           0
89856                   0          0     0         0            0           0
89881                   0          0     0         0            0           0
89962                   0          0     0         0            0           0
89969                   0          0     1         0            0           0
90001                   0          0     0         0            0           0
90006                   0          0     1         0            0           0
90031                   0          0     0         1            0           0
90065                   0          0     0         1            0           0
90167                   0          0     0         0            0           0
90206                   0          0     0         0            0           0
90239                   0          0     0         0            0           0
90327                   0          0     0         0            0           0

       Environmental  Expansion for Base-game  Exploration  Fan Expansion  \
0                  0                        0            0              0
1                  0                        0            0              0
2                  0                        0            0              0
3                  0                        0            0              0
4                  0                        0            0              0
5                  0                        0            0              0
6                  0                        0            0              0
7                  0                        0            0              0
8                  0                        0            1              0
```

9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	1	0
21	0	0	1	0
22	0	0	0	0
23	0	0	0	0
24	0	0	1	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	1	0
...	...	...	...	...
89526	0	0	0	0
89536	0	0	0	0
89537	0	0	0	0
89546	0	0	0	0
89547	0	0	0	0
89549	0	0	0	0
89570	0	0	0	0
89574	0	0	0	0
89621	0	0	0	0
89630	0	0	0	0
89668	0	0	1	0
89697	0	0	0	0
89727	0	0	0	0
89778	0	0	0	0
89786	0	0	0	0
89788	0	0	0	0
89821	0	0	0	0
89852	0	0	1	0
89856	0	0	0	0
89881	0	0	0	0
89962	0	0	0	0
89969	0	0	0	0
90001	0	0	0	0
90006	0	0	1	0
90031	0	0	0	0
90065	0	0	0	0

```
90167              0                        0            0              0
90206              0                        0            0              0
90239              0                        0            0              0
90327              0                        0            0              0

       Fantasy  Farming  Fighting  Game System  Horror  Humor  \
0            0        0         0            0       0      0
1            1        0         0            0       0      0
2            0        0         0            0       0      0
3            0        0         0            0       0      0
4            0        0         0            0       0      0
5            0        0         0            0       0      0
6            0        0         0            0       0      0
7            1        0         0            0       0      0
8            0        0         0            0       0      0
9            1        0         0            0       0      0
10           0        1         0            0       0      0
11           0        0         0            0       0      0
12           0        0         0            0       0      0
13           0        0         0            0       0      0
14           0        0         0            0       0      0
15           0        0         0            0       0      0
16           0        0         1            0       0      0
17           0        0         0            0       0      0
18           0        0         0            0       0      0
19           0        0         0            0       0      0
20           0        0         0            0       0      0
21           1        0         0            0       0      0
22           1        0         0            0       0      0
23           0        0         0            0       0      0
24           1        0         0            0       0      0
25           0        0         0            0       0      0
26           0        0         0            0       0      0
27           0        0         0            0       0      1
28           0        0         1            0       0      1
29           1        0         1            0       0      0
...        ...      ...       ...          ...     ...    ...
89526        0        0         1            0       0      0
89536        0        0         0            0       0      0
89537        0        0         0            0       0      0
89546        0        0         0            0       0      0
89547        0        0         1            0       0      0
89549        0        0         0            0       0      0
89570        1        0         0            0       0      0
89574        0        0         0            0       0      0
89621        0        0         0            0       0      0
89630        0        0         0            0       0      0
89668        1        0         0            0       0      0
```

```
89697        0        0         0            0       0      0
89727        0        0         0            0       0      0
89778        1        0         0            0       0      0
89786        0        0         0            0       0      0
89788        0        0         0            0       0      0
89821        1        0         0            0       0      0
89852        0        0         0            0       0      0
89856        0        0         0            0       0      0
89881        0        0         0            0       0      0
89962        0        0         0            0       0      1
89969        0        0         0            0       0      1
90001        0        0         0            0       0      0
90006        1        0         1            0       0      0
90031        0        0         0            0       0      0
90065        0        0         0            0       0      0
90167        0        0         0            0       0      0
90206        0        0         0            0       0      0
90239        0        0         0            0       0      0
90327        1        0         0            0       0      1

       Industry / Manufacturing  Korean War  Mafia  Math        ...         \
0                             0           0      0     0        ...
1                             0           0      0     0        ...
2                             0           0      0     0        ...
3                             0           0      0     0        ...
4                             0           0      0     0        ...
5                             0           0      0     0        ...
6                             0           0      0     0        ...
7                             0           0      0     0        ...
8                             0           0      0     0        ...
9                             0           0      0     0        ...
10                            0           0      0     0        ...
11                            0           0      0     0        ...
12                            0           0      0     0        ...
13                            0           0      0     0        ...
14                            0           0      0     0        ...
15                            0           0      0     0        ...
16                            0           0      0     0        ...
17                            0           0      0     0        ...
18                            0           0      0     0        ...
19                            0           0      0     0        ...
20                            0           0      0     0        ...
21                            0           0      0     0        ...
22                            0           0      0     0        ...
23                            0           0      0     0        ...
24                            0           0      0     0        ...
25                            0           0      0     0        ...
26                            0           0      0     0        ...
```

```
27                            0           0      0     0        ...
28                            0           0      0     0        ...
29                            0           0      0     0        ...
...                         ...         ...    ...   ...        ...
89526                         0           0      0     0        ...
89536                         0           0      0     0        ...
89537                         0           0      0     0        ...
89546                         0           0      0     0        ...
89547                         0           0      0     0        ...
89549                         0           0      0     0        ...
89570                         0           0      0     0        ...
89574                         0           0      0     0        ...
89621                         0           0      0     0        ...
89630                         1           0      0     1        ...
89668                         0           0      0     0        ...
89697                         0           0      0     0        ...
89727                         0           0      0     0        ...
89778                         0           0      0     0        ...
89786                         0           0      0     0        ...
89788                         0           0      0     0        ...
89821                         0           0      0     0        ...
89852                         0           0      0     0        ...
89856                         0           0      0     0        ...
89881                         0           0      0     0        ...
89962                         0           0      0     0        ...
89969                         0           0      0     0        ...
90001                         0           0      0     0        ...
90006                         0           0      0     0        ...
90031                         0           0      0     0        ...
90065                         0           0      0     0        ...
90167                         0           0      0     0        ...
90206                         0           0      0     0        ...
90239                         0           0      0     0        ...
90327                         0           0      0     0        ...

       Action / Movement Programming  Action Point Allowance System  \
0                                  0                              0
1                                  0                              0
2                                  0                              0
3                                  0                              1
4                                  0                              0
5                                  0                              0
6                                  0                              0
7                                  0                              0
8                                  0                              0
9                                  0                              0
10                                 0                              0
11                                 0                              0
```

12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	1	0
18	0	0
19	0	1
20	0	0
21	1	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	1
29	0	0
...	...	...
89526	0	0
89536	0	0
89537	0	0
89546	0	0
89547	0	0
89549	0	0
89570	0	0
89574	0	0
89621	0	0
89630	0	0
89668	0	0
89697	0	0
89727	0	0
89778	0	0
89786	0	0
89788	0	0
89821	0	0
89852	0	1
89856	0	0
89881	0	0
89962	0	0
89969	0	0
90001	0	0
90006	0	0
90031	0	0
90065	0	0
90167	0	0
90206	0	0
90239	0	0

```
90327                              0                              0

       Area Control / Area Influence  Area Enclosure  Area Movement  \
0                                  1               0              0
1                                  0               0              0
2                                  1               0              0
3                                  1               0              0
4                                  0               0              0
5                                  0               0              0
6                                  0               1              0
7                                  0               0              0
8                                  1               0              0
9                                  0               0              0
10                                 0               0              0
11                                 0               0              0
12                                 0               0              0
13                                 0               0              0
14                                 0               0              0
15                                 0               0              0
16                                 0               0              0
17                                 0               0              0
18                                 0               0              0
19                                 0               0              0
20                                 0               0              0
21                                 0               0              0
22                                 0               0              0
23                                 0               0              0
24                                 0               0              0
25                                 0               0              1
26                                 0               0              0
27                                 0               0              0
28                                 0               0              0
29                                 0               0              1
...                              ...             ...            ...
89526                              0               0              0
89536                              0               0              0
89537                              0               0              0
89546                              0               0              0
89547                              0               0              0
89549                              0               0              0
89570                              1               0              0
89574                              0               0              0
89621                              0               0              0
89630                              0               0              0
89668                              0               0              0
89697                              0               0              0
89727                              0               0              0
89778                              0               0              0
```

```
89786                              0               0              0
89788                              0               0              0
89821                              0               0              0
89852                              1               0              0
89856                              0               0              0
89881                              0               0              0
89962                              0               0              0
89969                              0               0              0
90001                              0               0              0
90006                              0               0              0
90031                              0               0              0
90065                              0               0              0
90167                              0               0              0
90206                              0               0              0
90239                              0               0              0
90327                              0               0              0

       Area-Impulse  Auction/Bidding  Betting/Wagering  \
0                 0                1                 0
1                 0                0                 0
2                 0                0                 0
3                 0                1                 0
4                 0                0                 0
5                 0                0                 0
6                 0                0                 0
7                 0                0                 0
8                 0                0                 0
9                 0                0                 0
10                0                0                 0
11                0                1                 0
12                0                0                 0
13                0                0                 0
14                0                0                 0
15                0                1                 0
16                0                0                 0
17                0                0                 0
18                0                0                 0
19                0                0                 0
20                0                0                 0
21                0                0                 0
22                0                0                 0
23                0                0                 0
24                0                0                 0
25                0                1                 0
26                0                0                 0
27                0                0                 0
28                0                0                 0
29                0                0                 0
```

```
...             ...              ...               ...
89526             0                0                 0
89536             0                0                 0
89537             0                0                 0
89546             0                0                 0
89547             0                0                 0
89549             0                0                 0
89570             0                0                 0
89574             0                0                 0
89621             0                0                 0
89630             0                1                 0
89668             0                0                 0
89697             0                0                 0
89727             0                0                 0
89778             0                0                 0
89786             0                0                 0
89788             0                0                 0
89821             0                0                 0
89852             0                0                 0
89856             0                0                 0
89881             0                0                 1
89962             0                0                 0
89969             0                0                 0
90001             0                0                 0
90006             0                0                 0
90031             0                0                 0
90065             0                0                 0
90167             0                0                 0
90206             0                0                 0
90239             0                0                 0
90327             0                0                 0

       Campaign / Battle Card Driven  Card Drafting  Chit-Pull System  \
0                                  0              0                 0
1                                  0              0                 0
2                                  0              0                 0
3                                  0              0                 0
4                                  0              0                 0
5                                  0              0                 0
6                                  0              0                 0
7                                  0              0                 0
8                                  0              0                 0
9                                  0              1                 0
10                                 0              0                 0
11                                 0              0                 0
12                                 0              0                 0
13                                 0              0                 0
14                                 0              0                 0
```

```
15                                 0              0                 0
16                                 0              0                 0
17                                 0              0                 0
18                                 0              0                 0
19                                 0              0                 0
20                                 0              0                 0
21                                 0              0                 0
22                                 0              0                 0
23                                 0              0                 0
24                                 0              0                 0
25                                 0              0                 0
26                                 0              0                 0
27                                 0              1                 0
28                                 0              0                 0
29                                 0              0                 0
...                              ...            ...               ...
89526                              0              0                 0
89536                              0              0                 0
89537                              0              0                 0
89546                              0              0                 0
89547                              0              0                 0
89549                              0              0                 0
89570                              0              0                 0
89574                              0              0                 0
89621                              0              0                 0
89630                              0              0                 0
89668                              0              0                 0
89697                              1              0                 0
89727                              0              0                 0
89778                              0              0                 0
89786                              0              0                 0
89788                              0              0                 0
89821                              0              1                 0
89852                              0              0                 0
89856                              0              0                 0
89881                              0              1                 0
89962                              0              0                 0
89969                              0              0                 0
90001                              0              0                 0
90006                              0              0                 0
90031                              0              0                 0
90065                              0              1                 0
90167                              0              0                 0
90206                              0              0                 0
90239                              0              0                 0
90327                              0              0                 0

       Co-operative Play  Commodity Speculation  Crayon Rail System  \
0           0           0           0
1           0           0           0
2           0           0           0
3           0           0           0
4           0           0           0
5           0           0           0
6           0           0           0
7           0           0           0
8           0           0           0
9           0           0           0
10          0           0           0
11          0           0           0
12          0           0           0
13          0           0           0
14          0           0           0
15          0           0           0
16          0           0           0
17          0           0           0
18          0           0           0
19          0           0           0
20          0           0           0
21          0           0           0
22          0           0           0
23          0           0           0
24          0           0           0
25          0           0           0
26          0           1           0
27          0           0           0
28          0           0           0
29          0           0           0
...       ...         ...         ...
89526       0           0           0
89536       0           0           0
89537       0           0           0
89546       0           0           0
89547       0           0           0
89549       0           0           0
89570       1           0           0
89574       0           0           0
89621       0           0           0
89630       0           1           0
89668       0           0           0
89697       0           0           0
89727       1           0           0
89778       0           0           0
89786       1           0           0
89788       1           0           0
89821       1           0           0
```

```
89852                  0                      0                   0
89856                  0                      0                   0
89881                  0                      0                   0
89962                  0                      0                   0
89969                  0                      0                   0
90001                  0                      0                   0
90006                  0                      0                   0
90031                  0                      1                   0
90065                  0                      0                   0
90167                  0                      0                   0
90206                  0                      0                   0
90239                  0                      0                   0
90327                  0                      0                   0

       Deck / Pool Building  Dice Rolling  Grid Movement  Hand Management  \
0                         0             1              0                1
1                         0             0              0                0
2                         0             0              0                1
3                         0             0              0                0
4                         0             0              0                1
5                         0             1              0                0
6                         0             0              0                0
7                         0             0              0                0
8                         0             0              0                0
9                         0             0              0                1
10                        0             0              0                1
11                        0             0              0                0
12                        0             1              0                1
13                        0             0              0                0
14                        0             0              0                1
15                        0             0              0                0
16                        0             1              0                0
17                        0             0              1                0
18                        0             0              0                0
19                        0             0              0                0
20                        0             0              0                0
21                        0             0              0                0
22                        0             1              0                0
23                        0             1              0                0
24                        0             0              0                0
25                        0             0              0                0
26                        0             1              0                0
27                        0             1              0                0
28                        0             0              0                0
29                        0             0              0                0
...                     ...           ...            ...              ...
89526                     0             0              0                1
89536                     0             0              0                0
```

```
89537                     0             0              0               0
89546                     0             0              0               0
89547                     1             1              0               0
89549                     0             0              0               0
89570                     0             1              0               0
89574                     0             0              0               0
89621                     0             0              0               1
89630                     0             0              0               1
89668                     0             1              0               0
89697                     0             1              0               0
89727                     0             0              0               0
89778                     0             1              0               0
89786                     0             0              0               0
89788                     0             0              0               0
89821                     1             0              0               1
89852                     0             1              0               1
89856                     0             0              0               1
89881                     0             0              0               0
89962                     0             0              0               0
89969                     0             1              0               0
90001                     1             0              0               0
90006                     0             1              1               0
90031                     0             0              0               0
90065                     0             0              0               1
90167                     0             0              0               0
90206                     0             0              0               1
90239                     0             0              0               0
90327                     1             0              0               1

       Hex-and-Counter  Line Drawing  Memory_mechanics  Modular Board  \
0                    0             0                 0              0
1                    0             0                 0              0
2                    0             0                 0              0
3                    0             0                 0              0
4                    0             0                 0              0
5                    0             0                 0              0
6                    0             0                 0              0
7                    0             0                 0              1
8                    0             0                 0              0
9                    0             0                 0              0
10                   0             0                 0              0
11                   0             0                 0              0
12                   0             0                 0              1
13                   0             0                 0              0
14                   0             0                 0              0
15                   0             0                 0              0
16                   0             0                 0              0
17                   0             0                 0              1
```

```
18                   0             0                 0              0
19                   0             0                 0              0
20                   0             0                 0              0
21                   0             0                 0              1
22                   1             0                 0              0
23                   1             0                 0              1
24                   0             0                 0              0
25                   0             0                 0              0
26                   0             0                 0              0
27                   0             0                 0              0
28                   0             0                 0              1
29                   0             0                 0              0
...                ...           ...               ...            ...
89526                0             0                 1              0
89536                0             0                 0              0
89537                0             0                 0              0
89546                0             0                 0              0
89547                0             0                 0              0
89549                0             0                 0              0
89570                0             0                 0              0
89574                0             0                 0              0
89621                0             0                 0              0
89630                0             0                 0              0
89668                0             0                 0              0
89697                1             0                 0              0
89727                0             0                 0              0
89778                0             0                 0              0
89786                0             0                 0              0
89788                0             0                 0              0
89821                0             0                 0              0
89852                0             0                 0              1
89856                0             0                 0              0
89881                0             0                 0              0
89962                0             0                 0              0
89969                0             0                 0              0
90001                0             0                 0              0
90006                0             0                 0              1
90031                0             0                 0              0
90065                0             0                 0              0
90167                0             0                 0              0
90206                0             0                 0              0
90239                0             0                 0              0
90327                0             0                 0              0

       Paper-and-Pencil  Partnerships  Pattern Building  Pattern Recognition  \
0                     0             0                 0                    0
1                     0             0                 0                    0
2                     0             0                 0                    0
```

3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	1	1
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
...	...	...	...	...
89526	0	0	0	0
89536	0	0	0	0
89537	0	0	0	0
89546	0	0	0	0
89547	0	0	0	0
89549	0	0	0	0
89570	0	0	0	0
89574	0	0	1	0
89621	0	0	0	0
89630	0	0	0	0
89668	0	0	0	0
89697	0	0	0	0
89727	0	0	0	0
89778	0	0	0	0
89786	0	0	0	0
89788	0	0	0	0
89821	0	0	0	0
89852	0	0	0	0
89856	0	1	0	0
89881	0	0	0	0

```
89962                 0             0                 0                    0
89969                 0             0                 0                    0
90001                 0             0                 0                    0
90006                 0             0                 0                    0
90031                 0             0                 0                    0
90065                 0             0                 0                    0
90167                 0             0                 0                    0
90206                 0             0                 0                    0
90239                 0             0                 0                    0
90327                 0             0                 0                    0

       Pick-up and Deliver  Player Elimination  Point to Point Movement  \
0                        0                   0                        0
1                        0                   0                        0
2                        0                   0                        0
3                        0                   0                        0
4                        0                   0                        0
5                        0                   0                        0
6                        0                   0                        0
7                        0                   0                        0
8                        0                   0                        0
9                        0                   0                        1
10                       0                   0                        0
11                       0                   0                        0
12                       0                   0                        0
13                       0                   0                        0
14                       0                   0                        0
15                       0                   0                        0
16                       0                   0                        0
17                       0                   0                        0
18                       0                   0                        0
19                       0                   0                        0
20                       0                   0                        0
21                       0                   0                        0
22                       0                   0                        0
23                       0                   0                        0
24                       0                   0                        0
25                       0                   0                        0
26                       0                   0                        0
27                       0                   0                        0
28                       0                   0                        0
29                       0                   0                        0
...                    ...                 ...                      ...
89526                    0                   0                        0
89536                    0                   0                        0
89537                    0                   0                        0
89546                    0                   0                        0
89547                    0                   0                        0
```

```
89549                    0                   0                        0
89570                    0                   0                        0
89574                    0                   0                        0
89621                    0                   0                        0
89630                    1                   0                        0
89668                    0                   0                        0
89697                    0                   0                        0
89727                    0                   0                        0
89778                    0                   0                        0
89786                    0                   0                        0
89788                    0                   0                        0
89821                    0                   0                        0
89852                    0                   0                        0
89856                    0                   0                        0
89881                    0                   0                        0
89962                    0                   0                        0
89969                    0                   0                        0
90001                    0                   0                        0
90006                    0                   0                        0
90031                    0                   0                        0
90065                    0                   0                        0
90167                    0                   0                        0
90206                    0                   0                        0
90239                    0                   0                        0
90327                    0                   0                        0

       Press Your Luck  Rock-Paper-Scissors  Role Playing  \
0                    0                    0             0
1                    0                    0             0
2                    0                    0             0
3                    0                    0             0
4                    0                    0             0
5                    0                    0             0
6                    0                    0             0
7                    0                    0             0
8                    0                    0             0
9                    0                    0             0
10                   0                    0             0
11                   1                    0             0
12                   0                    0             0
13                   0                    0             0
14                   0                    0             0
15                   0                    0             0
16                   1                    0             0
17                   0                    0             0
18                   0                    0             0
19                   0                    0             0
20                   0                    0             0
```

```
21                   0                    1             1
22                   0                    0             0
23                   0                    0             0
24                   0                    0             0
25                   0                    0             0
26                   0                    0             0
27                   0                    0             0
28                   0                    0             0
29                   1                    0             0
...                ...                  ...           ...
89526                0                    0             0
89536                0                    0             0
89537                0                    0             0
89546                0                    0             0
89547                0                    0             0
89549                0                    0             0
89570                0                    0             0
89574                0                    0             0
89621                0                    0             0
89630                0                    0             0
89668                0                    0             0
89697                0                    0             0
89727                0                    0             0
89778                0                    0             0
89786                0                    0             0
89788                0                    0             0
89821                0                    0             0
89852                0                    0             0
89856                0                    0             0
89881                0                    0             0
89962                0                    0             0
89969                1                    0             1
90001                0                    0             0
90006                0                    0             1
90031                0                    0             0
90065                0                    0             0
90167                0                    0             0
90206                0                    0             0
90239                0                    0             0
90327                0                    0             0

       Roll / Spin and Move  Route/Network Building  Secret Unit Deployment  \
0                         0                       0                       0
1                         0                       0                       0
2                         0                       0                       0
3                         0                       0                       0
4                         0                       0                       0
5                         0                       0                       0
```

6	0	0	0
7	0	0	0
8	0	0	0
9	0	1	0
10	0	0	0
11	0	0	0
12	0	1	0
13	1	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
20	0	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	1	0
28	0	0	0
29	0	0	0
...	...	...	...
89526	0	0	1
89536	0	0	0
89537	0	0	0
89546	0	0	0
89547	0	0	0
89549	0	0	0
89570	0	0	0
89574	0	0	0
89621	0	0	0
89630	0	0	0
89668	0	0	0
89697	0	0	0
89727	0	0	0
89778	0	0	0
89786	0	0	0
89788	0	0	0
89821	0	0	0
89852	0	0	0
89856	0	0	0
89881	0	0	0
89962	0	0	0
89969	0	0	0
90001	0	0	0

```
90006                     0                        0                       0
90031                     0                        0                       0
90065                     0                        0                       0
90167                     0                        0                       0
90206                     0                        0                       0
90239                     0                        0                       0
90327                     0                        0                       0

       Set Collection  Simulation  Simultaneous Action Selection  Singing  \
0                   0           0                              1        0
1                   0           0                              0        0
2                   1           0                              0        0
3                   1           0                              0        0
4                   0           0                              0        0
5                   0           0                              0        0
6                   0           0                              0        0
7                   0           0                              0        0
8                   0           0                              0        0
9                   0           0                              0        0
10                  1           0                              0        0
11                  1           0                              0        0
12                  0           0                              0        0
13                  1           0                              1        0
14                  0           0                              0        0
15                  0           0                              0        0
16                  0           0                              0        0
17                  0           0                              1        0
18                  0           0                              0        0
19                  0           0                              0        0
20                  0           0                              0        0
21                  0           0                              1        0
22                  0           0                              0        0
23                  0           0                              0        0
24                  0           0                              0        0
25                  0           0                              0        0
26                  0           0                              0        0
27                  0           0                              0        0
28                  0           0                              0        0
29                  0           0                              0        0
...               ...         ...                            ...      ...
89526               0           0                              0        0
89536               0           0                              0        0
89537               0           0                              1        0
89546               0           0                              0        0
89547               0           0                              0        0
89549               0           0                              0        0
89570               0           0                              0        0
89574               0           0                              0        0
```

```
89621               1           0                              0        0
89630               0           0                              0        0
89668               0           0                              0        0
89697               0           1                              0        0
89727               0           0                              0        0
89778               1           0                              0        0
89786               0           0                              0        0
89788               0           0                              0        0
89821               0           0                              0        0
89852               0           0                              0        0
89856               0           0                              0        0
89881               0           0                              0        0
89962               0           0                              0        0
89969               1           0                              0        0
90001               0           0                              0        0
90006               0           0                              0        0
90031               0           0                              1        0
90065               0           0                              0        0
90167               0           0                              0        0
90206               1           0                              0        0
90239               0           0                              0        0
90327               0           0                              0        0

       Stock Holding  Storytelling  Take That  Tile Placement  Time Track  \
0                  0             0          0               0           0
1                  0             0          0               0           0
2                  0             0          0               1           0
3                  0             0          0               0           0
4                  1             0          0               1           0
5                  0             0          0               0           0
6                  0             0          0               1           0
7                  0             0          0               0           0
8                  0             0          0               1           0
9                  0             0          0               0           0
10                 0             0          0               0           0
11                 0             0          0               0           0
12                 0             0          0               0           0
13                 0             0          0               0           0
14                 0             0          0               0           0
15                 0             0          0               0           0
16                 0             0          0               0           0
17                 0             0          0               0           0
18                 0             0          0               1           0
19                 0             0          0               0           0
20                 0             0          0               0           0
21                 0             0          0               0           0
22                 0             0          0               0           0
23                 0             0          0               1           0
```

```
24                 0             0          0               0           0
25                 0             0          0               0           0
26                 0             0          0               0           0
27                 0             0          0               1           0
28                 0             0          0               0           0
29                 0             0          0               0           0
...              ...           ...        ...             ...         ...
89526              0             0          1               0           0
89536              0             0          0               0           0
89537              0             0          0               1           0
89546              0             0          0               0           0
89547              0             0          0               0           0
89549              0             0          0               0           0
89570              0             0          0               0           0
89574              0             0          0               0           0
89621              0             0          1               0           0
89630              1             0          1               0           0
89668              0             1          0               1           0
89697              0             0          0               0           0
89727              0             0          0               0           0
89778              0             0          0               0           0
89786              0             0          0               0           0
89788              0             0          0               0           0
89821              0             0          0               0           0
89852              0             0          0               0           0
89856              0             0          0               0           0
89881              0             0          0               0           0
89962              0             0          0               0           0
89969              0             0          0               0           0
90001              0             0          0               0           0
90006              0             1          0               0           0
90031              0             0          0               0           0
90065              0             0          0               0           0
90167              0             0          0               0           0
90206              0             0          0               0           0
90239              0             0          0               1           0
90327              0             0          0               0           0

       Trading  Trick-taking  Variable Phase Order  Variable Player Powers  \
0            0             0                     0                       0
1            0             1                     0                       0
2            0             0                     0                       0
3            0             0                     0                       0
4            0             0                     0                       0
5            0             0                     0                       0
6            0             0                     0                       0
7            0             0                     0                       0
8            0             0                     0                       0
```

9	0	0	0	0
10	1	0	0	0
11	0	0	0	0
12	1	0	0	0
13	0	0	0	0
14	0	0	0	1
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	1
22	0	0	1	0
23	0	0	0	1
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	1
28	0	0	0	0
29	0	0	0	0
...	...	...	...	...
89526	0	0	0	0
89536	0	0	0	0
89537	0	0	0	0
89546	0	0	0	0
89547	0	0	0	1
89549	0	0	0	0
89570	0	0	0	0
89574	0	0	0	0
89621	0	0	0	0
89630	0	0	0	1
89668	0	0	0	1
89697	0	0	0	0
89727	0	0	0	0
89778	0	0	0	1
89786	0	0	0	0
89788	0	0	0	0
89821	0	0	1	1
89852	0	0	0	1
89856	0	0	0	0
89881	0	0	0	1
89962	0	0	0	0
89969	0	0	0	0
90001	0	0	0	0
90006	0	0	0	1
90031	0	0	0	0
90065	0	0	0	0

```
90167        0             0                     0                       0
90206        0             0                     0                       0
90239        0             0                     0                       0
90327        0             0                     0                       0

       Voting  Worker Placement
0           0                 0
1           0                 0
2           0                 0
3           0                 0
4           0                 0
5           0                 0
6           0                 0
7           0                 0
8           0                 0
9           0                 0
10          0                 0
11          0                 0
12          0                 0
13          0                 0
14          0                 0
15          0                 0
16          0                 0
17          0                 0
18          1                 0
19          0                 0
20          0                 0
21          0                 0
22          0                 0
23          1                 0
24          0                 0
25          0                 0
26          0                 0
27          0                 0
28          0                 0
29          0                 0
...       ...               ...
89526       0                 0
89536       0                 0
89537       0                 0
89546       0                 0
89547       0                 0
89549       0                 0
89570       0                 0
89574       0                 0
89621       0                 0
89630       0                 0
89668       0                 0
```

```
        89697       0                 0
        89727       0                 0
        89778       0                 1
        89786       0                 0
        89788       0                 0
        89821       0                 0
        89852       0                 0
        89856       1                 0
        89881       0                 0
        89962       0                 0
        89969       0                 0
        90001       0                 0
        90006       0                 0
        90031       0                 0
        90065       0                 1
        90167       0                 0
        90206       0                 0
        90239       0                 0
        90327       0                 0

        [20842 rows x 145 columns]
```

```
In [24]: len(df_cats.columns) + len(df_mechs.columns) + len(df_limit.columns) - len(df_data.co

Out[24]: True
```

```
In [25]: #Check if there are any NaNs
         nanlist = df_data.isnull().sum(axis=1).tolist()

         for i in nanlist:
             if i != 0:
                 print("Boop")
         print("done")

done
```

```
In [26]: #We see that there are some games that have the same name, but not that many.
         df_data['details.name'].value_counts()

Out[26]: Robin Hood                                  5
         Mafia                                       5
         Cosmic Encounter                            4
         Gangster                                    4
         Quicksand                                   4
         Chaos                                       4
         Samurai                                     4
         Saga                                        4
         Grand Prix                                  4
```

```
Vegas                                          4
Battle of the Bulge                            3
Around the World in 80 Days                    3
Versailles                                     3
Combat                                         3
Polarity                                       3
Artifact                                       3
Dallas                                         3
The Hobbit: An Unexpected Journey              3
Horus Heresy                                   3
Austerlitz                                     3
En Garde!                                      3
Waterloo                                       3
Blindes Huhn                                   3
Guadalcanal                                    3
Inferno                                        3
King Arthur                                    3
Barbarossa                                     3
Siege                                          3
Witch Hunt                                     3
Imperator                                      3
                                              ..
Creationary                                    1
Just a Peiper Dream?                           1
I Say, Holmes! (Second Edition)                1
Hooker and Lee                                 1
Emerald                                        1
Mentalis                                       1
Piraten                                        1
Battlestar Galactica Collectible Card Game     1
Strafexpedition 1916                           1
Red Army                                       1
Congo Merc: The Congo, 1964                    1
Hero of Weehawken                              1
A Famous Victory                               1
Rincala                                        1
Wabbit Wampage                                 1
How the Grinch Stole Christmas! Game           1
Rails Through the Rockies                      1
Strategos                                      1
Wacky Pirates                                  1
Maestro                                        1
Cauldron Quest                                 1
Soldiers: Man-to-Man Combat in World War II    1
Festival of Thousand Cats                      1
Uncharted: The Board Game                      1
Mount Everest                                  1
Breaking Away                                  1
```

```
Panzer Grenadier: Kursk  Burning Tigers       1
1000 Bornes Express                            1
Edison & Co.                                   1
Antartik                                       1
Name: details.name, Length: 20340, dtype: int64
```

1.3.3 Processing Response Variables

The output variable for this analysis will be "success", as measured by the player enjoyment rating (using a 10-star likert scale). The variables listed below capture this outcome in various ways.

Response Variables

- stats.average (0-10 stars)

- stats.stddev (for average star rating)

We'll make two adjustments to our outcome variable. - As given, the stats.average variable is a continuous variable between 0 and 10. Our models will work best with a finite number of outcome groups, so we'll bin the rating by star levels. To keep things simple, we'll round down each star rating to a whole number (so 5.7 will become 5, for example). This will be stored as "binned_average". - Some of our models may work best with a binary outcome measurement. For that, we can create a binary measure for the player enjoyment rating. Games with an average rating greater than 7 are considered successful, and those less than 7 are considered unsuccessful. (This threshold is set based on our experience, and has no concrete mathematical derivation.) We'll store these values as the integers 1 (success) and 0 (unsuccessful).

```
In [27]: df_data['binned.average'] = np.floor(df_data['stats.average'])
         df_data['binary.success'] = (df_data['binned.average'] > 6.5)*1
```

1.4 Exporatory Data Analaysis

With our new data frame, we can conduct an EDA to begin to look at the data. This will help us perform any additional filtering or processing that is necessary; it may also help reveal insights into game trends.

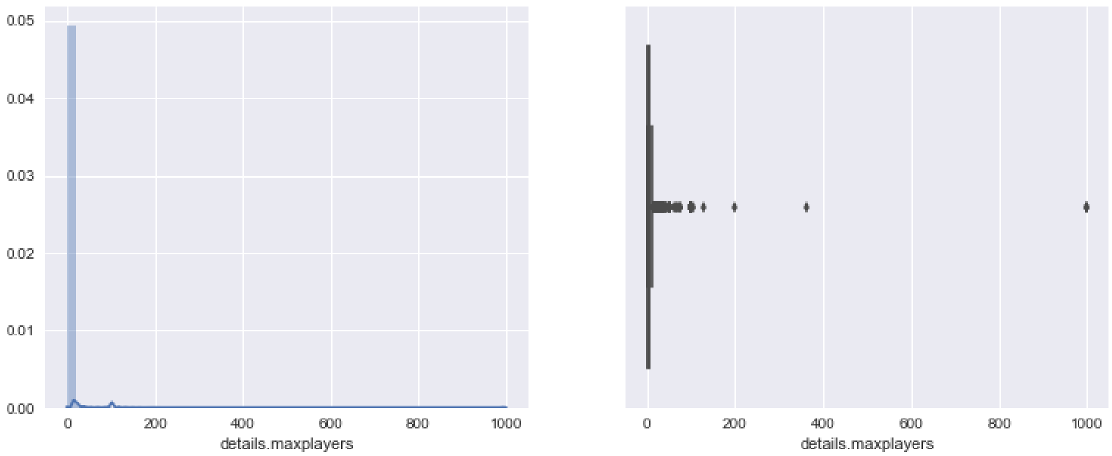
The cells below explore the key variables in our dataset. We also investigate apparent outliers, to see if they should be removed from the analysis.

```
In [28]: import matplotlib.pyplot as plt
         def analyze_feature(data, feat_name):
             print(data[feat_name].describe())
             plt.figure(figsize = (20,5))
             plt.subplot(1,3,2)
             sns.distplot(data[feat_name])
             plt.subplot(1,3,3)
             sns.boxplot(data[feat_name])
```

MaxPlayers

```
In [29]: analyze_feature(df_data, "details.maxplayers")
```

```
count    20842.000000
mean         5.341618
std         14.373976
min          0.000000
25%          2.000000
50%          4.000000
75%          6.000000
max        999.000000
Name: details.maxplayers, dtype: float64
```



```
In [30]: df_data.loc[df_data['details.maxplayers']==999]
```

```
Out[30]:                                      details.name  details.maxplayers  \
         23008  Start Player: A Kinda Collectible Card Game               999.0
         26326       I Don't Know, What Do You Want To Play?               999.0
         81044                            Scrimish Card Game               999.0

                details.minage  details.minplayers  details.playingtime  \
         23008             6.0                 2.0                  1.0
         26326             8.0                 2.0                  5.0
         81044             8.0                 2.0                100.0

                details.yearpublished  stats.averageweight  stats.average  stats.owned  \
         23008                 2006.0               1.0000        6.49793        263.0
         26326                 2007.0               1.0625        6.81325        117.0
         81044                 2015.0               1.3333        6.13548        297.0

                stats.stddev  Abstract Strategy  Action / Dexterity  Adventure  \
         23008       1.91599                  0                   0          0
         26326       1.89398                  0                   0          0
         81044       1.60829                  0                   0          0
```

```
       Age of Reason  American Civil War  American Indian Wars  \
23008              0                   0                     0   
26326              0                   0                     0   
81044              0                   0                     0   

       American Revolutionary War  American West  Ancient  Animals  Arabian  \
23008                           0              0        0        0        0   
26326                           0              0        0        0        0   
81044                           0              0        0        0        0   

       Aviation / Flight  Bluffing  Book  Card Game  Children's Game  \
23008                  0         0     0          1                0   
26326                  0         0     0          1                0   
81044                  0         0     0          1                0   

       City Building  Civil War  Civilization  Collectible Components  \
23008              0          0             0                       1   
26326              0          0             0                       0   
81044              0          0             0                       0   

       Comic Book / Strip  Deduction  Dice  Economic  Educational  Electronic  \
23008                   1          0     0         0            0           0   
26326                   0          0     0         0            0           0   
81044                   0          0     0         0            0           0   

       Environmental  Expansion for Base-game  Exploration  Fan Expansion  \
23008              0                        0            0              0   
26326              0                        0            0              0   
81044              0                        0            0              0   

       Fantasy  Farming  Fighting  Game System  Horror  Humor  \
23008        0        0         0            0       0      1   
26326        0        0         0            0       0      0   
81044        0        0         0            0       0      0   

       Industry / Manufacturing  Korean War  Mafia  Math       ...        \
23008                         0           0      0     0       ...         
26326                         0           0      0     0       ...         
81044                         0           0      0     0       ...         

       Area Control / Area Influence  Area Enclosure  Area Movement  \
23008                              0               0              0   
26326                              0               0              0   
81044                              0               0              0   

       Area-Impulse  Auction/Bidding  Betting/Wagering  \
23008             0                0                 0   
```

```
26326             0                0                 0
81044             0                0                 0

       Campaign / Battle Card Driven  Card Drafting  Chit-Pull System  \
23008                              0              0                 0
26326                              0              0                 0
81044                              0              0                 0

       Co-operative Play  Commodity Speculation  Crayon Rail System  \
23008                  0                      0                   0
26326                  0                      0                   0
81044                  0                      0                   0

       Deck / Pool Building  Dice Rolling  Grid Movement  Hand Management  \
23008                     0             0              0                0
26326                     0             0              0                0
81044                     0             0              0                0

       Hex-and-Counter  Line Drawing  Memory_mechanics  Modular Board  \
23008                0             0                 0              0
26326                0             0                 0              0
81044                0             0                 1              0

       Paper-and-Pencil  Partnerships  Pattern Building  Pattern Recognition  \
23008                 0             0                 0                    0
26326                 0             0                 0                    0
81044                 0             0                 0                    0

       Pick-up and Deliver  Player Elimination  Point to Point Movement  \
23008                    0                   0                        0
26326                    0                   0                        0
81044                    0                   0                        0

       Press Your Luck  Rock-Paper-Scissors  Role Playing  \
23008                0                    0             0
26326                0                    0             0
81044                0                    0             0

       Roll / Spin and Move  Route/Network Building  Secret Unit Deployment  \
23008                     0                       0                       0
26326                     0                       0                       0
81044                     0                       0                       0

       Set Collection  Simulation  Simultaneous Action Selection  Singing  \
23008               0           0                              0        0
26326               0           0                              0        0
81044               0           0                              0        0
```

```
       Stock Holding  Storytelling  Take That  Tile Placement  Time Track  \
23008              0             0          0               0           0
26326              0             0          0               0           0
81044              0             0          0               0           0

       Trading  Trick-taking  Variable Phase Order  Variable Player Powers  \
23008        0             0                     0                       0
26326        0             0                     0                       0
81044        0             0                     0                       0

       Voting  Worker Placement  binned.average  binary.success
23008       0                 0             6.0               0
26326       1                 0             6.0               0
81044       0                 0             6.0               0

[3 rows x 147 columns]
```

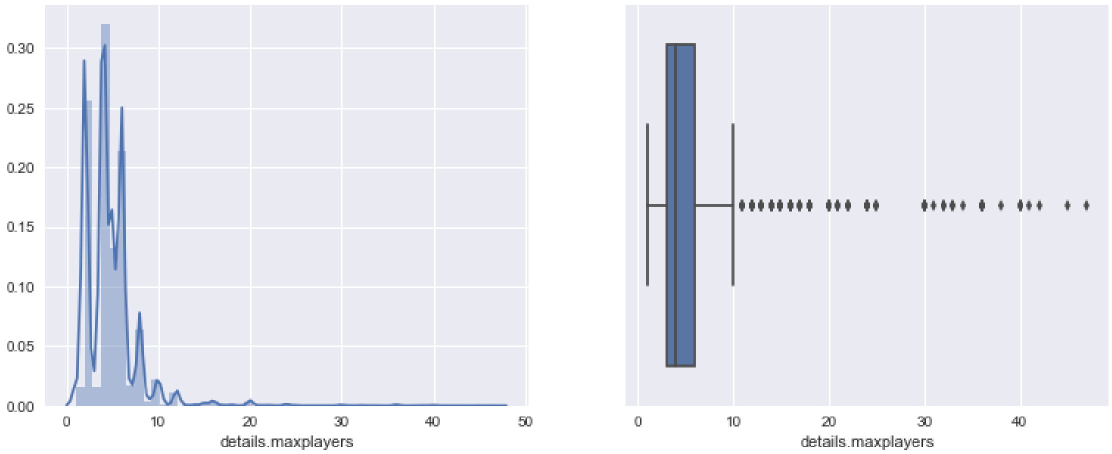
We see from the above analysis, that there are some games that could be considered outliers, as they have values for the maximum number of players, approaching 999 - which in itself might be an artificial contraint that the source imposes on game data input. Consequently it is the judgement of the investigators to limit the games investigated to a measure of maximum players three positive and negative standard deviations around the mean.

```
In [31]: df_data['details.maxplayers'].mean()

Out[31]: 5.341617886959025

In [32]: df_data['details.maxplayers'].std()

Out[32]: 14.373975920228531

In [33]: df_data['details.maxplayers'].std()*3

Out[33]: 43.121927760685594

In [34]: df_data['details.maxplayers'].mean()+df_data['details.maxplayers'].std()*3

Out[34]: 48.46354564764462
```

We see that the mean number of players is approximately 5. Consequently three standard deviations below this value is a negative number that does not make sense. Neither does a board game that can be played with zero players. Consequently we will set our minimum limit to 1 player. Our maximum player limit will be 48.46, or rounded to 49 players.

```
In [35]: df_data1 = df_data[(df_data['details.maxplayers']>=1) & (df_data['details.maxplayers'

In [36]: analyze_feature(df_data1, "details.maxplayers")
```

```
count    20367.000000
mean         4.730348
std          2.948834
min          1.000000
25%          3.000000
50%          4.000000
75%          6.000000
max         47.000000
Name: details.maxplayers, dtype: float64
```



```
In [37]: df_data['details.maxplayers'].count()-df_data1['details.maxplayers'].count()
```

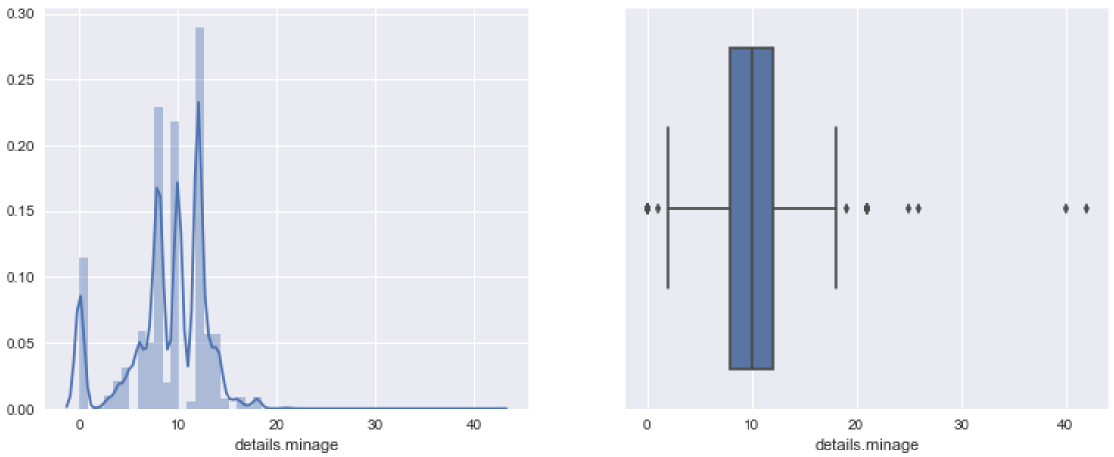
```
Out[37]: 475
```

While we still observe a number of outliers based on the box and whisker plot, the investigators believe that this proceedure above will increase the robustness of our analysis. We observe we have filtered out 475 records.

MinAge

```
In [38]: analyze_feature(df_data1, "details.minage")
```

```
count    20367.000000
mean         8.989198
std          3.959902
min          0.000000
25%          8.000000
50%         10.000000
75%         12.000000
max         42.000000
Name: details.minage, dtype: float64
```



```
In [39]: df_data.loc[df_data['details.minage']==0]

Out[39]:                                  details.name  details.maxplayers  \
         100                       Peaceful Resistance                 3.0
         133                                Wortelboer                 4.0
         152                               Black Death                 6.0
         221                                  Politika                 7.0
         258                              Rossyïa 1917                 5.0
         337                         Wrott & Swindlers                 6.0
         402                           Beutelschneider                 4.0
         430                          Age of Arguments                 4.0
         447                         Sufferin' Spirits                 4.0
         504                         Doolittle & Waite                15.0
         508                            Quartier Latin                 6.0
         511                              Terrain Game                 6.0
         526                                    Sumera                 4.0
         551                               Cube Fusion                 2.0
         571                                 Blindside                 4.0
         575                                    Oodles                10.0
         597                       Plague & Pestilence                 6.0
         611                                 Marrakesh                 2.0
         619                                 Fibonacci                 2.0
         629                          Caesar in Gallia                 2.0
         644                              Oregon Trail                 8.0
         650                        The Sun Never Sets                 2.0
         668                          Dutch Mountains                 2.0
         768                                  Atlantis                 0.0
         774                                   Pythago                 6.0
         780                                     Derby                 5.0
         899            Xenophon: 10,000 Against Persia                 2.0
         1015                                   Tendix                 3.0
```

```
1020                                          Casablanca                 4.0
1063                                     Saludos Amigos!                 7.0
...                                                  ...                 ...
84695  Nine Years: The War of the Grand Alliance 1688...                 2.0
84698           Buffy the Vampire Slayer: The Board Game                 6.0
84739                                         Gorechosen                 4.0
84827                                 The Shooting Party                 1.0
84828                                             Ta-Da!                 6.0
84843               Evil Dead 2: The Official Board Game                 6.0
84871                                               Akua                 4.0
84952                                           Handsket                 6.0
85734                             Shadow War: Armageddon                 2.0
86820                                           Xenofera                 5.0
86842                                 SUPERHOT Card Game                 3.0
86845                                             Gangsi                 5.0
86862                                Wallenstein Big Box                 5.0
87041                                      Iberian Rails                 5.0
87139                              Thunder in the Ozarks                 2.0
87297                                Ahead in the Clouds                 2.0
87363                                              Siege                 6.0
87557                                     Phobos Rising!                 1.0
87762               Gwent: Nilfgaard and Northern Realms                 2.0
87911                            Fall Of The Third Reich                 4.0
88111                                 Dia de los Muertos                 6.0
88240              The Horus Heresy: Burning of Prospero                 2.0
88378                           Omen: Edge of the Aegean                 2.0
88571                                  Circle the Wagons                 2.0
88733                                      Pyramid Poker                 2.0
88797                                        Tenkatoitsu                 2.0
89057                    Tao Long: The Way of the Dragon                 2.0
89060                    Ascension: Gift of the Elements                 4.0
89697                               Napoleons Quagmire                 2.0
90006            Warhammer Quest: Shadows Over Hammerhal                 5.0

       details.minage  details.minplayers  details.playingtime  \
100               0.0                 2.0                 30.0
133               0.0                 2.0                 30.0
152               0.0                 2.0                120.0
221               0.0                 3.0                  0.0
258               0.0                 2.0                300.0
337               0.0                 3.0                 90.0
402               0.0                 3.0                 30.0
430               0.0                 4.0                120.0
447               0.0                 2.0                120.0
504               0.0                 4.0                 90.0
508               0.0                 4.0                 45.0
511               0.0                 2.0                 60.0
526               0.0                 2.0                 30.0
```

```
551                 0.0                 2.0                 15.0
571                 0.0                 4.0                  0.0
575                 0.0                 3.0                  0.0
597                 0.0                 2.0                 30.0
611                 0.0                 2.0                 45.0
619                 0.0                 2.0                 30.0
629                 0.0                 2.0                300.0
644                 0.0                 1.0                120.0
650                 0.0                 2.0                180.0
668                 0.0                 2.0                  0.0
768                 0.0                 0.0                  0.0
774                 0.0                 1.0                 60.0
780                 0.0                 3.0                 60.0
899                 0.0                 2.0                120.0
1015                0.0                 2.0                 45.0
1020                0.0                 2.0                 30.0
1063                0.0                 4.0                 60.0
...                 ...                 ...                  ...
84695               0.0                 2.0                  0.0
84698               0.0                 1.0                 60.0
84739               0.0                 2.0                 75.0
84827               0.0                 1.0                 15.0
84828               0.0                 2.0                  0.0
84843               0.0                 1.0                 90.0
84871               0.0                 2.0                 40.0
84952               0.0                 1.0                 30.0
85734               0.0                 2.0                  0.0
86820               0.0                 2.0                 75.0
86842               0.0                 1.0                  0.0
86845               0.0                 2.0                  0.0
86862               0.0                 3.0                120.0
87041               0.0                 2.0                 90.0
87139               0.0                 2.0                  0.0
87297               0.0                 2.0                 20.0
87363               0.0                 2.0                  0.0
87557               0.0                 1.0                  0.0
87762               0.0                 2.0                 30.0
87911               0.0                 1.0                600.0
88111               0.0                 3.0                 15.0
88240               0.0                 2.0                 90.0
88378               0.0                 2.0                 30.0
88571               0.0                 2.0                 15.0
88733               0.0                 2.0                  0.0
88797               0.0                 1.0                  0.0
89057               0.0                 2.0                 30.0
89060               0.0                 1.0                 60.0
89697               0.0                 2.0                  0.0
90006               0.0                 2.0                120.0
```

```
       details.yearpublished  stats.averageweight  stats.average  stats.owned  \
100                   1995.0               0.0000        5.62778         44.0
133                   1999.0               0.0000        4.11765         37.0
152                   1993.0               1.8421        5.70588        244.0
221                   1996.0               1.6667        4.48936         78.0
258                   1995.0               4.0000        7.25508        189.0
337                   1995.0               1.8000        6.48438         57.0
402                   1997.0               1.5000        6.03429         95.0
430                   1998.0               0.0000        5.57143         27.0
447                   1987.0               2.0000        5.86842         53.0
504                   1986.0               1.8571        6.21793        149.0
508                   1997.0               0.0000        5.18750         56.0
511                   1997.0               1.6667        4.92857         13.0
526                   1999.0               3.0000        6.31071         63.0
551                   1968.0               2.0000        5.33333         71.0
571                   1998.0               2.0000        6.25294         36.0
575                   1992.0               1.3684        6.15255        481.0
597                   1993.0               1.3889        6.12509        781.0
611                   1978.0               2.0000        7.03191         79.0
619                   1992.0               1.8333        6.33246        112.0
629                   1993.0               3.0714        6.68922        319.0
644                   1981.0               2.2500        5.48649        108.0
650                   1997.0               2.8571        6.91463        162.0
668                   2000.0               1.0000        5.16667         79.0
768                   2000.0               0.0000        6.27273         25.0
774                   2000.0               1.0000        4.31818         28.0
780                   2000.0               1.6667        6.12237         69.0
899                   2000.0               3.7500        6.49600        181.0
1015                  1998.0               2.0000        5.67857         39.0
1020                  1977.0               1.0000        4.96875         42.0
1063                  1996.0               1.8750        5.45704        141.0
...                      ...                  ...            ...          ...
84695                 2017.0               0.0000        8.57308         63.0
84698                 2016.0               2.6000        7.31916        597.0
84739                 2016.0               2.0000        7.39058        372.0
84827                 2016.0               1.5000        6.77273         31.0
84828                 2016.0               1.0000        6.35795        193.0
84843                 2016.0               2.0000        8.46909         74.0
84871                 2016.0               0.0000        6.31452        246.0
84952                 2016.0               1.0000        7.35385         14.0
85734                 2017.0               4.0000        8.64286        131.0
86820                 2017.0               0.0000        7.34375         10.0
86842                 2017.0               2.0000        7.07857         90.0
86845                 2016.0               1.0000        6.14919         55.0
86862                 2016.0               3.0000        7.92550        189.0
87041                 2017.0               0.0000        7.66667         10.0
87139                 2016.0               3.5000        7.91667        104.0
```

```
87297                 2016.0               1.5000        7.51923        203.0
87363                 2016.0               1.5000        5.50000         70.0
87557                 2016.0               2.0000        6.80000        118.0
87762                 2016.0               1.5000        7.10388        254.0
87911                 2016.0               0.0000        8.00000         37.0
88111                 2016.0               0.0000        6.06000         55.0
88240                 2016.0               0.0000        7.73714        198.0
88378                 2016.0               2.0000        7.95444        340.0
88571                 2017.0               2.0000        7.95455         35.0
88733                 2017.0               2.0000        7.20690         67.0
88797                 2016.0               2.4000        8.62000         98.0
89057                 2017.0               2.6667        8.55355        142.0
89060                 2017.0               2.5000        7.82174         95.0
89697                 2017.0               0.0000        8.45833         60.0
90006                 2017.0               2.0000        8.09000        207.0

       stats.stddev  Abstract Strategy  Action / Dexterity  Adventure  \
100        1.570490                  1                   0          0
133        1.996540                  0                   0          0
152        1.606720                  0                   0          0
221        1.772990                  0                   0          0
258        1.280400                  0                   0          0
337        1.118510                  0                   0          0
402        1.376320                  0                   0          0
430        1.678190                  0                   0          0
447        1.435290                  0                   0          0
504        1.240740                  0                   0          0
508        1.058820                  0                   0          0
511        1.656770                  0                   0          0
526        1.723650                  1                   0          0
551        1.247220                  1                   0          0
571        0.994170                  0                   0          0
575        1.547240                  0                   0          0
597        1.655740                  0                   0          0
611        1.955360                  1                   0          0
619        1.466300                  1                   0          0
629        1.280140                  0                   0          0
644        1.449540                  0                   0          1
650        1.456280                  0                   0          0
668        1.126870                  1                   0          0
768        0.862439                  0                   0          0
774        1.418590                  0                   0          0
780        1.096690                  0                   0          0
899        1.562680                  0                   0          0
1015       1.357610                  0                   0          0
1020       1.152020                  0                   0          0
1063       1.443400                  0                   0          0
...             ...                ...                 ...        ...
```

```
84695      0.634464                  0                    0          0
84698      1.523260                  0                    0          0
84739      1.299980                  0                    0          0
84827      1.346100                  0                    0          0
84828      1.769100                  0                    0          0
84843      2.701600                  0                    0          0
84871      1.942690                  0                    0          0
84952      1.145300                  0                    1          0
85734      0.921216                  0                    0          0
86820      2.590360                  0                    0          0
86842      2.001490                  0                    0          0
86845      1.292050                  0                    0          0
86862      1.443070                  0                    0          0
87041      2.645750                  0                    0          0
87139      2.191210                  0                    0          0
87297      1.226560                  0                    0          0
87363      2.107810                  0                    0          0
87557      0.806226                  0                    0          0
87762      1.641910                  0                    0          0
87911      2.287090                  0                    0          0
88111      1.756060                  0                    0          0
88240      1.269660                  0                    0          0
88378      1.426250                  0                    0          0
88571      1.096580                  0                    0          0
88733      1.477400                  0                    0          0
88797      0.930376                  0                    0          0
89057      1.223250                  1                    0          0
89060      2.156070                  0                    0          0
89697      1.029930                  0                    0          0
90006      1.654360                  0                    0          1

       Age of Reason  American Civil War  American Indian Wars  \
100                0                   0                     0
133                0                   0                     0
152                0                   0                     0
221                0                   0                     0
258                0                   0                     0
337                0                   0                     0
402                0                   0                     0
430                1                   0                     0
447                0                   0                     0
504                0                   0                     0
508                0                   0                     0
511                0                   0                     0
526                0                   0                     0
551                0                   0                     0
571                0                   0                     0
575                0                   0                     0
```

```
597                0                   0                     0
611                0                   0                     0
619                0                   0                     0
629                0                   0                     0
644                0                   0                     0
650                0                   0                     0
668                0                   0                     0
768                0                   0                     0
774                0                   0                     0
780                0                   0                     0
899                0                   0                     0
1015               0                   0                     0
1020               0                   0                     0
1063               0                   0                     0
...              ...                 ...                   ...
84695              0                   0                     0
84698              0                   0                     0
84739              0                   0                     0
84827              0                   0                     0
84828              0                   0                     0
84843              0                   0                     0
84871              0                   0                     0
84952              0                   0                     0
85734              0                   0                     0
86820              0                   0                     0
86842              0                   0                     0
86845              0                   0                     0
86862              0                   0                     0
87041              0                   0                     0
87139              0                   1                     0
87297              0                   0                     0
87363              0                   0                     0
87557              0                   0                     0
87762              0                   0                     0
87911              0                   0                     0
88111              0                   0                     0
88240              0                   0                     0
88378              0                   0                     0
88571              0                   0                     0
88733              0                   0                     0
88797              0                   0                     0
89057              0                   0                     0
89060              0                   0                     0
89697              0                   0                     0
90006              0                   0                     0

       American Revolutionary War  American West  Ancient  Animals  Arabian  \
100                             0              0        0        0        0
```

133	0	0	0	1	0
152	0	0	0	0	0
221	0	0	0	0	0
258	0	0	0	0	0
337	0	0	0	0	0
402	0	0	0	0	0
430	0	0	0	0	0
447	0	0	0	0	0
504	0	0	0	0	0
508	0	0	0	0	0
511	0	0	0	0	0
526	0	0	0	0	0
551	0	0	0	0	0
571	0	0	0	0	0
575	0	0	0	0	0
597	0	0	0	0	0
611	0	0	0	0	0
619	0	0	0	0	0
629	0	0	1	0	0
644	0	1	0	0	0
650	0	0	0	0	0
668	0	0	0	0	0
768	0	0	0	0	0
774	0	0	0	0	0
780	0	0	0	0	0
899	0	0	1	0	0
1015	0	0	0	0	0
1020	0	0	0	0	0
1063	0	0	0	0	0
...	...	...	...	...	...
84695	0	0	0	0	0
84698	0	0	0	0	0
84739	0	0	0	0	0
84827	0	0	0	0	0
84828	0	0	0	0	0
84843	0	0	0	0	0
84871	0	0	0	0	0
84952	0	0	0	0	0
85734	0	0	0	0	0
86820	0	0	0	0	0
86842	0	0	0	0	0
86845	0	0	0	0	0
86862	0	0	0	0	0
87041	0	0	0	0	0
87139	0	0	0	0	0
87297	0	0	0	0	0
87363	0	0	0	0	0
87557	0	0	0	0	0

```
87762                           0              0        0        0        0
87911                           0              0        0        0        0
88111                           0              0        0        0        0
88240                           0              0        0        0        0
88378                           0              0        1        0        0
88571                           0              1        0        0        0
88733                           0              0        0        0        0
88797                           0              0        0        0        0
89057                           0              0        0        0        0
89060                           0              0        0        0        0
89697                           0              0        0        0        0
90006                           0              0        0        0        0

       Aviation / Flight  Bluffing  Book  Card Game  Children's Game  \
100                    0         0     0          0                0
133                    0         0     0          1                0
152                    0         0     0          0                0
221                    0         0     0          1                0
258                    0         0     0          0                0
337                    0         1     0          1                0
402                    0         0     0          1                0
430                    0         0     0          0                0
447                    0         0     0          0                0
504                    0         1     0          1                0
508                    0         0     0          1                0
511                    0         0     0          0                0
526                    0         0     0          0                0
551                    0         0     0          0                0
571                    0         0     0          1                0
575                    0         0     0          0                0
597                    0         0     0          1                0
611                    0         0     0          1                0
619                    0         0     0          0                0
629                    0         0     0          0                0
644                    0         0     0          0                0
650                    0         0     0          0                0
668                    0         0     0          0                0
768                    0         0     0          0                0
774                    0         0     0          0                0
780                    0         1     0          0                0
899                    0         0     0          0                0
1015                   0         0     0          0                0
1020                   0         1     0          0                0
1063                   0         0     0          0                0
...                  ...       ...   ...        ...              ...
84695                  0         0     0          0                0
84698                  0         0     0          0                0
84739                  0         0     0          0                0
```

```
84827                  0         0     0          1                0
84828                  0         0     0          0                0
84843                  0         0     0          0                0
84871                  0         0     0          0                0
84952                  0         0     0          0                0
85734                  0         0     0          0                0
86820                  0         0     0          1                0
86842                  0         0     0          1                0
86845                  0         0     0          0                1
86862                  0         0     0          0                0
87041                  0         0     0          0                0
87139                  0         0     0          0                0
87297                  0         0     0          1                0
87363                  0         1     0          1                0
87557                  0         0     0          0                0
87762                  0         0     0          1                0
87911                  0         0     0          0                0
88111                  0         0     0          0                0
88240                  0         0     0          0                0
88378                  0         0     0          1                0
88571                  0         0     0          1                0
88733                  0         0     0          0                0
88797                  0         0     0          0                0
89057                  0         0     0          0                0
89060                  0         0     0          1                0
89697                  0         0     0          0                0
90006                  0         0     0          0                0

       City Building  Civil War  Civilization  Collectible Components  \
100                0          0             0                       0
133                0          0             0                       0
152                0          0             0                       0
221                0          0             0                       0
258                0          1             0                       0
337                0          0             0                       0
402                0          0             0                       0
430                0          0             0                       0
447                0          0             0                       0
504                0          0             0                       0
508                0          0             0                       0
511                0          0             0                       0
526                0          0             0                       0
551                0          0             0                       0
571                0          0             0                       0
575                0          0             0                       0
597                0          0             0                       0
611                0          0             0                       0
619                0          0             0                       0
```

```
629                0          0             0                       0
644                0          0             0                       0
650                0          0             0                       0
668                0          0             0                       0
768                0          0             0                       0
774                0          0             0                       0
780                0          0             0                       0
899                0          0             0                       0
1015               0          0             0                       0
1020               0          0             0                       0
1063               0          0             0                       0
...              ...        ...           ...                     ...
84695              0          0             0                       0
84698              0          0             0                       0
84739              0          0             0                       0
84827              0          0             0                       0
84828              0          0             0                       0
84843              0          0             0                       0
84871              0          0             0                       0
84952              0          0             0                       0
85734              0          0             0                       0
86820              0          0             0                       0
86842              0          0             0                       0
86845              0          0             0                       0
86862              0          0             0                       0
87041              0          0             0                       0
87139              0          0             0                       0
87297              0          0             0                       0
87363              0          0             0                       0
87557              0          0             0                       0
87762              0          0             0                       1
87911              0          0             0                       0
88111              0          0             0                       0
88240              0          0             0                       0
88378              0          0             0                       0
88571              1          0             0                       0
88733              0          0             0                       0
88797              0          0             0                       0
89057              0          0             0                       0
89060              0          0             0                       0
89697              0          0             0                       0
90006              0          0             0                       0

       Comic Book / Strip  Deduction  Dice  Economic  Educational  Electronic   \
100                     0          0     0         0            0           0
133                     0          0     0         0            0           0
152                     0          0     0         0            1           0
221                     0          0     0         0            0           0
```

258	0	0	0	0	0	0
337	0	0	0	0	0	0
402	0	0	0	0	0	0
430	0	0	0	0	0	0
447	0	0	0	0	0	0
504	0	0	0	0	0	0
508	0	0	0	0	0	0
511	0	0	0	0	0	0
526	0	0	0	0	0	0
551	0	0	0	0	0	0
571	0	0	0	0	0	0
575	0	0	0	0	0	0
597	0	0	0	0	0	0
611	0	0	1	0	0	0
619	0	0	0	0	0	0
629	0	0	0	0	0	0
644	0	0	0	0	0	0
650	0	0	0	0	0	0
668	0	0	0	0	0	0
768	0	0	0	0	0	0
774	0	0	0	0	0	0
780	0	0	0	0	0	0
899	0	0	0	0	0	0
1015	0	0	0	0	0	0
1020	0	0	0	0	0	0
1063	0	0	0	0	0	0
...	...	...	...	...	...	...
84695	0	0	0	0	0	0
84698	0	0	0	0	0	0
84739	0	0	1	0	0	0
84827	0	0	0	0	0	0
84828	0	0	0	0	0	0
84843	0	0	0	0	0	0
84871	0	0	0	0	0	0
84952	0	0	0	0	0	0
85734	0	0	0	0	0	0
86820	0	0	0	0	0	0
86842	0	0	0	0	0	0
86845	0	1	0	0	0	0
86862	0	0	0	1	0	0
87041	0	0	0	1	0	0
87139	0	0	0	0	0	0
87297	0	0	0	0	0	0
87363	0	0	0	0	0	0
87557	0	0	0	0	0	0
87762	0	0	0	0	0	0
87911	0	0	0	0	0	0
88111	0	0	0	0	0	0

```
88240                   0          0     0         0            0           0
88378                   0          0     0         0            0           0
88571                   0          0     0         0            0           0
88733                   0          0     0         0            0           0
88797                   0          0     0         0            0           0
89057                   0          0     0         0            0           0
89060                   0          0     0         0            0           0
89697                   0          0     0         0            0           0
90006                   0          0     1         0            0           0

       Environmental  Expansion for Base-game  Exploration  Fan Expansion   \
100                0                        0            0              0
133                0                        0            0              0
152                0                        0            0              0
221                0                        0            0              0
258                0                        0            0              0
337                0                        0            0              0
402                0                        0            0              0
430                0                        0            0              0
447                0                        0            0              0
504                0                        0            0              0
508                0                        0            0              0
511                0                        0            0              0
526                0                        0            0              0
551                0                        0            0              0
571                0                        0            0              0
575                0                        0            0              0
597                0                        0            0              0
611                0                        0            0              0
619                0                        0            0              0
629                0                        0            0              0
644                0                        0            1              0
650                0                        0            0              0
668                0                        0            0              0
768                0                        0            0              0
774                0                        0            0              0
780                0                        0            0              0
899                0                        0            0              0
1015               0                        0            0              0
1020               0                        0            0              0
1063               0                        0            0              0
...              ...                      ...          ...            ...
84695              0                        0            0              0
84698              0                        0            0              0
84739              0                        0            0              0
84827              0                        0            0              0
84828              0                        0            0              0
84843              0                        0            0              0
```

```
84871              0                        0           0              0
84952              0                        0           0              0
85734              0                        0           0              0
86820              0                        0           0              0
86842              0                        0           0              0
86845              0                        0           0              0
86862              0                        0           0              0
87041              0                        0           0              0
87139              0                        0           0              0
87297              0                        0           0              0
87363              0                        0           0              0
87557              0                        0           0              0
87762              0                        0           0              0
87911              0                        0           0              0
88111              0                        0           0              0
88240              0                        0           0              0
88378              0                        0           0              0
88571              0                        0           0              0
88733              0                        0           0              0
88797              0                        0           0              0
89057              0                        0           0              0
89060              0                        0           0              0
89697              0                        0           0              0
90006              0                        0           1              0

       Fantasy  Farming  Fighting  Game System  Horror  Humor  \
100          0        0         0            0       0      0
133          0        0         0            0       0      0
152          0        0         0            0       0      0
221          0        0         0            0       0      0
258          0        0         0            0       0      0
337          0        0         0            0       0      0
402          0        0         0            0       0      0
430          0        0         0            0       0      0
447          0        0         0            0       1      0
504          0        0         0            0       0      0
508          0        0         0            0       0      0
511          0        0         0            0       0      0
526          0        0         0            0       0      0
551          0        0         0            0       0      0
571          0        0         0            0       0      0
575          0        0         0            0       0      0
597          0        0         0            0       0      0
611          0        0         0            0       0      0
619          0        0         0            0       0      0
629          0        0         0            0       0      0
644          0        0         0            0       0      0
650          0        0         0            0       0      0
```

```
668          0        0         0            0       0      0
768          0        0         0            0       0      0
774          0        0         0            0       0      0
780          0        0         0            0       0      0
899          0        0         0            0       0      0
1015         0        0         0            0       0      0
1020         0        0         0            0       0      0
1063         0        0         0            0       0      0
...        ...      ...       ...          ...     ...    ...
84695        0        0         0            0       0      0
84698        0        0         0            0       0      0
84739        1        0         1            0       0      0
84827        0        0         0            0       0      0
84828        0        0         0            0       0      0
84843        0        0         0            0       1      0
84871        0        0         0            0       0      0
84952        0        0         0            0       0      0
85734        0        0         0            0       0      0
86820        0        0         0            0       0      0
86842        0        0         1            0       0      0
86845        0        0         0            0       0      0
86862        0        0         0            0       0      0
87041        0        0         0            0       0      0
87139        0        0         0            0       0      0
87297        0        0         0            0       0      0
87363        0        0         1            0       0      0
87557        0        0         0            0       0      0
87762        0        0         0            0       0      0
87911        0        0         0            0       0      0
88111        0        0         0            0       1      0
88240        0        0         1            0       0      0
88378        1        0         1            0       0      0
88571        0        0         0            0       0      0
88733        0        0         0            0       0      0
88797        0        0         0            0       0      0
89057        0        0         0            0       0      0
89060        1        0         0            0       0      0
89697        0        0         0            0       0      0
90006        1        0         1            0       0      0

       Industry / Manufacturing  Korean War  Mafia  Math       ...        \
100                           0           0      0     0       ...
133                           0           0      0     0       ...
152                           0           0      0     0       ...
221                           0           0      0     0       ...
258                           0           0      0     0       ...
337                           0           0      0     0       ...
402                           0           0      0     0       ...
```

```
430                           0           0     0     0       ...
447                           0           0     0     0       ...
504                           0           0     0     0       ...
508                           0           0     0     0       ...
511                           0           0     0     0       ...
526                           0           0     0     0       ...
551                           0           0     0     0       ...
571                           0           0     0     0       ...
575                           0           0     0     0       ...
597                           0           0     0     0       ...
611                           0           0     0     0       ...
619                           0           0     0     0       ...
629                           0           0     0     0       ...
644                           0           0     0     0       ...
650                           0           0     0     0       ...
668                           0           0     0     0       ...
768                           0           0     0     0       ...
774                           0           0     0     0       ...
780                           0           0     0     0       ...
899                           0           0     0     0       ...
1015                          0           0     0     0       ...
1020                          0           0     0     0       ...
1063                          0           0     0     0       ...
...                         ...         ...   ...   ...       ...
84695                         0           0     0     0       ...
84698                         0           0     0     0       ...
84739                         0           0     0     0       ...
84827                         0           0     0     0       ...
84828                         0           0     0     0       ...
84843                         0           0     0     0       ...
84871                         0           0     0     0       ...
84952                         0           0     0     0       ...
85734                         0           0     0     0       ...
86820                         0           0     0     0       ...
86842                         0           0     0     0       ...
86845                         0           0     0     0       ...
86862                         0           0     0     0       ...
87041                         0           0     0     0       ...
87139                         0           0     0     0       ...
87297                         0           0     0     0       ...
87363                         0           0     0     0       ...
87557                         0           0     0     0       ...
87762                         0           0     0     0       ...
87911                         0           0     0     0       ...
88111                         0           0     0     0       ...
88240                         0           0     0     0       ...
88378                         0           0     0     0       ...
88571                         0           0     0     0       ...
```

```
88733                         0           0      0     0       ...
88797                         0           0      0     0       ...
89057                         0           0      0     0       ...
89060                         0           0      0     0       ...
89697                         0           0      0     0       ...
90006                         0           0      0     0       ...

       Area Control / Area Influence  Area Enclosure  Area Movement  \
100                                0               0              0
133                                0               0              0
152                                0               0              0
221                                0               0              0
258                                0               0              0
337                                0               0              0
402                                0               0              0
430                                0               0              0
447                                0               0              0
504                                0               0              0
508                                0               0              0
511                                0               0              0
526                                0               0              0
551                                0               0              0
571                                0               0              0
575                                0               0              0
597                                0               0              0
611                                0               0              0
619                                0               0              0
629                                0               0              0
644                                0               0              0
650                                0               0              0
668                                0               0              0
768                                0               0              0
774                                0               0              0
780                                0               0              0
899                                0               0              0
1015                               0               0              0
1020                               0               0              0
1063                               0               0              0
...                              ...             ...            ...
84695                              0               0              0
84698                              0               0              0
84739                              0               0              0
84827                              0               0              0
84828                              0               0              0
84843                              0               0              1
84871                              1               0              0
84952                              0               0              0
85734                              0               0              0
```

```
86820                              0              0              0
86842                              0              0              0
86845                              0              0              0
86862                              1              0              1
87041                              0              0              0
87139                              0              0              0
87297                              0              0              0
87363                              0              0              0
87557                              0              0              0
87762                              0              0              0
87911                              0              0              0
88111                              0              0              0
88240                              0              0              0
88378                              1              0              0
88571                              0              0              0
88733                              0              0              0
88797                              0              0              0
89057                              0              0              0
89060                              0              0              0
89697                              0              0              0
90006                              0              0              0

       Area-Impulse  Auction/Bidding  Betting/Wagering  \
100               0                0                 0
133               0                0                 0
152               0                0                 0
221               0                0                 0
258               0                0                 0
337               0                1                 0
402               0                0                 0
430               0                1                 0
447               0                0                 0
504               0                1                 0
508               0                0                 0
511               0                0                 0
526               0                0                 0
551               0                0                 0
571               0                0                 0
575               0                0                 0
597               0                0                 0
611               0                0                 0
619               0                0                 0
629               0                0                 0
644               0                0                 0
650               0                0                 0
668               0                0                 0
768               0                0                 0
774               0                0                 0
```

```
780               0                0                 1
899               0                0                 0
1015              0                0                 0
1020              0                0                 1
1063              0                0                 0
...             ...              ...               ...
84695             0                0                 0
84698             0                0                 0
84739             0                0                 0
84827             0                0                 0
84828             0                0                 0
84843             0                0                 0
84871             0                0                 0
84952             0                0                 0
85734             0                0                 0
86820             0                0                 0
86842             0                0                 0
86845             0                0                 0
86862             0                0                 0
87041             0                1                 0
87139             0                0                 0
87297             0                0                 0
87363             0                0                 0
87557             0                0                 0
87762             0                0                 0
87911             0                0                 0
88111             0                0                 0
88240             0                0                 0
88378             0                0                 0
88571             0                0                 0
88733             0                0                 0
88797             0                0                 0
89057             0                0                 0
89060             0                0                 0
89697             0                0                 0
90006             0                0                 0

       Campaign / Battle Card Driven  Card Drafting  Chit-Pull System  \
100                                0              0                 0
133                                0              0                 0
152                                0              0                 0
221                                0              0                 0
258                                0              0                 0
337                                0              0                 0
402                                0              0                 0
430                                0              0                 0
447                                0              0                 0
504                                0              0                 0
```

508	0	0	0
511	0	0	0
526	0	0	0
551	0	0	0
571	0	0	0
575	0	0	0
597	0	1	0
611	0	0	0
619	0	0	0
629	0	0	0
644	0	0	0
650	0	0	0
668	0	0	0
768	0	0	0
774	0	0	0
780	0	0	0
899	0	0	0
1015	0	0	0
1020	0	0	0
1063	0	0	0
...	...	...	...
84695	1	0	0
84698	0	0	0
84739	0	0	0
84827	0	1	0
84828	0	0	0
84843	0	0	0
84871	0	0	0
84952	0	0	0
85734	0	0	0
86820	0	0	0
86842	0	0	0
86845	0	0	0
86862	0	0	0
87041	0	0	0
87139	0	0	0
87297	0	0	0
87363	0	0	0
87557	0	0	0
87762	0	0	0
87911	0	0	0
88111	0	0	0
88240	0	0	0
88378	0	0	0
88571	0	1	0
88733	0	0	0
88797	0	0	1
89057	0	0	0

```
89060                              0              1                 0
89697                              1              0                 0
90006                              0              0                 0

       Co-operative Play  Commodity Speculation  Crayon Rail System  \
100                    0                      0                   0
133                    0                      0                   0
152                    0                      0                   0
221                    0                      0                   0
258                    0                      0                   0
337                    0                      0                   0
402                    0                      0                   0
430                    0                      0                   0
447                    0                      0                   0
504                    0                      0                   0
508                    0                      0                   0
511                    0                      0                   0
526                    0                      0                   0
551                    0                      0                   0
571                    0                      0                   0
575                    0                      0                   0
597                    0                      0                   0
611                    0                      0                   0
619                    0                      0                   0
629                    0                      0                   0
644                    0                      0                   0
650                    0                      0                   0
668                    0                      0                   0
768                    0                      0                   0
774                    0                      0                   0
780                    0                      0                   0
899                    0                      0                   0
1015                   0                      0                   0
1020                   0                      0                   0
1063                   0                      0                   0
...                  ...                    ...                 ...
84695                  0                      0                   0
84698                  1                      0                   0
84739                  0                      0                   0
84827                  0                      0                   0
84828                  0                      0                   0
84843                  1                      0                   0
84871                  0                      0                   0
84952                  0                      0                   0
85734                  0                      0                   0
86820                  0                      0                   0
86842                  1                      0                   0
86845                  0                      0                   0
```

```
86862                  0                      0                   0
87041                  0                      1                   0
87139                  0                      0                   0
87297                  0                      0                   0
87363                  0                      0                   0
87557                  0                      0                   0
87762                  0                      0                   0
87911                  0                      0                   0
88111                  0                      0                   0
88240                  0                      0                   0
88378                  0                      0                   0
88571                  0                      0                   0
88733                  0                      0                   0
88797                  0                      0                   0
89057                  0                      0                   0
89060                  0                      0                   0
89697                  0                      0                   0
90006                  0                      0                   0

       Deck / Pool Building  Dice Rolling  Grid Movement  Hand Management  \
100                       0             0              0                0
133                       0             0              0                0
152                       0             1              0                0
221                       0             0              0                0
258                       0             0              0                0
337                       0             0              0                0
402                       0             0              0                0
430                       0             0              0                0
447                       0             0              0                0
504                       0             0              0                0
508                       0             0              0                0
511                       0             0              0                0
526                       0             0              0                0
551                       0             0              0                0
571                       0             0              0                0
575                       0             0              0                0
597                       0             1              0                0
611                       0             1              0                0
619                       0             0              0                0
629                       0             1              0                0
644                       0             0              0                0
650                       0             0              0                0
668                       0             0              0                0
768                       0             0              0                0
774                       0             0              0                0
780                       0             0              0                0
899                       0             0              0                0
1015                      0             0              0                0
```

```
1020                      0             0              0                0
1063                      0             0              0                0
...                     ...           ...            ...              ...
84695                     0             1              0                0
84698                     0             0              0                1
84739                     1             1              1                0
84827                     0             0              0                1
84828                     0             1              0                0
84843                     0             1              0                1
84871                     0             0              0                0
84952                     0             0              0                0
85734                     0             1              0                0
86820                     0             0              0                1
86842                     1             0              0                1
86845                     0             0              0                0
86862                     0             0              0                0
87041                     0             0              0                0
87139                     0             0              0                0
87297                     0             0              0                0
87363                     0             0              0                0
87557                     0             0              0                0
87762                     0             0              0                1
87911                     0             0              0                0
88111                     0             0              0                0
88240                     0             1              0                0
88378                     0             0              0                1
88571                     0             0              0                0
88733                     0             0              0                0
88797                     0             0              0                0
89057                     0             0              1                0
89060                     1             0              0                1
89697                     0             1              0                0
90006                     0             1              1                0

       Hex-and-Counter  Line Drawing  Memory_mechanics  Modular Board  \
100                  0             0                 0              1
133                  0             0                 0              0
152                  0             0                 0              0
221                  0             0                 0              0
258                  1             0                 0              0
337                  0             0                 0              0
402                  0             0                 0              0
430                  0             0                 0              0
447                  0             0                 0              0
504                  0             0                 0              0
508                  0             0                 0              0
511                  0             0                 0              1
526                  0             0                 0              0
```

551	0	0	0	0
571	0	0	0	0
575	0	0	0	0
597	0	0	0	0
611	0	0	0	0
619	0	0	0	0
629	1	0	0	0
644	0	0	0	0
650	1	0	0	0
668	0	0	0	0
768	0	0	0	0
774	0	0	0	0
780	0	0	0	0
899	1	0	0	0
1015	0	0	0	0
1020	0	0	0	0
1063	0	0	0	0
...	...	...	...	...
84695	0	0	0	0
84698	0	0	0	0
84739	0	0	0	0
84827	0	0	0	0
84828	0	0	0	0
84843	0	0	0	0
84871	0	0	0	0
84952	0	0	0	0
85734	0	0	0	1
86820	0	0	0	0
86842	0	0	0	0
86845	0	0	0	0
86862	0	0	0	0
87041	0	0	0	0
87139	1	0	0	0
87297	0	0	0	0
87363	0	0	1	0
87557	0	0	0	0
87762	0	0	0	0
87911	1	0	0	0
88111	0	0	0	0
88240	0	0	0	0
88378	0	0	0	0
88571	0	0	0	0
88733	0	0	0	0
88797	1	0	0	0
89057	0	0	0	1
89060	0	0	0	0
89697	1	0	0	0
90006	0	0	0	1

```
       Paper-and-Pencil  Partnerships  Pattern Building  Pattern Recognition  \
100                   0             0                 0                    0
133                   0             0                 0                    0
152                   0             0                 0                    0
221                   0             0                 0                    0
258                   0             0                 0                    0
337                   0             0                 0                    0
402                   0             0                 0                    0
430                   0             0                 0                    0
447                   0             0                 0                    0
504                   0             0                 0                    0
508                   0             1                 0                    0
511                   0             0                 0                    0
526                   0             0                 0                    0
551                   0             0                 1                    0
571                   0             0                 0                    0
575                   0             0                 0                    0
597                   0             0                 0                    0
611                   0             0                 0                    0
619                   0             0                 0                    0
629                   0             0                 0                    0
644                   0             0                 0                    0
650                   0             0                 0                    0
668                   0             0                 0                    0
768                   0             0                 0                    0
774                   0             0                 0                    0
780                   0             0                 0                    0
899                   0             0                 0                    0
1015                  0             0                 0                    0
1020                  0             0                 0                    0
1063                  0             1                 0                    0
...                 ...           ...               ...                  ...
84695                 0             0                 0                    0
84698                 0             0                 0                    0
84739                 0             0                 0                    0
84827                 0             0                 0                    0
84828                 0             0                 0                    0
84843                 0             0                 0                    0
84871                 0             0                 0                    0
84952                 0             0                 0                    0
85734                 0             0                 0                    0
86820                 0             0                 0                    0
86842                 0             0                 0                    0
86845                 0             0                 0                    0
86862                 0             0                 0                    0
87041                 0             0                 0                    0
87139                 0             0                 0                    0
```

```
87297                 0             0                 0                    0
87363                 0             0                 0                    0
87557                 0             0                 0                    0
87762                 0             0                 0                    0
87911                 0             0                 0                    0
88111                 0             0                 0                    0
88240                 0             0                 0                    0
88378                 0             0                 0                    0
88571                 0             0                 0                    0
88733                 0             0                 1                    0
88797                 0             0                 0                    0
89057                 0             0                 0                    0
89060                 0             0                 0                    0
89697                 0             0                 0                    0
90006                 0             0                 0                    0

       Pick-up and Deliver  Player Elimination  Point to Point Movement  \
100                      0                   0                        0
133                      0                   0                        0
152                      0                   0                        1
221                      0                   0                        0
258                      0                   0                        0
337                      0                   0                        0
402                      0                   0                        0
430                      0                   0                        0
447                      0                   0                        0
504                      0                   0                        0
508                      0                   0                        0
511                      0                   0                        0
526                      0                   0                        0
551                      0                   0                        0
571                      0                   0                        0
575                      0                   0                        0
597                      0                   0                        0
611                      0                   0                        0
619                      0                   0                        0
629                      0                   0                        0
644                      0                   0                        0
650                      0                   0                        0
668                      0                   0                        0
768                      0                   0                        0
774                      0                   0                        0
780                      0                   0                        0
899                      0                   0                        0
1015                     0                   0                        0
1020                     0                   0                        0
1063                     0                   0                        0
...                    ...                 ...                      ...
```

```
84695                    0                   0                        1
84698                    0                   0                        0
84739                    0                   0                        0
84827                    0                   0                        0
84828                    0                   0                        0
84843                    0                   0                        0
84871                    0                   0                        0
84952                    0                   0                        0
85734                    0                   0                        0
86820                    0                   0                        0
86842                    0                   0                        0
86845                    0                   0                        0
86862                    0                   0                        0
87041                    0                   0                        0
87139                    0                   0                        0
87297                    0                   0                        0
87363                    0                   1                        0
87557                    0                   0                        0
87762                    0                   0                        0
87911                    0                   0                        0
88111                    0                   0                        0
88240                    0                   0                        0
88378                    0                   0                        0
88571                    0                   0                        0
88733                    0                   0                        0
88797                    0                   0                        0
89057                    0                   0                        1
89060                    0                   0                        0
89697                    0                   0                        0
90006                    0                   0                        0

       Press Your Luck  Rock-Paper-Scissors  Role Playing  \
100                  0                    0             0
133                  0                    0             0
152                  0                    0             0
221                  0                    0             0
258                  0                    0             0
337                  0                    0             0
402                  0                    0             0
430                  0                    0             0
447                  0                    0             0
504                  0                    0             0
508                  0                    0             0
511                  0                    0             0
526                  0                    0             0
551                  0                    0             0
571                  0                    0             0
575                  0                    0             0
```

```
597                  0                    0             0
611                  0                    0             0
619                  0                    0             0
629                  0                    0             0
644                  0                    0             0
650                  0                    0             0
668                  0                    0             0
768                  0                    0             0
774                  0                    0             0
780                  0                    0             0
899                  0                    0             0
1015                 0                    0             0
1020                 0                    0             0
1063                 0                    0             0
...                ...                  ...           ...
84695                0                    0             0
84698                0                    0             0
84739                0                    0             0
84827                0                    0             0
84828                0                    0             0
84843                0                    0             0
84871                0                    0             0
84952                0                    0             0
85734                0                    0             1
86820                0                    0             0
86842                0                    0             0
86845                0                    0             0
86862                0                    0             0
87041                0                    0             0
87139                0                    0             0
87297                0                    0             0
87363                0                    0             0
87557                0                    0             0
87762                0                    0             0
87911                0                    0             0
88111                0                    0             0
88240                0                    0             0
88378                0                    0             0
88571                0                    0             0
88733                0                    0             0
88797                0                    0             0
89057                0                    0             0
89060                0                    0             0
89697                0                    0             0
90006                0                    0             1

       Roll / Spin and Move  Route/Network Building  Secret Unit Deployment  \
100                       0                       0                       0
```

133	0	0	0
152	0	0	0
221	0	0	0
258	0	0	0
337	0	0	0
402	0	0	0
430	0	0	0
447	0	0	0
504	0	0	0
508	0	0	0
511	0	0	0
526	0	0	0
551	0	0	0
571	0	0	0
575	0	0	0
597	0	0	0
611	0	0	0
619	0	0	0
629	0	0	0
644	0	0	0
650	0	0	0
668	0	0	0
768	0	0	0
774	0	0	0
780	0	0	0
899	0	0	0
1015	0	0	0
1020	0	0	0
1063	0	0	0
...	...	...	...
84695	0	0	0
84698	0	0	0
84739	0	0	0
84827	0	0	0
84828	0	0	0
84843	0	0	0
84871	0	0	0
84952	0	0	0
85734	0	0	0
86820	0	0	0
86842	0	0	0
86845	0	0	0
86862	0	0	0
87041	0	1	0
87139	0	0	0
87297	0	1	0
87363	0	0	0
87557	0	0	0

```
87762                     0                       0                       0
87911                     0                       0                       0
88111                     0                       0                       0
88240                     0                       0                       0
88378                     0                       0                       0
88571                     0                       0                       0
88733                     0                       0                       0
88797                     0                       0                       0
89057                     0                       0                       0
89060                     0                       0                       0
89697                     0                       0                       0
90006                     0                       0                       0

       Set Collection  Simulation  Simultaneous Action Selection  Singing  \
100                 0           0                              0        0
133                 0           0                              0        0
152                 0           1                              0        0
221                 0           0                              0        0
258                 0           0                              0        0
337                 0           0                              0        0
402                 0           0                              0        0
430                 0           0                              0        0
447                 0           0                              0        0
504                 0           0                              0        0
508                 0           0                              0        0
511                 0           0                              0        0
526                 0           0                              0        0
551                 0           0                              0        0
571                 0           0                              0        0
575                 0           0                              0        0
597                 0           0                              0        0
611                 0           0                              0        0
619                 0           0                              0        0
629                 0           0                              0        0
644                 0           0                              0        0
650                 0           0                              0        0
668                 0           0                              0        0
768                 0           0                              0        0
774                 0           0                              0        0
780                 0           0                              0        0
899                 0           0                              0        0
1015                0           0                              0        0
1020                1           0                              0        0
1063                0           0                              0        0
...               ...         ...                            ...      ...
84695               0           0                              0        0
84698               0           0                              0        0
84739               0           0                              0        0
```

```
84827               1           0                              0        0
84828               0           0                              1        0
84843               0           0                              0        0
84871               0           0                              0        0
84952               0           0                              0        0
85734               0           0                              0        0
86820               1           0                              0        0
86842               0           0                              0        0
86845               0           0                              0        0
86862               0           0                              1        0
87041               0           0                              0        0
87139               0           0                              0        0
87297               1           0                              0        0
87363               0           0                              0        0
87557               0           0                              0        0
87762               0           0                              0        0
87911               0           0                              0        0
88111               0           0                              0        0
88240               0           0                              0        0
88378               0           0                              0        0
88571               0           0                              0        0
88733               0           0                              0        0
88797               0           0                              0        0
89057               0           0                              0        0
89060               0           0                              0        0
89697               0           1                              0        0
90006               0           0                              0        0

       Stock Holding  Storytelling  Take That  Tile Placement  Time Track  \
100                0             0          0               0           0
133                0             0          1               0           0
152                0             0          0               0           0
221                0             0          0               0           0
258                0             0          0               0           0
337                0             0          0               0           0
402                0             0          0               0           0
430                0             0          0               0           0
447                0             0          0               0           0
504                0             0          0               0           0
508                0             0          0               0           0
511                0             0          0               0           0
526                0             0          0               1           0
551                0             0          0               1           0
571                0             0          0               0           0
575                0             0          0               0           0
597                0             0          1               0           0
611                0             0          0               0           0
619                0             0          0               0           0
```

```
629                0             0          0               0           0
644                0             0          0               0           0
650                0             0          0               0           0
668                0             0          0               0           0
768                0             0          0               0           0
774                0             0          0               0           0
780                0             0          0               0           0
899                0             0          0               0           0
1015               0             0          0               0           0
1020               0             0          0               0           0
1063               0             0          0               0           0
...              ...           ...        ...             ...         ...
84695              0             0          0               0           0
84698              0             0          0               0           0
84739              0             0          1               0           0
84827              0             0          0               0           0
84828              0             0          0               0           0
84843              0             0          0               0           0
84871              0             0          0               0           0
84952              0             0          0               0           0
85734              0             0          0               0           0
86820              0             0          1               0           0
86842              0             0          0               0           0
86845              0             0          0               0           0
86862              0             0          0               0           0
87041              0             0          0               0           0
87139              0             0          0               0           0
87297              0             0          0               0           0
87363              0             0          1               0           0
87557              0             0          0               0           0
87762              0             0          0               0           0
87911              0             0          0               0           0
88111              0             0          0               0           0
88240              0             0          0               0           0
88378              0             0          0               0           0
88571              0             0          0               1           0
88733              0             0          0               0           0
88797              0             0          0               0           0
89057              0             0          0               0           0
89060              0             0          0               0           0
89697              0             0          0               0           0
90006              0             1          0               0           0

       Trading  Trick-taking  Variable Phase Order  Variable Player Powers  \
100          0             0                     0                       0
133          0             0                     0                       0
152          0             0                     0                       1
221          0             0                     0                       0
```

258	0	0	0	0
337	0	0	0	0
402	0	1	0	0
430	0	0	0	0
447	0	0	0	0
504	0	0	0	0
508	0	0	0	0
511	0	0	0	0
526	0	0	0	0
551	0	0	0	0
571	0	1	0	0
575	0	0	0	0
597	0	0	0	0
611	0	1	0	0
619	0	0	0	0
629	0	0	0	0
644	0	0	0	0
650	0	0	0	0
668	0	0	0	0
768	0	0	0	0
774	0	0	0	0
780	0	0	0	0
899	0	0	0	0
1015	0	0	0	0
1020	0	0	0	0
1063	0	0	0	0
...	...	...	...	...
84695	0	0	0	0
84698	0	0	0	1
84739	0	0	0	0
84827	0	0	0	0
84828	0	0	0	0
84843	0	0	0	0
84871	0	0	0	0
84952	0	0	0	0
85734	0	0	0	0
86820	0	0	0	0
86842	0	0	0	0
86845	0	0	0	0
86862	0	0	1	0
87041	0	0	0	0
87139	0	0	0	0
87297	0	0	0	0
87363	0	0	0	0
87557	0	0	0	0
87762	0	0	0	0
87911	0	0	0	0
88111	0	1	0	0

```
88240        0             0                     0                       1
88378        0             0                     0                       1
88571        0             0                     0                       0
88733        0             0                     0                       0
88797        0             0                     0                       0
89057        0             0                     0                       0
89060        0             0                     0                       0
89697        0             0                     0                       0
90006        0             0                     0                       1

       Voting  Worker Placement  binned.average  binary.success
100         0                 0             5.0               0
133         0                 0             4.0               0
152         0                 0             5.0               0
221         0                 0             4.0               0
258         0                 0             7.0               1
337         0                 0             6.0               0
402         0                 0             6.0               0
430         0                 0             5.0               0
447         0                 0             5.0               0
504         0                 0             6.0               0
508         0                 0             5.0               0
511         0                 0             4.0               0
526         0                 0             6.0               0
551         0                 0             5.0               0
571         0                 0             6.0               0
575         0                 0             6.0               0
597         0                 0             6.0               0
611         0                 0             7.0               1
619         0                 0             6.0               0
629         0                 0             6.0               0
644         0                 0             5.0               0
650         0                 0             6.0               0
668         0                 0             5.0               0
768         0                 0             6.0               0
774         0                 0             4.0               0
780         0                 0             6.0               0
899         0                 0             6.0               0
1015        0                 0             5.0               0
1020        0                 0             4.0               0
1063        0                 0             5.0               0
...       ...               ...             ...             ...
84695       0                 0             8.0               1
84698       0                 0             7.0               1
84739       0                 0             7.0               1
84827       0                 0             6.0               0
84828       0                 0             6.0               0
84843       0                 0             8.0               1
```

```
84871       0                  1            6.0                0
84952       0                  0            7.0                1
85734       0                  0            8.0                1
86820       0                  0            7.0                1
86842       0                  0            7.0                1
86845       0                  0            6.0                0
86862       0                  0            7.0                1
87041       0                  0            7.0                1
87139       0                  0            7.0                1
87297       0                  0            7.0                1
87363       0                  0            5.0                0
87557       0                  0            6.0                0
87762       0                  0            7.0                1
87911       0                  0            8.0                1
88111       0                  0            6.0                0
88240       0                  0            7.0                1
88378       0                  0            7.0                1
88571       0                  0            7.0                1
88733       0                  0            7.0                1
88797       0                  0            8.0                1
89057       0                  0            8.0                1
89060       0                  0            7.0                1
89697       0                  0            8.0                1
90006       0                  0            8.0                1

[2089 rows x 147 columns]
```

```
In [40]: df_data.loc[df_data['details.minage']==42]
```

```
Out[40]:                  details.name  details.maxplayers  details.minage  \
         50948  South African Railroads                 6.0            42.0

                details.minplayers  details.playingtime  details.yearpublished  \
         50948                 3.0                 40.0                 2011.0

                stats.averageweight  stats.average  stats.owned  stats.stddev  \
         50948               3.1667        7.58116         89.0       1.24822

                Abstract Strategy  Action / Dexterity  Adventure  Age of Reason  \
         50948                  0                   0          0              0

                American Civil War  American Indian Wars  American Revolutionary War  \
         50948                   0                     0                           0

                American West  Ancient  Animals  Arabian  Aviation / Flight  Bluffing  \
         50948              0        0        0        0                  0         0

                Book  Card Game  Children's Game  City Building  Civil War  \
         50948     0          0                0              0          0

                Civilization  Collectible Components  Comic Book / Strip  Deduction  \
         50948             0                       0                   0          0

                Dice  Economic  Educational  Electronic  Environmental  \
         50948     0         1            0           0              0

                Expansion for Base-game  Exploration  Fan Expansion  Fantasy  Farming  \
         50948                        0            0              0        0        0

                Fighting  Game System  Horror  Humor  Industry / Manufacturing  \
         50948         0            0       0      0                         0

                Korean War  Mafia  Math       ...        Area Control / Area Influence  \
         50948           0      0     0       ...                                    0

                Area Enclosure  Area Movement  Area-Impulse  Auction/Bidding  \
         50948               0              0             0                1

                Betting/Wagering  Campaign / Battle Card Driven  Card Drafting  \
         50948                 0                              0              0

                Chit-Pull System  Co-operative Play  Commodity Speculation  \
         50948                 0                  0                      0

                Crayon Rail System  Deck / Pool Building  Dice Rolling  Grid Movement  \
         50948                   0                     0             0              0

                Hand Management  Hex-and-Counter  Line Drawing  Memory_mechanics  \
         50948                0                0             0                 0

                Modular Board  Paper-and-Pencil  Partnerships  Pattern Building  \
         50948              0                 0             0                 0

                Pattern Recognition  Pick-up and Deliver  Player Elimination  \
         50948                    0                    0                   0

                Point to Point Movement  Press Your Luck  Rock-Paper-Scissors  \
         50948                        0                0                    0

                Role Playing  Roll / Spin and Move  Route/Network Building  \
         50948             0                     0                       0

                Secret Unit Deployment  Set Collection  Simulation  \
         50948                       0               0           0

                Simultaneous Action Selection  Singing  Stock Holding  Storytelling  \
         50948                              0        0              1             0

                Take That  Tile Placement  Time Track  Trading  Trick-taking  \
         50948          0               0           0        0             0

                Variable Phase Order  Variable Player Powers  Voting  Worker Placement  \
         50948                     0                       0       0                 0

                binned.average  binary.success
         50948             7.0               1

         [1 rows x 147 columns]
```

We observe some interesting records, with a non-trival number of games that have a minimum age of 0, and one game, the infamous game, “South African Railroads,” at the maximum extremes. As there are some board games that might be suitable for children, to distinguish between games that have been mis-inputted, we will set the minimum age to 1. While not thrilled about including South African Railroad’s 42 year minimum age in (but very much morbidly curious), we will nevertheless keep it in.

```
In [41]: df_data2 = df_data1[(df_data1['details.minage']>=1)]
```

```
In [42]: df_data1['details.minage'].count()-df_data2['details.minage'].count()
```

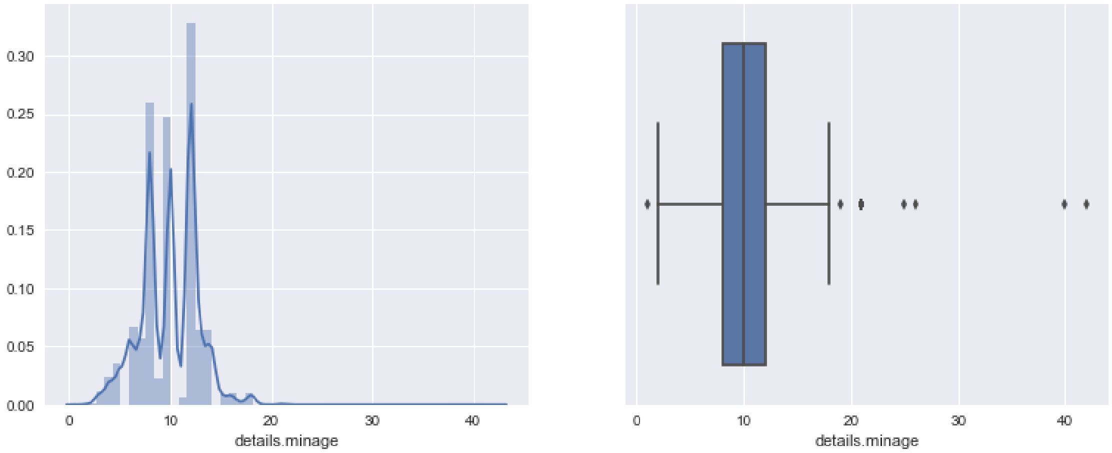
```
Out[42]: 1971
```

```
In [43]: df_data2['details.minage'].count()
```

```
Out[43]: 18396
```

```
In [44]: analyze_feature(df_data2, "details.minage")
```

```
count    18396.000000
mean         9.952327
std          2.788389
min          1.000000
25%          8.000000
50%         10.000000
75%         12.000000
max         42.000000
Name: details.minage, dtype: float64
```

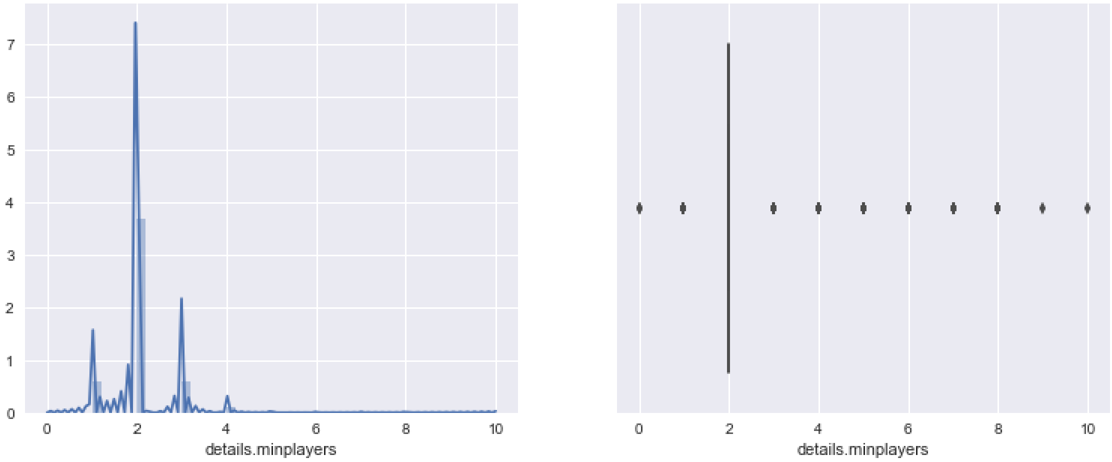


We eliminated 1971 games based upon the parameter that the value of minimum age was zero, and are now left with 18396 records.

MinPlayers

```
In [45]: analyze_feature(df_data2, "details.minplayers")
```

```
count    18396.000000
mean         2.070450
std          0.662213
min          0.000000
25%          2.000000
50%          2.000000
75%          2.000000
max         10.000000
Name: details.minplayers, dtype: float64
```



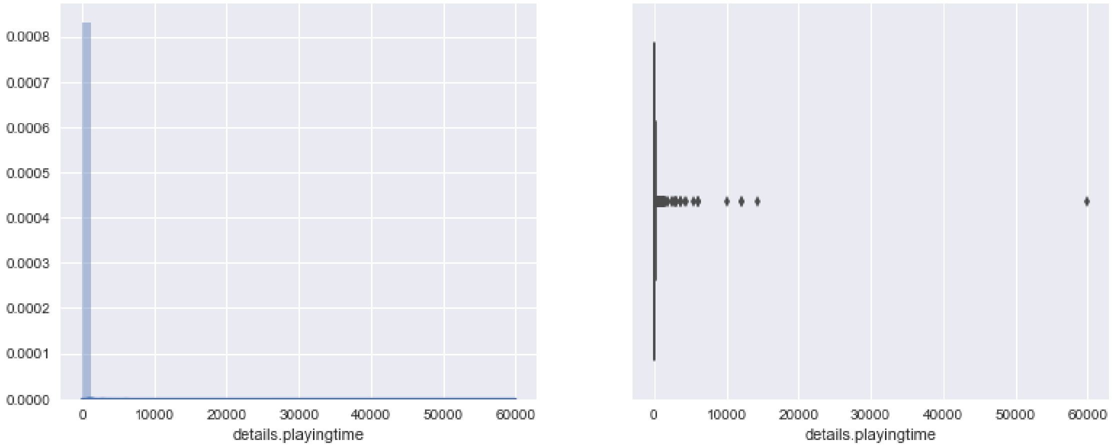
We still see the issue that somes games have a minimum number of players that are equivalent to zero. As stated above, we believe that this does not make logical sense and we will filter these games out.

```
In [46]: df_data3 = df_data2[(df_data2['details.minplayers']>=1)]

In [47]: df_data2['details.minage'].count()-df_data3['details.minage'].count()

Out[47]: 4

In [48]: df_data3['details.minplayers'].describe()

Out[48]: count    18392.000000
         mean         2.070900
         std          0.661581
         min          1.000000
         25%          2.000000
         50%          2.000000
         75%          2.000000
         max         10.000000
         Name: details.minplayers, dtype: float64
```

We have filtered out four games and now have 18392 records

Playing Time

```
In [49]: analyze_feature(df_data3, "details.playingtime")

count    18392.000000
mean        75.952371
std        499.378068
min          0.000000
25%         20.000000
50%         45.000000
75%         90.000000
max      60000.000000
Name: details.playingtime, dtype: float64
```



```
In [50]: df_data3.loc[df_data['details.playingtime']==60000]
```

```
Out[50]:                        details.name  details.maxplayers  details.minage  \
         4360  The Campaign for North Africa                10.0            14.0

               details.minplayers  details.playingtime  details.yearpublished  \
         4360                 8.0              60000.0                 1979.0

               stats.averageweight  stats.average  stats.owned  stats.stddev  \
         4360                  5.0        5.62887        283.0       2.77789

               Abstract Strategy  Action / Dexterity  Adventure  Age of Reason  \
         4360                  0                   0          0              0

               American Civil War  American Indian Wars  American Revolutionary War  \
         4360                   0                     0                           0

               American West  Ancient  Animals  Arabian  Aviation / Flight  Bluffing  \
         4360              0        0        0        0                  0         0

               Book  Card Game  Children's Game  City Building  Civil War  \
         4360     0          0                0              0          0

               Civilization  Collectible Components  Comic Book / Strip  Deduction  \
         4360             0                       0                   0          0

               Dice  Economic  Educational  Electronic  Environmental  \
         4360     0         0            0           0              0

               Expansion for Base-game  Exploration  Fan Expansion  Fantasy  Farming  \
         4360                        0            0              0        0        0
```

```
    Fighting  Game System  Horror  Humor  Industry / Manufacturing  \
4360         0            0       0      0                         0

    Korean War  Mafia  Math       ...        Area Control / Area Influence  \
4360           0      0     0       ...                                    0

    Area Enclosure  Area Movement  Area-Impulse  Auction/Bidding  \
4360               0              0             0                0

    Betting/Wagering  Campaign / Battle Card Driven  Card Drafting  \
4360                 0                              0              0

    Chit-Pull System  Co-operative Play  Commodity Speculation  \
4360                 0                  0                      0

    Crayon Rail System  Deck / Pool Building  Dice Rolling  Grid Movement  \
4360                   0                     0             0              0

    Hand Management  Hex-and-Counter  Line Drawing  Memory_mechanics  \
4360                0                1             0                 0

    Modular Board  Paper-and-Pencil  Partnerships  Pattern Building  \
4360              0                 0             0                 0

    Pattern Recognition  Pick-up and Deliver  Player Elimination  \
4360                    0                    0                   0

    Point to Point Movement  Press Your Luck  Rock-Paper-Scissors  \
4360                        0                0                    0

    Role Playing  Roll / Spin and Move  Route/Network Building  \
4360             0                     0                       0

    Secret Unit Deployment  Set Collection  Simulation  \
4360                       0               0           0

    Simultaneous Action Selection  Singing  Stock Holding  Storytelling  \
4360                              0        0              0             0

    Take That  Tile Placement  Time Track  Trading  Trick-taking  \
4360          0               0           0        0             0

    Variable Phase Order  Variable Player Powers  Voting  Worker Placement  \
4360                     0                       0       0                 0

    binned.average  binary.success
4360             5.0               0
```

```
[1 rows x 147 columns]
```

```
In [51]: df_data3.loc[df_data3['details.playingtime']==0]
```

```
Out[51]:
                                            details.name  details.maxplayers  \
20                                  Gateway to the Stars                 7.0
50                                              Brauerei                 6.0
52                                        Sophie's World                 6.0
250                             Neue Spiele im alten Rom                 7.0
251                                 Ostindiska Kompaniet                 5.0
439                                                Pacal                 2.0
482                                           Ice Blocks                 2.0
489                                           Flohzirkus                 4.0
491                                            Aerodrome                12.0
581                                           Vox Populi                 6.0
664                                    War of Resistance                 2.0
676                                         Lunatix Loop                 6.0
681                                      Formula C Minus                 6.0
724                                               Amoeba                 4.0
771                                                 Fire                 5.0
819                                               Corner                 4.0
864                                                 1848                 2.0
871                                         Panda Monium                 6.0
1004                                           Dow Jones                 7.0
1163                                    Legend of Heroes                 5.0
1191                            Abenteuer im Wichtelwald                 4.0
1192                                         Aber Hallo!                 4.0
1195                                         Alles klar?                 5.0
1200                                              Basta!                 6.0
1775                                               Votum                 6.0
1783                                     The Gothic Game                 8.0
1787                                        Steinbeisser                 6.0
2216                                         Chaos Tiles                 5.0
2217                                     The Chicago Way                 4.0
2226                                       Express Chess                 2.0
...                                                  ...                 ...
87579                              Avec Infini Regret II                 2.0
87655                  Lady Richmond: Ein erzocktes Erbe                 5.0
87657                                        Drachenturm                 4.0
87679                                          Picassimo                 6.0
87681                                       Hamsterbande                 4.0
87714                                              Totem                 4.0
87963                                             SLAPZI                10.0
87985               Doctor Who: Time Clash  Starter Set                 4.0
88025  Magic: The Gathering  Duel Decks: Elspeth vs...                 2.0
88028  Magic: The Gathering  Duel Decks: Venser vs. ...                 2.0
88030  Magic: The Gathering  Duel Decks: Sorin vs. T...                 2.0
88031  Magic: The Gathering  Duel Decks: Heroes vs. ...                 2.0
```

```
88033  Magic: The Gathering  Duel Decks: Elspeth vs...                2.0
88034  Magic: The Gathering  Duel Decks: Nissa vs. O...                2.0
88209                                         Take That                 4.0
88328                                      Balloon Pop!                10.0
88500                          Level 8: Das Kartenspiel                 6.0
88505                                      Tzulan Quest                 5.0
88624                                        Braintopia                 6.0
88629                         The Legend of the Wendigo                 6.0
88630                                          Pyramids                 5.0
88698           The Terminator: The Official Board Game                 5.0
88699         Ascension: Year Three Collector's Edition                 6.0
88920                                   Watch Ya' Mouth                10.0
89080                                              IKAN                 4.0
89546                           Qwinto: Das Kartenspiel                 4.0
89549                                        Twenty One                 6.0
89786                              Deckscape: Test Time                 6.0
89788                                         3 Secrets                 8.0
89821                           Aeon's End: War Eternal                 4.0

       details.minage  details.minplayers  details.playingtime  \
20               12.0                 1.0                  0.0
50               14.0                 3.0                  0.0
52               12.0                 2.0                  0.0
250              10.0                 2.0                  0.0
251              10.0                 2.0                  0.0
439              12.0                 2.0                  0.0
482              10.0                 2.0                  0.0
489               5.0                 2.0                  0.0
491              12.0                 2.0                  0.0
581              12.0                 3.0                  0.0
664              12.0                 2.0                  0.0
676              10.0                 4.0                  0.0
681              10.0                 2.0                  0.0
724               8.0                 2.0                  0.0
771               6.0                 2.0                  0.0
819              10.0                 2.0                  0.0
864              12.0                 2.0                  0.0
871               6.0                 3.0                  0.0
1004             12.0                 3.0                  0.0
1163              8.0                 1.0                  0.0
1191              8.0                 2.0                  0.0
1192             10.0                 3.0                  0.0
1195             10.0                 2.0                  0.0
1200              9.0                 2.0                  0.0
1775             14.0                 4.0                  0.0
1783             10.0                 2.0                  0.0
1787              7.0                 2.0                  0.0
2216              8.0                 1.0                  0.0
```

```
2217             14.0                 3.0                  0.0
2226              8.0                 2.0                  0.0
...               ...                 ...                  ...
87579            12.0                 2.0                  0.0
87655             8.0                 2.0                  0.0
87657             5.0                 2.0                  0.0
87679             8.0                 3.0                  0.0
87681             4.0                 1.0                  0.0
87714             7.0                 2.0                  0.0
87963             8.0                 2.0                  0.0
87985            14.0                 2.0                  0.0
88025            13.0                 2.0                  0.0
88028            13.0                 2.0                  0.0
88030            13.0                 2.0                  0.0
88031            13.0                 2.0                  0.0
88033            13.0                 2.0                  0.0
88034            13.0                 2.0                  0.0
88209             8.0                 2.0                  0.0
88328            13.0                 1.0                  0.0
88500            10.0                 2.0                  0.0
88505             8.0                 2.0                  0.0
88624             8.0                 2.0                  0.0
88629             6.0                 2.0                  0.0
88630            10.0                 2.0                  0.0
88698            14.0                 2.0                  0.0
88699            13.0                 1.0                  0.0
88920             8.0                 3.0                  0.0
89080             8.0                 2.0                  0.0
89546             8.0                 1.0                  0.0
89549             8.0                 2.0                  0.0
89786            12.0                 1.0                  0.0
89788            14.0                 2.0                  0.0
89821            14.0                 1.0                  0.0

       details.yearpublished  stats.averageweight  stats.average  stats.owned  \
20                    1981.0               3.0000        5.35714         80.0
50                    1996.0               3.0000        5.83148         85.0
52                    1998.0               1.5714        4.93768        184.0
250                   1994.0               2.1818        6.81040        390.0
251                   1991.0               2.5455        4.75000        196.0
439                   1999.0               1.6667        6.19779        132.0
482                   2000.0               1.5000        5.38462         21.0
489                   1997.0               1.0000        6.68182         28.0
491                   1994.0               2.1667        7.63393         60.0
581                   1999.0               2.1111        4.45733        200.0
664                   1998.0               4.5000        6.86226        230.0
676                   2000.0               2.0000        6.26538         69.0
681                   2000.0               1.0000        4.81034         75.0
```

```
724                   1975.0            2.0000       5.99359       88.0
771                   1996.0            1.1429       6.09643      127.0
819                   1980.0            1.6000       6.42632       95.0
864                   1998.0            3.0000       4.54348       80.0
871                   1994.0            1.0000       5.38559      229.0
1004                  1993.0            0.0000       2.78571       24.0
1163                  1987.0            1.4000       5.64634      129.0
1191                  2000.0            0.0000       5.78947       46.0
1192                  2000.0            1.8000       5.62963       59.0
1195                  1999.0            2.0000       5.28947       39.0
1200                  1994.0            1.0000       4.36667       29.0
1775                  1987.0            2.0000       2.84615       56.0
1783                  1992.0            1.3846       6.44103       99.0
1787                  1999.0            0.0000       5.50000       22.0
2216                  1999.0            2.0000       5.24146      101.0
2217                  2000.0            1.5000       3.27308       74.0
2226                  1996.0            0.0000       4.58333       85.0
...                      ...               ...           ...        ...
87579                 2016.0            3.0000       7.41176       77.0
87655                 2016.0            2.0000       5.75000       50.0
87657                 2016.0            1.3333       6.39259       44.0
87679                 2016.0            2.0000       6.32143       49.0
87681                 2016.0            1.0000       5.80769       34.0
87714                 2016.0            0.0000       4.80263       15.0
87963                 2015.0            1.0000       6.16538       31.0
87985                 2016.0            2.6667       6.02500       63.0
88025                 2010.0            0.0000       7.52727       23.0
88028                 2012.0            0.0000       7.34545       29.0
88030                 2013.0            0.0000       8.27273       36.0
88031                 2013.0            0.0000       7.63846       54.0
88033                 2015.0            4.0000       8.20833       51.0
88034                 2016.0            0.0000       7.59615       68.0
88209                 2016.0            2.0000       6.34615      108.0
88328                 2017.0            1.0000       6.37143       85.0
88500                 2016.0            1.0000       5.00000       98.0
88505                 2016.0            2.0000       5.81818       28.0
88624                 2017.0            1.5000       7.12702      121.0
88629                 2017.0            0.0000       6.64706       43.0
88630                 2017.0            2.0000       7.02499      221.0
88698                 2017.0            0.0000       8.43478       30.0
88699                 2016.0            0.0000       8.81579       99.0
88920                 2016.0            0.0000       5.15618       95.0
89080                 2017.0            2.0000       9.36667        0.0
89546                 2017.0            0.0000       6.74375       31.0
89549                 2017.0            1.0000       6.37356      126.0
89786                 2017.0            1.0000       7.32069       70.0
89788                 2017.0            2.0000       6.46364       38.0
89821                 2017.0            0.0000       9.28333       56.0
```

```
       stats.stddev  Abstract Strategy  Action / Dexterity  Adventure  \
20         1.673620                  0                   0          0
50         1.339370                  0                   0          0
52         1.958640                  0                   0          0
250        1.359410                  1                   0          0
251        1.599580                  0                   0          0
439        1.043010                  0                   0          0
482        1.227160                  1                   0          0
489        1.108900                  0                   1          0
491        1.344330                  0                   0          0
581        1.629740                  0                   0          0
664        1.826870                  0                   0          0
676        1.431590                  0                   0          0
681        1.821390                  0                   0          0
724        1.256380                  1                   0          0
771        1.288200                  0                   1          0
819        1.558790                  1                   0          0
864        2.058460                  0                   0          0
871        1.272990                  0                   1          0
1004       1.566550                  0                   0          0
1163       1.440880                  0                   0          1
1191       1.150700                  0                   0          0
1192       1.848890                  0                   0          0
1195       1.228130                  0                   0          0
1200       1.793200                  0                   0          0
1775       1.511300                  0                   0          0
1783       1.920170                  0                   0          0
1787       1.066000                  0                   0          0
2216       1.805270                  1                   0          0
2217       1.588070                  0                   0          0
2226       1.879860                  1                   0          0
...             ...                ...                 ...        ...
87579      0.911290                  0                   0          0
87655      1.462680                  0                   0          0
87657      1.577840                  0                   1          0
87679      1.304570                  0                   0          0
87681      2.135220                  0                   0          0
87714      1.273670                  0                   0          0
87963      1.248290                  0                   1          0
87985      1.945990                  0                   0          0
88025      2.423030                  0                   0          0
88028      2.528520                  0                   0          0
88030      1.542780                  0                   0          0
88031      1.713990                  0                   0          0
88033      1.406210                  0                   0          0
88034      2.344260                  0                   0          0
88209      1.297850                  0                   0          0
```

```
88328      1.104170                  0                  0          0
88500      1.710260                  0                  0          0
88505      2.308800                  0                  0          1
88624      0.977128                  0                  0          0
88629      1.233890                  0                  0          0
88630      1.152370                  0                  0          0
88698      2.410590                  0                  0          0
88699      0.846207                  0                  0          0
88920      1.742080                  0                  0          0
89080      0.865384                  0                  0          1
89546      1.669190                  0                  0          0
89549      1.381530                  0                  0          0
89786      0.882934                  0                  0          0
89788      1.270490                  0                  0          0
89821      1.737020                  0                  0          0

       Age of Reason  American Civil War  American Indian Wars  \
20                 0                   0                     0
50                 0                   0                     0
52                 0                   0                     0
250                0                   0                     0
251                0                   0                     0
439                0                   0                     0
482                0                   0                     0
489                0                   0                     0
491                0                   0                     0
581                0                   0                     0
664                0                   0                     0
676                0                   0                     0
681                0                   0                     0
724                0                   0                     0
771                0                   0                     0
819                0                   0                     0
864                0                   0                     0
871                0                   0                     0
1004               0                   0                     0
1163               0                   0                     0
1191               0                   0                     0
1192               0                   0                     0
1195               0                   0                     0
1200               0                   0                     0
1775               0                   0                     0
1783               0                   0                     0
1787               0                   0                     0
2216               0                   0                     0
2217               0                   0                     0
2226               0                   0                     0
...              ...                 ...                   ...
```

```
87579              0                   0                     0
87655              0                   0                     0
87657              0                   0                     0
87679              0                   0                     0
87681              0                   0                     0
87714              0                   0                     0
87963              0                   0                     0
87985              0                   0                     0
88025              0                   0                     0
88028              0                   0                     0
88030              0                   0                     0
88031              0                   0                     0
88033              0                   0                     0
88034              0                   0                     0
88209              0                   0                     0
88328              0                   0                     0
88500              0                   0                     0
88505              0                   0                     0
88624              0                   0                     0
88629              0                   0                     0
88630              0                   0                     0
88698              0                   0                     0
88699              0                   0                     0
88920              0                   0                     0
89080              0                   0                     0
89546              0                   0                     0
89549              0                   0                     0
89786              0                   0                     0
89788              0                   0                     0
89821              0                   0                     0

       American Revolutionary War  American West  Ancient  Animals  Arabian  \
20                              0              0        0        0        0
50                              0              0        0        0        0
52                              0              0        0        0        0
250                             0              0        0        0        0
251                             0              0        0        0        0
439                             0              0        0        0        0
482                             0              0        0        0        0
489                             0              0        0        0        0
491                             0              0        0        0        0
581                             0              0        0        0        0
664                             0              0        0        0        0
676                             0              0        0        0        0
681                             0              0        0        0        0
724                             0              0        0        0        0
771                             0              0        0        0        0
819                             0              0        0        0        0
```

```
864                             0              0        0        0        0
871                             0              0        0        0        0
1004                            0              0        0        0        0
1163                            0              0        0        0        0
1191                            0              0        0        0        0
1192                            0              0        0        0        0
1195                            0              0        0        0        0
1200                            0              0        0        0        0
1775                            0              0        0        0        0
1783                            0              0        0        0        0
1787                            0              0        0        0        0
2216                            0              0        0        0        0
2217                            0              0        0        0        0
2226                            0              0        0        0        0
...                           ...            ...      ...      ...      ...
87579                           0              0        0        0        0
87655                           0              0        0        0        0
87657                           0              0        0        0        0
87679                           0              0        0        0        0
87681                           0              0        0        1        0
87714                           0              0        0        0        0
87963                           0              0        0        0        0
87985                           0              0        0        0        0
88025                           0              0        0        0        0
88028                           0              0        0        0        0
88030                           0              0        0        0        0
88031                           0              0        0        0        0
88033                           0              0        0        0        0
88034                           0              0        0        0        0
88209                           0              0        0        0        0
88328                           0              0        0        0        0
88500                           0              0        0        0        0
88505                           0              0        0        0        0
88624                           0              0        0        0        0
88629                           0              0        0        0        0
88630                           0              0        0        0        0
88698                           0              0        0        0        0
88699                           0              0        0        0        0
88920                           0              0        0        0        0
89080                           0              0        0        0        0
89546                           0              0        0        0        0
89549                           0              0        0        0        0
89786                           0              0        0        0        0
89788                           0              0        0        0        0
89821                           0              0        0        0        0

       Aviation / Flight  Bluffing  Book  Card Game  Children's Game  \
20                     0         0     0          0                0
```

50	0	0	0	0	0
52	0	0	0	0	0
250	0	0	0	0	0
251	0	0	0	0	0
439	0	0	0	1	0
482	0	0	0	0	0
489	0	0	0	0	0
491	1	0	0	0	0
581	0	0	0	0	0
664	0	0	0	0	0
676	0	0	0	0	0
681	0	0	0	0	0
724	0	0	0	0	0
771	0	0	0	0	0
819	0	0	0	0	0
864	0	0	0	1	0
871	0	0	0	1	1
1004	0	0	0	0	0
1163	0	0	0	0	0
1191	0	0	0	0	0
1192	0	0	0	1	0
1195	0	0	0	1	0
1200	0	0	0	1	0
1775	0	0	0	0	0
1783	0	0	0	0	0
1787	0	0	0	0	0
2216	0	0	0	0	0
2217	0	0	0	0	0
2226	0	0	0	1	0
...	...	...	...	...	...
87579	0	0	0	0	0
87655	0	1	0	1	0
87657	0	0	0	0	1
87679	0	0	0	0	0
87681	0	0	0	0	1
87714	0	0	0	0	0
87963	0	0	0	1	1
87985	0	0	0	1	0
88025	0	0	0	1	0
88028	0	0	0	1	0
88030	0	0	0	1	0
88031	0	0	0	1	0
88033	0	0	0	1	0
88034	0	0	0	1	0
88209	0	0	0	1	0
88328	0	0	0	0	0
88500	0	0	0	1	0
88505	0	0	0	1	0

```
88624                  0         0     0          0                0
88629                  0         0     0          0                1
88630                  0         0     0          1                0
88698                  0         0     0          0                0
88699                  0         0     0          1                0
88920                  0         0     0          0                0
89080                  0         0     0          0                0
89546                  0         0     0          1                0
89549                  0         0     0          0                0
89786                  0         0     0          0                0
89788                  0         0     0          0                0
89821                  0         0     0          1                0

       City Building  Civil War  Civilization  Collectible Components  \
20                 0          0             1                       0
50                 0          0             0                       0
52                 0          0             0                       0
250                0          0             0                       0
251                0          0             0                       0
439                0          0             0                       0
482                0          0             0                       0
489                0          0             0                       0
491                0          0             0                       0
581                0          0             0                       0
664                0          0             0                       0
676                0          0             0                       0
681                0          0             0                       0
724                0          0             0                       0
771                0          0             0                       0
819                0          0             0                       0
864                0          0             0                       0
871                0          0             0                       0
1004               0          0             0                       0
1163               0          0             0                       0
1191               0          0             0                       0
1192               0          0             0                       0
1195               0          0             0                       0
1200               0          0             0                       0
1775               0          0             0                       0
1783               0          0             0                       0
1787               0          0             0                       0
2216               0          0             0                       0
2217               0          0             0                       0
2226               0          0             0                       0
...              ...        ...           ...                     ...
87579              0          0             0                       0
87655              0          0             0                       0
87657              0          0             0                       0
```

```
87679              0          0             0                       0
87681              0          0             0                       0
87714              0          0             0                       0
87963              0          0             0                       0
87985              0          0             0                       0
88025              0          0             0                       0
88028              0          0             0                       0
88030              0          0             0                       0
88031              0          0             0                       0
88033              0          0             0                       0
88034              0          0             0                       0
88209              0          0             0                       0
88328              0          0             0                       0
88500              0          0             0                       0
88505              0          0             0                       0
88624              0          0             0                       0
88629              0          0             0                       0
88630              0          0             0                       0
88698              0          0             0                       0
88699              0          0             0                       0
88920              0          0             0                       0
89080              0          0             0                       0
89546              0          0             0                       0
89549              0          0             0                       0
89786              0          0             0                       0
89788              0          0             0                       0
89821              0          0             0                       0

       Comic Book / Strip  Deduction  Dice  Economic  Educational  Electronic  \
20                      0          0     0         0            0           0
50                      0          0     0         1            0           0
52                      0          0     0         0            0           0
250                     0          0     0         0            0           0
251                     0          0     0         1            0           0
439                     0          0     0         0            0           0
482                     0          0     0         0            0           0
489                     0          0     0         0            0           0
491                     0          0     0         0            0           0
581                     0          0     0         0            0           0
664                     0          0     0         0            0           0
676                     0          0     0         0            0           0
681                     0          0     0         0            0           0
724                     0          0     0         0            0           0
771                     0          0     0         0            0           0
819                     0          0     0         0            0           0
864                     0          0     0         0            0           0
871                     0          0     0         0            0           0
1004                    0          0     0         0            0           0
```

```
1163                    0          0     0         0            0           0
1191                    0          0     0         0            0           0
1192                    0          0     0         0            0           0
1195                    0          0     0         0            0           0
1200                    0          0     0         0            0           0
1775                    0          0     0         0            0           0
1783                    0          0     0         0            0           0
1787                    0          0     0         0            0           0
2216                    0          0     0         0            0           0
2217                    0          0     0         0            0           0
2226                    0          0     0         0            0           0
...                   ...        ...   ...       ...          ...         ...
87579                   0          0     0         0            0           0
87655                   0          0     0         0            0           0
87657                   0          0     0         0            0           0
87679                   0          1     0         0            0           0
87681                   0          0     1         0            0           0
87714                   0          0     0         0            0           0
87963                   0          0     0         0            1           0
87985                   0          0     0         0            0           0
88025                   0          0     0         0            0           0
88028                   0          0     0         0            0           0
88030                   0          0     0         0            0           0
88031                   0          0     0         0            0           0
88033                   0          0     0         0            0           0
88034                   0          0     0         0            0           0
88209                   0          0     0         0            0           0
88328                   0          0     1         0            0           0
88500                   0          0     0         0            0           0
88505                   0          0     0         0            0           0
88624                   0          0     0         0            0           0
88629                   0          0     0         0            0           0
88630                   0          0     0         0            0           0
88698                   0          0     0         0            0           0
88699                   0          0     0         0            0           0
88920                   0          0     0         0            0           0
89080                   0          0     0         0            0           0
89546                   0          0     0         0            0           0
89549                   0          0     1         0            0           0
89786                   0          0     0         0            0           0
89788                   0          1     0         0            0           0
89821                   0          0     0         0            0           0

       Environmental  Expansion for Base-game  Exploration  Fan Expansion  \
20                 0                        0            1              0
50                 0                        0            0              0
52                 0                        0            0              0
250                0                        0            0              0
```

251	0	0	0	0
439	0	0	0	0
482	0	0	0	0
489	0	0	0	0
491	0	0	0	0
581	0	0	0	0
664	0	0	0	0
676	0	0	0	0
681	0	0	0	0
724	0	0	0	0
771	0	0	0	0
819	0	0	0	0
864	0	0	0	0
871	0	0	0	0
1004	0	0	0	0
1163	0	0	0	0
1191	0	0	0	0
1192	0	0	0	0
1195	0	0	0	0
1200	0	0	0	0
1775	0	0	0	0
1783	0	0	0	0
1787	0	0	0	0
2216	0	0	0	0
2217	0	0	0	0
2226	0	0	0	0
...	...	...	...	...
87579	0	0	0	0
87655	0	0	0	0
87657	0	0	0	0
87679	0	0	0	0
87681	0	0	0	0
87714	0	0	0	0
87963	0	0	0	0
87985	0	0	0	0
88025	0	0	0	0
88028	0	0	0	0
88030	0	0	0	0
88031	0	0	0	0
88033	0	0	0	0
88034	0	0	0	0
88209	0	0	0	0
88328	0	0	0	0
88500	0	0	0	0
88505	0	0	1	0
88624	0	0	0	0
88629	0	0	0	0
88630	0	0	0	0

```
88698              0                        0            0              0
88699              0                        0            0              0
88920              0                        0            0              0
89080              0                        0            0              0
89546              0                        0            0              0
89549              0                        0            0              0
89786              0                        0            0              0
89788              0                        0            0              0
89821              0                        0            0              0

       Fantasy  Farming  Fighting  Game System  Horror  Humor  \
20           0        0         0            0       0      0
50           0        0         0            0       0      0
52           0        0         0            0       0      0
250          0        0         0            1       0      0
251          0        0         0            0       0      0
439          0        0         0            0       0      0
482          0        0         0            0       0      0
489          0        0         0            0       0      0
491          0        0         0            0       0      0
581          0        0         1            0       0      0
664          0        0         0            0       0      0
676          0        0         0            0       0      0
681          0        0         0            0       0      1
724          0        0         0            0       0      0
771          0        0         0            0       0      0
819          0        0         0            0       0      0
864          0        0         0            0       0      0
871          0        0         0            0       0      0
1004         0        0         0            0       0      0
1163         1        0         0            0       0      0
1191         0        0         0            0       0      0
1192         0        0         0            0       0      0
1195         0        0         0            0       0      0
1200         0        0         0            0       0      0
1775         0        0         0            0       0      0
1783         0        0         0            0       1      1
1787         0        0         0            0       0      0
2216         0        0         0            0       0      0
2217         0        0         0            0       0      0
2226         0        0         0            0       0      0
...        ...      ...       ...          ...     ...    ...
87579        0        0         0            0       0      0
87655        0        0         0            0       0      1
87657        1        0         0            0       0      0
87679        0        0         0            0       0      0
87681        0        0         0            0       0      0
87714        0        0         0            0       0      0
```

```
87963        0        0         0            0       0      0
87985        0        0         0            0       0      0
88025        1        0         1            0       0      0
88028        1        0         1            0       0      0
88030        1        0         1            0       0      0
88031        1        0         1            0       0      0
88033        1        0         1            0       0      0
88034        1        0         1            0       0      0
88209        0        0         0            0       0      0
88328        0        0         0            0       0      0
88500        0        0         0            0       0      0
88505        0        0         0            0       0      0
88624        0        0         0            0       0      0
88629        0        0         0            0       0      0
88630        0        0         0            0       0      0
88698        0        0         0            0       0      0
88699        1        0         0            0       0      0
88920        0        0         0            0       0      0
89080        0        0         0            0       0      0
89546        0        0         0            0       0      0
89549        0        0         0            0       0      0
89786        0        0         0            0       0      0
89788        0        0         0            0       0      0
89821        1        0         0            0       0      0

       Industry / Manufacturing  Korean War  Mafia  Math       ...        \
20                            0           0      0     0       ...
50                            0           0      0     0       ...
52                            0           0      0     0       ...
250                           0           0      0     0       ...
251                           0           0      0     0       ...
439                           0           0      0     0       ...
482                           0           0      0     0       ...
489                           0           0      0     0       ...
491                           0           0      0     0       ...
581                           0           0      0     0       ...
664                           0           0      0     0       ...
676                           0           0      0     0       ...
681                           0           0      0     0       ...
724                           0           0      0     0       ...
771                           0           0      0     0       ...
819                           0           0      0     0       ...
864                           0           0      0     0       ...
871                           0           0      0     0       ...
1004                          0           0      0     0       ...
1163                          0           0      0     0       ...
1191                          0           0      0     0       ...
1192                          0           0      0     0       ...
```

```
1195                          0           0      0     0       ...
1200                          0           0      0     0       ...
1775                          0           0      0     0       ...
1783                          0           0      0     0       ...
1787                          0           0      0     0       ...
2216                          0           0      0     0       ...
2217                          0           0      0     0       ...
2226                          0           0      0     0       ...
...                         ...         ...    ...   ...       ...
87579                         0           0      0     0       ...
87655                         0           0      0     0       ...
87657                         0           0      0     0       ...
87679                         0           0      0     0       ...
87681                         0           0      0     0       ...
87714                         0           0      0     0       ...
87963                         0           0      0     0       ...
87985                         0           0      0     0       ...
88025                         0           0      0     0       ...
88028                         0           0      0     0       ...
88030                         0           0      0     0       ...
88031                         0           0      0     0       ...
88033                         0           0      0     0       ...
88034                         0           0      0     0       ...
88209                         0           0      0     0       ...
88328                         0           0      0     0       ...
88500                         0           0      0     0       ...
88505                         0           0      0     0       ...
88624                         0           0      0     0       ...
88629                         0           0      0     0       ...
88630                         0           0      0     0       ...
88698                         0           0      0     0       ...
88699                         0           0      0     0       ...
88920                         0           0      0     0       ...
89080                         0           0      0     0       ...
89546                         0           0      0     0       ...
89549                         0           0      0     0       ...
89786                         0           0      0     0       ...
89788                         0           0      0     0       ...
89821                         0           0      0     0       ...

       Area Control / Area Influence  Area Enclosure  Area Movement  \
20                                 0               0              0
50                                 0               0              0
52                                 0               0              0
250                                0               0              0
251                                0               0              0
439                                0               0              0
482                                0               0              0
```

489	0	0	0
491	0	0	0
581	0	0	0
664	0	0	0
676	0	0	0
681	0	0	0
724	0	0	0
771	0	0	0
819	0	0	0
864	0	0	0
871	0	0	0
1004	0	0	0
1163	0	0	0
1191	0	0	0
1192	0	0	0
1195	0	0	0
1200	0	0	0
1775	0	0	0
1783	0	0	0
1787	0	0	0
2216	0	0	0
2217	0	0	0
2226	0	0	0
...	...	...	...
87579	0	0	0
87655	0	0	0
87657	0	0	0
87679	0	0	0
87681	0	0	0
87714	0	0	0
87963	0	0	0
87985	0	0	0
88025	0	0	0
88028	0	0	0
88030	0	0	0
88031	0	0	0
88033	0	0	0
88034	0	0	0
88209	0	0	0
88328	0	0	0
88500	0	0	0
88505	0	0	0
88624	0	0	0
88629	0	0	0
88630	0	0	0
88698	0	0	1
88699	0	0	0
88920	0	0	0

```
89080                              0               0              0
89546                              0               0              0
89549                              0               0              0
89786                              0               0              0
89788                              0               0              0
89821                              0               0              0

       Area-Impulse  Auction/Bidding  Betting/Wagering  \
20                0                0                 0
50                0                0                 0
52                0                0                 0
250               0                0                 0
251               0                0                 0
439               0                0                 0
482               0                0                 0
489               0                0                 0
491               0                0                 0
581               0                0                 0
664               0                0                 0
676               0                0                 0
681               0                0                 0
724               0                0                 0
771               0                0                 0
819               0                0                 0
864               0                0                 0
871               0                0                 0
1004              0                0                 0
1163              0                0                 0
1191              0                0                 0
1192              0                0                 0
1195              0                0                 0
1200              0                0                 0
1775              0                0                 0
1783              0                0                 0
1787              0                0                 0
2216              0                0                 0
2217              0                0                 0
2226              0                0                 0
...             ...              ...               ...
87579             0                0                 0
87655             0                1                 0
87657             0                0                 0
87679             0                0                 0
87681             0                0                 0
87714             0                0                 0
87963             0                0                 0
87985             0                0                 0
88025             0                0                 0
```

```
88028             0                0                 0
88030             0                0                 0
88031             0                0                 0
88033             0                0                 0
88034             0                0                 0
88209             0                0                 0
88328             0                0                 0
88500             0                0                 0
88505             0                0                 0
88624             0                0                 0
88629             0                0                 0
88630             0                0                 0
88698             0                0                 0
88699             0                0                 0
88920             0                0                 0
89080             0                0                 0
89546             0                0                 0
89549             0                0                 0
89786             0                0                 0
89788             0                0                 0
89821             0                0                 0

       Campaign / Battle Card Driven  Card Drafting  Chit-Pull System  \
20                                 0              0                 0
50                                 0              0                 0
52                                 0              0                 0
250                                0              0                 0
251                                0              0                 0
439                                0              0                 0
482                                0              0                 0
489                                0              0                 0
491                                0              0                 0
581                                0              0                 0
664                                0              0                 0
676                                0              0                 0
681                                0              0                 0
724                                0              0                 0
771                                0              0                 0
819                                0              0                 0
864                                0              0                 0
871                                0              0                 0
1004                               0              0                 0
1163                               0              0                 0
1191                               0              0                 0
1192                               0              0                 0
1195                               0              0                 0
1200                               0              0                 0
1775                               0              0                 0
```

```
1783                               0              0                 0
1787                               0              0                 0
2216                               0              0                 0
2217                               0              0                 0
2226                               0              0                 0
...                              ...            ...               ...
87579                              0              0                 0
87655                              0              0                 0
87657                              0              0                 0
87679                              0              0                 0
87681                              0              0                 0
87714                              0              0                 0
87963                              0              0                 0
87985                              0              0                 0
88025                              1              0                 0
88028                              1              0                 0
88030                              1              0                 0
88031                              1              0                 0
88033                              1              0                 0
88034                              1              0                 0
88209                              0              0                 0
88328                              0              0                 0
88500                              0              0                 0
88505                              0              0                 0
88624                              0              0                 0
88629                              0              0                 0
88630                              0              1                 0
88698                              0              0                 0
88699                              0              0                 0
88920                              0              0                 0
89080                              0              0                 0
89546                              0              0                 0
89549                              0              0                 0
89786                              0              0                 0
89788                              0              0                 0
89821                              0              1                 0

       Co-operative Play  Commodity Speculation  Crayon Rail System  \
20                     0                      0                   0
50                     0                      0                   0
52                     0                      0                   0
250                    0                      0                   0
251                    0                      1                   0
439                    0                      0                   0
482                    0                      0                   0
489                    0                      0                   0
491                    0                      0                   0
581                    0                      0                   0
```

664	0	0	0
676	0	0	0
681	0	0	0
724	0	0	0
771	0	0	0
819	0	0	0
864	0	0	0
871	0	0	0
1004	0	0	0
1163	0	0	0
1191	0	0	0
1192	0	0	0
1195	0	0	0
1200	0	0	0
1775	0	0	0
1783	0	0	0
1787	0	0	0
2216	0	0	0
2217	0	0	0
2226	0	0	0
...	...	...	...
87579	0	0	0
87655	0	0	0
87657	1	0	0
87679	0	0	0
87681	1	0	0
87714	0	0	0
87963	0	0	0
87985	0	0	0
88025	0	0	0
88028	0	0	0
88030	0	0	0
88031	0	0	0
88033	0	0	0
88034	0	0	0
88209	0	0	0
88328	0	0	0
88500	0	0	0
88505	0	0	0
88624	0	0	0
88629	0	0	0
88630	0	0	0
88698	1	0	0
88699	0	0	0
88920	0	0	0
89080	1	0	0
89546	0	0	0
89549	0	0	0

```
89786                  1                      0                   0
89788                  1                      0                   0
89821                  1                      0                   0

       Deck / Pool Building  Dice Rolling  Grid Movement  Hand Management  \
20                        0             0              0                0
50                        0             0              0                0
52                        0             0              0                0
250                       0             0              0                0
251                       0             0              0                0
439                       0             0              0                1
482                       0             0              0                0
489                       0             0              0                0
491                       0             0              0                0
581                       0             0              0                0
664                       0             0              0                0
676                       0             0              0                0
681                       0             1              0                1
724                       0             0              0                0
771                       0             0              0                0
819                       0             0              0                0
864                       0             0              0                0
871                       0             0              0                0
1004                      0             1              0                0
1163                      0             0              0                0
1191                      0             0              0                0
1192                      0             0              0                0
1195                      0             0              0                1
1200                      0             0              0                0
1775                      0             0              0                0
1783                      0             0              0                0
1787                      0             0              0                0
2216                      0             0              0                0
2217                      0             0              0                0
2226                      0             0              1                0
...                     ...           ...            ...              ...
87579                     0             1              0                0
87655                     0             0              0                0
87657                     0             0              0                0
87679                     0             0              0                0
87681                     0             0              0                0
87714                     0             0              0                0
87963                     0             0              0                0
87985                     0             0              0                0
88025                     0             0              0                1
88028                     0             0              0                1
88030                     0             0              0                1
88031                     0             0              0                1
```

```
88033                     0             0              0                1
88034                     0             0              0                1
88209                     0             0              0                1
88328                     0             0              0                0
88500                     0             0              0                0
88505                     0             0              0                1
88624                     0             0              0                0
88629                     0             0              0                0
88630                     0             0              0                0
88698                     0             0              0                0
88699                     1             0              0                1
88920                     0             0              0                0
89080                     0             0              0                0
89546                     0             0              0                0
89549                     0             0              0                0
89786                     0             0              0                0
89788                     0             0              0                0
89821                     1             0              0                1

       Hex-and-Counter  Line Drawing  Memory_mechanics  Modular Board  \
20                   0             0                 0              0
50                   0             0                 0              0
52                   0             0                 0              0
250                  0             0                 0              0
251                  0             0                 0              0
439                  0             0                 0              0
482                  0             0                 0              0
489                  0             0                 0              0
491                  0             0                 0              0
581                  0             0                 0              0
664                  1             0                 0              0
676                  0             0                 0              0
681                  0             0                 0              0
724                  0             0                 0              0
771                  0             0                 0              0
819                  0             0                 0              0
864                  0             0                 0              0
871                  0             0                 0              0
1004                 0             0                 0              0
1163                 0             0                 0              0
1191                 0             0                 0              0
1192                 0             0                 0              0
1195                 0             0                 0              0
1200                 0             0                 0              0
1775                 0             0                 0              0
1783                 0             0                 0              0
1787                 0             0                 0              0
2216                 0             0                 0              0
```

```
2217                 0             0                 0              0
2226                 0             0                 0              0
...                ...           ...               ...            ...
87579                1             0                 0              0
87655                0             0                 0              0
87657                0             0                 1              0
87679                0             0                 0              1
87681                0             0                 0              0
87714                0             0                 0              0
87963                0             0                 0              0
87985                0             0                 0              0
88025                0             0                 0              0
88028                0             0                 0              0
88030                0             0                 0              0
88031                0             0                 0              0
88033                0             0                 0              0
88034                0             0                 0              0
88209                0             0                 0              0
88328                0             0                 0              0
88500                0             0                 0              0
88505                0             0                 0              0
88624                0             0                 0              0
88629                0             0                 1              0
88630                0             0                 0              0
88698                0             0                 0              0
88699                0             0                 0              0
88920                0             0                 0              0
89080                0             0                 1              1
89546                0             0                 0              0
89549                0             0                 0              0
89786                0             0                 0              0
89788                0             0                 0              0
89821                0             0                 0              0

       Paper-and-Pencil  Partnerships  Pattern Building  Pattern Recognition  \
20                    0             0                 0                    0
50                    0             0                 0                    0
52                    0             0                 0                    0
250                   0             0                 0                    0
251                   0             0                 0                    0
439                   0             0                 0                    0
482                   0             0                 0                    0
489                   0             0                 0                    0
491                   0             0                 0                    0
581                   0             0                 0                    0
664                   0             0                 0                    0
676                   0             0                 0                    0
681                   0             0                 0                    0
```

724	0	0	1	0
771	0	0	0	0
819	0	1	0	0
864	0	0	0	0
871	0	0	0	0
1004	0	0	0	0
1163	0	0	0	0
1191	0	0	0	0
1192	0	0	0	0
1195	0	0	0	0
1200	0	0	0	0
1775	0	0	0	0
1783	0	0	0	0
1787	0	0	0	0
2216	0	0	0	0
2217	0	0	0	0
2226	0	0	0	0
...	...	...	...	...
87579	0	0	0	0
87655	0	0	0	0
87657	0	0	0	0
87679	1	0	0	0
87681	0	0	0	0
87714	0	0	0	0
87963	0	0	0	0
87985	0	0	0	0
88025	0	0	0	0
88028	0	0	0	0
88030	0	0	0	0
88031	0	0	0	0
88033	0	0	0	0
88034	0	0	0	0
88209	0	0	0	0
88328	0	0	0	0
88500	0	0	0	0
88505	0	0	0	0
88624	0	0	0	0
88629	0	0	0	0
88630	0	0	1	0
88698	0	0	0	0
88699	0	0	0	0
88920	0	0	0	0
89080	0	0	0	0
89546	0	0	0	0
89549	0	0	0	0
89786	0	0	0	0
89788	0	0	0	0
89821	0	0	0	0

```
       Pick-up and Deliver  Player Elimination  Point to Point Movement  \
20                       0                   0                        0
50                       0                   0                        0
52                       0                   0                        0
250                      0                   0                        0
251                      1                   0                        0
439                      0                   0                        0
482                      0                   0                        0
489                      0                   0                        0
491                      0                   0                        0
581                      0                   0                        0
664                      0                   0                        0
676                      0                   0                        0
681                      0                   0                        0
724                      0                   0                        0
771                      0                   0                        0
819                      0                   0                        0
864                      0                   0                        0
871                      0                   0                        0
1004                     0                   0                        0
1163                     0                   0                        0
1191                     0                   0                        0
1192                     0                   0                        0
1195                     0                   0                        0
1200                     0                   0                        0
1775                     0                   0                        0
1783                     0                   0                        0
1787                     0                   0                        0
2216                     0                   0                        0
2217                     0                   0                        0
2226                     0                   0                        0
...                    ...                 ...                      ...
87579                    0                   0                        0
87655                    0                   0                        0
87657                    0                   0                        0
87679                    0                   0                        0
87681                    1                   0                        0
87714                    0                   0                        0
87963                    0                   0                        0
87985                    0                   0                        0
88025                    0                   1                        0
88028                    0                   1                        0
88030                    0                   1                        0
88031                    0                   1                        0
88033                    0                   1                        0
88034                    0                   1                        0
88209                    0                   0                        0
```

```
88328                    0                   0                        0
88500                    0                   0                        0
88505                    0                   0                        0
88624                    0                   0                        0
88629                    0                   0                        0
88630                    0                   0                        0
88698                    0                   0                        0
88699                    0                   0                        0
88920                    0                   0                        0
89080                    0                   0                        0
89546                    0                   0                        0
89549                    0                   0                        0
89786                    0                   0                        0
89788                    0                   0                        0
89821                    0                   0                        0

       Press Your Luck  Rock-Paper-Scissors  Role Playing  \
20                   0                    0             0
50                   0                    0             0
52                   0                    0             0
250                  0                    0             0
251                  0                    0             0
439                  0                    0             0
482                  0                    0             0
489                  0                    0             0
491                  0                    0             0
581                  0                    0             0
664                  0                    0             0
676                  0                    0             0
681                  0                    0             0
724                  0                    0             0
771                  0                    0             0
819                  0                    0             0
864                  0                    0             0
871                  0                    0             0
1004                 0                    0             0
1163                 0                    0             0
1191                 0                    0             0
1192                 0                    0             0
1195                 0                    0             0
1200                 1                    0             0
1775                 0                    0             0
1783                 0                    0             0
1787                 0                    0             0
2216                 0                    0             0
2217                 0                    0             0
2226                 0                    0             0
...                ...                  ...           ...
```

```
87579                0                    0             0
87655                1                    0             0
87657                0                    0             0
87679                0                    0             0
87681                0                    0             0
87714                0                    0             0
87963                0                    0             0
87985                0                    0             0
88025                0                    0             0
88028                0                    0             0
88030                0                    0             0
88031                0                    0             0
88033                0                    0             0
88034                0                    0             0
88209                0                    0             0
88328                1                    0             0
88500                0                    0             0
88505                0                    0             0
88624                0                    0             0
88629                0                    0             0
88630                0                    0             0
88698                0                    0             0
88699                0                    0             0
88920                0                    0             0
89080                0                    0             0
89546                0                    0             0
89549                0                    0             0
89786                0                    0             0
89788                0                    0             0
89821                0                    0             0

       Roll / Spin and Move  Route/Network Building  Secret Unit Deployment  \
20                        0                       0                       0
50                        0                       0                       0
52                        0                       0                       0
250                       0                       0                       0
251                       0                       0                       0
439                       0                       0                       0
482                       0                       0                       0
489                       0                       0                       0
491                       0                       0                       0
581                       0                       0                       0
664                       0                       0                       0
676                       0                       0                       0
681                       1                       0                       0
724                       0                       0                       0
771                       0                       0                       0
819                       0                       0                       0
```

```
864                       0                       0                       0
871                       0                       0                       0
1004                      0                       0                       0
1163                      0                       0                       0
1191                      0                       0                       0
1192                      0                       0                       0
1195                      0                       0                       0
1200                      0                       0                       0
1775                      0                       0                       0
1783                      1                       0                       0
1787                      0                       0                       0
2216                      0                       0                       0
2217                      1                       0                       0
2226                      0                       0                       0
...                     ...                     ...                     ...
87579                     0                       0                       0
87655                     0                       0                       0
87657                     0                       0                       0
87679                     0                       0                       0
87681                     1                       0                       0
87714                     0                       0                       0
87963                     0                       0                       0
87985                     0                       0                       0
88025                     0                       0                       0
88028                     0                       0                       0
88030                     0                       0                       0
88031                     0                       0                       0
88033                     0                       0                       0
88034                     0                       0                       0
88209                     0                       0                       0
88328                     0                       0                       0
88500                     0                       0                       0
88505                     0                       0                       0
88624                     0                       0                       0
88629                     0                       0                       0
88630                     0                       0                       0
88698                     0                       0                       0
88699                     0                       0                       0
88920                     0                       0                       0
89080                     0                       0                       0
89546                     0                       0                       0
89549                     0                       0                       0
89786                     0                       0                       0
89788                     0                       0                       0
89821                     0                       0                       0

       Set Collection  Simulation  Simultaneous Action Selection  Singing  \
20                  0           0                              0        0
```

50	0	0	0	0
52	0	0	0	0
250	0	0	0	0
251	0	0	0	0
439	0	0	0	0
482	0	0	0	0
489	0	0	0	0
491	0	0	0	0
581	0	0	0	0
664	0	0	0	0
676	0	0	0	0
681	0	0	0	0
724	0	0	0	0
771	0	0	0	0
819	0	0	0	0
864	0	0	0	0
871	0	0	0	0
1004	0	0	0	0
1163	0	0	0	0
1191	0	0	0	0
1192	0	0	0	0
1195	0	0	0	0
1200	0	0	0	0
1775	0	0	0	0
1783	0	0	0	0
1787	0	0	0	0
2216	0	0	0	0
2217	1	0	0	0
2226	0	0	0	0
...	...	...	...	...
87579	0	1	0	0
87655	0	0	0	0
87657	0	0	0	0
87679	0	0	0	0
87681	0	0	0	0
87714	0	0	0	0
87963	0	0	0	0
87985	0	0	0	0
88025	0	0	0	0
88028	0	0	0	0
88030	0	0	0	0
88031	0	0	0	0
88033	0	0	0	0
88034	0	0	0	0
88209	0	0	0	0
88328	0	0	0	0
88500	1	0	0	0
88505	0	0	0	0

```
88624               0           0                              0        0
88629               0           0                              0        0
88630               0           0                              0        0
88698               0           0                              0        0
88699               0           0                              0        0
88920               0           0                              0        0
89080               0           0                              0        0
89546               0           0                              0        0
89549               0           0                              0        0
89786               0           0                              0        0
89788               0           0                              0        0
89821               0           0                              0        0

       Stock Holding  Storytelling  Take That  Tile Placement  Time Track  \
20                 0             0          0               0           0
50                 0             0          0               0           0
52                 0             0          0               0           0
250                0             0          0               0           0
251                0             0          0               0           0
439                0             0          0               0           0
482                0             0          0               0           0
489                0             0          0               0           0
491                0             0          0               0           0
581                0             0          0               1           0
664                0             0          0               0           0
676                0             0          0               0           0
681                0             0          0               0           0
724                0             0          0               0           0
771                0             0          0               0           0
819                0             0          0               0           0
864                0             0          0               0           0
871                0             0          0               0           0
1004               0             0          0               0           0
1163               0             0          0               0           0
1191               0             0          0               0           0
1192               0             0          0               0           0
1195               0             0          0               0           0
1200               0             0          0               0           0
1775               0             0          0               0           0
1783               0             0          0               0           0
1787               0             0          0               0           0
2216               0             0          0               1           0
2217               0             0          0               0           0
2226               0             0          0               0           0
...              ...           ...        ...             ...         ...
87579              0             0          0               0           0
87655              0             0          0               0           0
87657              0             0          0               0           0
```

```
87679              0             0          0               0           0
87681              0             0          0               0           1
87714              0             0          0               0           0
87963              0             0          0               0           0
87985              0             0          0               0           0
88025              0             0          0               0           0
88028              0             0          0               0           0
88030              0             0          0               0           0
88031              0             0          0               0           0
88033              0             0          0               0           0
88034              0             0          0               0           0
88209              0             0          1               0           0
88328              0             0          0               0           0
88500              0             0          0               0           0
88505              0             0          1               0           0
88624              0             0          0               0           0
88629              0             0          0               0           0
88630              0             0          0               0           0
88698              0             0          0               0           0
88699              0             0          0               0           0
88920              0             0          0               0           0
89080              0             0          0               0           0
89546              0             0          0               0           0
89549              0             0          0               0           0
89786              0             0          0               0           0
89788              0             0          0               0           0
89821              0             0          0               0           0

       Trading  Trick-taking  Variable Phase Order  Variable Player Powers  \
20           0             0                     0                       0
50           0             0                     0                       0
52           0             0                     0                       0
250          0             0                     0                       0
251          0             0                     0                       0
439          0             0                     0                       0
482          0             0                     0                       0
489          0             0                     0                       0
491          0             0                     0                       0
581          0             0                     0                       0
664          0             0                     0                       0
676          0             0                     0                       0
681          0             0                     0                       0
724          0             0                     0                       0
771          0             0                     0                       0
819          0             0                     0                       0
864          0             0                     0                       0
871          0             0                     0                       0
1004         0             0                     0                       0
```

```
1163         0             0                     0                      0
1191         0             0                     0                      0
1192         0             1                     0                      0
1195         0             0                     0                      0
1200         0             0                     0                      0
1775         0             0                     0                      0
1783         0             0                     0                      0
1787         0             0                     0                      0
2216         0             0                     0                      0
2217         0             0                     0                      0
2226         0             0                     0                      0
...        ...           ...                   ...                    ...
87579        0             0                     0                      0
87655        0             0                     0                      0
87657        0             0                     0                      0
87679        0             0                     0                      0
87681        0             0                     0                      0
87714        0             0                     0                      0
87963        0             0                     0                      0
87985        0             0                     0                      0
88025        0             0                     0                      0
88028        0             0                     0                      0
88030        0             0                     0                      0
88031        0             0                     0                      0
88033        0             0                     0                      0
88034        0             0                     0                      0
88209        0             0                     0                      0
88328        0             0                     0                      0
88500        0             0                     0                      0
88505        1             0                     0                      0
88624        0             0                     0                      0
88629        0             0                     0                      0
88630        0             0                     0                      0
88698        0             0                     0                      0
88699        0             0                     0                      0
88920        0             0                     0                      0
89080        0             0                     0                      0
89546        0             0                     0                      0
89549        0             0                     0                      0
89786        0             0                     0                      0
89788        0             0                     0                      0
89821        0             0                     1                      1

       Voting  Worker Placement  binned.average  binary.success
20          0                 0             5.0               0
50          0                 0             5.0               0
52          0                 0             4.0               0
250         0                 0             6.0               0
```

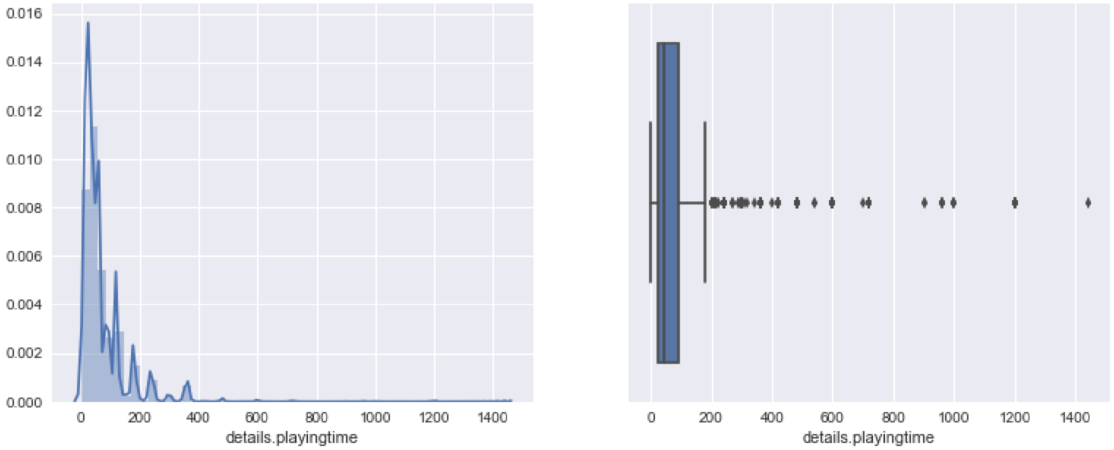
```
251         0                 0            4.0               0
439         0                 0            6.0               0
482         0                 0            5.0               0
489         0                 0            6.0               0
491         0                 0            7.0               1
581         0                 0            4.0               0
664         0                 0            6.0               0
676         0                 0            6.0               0
681         0                 0            4.0               0
724         0                 0            5.0               0
771         0                 0            6.0               0
819         0                 0            6.0               0
864         0                 0            4.0               0
871         0                 0            5.0               0
1004        0                 0            2.0               0
1163        0                 0            5.0               0
1191        0                 0            5.0               0
1192        0                 0            5.0               0
1195        0                 0            5.0               0
1200        0                 0            4.0               0
1775        0                 0            2.0               0
1783        0                 0            6.0               0
1787        0                 0            5.0               0
2216        0                 0            5.0               0
2217        0                 0            3.0               0
2226        0                 0            4.0               0
...       ...               ...            ...             ...
87579       0                 0            7.0               1
87655       0                 0            5.0               0
87657       0                 0            6.0               0
87679       0                 0            6.0               0
87681       0                 0            5.0               0
87714       0                 0            4.0               0
87963       0                 0            6.0               0
87985       0                 0            6.0               0
88025       0                 0            7.0               1
88028       0                 0            7.0               1
88030       0                 0            8.0               1
88031       0                 0            7.0               1
88033       0                 0            8.0               1
88034       0                 0            7.0               1
88209       0                 0            6.0               0
88328       0                 0            6.0               0
88500       0                 0            5.0               0
88505       0                 0            5.0               0
88624       0                 0            7.0               1
88629       0                 0            6.0               0
88630       0                 0            7.0               1
```

```
88698         0                  0             8.0                1
88699         0                  0             8.0                1
88920         0                  0             5.0                0
89080         0                  0             9.0                1
89546         0                  0             6.0                0
89549         0                  0             6.0                0
89786         0                  0             7.0                1
89788         0                  0             6.0                0
89821         0                  0             9.0                1

[949 rows x 147 columns]
```

We observe that there are a non-trivial number of games that have a playing time of 0 minutes. We suspect that this is a data entry error and will filter these out. It is reasonable to expect that there may be some games that take one minute, but are played in rapid succession. We also observe the infamous "The Campaign for North Africa," which has been validated to being a beast of a game. Because these data might impact the models, we will limit the maximum playing time of a game to be 3 standard deviations above the mean.

For more on The Campaign for North Africa, visit: https://kotaku.com/the-notorious-board-game-that-takes-1500-hours-to-compl-1818510912

```
In [52]: df_data3['details.playingtime'].std()*3

Out[52]: 1498.1342046629006

In [53]: df_data4 = df_data3[(df_data3['details.playingtime']>=1) & (df_data3['details.playing

In [54]: df_data3['details.playingtime'].count()-df_data4['details.playingtime'].count()

Out[54]: 975

In [55]: analyze_feature(df_data4, "details.playingtime")

count    17417.000000
mean        69.913073
std         85.272529
min          1.000000
25%         25.000000
50%         45.000000
75%         90.000000
max       1440.000000
Name: details.playingtime, dtype: float64
```

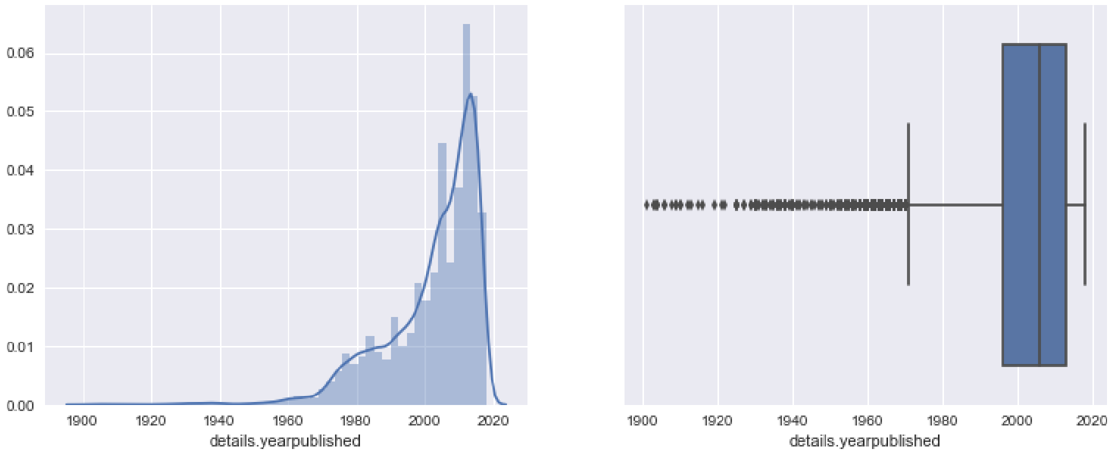


We have removed 975 games and have 17417 records in our dataframe.

Year Published

```
In [56]: analyze_feature(df_data4, "details.yearpublished")
```

```
count    17417.000000
mean      2002.295344
std         13.755996
min       1901.000000
25%       1996.000000
50%       2006.000000
75%       2013.000000
max       2018.000000
Name: details.yearpublished, dtype: float64
```



The distribution of board games appears to be skewed left, with the vast prepondarnce of the records published in the last two or so decades. No abnormalities were identified in the records.

Board Game Category

```
In [57]: #What are the first and last in the categories?
         print(cats_selector[0])
         print(cats_selector[-1])
```

```
Abstract Strategy
Zombies
```

```
In [58]: #Get the column positions
         print(df_data4.columns.get_loc('Abstract Strategy'))
         print(df_data4.columns.get_loc('Zombies')+1)
```

```
10
94
```

```
In [59]: df_data4.iloc[:, 10:94]
```

```
Out[59]:        Abstract Strategy  Action / Dexterity  Adventure  Age of Reason  \
         0                      0                   0          0              0
         1                      0                   0          0              0
         2                      1                   0          0              0
         3                      0                   0          0              0
         4                      0                   0          0              0
         5                      0                   0          0              0
         6                      1                   0          0              0
         7                      0                   0          0              0
         8                      0                   0          0              0
         9                      0                   0          0              0
         10                     0                   0          0              0
         11                     0                   0          0              0
         12                     0                   0          0              0
         13                     0                   0          0              0
         14                     0                   0          0              0
         15                     0                   0          0              0
         16                     0                   0          0              0
         17                     0                   0          0              0
         18                     0                   0          0              0
         19                     0                   0          0              0
         21                     0                   0          1              0
         22                     0                   0          0              0
         23                     0                   0          0              0
         24                     0                   0          0              0
         25                     0                   0          0              0
```

```
26                     0                   0          0              0
27                     0                   0          0              0
28                     0                   0          0              0
29                     0                   0          1              0
30                     0                   0          1              0
...                  ...                 ...        ...            ...
89496                  0                   0          0              0
89497                  0                   0          0              0
89498                  0                   0          0              0
89502                  0                   0          0              0
89505                  0                   0          0              0
89517                  0                   0          0              0
89521                  0                   0          0              0
89526                  0                   0          0              0
89536                  0                   0          0              0
89537                  0                   0          0              0
89547                  0                   0          0              0
89570                  0                   0          0              0
89574                  0                   1          0              0
89621                  0                   0          0              0
89630                  1                   0          0              0
89668                  0                   0          0              0
89727                  0                   0          0              0
89778                  0                   0          0              0
89852                  0                   0          0              0
89856                  0                   0          0              0
89881                  0                   0          0              0
89962                  0                   0          0              0
89969                  0                   0          0              0
90001                  0                   0          0              0
90031                  0                   0          0              0
90065                  0                   0          0              0
90167                  0                   0          0              0
90206                  0                   0          0              0
90239                  0                   0          0              0
90327                  0                   0          0              0

       American Civil War  American Indian Wars  American Revolutionary War  \
0                       0                     0                           0
1                       0                     0                           0
2                       0                     0                           0
3                       0                     0                           0
4                       0                     0                           0
5                       0                     0                           0
6                       0                     0                           0
7                       0                     0                           0
8                       0                     0                           0
9                       0                     0                           0
```

10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
...	...	...	...
89496	0	0	0
89497	0	0	0
89498	0	0	0
89502	0	0	0
89505	0	0	0
89517	0	0	0
89521	0	0	0
89526	0	0	0
89536	0	0	0
89537	0	0	0
89547	0	0	0
89570	0	0	0
89574	0	0	0
89621	0	0	0
89630	0	0	0
89668	0	0	0
89727	0	0	0
89778	0	0	0
89852	0	0	0
89856	0	0	0
89881	0	0	0
89962	0	0	0
89969	0	0	0
90001	0	0	0
90031	0	0	0
90065	0	0	0
90167	0	0	0

```
90206                   0                     0                           0
90239                   0                     0                           0
90327                   0                     0                           0

       American West  Ancient  Animals  Arabian  Aviation / Flight  Bluffing  \
0                  0        0        0        0                  0         0
1                  0        0        0        0                  0         0
2                  0        0        0        0                  0         0
3                  0        1        0        0                  0         0
4                  0        0        0        0                  0         0
5                  0        0        0        0                  0         0
6                  0        0        0        0                  0         0
7                  0        0        0        0                  0         0
8                  0        0        0        0                  0         0
9                  0        0        0        0                  0         0
10                 0        0        0        0                  0         0
11                 0        1        0        0                  0         0
12                 0        0        0        0                  0         0
13                 0        0        0        0                  0         0
14                 0        0        0        0                  0         1
15                 0        0        0        0                  0         0
16                 0        0        0        0                  0         0
17                 0        0        0        0                  0         0
18                 1        0        0        0                  0         1
19                 0        0        0        0                  0         0
21                 0        0        0        0                  0         0
22                 0        0        0        0                  0         0
23                 0        0        0        0                  0         0
24                 0        0        0        0                  0         0
25                 0        0        0        0                  0         0
26                 0        0        0        0                  0         0
27                 0        0        0        0                  0         0
28                 0        0        0        0                  0         0
29                 0        0        0        0                  0         0
30                 0        0        0        0                  0         0
...              ...      ...      ...      ...                ...       ...
89496              0        0        0        0                  0         0
89497              0        0        0        0                  0         0
89498              0        0        0        0                  0         0
89502              0        0        1        0                  0         0
89505              0        0        0        0                  0         0
89517              0        0        0        0                  0         0
89521              0        0        0        0                  0         0
89526              0        0        0        0                  0         1
89536              0        0        1        0                  0         0
89537              0        0        0        0                  0         0
89547              0        0        0        0                  0         0
89570              0        0        0        0                  0         0
```

```
89574              0        0        0        0                  0         0
89621              0        0        0        0                  0         0
89630              0        0        0        0                  0         1
89668              0        0        0        0                  0         0
89727              0        0        0        0                  0         0
89778              0        0        0        0                  0         0
89852              0        0        0        0                  0         0
89856              0        0        0        0                  0         0
89881              0        0        0        0                  0         0
89962              0        0        0        0                  0         0
89969              0        0        0        0                  0         0
90001              0        0        0        0                  0         0
90031              0        0        0        0                  0         1
90065              0        0        0        0                  0         0
90167              0        0        0        0                  0         0
90206              0        0        0        0                  0         0
90239              0        0        1        0                  0         0
90327              0        0        0        0                  0         0

       Book  Card Game  Children's Game  City Building  Civil War  \
0         0          0                0              0          0
1         0          1                0              0          0
2         0          0                0              0          0
3         0          0                0              0          0
4         0          0                0              0          0
5         0          0                0              0          0
6         0          0                0              0          0
7         0          0                0              0          0
8         0          0                0              0          0
9         0          0                0              0          0
10        0          1                0              0          0
11        0          0                0              0          0
12        0          0                0              0          0
13        0          0                0              0          0
14        0          0                0              0          0
15        0          0                0              0          0
16        0          0                0              0          0
17        0          0                0              0          0
18        0          0                0              1          0
19        0          0                0              0          0
21        0          0                0              0          0
22        0          0                0              0          0
23        0          0                0              0          0
24        0          0                0              0          0
25        0          0                0              0          0
26        0          0                0              0          0
27        0          1                0              0          0
28        0          0                0              0          0
```

```
29        0          0                0              0          0
30        0          0                0              0          0
...     ...        ...              ...            ...        ...
89496     0          0                0              0          0
89497     0          0                0              0          0
89498     0          1                0              0          0
89502     0          0                0              0          0
89505     0          0                0              0          0
89517     0          0                0              0          0
89521     0          1                0              0          0
89526     0          1                0              0          0
89536     0          1                0              0          0
89537     0          0                0              0          0
89547     0          0                0              0          0
89570     0          0                0              0          0
89574     0          0                1              0          0
89621     0          1                0              0          0
89630     0          1                0              0          0
89668     0          0                0              0          0
89727     0          0                0              0          0
89778     0          0                0              1          0
89852     0          0                0              0          0
89856     0          1                0              0          0
89881     0          0                0              0          0
89962     0          0                0              0          0
89969     0          1                0              0          0
90001     0          0                0              1          0
90031     0          1                0              0          0
90065     0          1                0              1          0
90167     0          0                0              0          0
90206     0          1                0              0          0
90239     0          0                0              0          0
90327     0          1                0              0          0

       Civilization  Collectible Components  Comic Book / Strip  Deduction  \
0                 0                       0                   0          0
1                 0                       0                   0          0
2                 0                       0                   0          0
3                 0                       0                   0          0
4                 0                       0                   0          0
5                 1                       0                   0          0
6                 0                       0                   0          0
7                 1                       0                   0          0
8                 0                       0                   0          0
9                 0                       0                   0          0
10                0                       0                   0          0
11                0                       0                   0          0
12                0                       0                   0          0
```

13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	1	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	1	0	0	0
24	0	0	0	0
25	1	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
...	...	...	...	...
89496	0	0	0	0
89497	0	0	0	0
89498	0	0	0	0
89502	0	0	0	0
89505	0	0	0	0
89517	1	0	0	0
89521	0	0	0	0
89526	0	0	0	0
89536	0	0	0	0
89537	0	0	0	0
89547	0	0	1	0
89570	0	0	0	0
89574	0	0	0	0
89621	0	0	0	0
89630	0	0	0	0
89668	0	0	0	0
89727	0	0	0	1
89778	0	0	0	0
89852	1	0	0	0
89856	0	0	0	0
89881	0	0	0	0
89962	0	0	0	0
89969	0	0	0	0
90001	0	0	0	0
90031	0	0	0	0
90065	0	0	0	0
90167	0	0	0	0
90206	0	0	0	0
90239	0	0	0	0
90327	0	0	0	0

```
       Dice  Economic  Educational  Electronic  Environmental  \
0         0         1            0           0              0
1         0         0            0           0              0
2         0         0            0           0              0
3         0         0            0           0              0
4         0         1            0           0              0
5         0         0            0           0              0
6         0         0            0           0              0
7         0         0            0           0              0
8         0         0            0           0              0
9         0         0            0           0              0
10        0         0            0           0              0
11        0         0            0           0              0
12        0         0            0           0              0
13        0         0            0           0              0
14        0         0            0           0              0
15        0         1            0           0              0
16        1         0            0           0              0
17        0         0            0           0              0
18        0         0            0           0              0
19        0         0            0           0              0
21        0         0            0           0              0
22        0         0            0           0              0
23        0         0            0           0              0
24        0         0            0           0              0
25        0         1            0           0              0
26        0         1            0           0              0
27        0         0            0           0              0
28        0         0            0           0              0
29        0         0            0           1              0
30        0         0            0           0              0
...     ...       ...          ...         ...            ...
89496     1         0            0           0              0
89497     1         0            0           0              0
89498     0         0            0           0              0
89502     0         0            0           0              0
89505     0         0            0           0              0
89517     0         0            0           0              0
89521     0         0            0           0              0
89526     0         0            0           0              0
89536     0         0            0           0              0
89537     0         0            0           0              0
89547     1         0            0           0              0
89570     0         0            0           0              0
89574     0         0            0           0              0
89621     0         0            0           0              0
89630     0         1            0           0              0
```

```
89668     0         0            0          0              0
89727     0         0            0          0              0
89778     1         1            0          0              0
89852     0         1            0          0              0
89856     0         0            0          0              0
89881     0         0            0          0              0
89962     0         0            0          0              0
89969     1         0            0          0              0
90001     0         0            0          0              0
90031     0         1            0          0              0
90065     0         1            0          0              0
90167     0         0            0          0              0
90206     0         0            0          0              0
90239     0         0            0          0              0
90327     0         0            0          0              0

       Expansion for Base-game  Exploration  Fan Expansion  Fantasy  Farming  \
0                            0            0              0        0        0
1                            0            0              0        1        0
2                            0            0              0        0        0
3                            0            0              0        0        0
4                            0            0              0        0        0
5                            0            0              0        0        0
6                            0            0              0        0        0
7                            0            0              0        1        0
8                            0            1              0        0        0
9                            0            0              0        1        0
10                           0            0              0        0        1
11                           0            0              0        0        0
12                           0            0              0        0        0
13                           0            0              0        0        0
14                           0            0              0        0        0
15                           0            0              0        0        0
16                           0            0              0        0        0
17                           0            0              0        0        0
18                           0            0              0        0        0
19                           0            0              0        0        0
21                           0            1              0        1        0
22                           0            0              0        1        0
23                           0            0              0        0        0
24                           0            1              0        1        0
25                           0            0              0        0        0
26                           0            0              0        0        0
27                           0            0              0        0        0
28                           0            0              0        0        0
29                           0            1              0        1        0
30                           0            1              0        1        0
...                        ...          ...            ...      ...      ...
```

```
89496                        0            0              0        0        0
89497                        0            0              0        0        0
89498                        0            0              0        0        0
89502                        0            0              0        1        0
89505                        0            0              0        0        0
89517                        0            0              0        1        0
89521                        0            0              0        0        0
89526                        0            0              0        0        0
89536                        0            0              0        0        0
89537                        0            0              0        0        0
89547                        0            0              0        0        0
89570                        0            0              0        1        0
89574                        0            0              0        0        0
89621                        0            0              0        0        0
89630                        0            0              0        0        0
89668                        0            1              0        1        0
89727                        0            0              0        0        0
89778                        0            0              0        1        0
89852                        0            1              0        0        0
89856                        0            0              0        0        0
89881                        0            0              0        0        0
89962                        0            0              0        0        0
89969                        0            0              0        0        0
90001                        0            0              0        0        0
90031                        0            0              0        0        0
90065                        0            0              0        0        0
90167                        0            0              0        0        0
90206                        0            0              0        0        0
90239                        0            0              0        0        0
90327                        0            0              0        1        0

       Fighting  Game System  Horror  Humor  Industry / Manufacturing  \
0             0            0       0      0                         0
1             0            0       0      0                         0
2             0            0       0      0                         0
3             0            0       0      0                         0
4             0            0       0      0                         0
5             0            0       0      0                         0
6             0            0       0      0                         0
7             0            0       0      0                         0
8             0            0       0      0                         0
9             0            0       0      0                         0
10            0            0       0      0                         0
11            0            0       0      0                         0
12            0            0       0      0                         0
13            0            0       0      0                         0
14            0            0       0      0                         0
15            0            0       0      0                         0
```

```
16            1            0       0      0                         0
17            0            0       0      0                         0
18            0            0       0      0                         0
19            0            0       0      0                         0
21            0            0       0      0                         0
22            0            0       0      0                         0
23            0            0       0      0                         0
24            0            0       0      0                         0
25            0            0       0      0                         0
26            0            0       0      0                         0
27            0            0       0      1                         0
28            1            0       0      1                         0
29            1            0       0      0                         0
30            1            0       0      0                         0
...         ...          ...     ...    ...                       ...
89496         0            0       0      0                         0
89497         0            0       0      0                         0
89498         0            0       0      0                         0
89502         0            0       0      0                         0
89505         0            0       0      0                         0
89517         0            0       0      0                         0
89521         0            0       0      0                         0
89526         1            0       0      0                         0
89536         0            0       0      0                         0
89537         0            0       0      0                         0
89547         1            0       0      0                         0
89570         0            0       0      0                         0
89574         0            0       0      0                         0
89621         0            0       0      0                         0
89630         0            0       0      0                         1
89668         0            0       0      0                         0
89727         0            0       0      0                         0
89778         0            0       0      0                         0
89852         0            0       0      0                         0
89856         0            0       0      0                         0
89881         0            0       0      0                         0
89962         0            0       0      1                         0
89969         0            0       0      1                         0
90001         0            0       0      0                         0
90031         0            0       0      0                         0
90065         0            0       0      0                         0
90167         0            0       0      0                         0
90206         0            0       0      0                         0
90239         0            0       0      0                         0
90327         0            0       0      1                         0

       Korean War  Mafia  Math  Mature / Adult  Maze  Medical  Medieval  \
0               0      0     0               0     0        0         0
```

1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	1
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	0	0	0	0	0	0	1
26	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0
...	...	...	...	...	...	...	...
89496	0	0	0	0	0	0	0
89497	0	0	0	0	0	0	0
89498	0	0	0	0	0	0	0
89502	0	0	0	0	0	0	0
89505	0	0	0	0	0	0	0
89517	0	0	0	0	0	0	1
89521	0	0	0	0	0	0	0
89526	0	0	0	0	0	0	1
89536	0	0	0	0	0	0	0
89537	0	0	0	0	0	0	0
89547	0	0	0	0	0	0	0
89570	0	0	0	0	0	0	0
89574	0	0	0	0	0	0	0
89621	0	0	0	0	0	0	0
89630	0	0	1	0	0	0	0
89668	0	0	0	0	0	0	0
89727	0	0	0	0	0	0	0
89778	0	0	0	0	0	0	0

```
89852           0      0     0               0     0        0         0
89856           0      0     0               0     0        0         0
89881           0      0     0               0     0        0         0
89962           0      0     0               0     0        0         0
89969           0      0     0               0     0        0         0
90001           0      0     0               0     0        0         0
90031           0      0     0               0     0        0         0
90065           0      0     0               0     0        0         0
90167           0      0     0               0     0        0         0
90206           0      0     0               0     0        0         0
90239           0      0     0               0     0        0         0
90327           0      0     0               0     0        0         1

       Memory_category  Miniatures  Modern Warfare  Movies / TV / Radio theme  \
0                    0           0               0                          0
1                    0           0               0                          0
2                    0           0               0                          0
3                    0           0               0                          0
4                    0           0               0                          0
5                    0           0               0                          0
6                    0           0               0                          0
7                    0           0               0                          0
8                    0           0               0                          0
9                    0           0               0                          0
10                   0           0               0                          0
11                   0           0               0                          0
12                   0           0               0                          0
13                   0           0               0                          0
14                   0           0               0                          0
15                   0           0               0                          0
16                   0           0               0                          0
17                   0           1               0                          0
18                   0           0               0                          0
19                   0           0               0                          0
21                   0           0               0                          0
22                   0           0               0                          0
23                   0           0               0                          0
24                   0           0               0                          0
25                   0           0               0                          0
26                   0           0               0                          0
27                   0           0               0                          0
28                   0           0               0                          0
29                   0           0               0                          0
30                   0           1               0                          0
...                ...         ...             ...                        ...
89496                0           0               0                          0
89497                0           0               0                          0
89498                0           0               0                          0
```

```
89502                0           1               0                          0
89505                0           0               0                          0
89517                0           0               0                          0
89521                0           0               0                          0
89526                0           0               0                          0
89536                0           0               0                          0
89537                0           0               0                          0
89547                0           0               0                          1
89570                0           1               0                          0
89574                0           0               0                          0
89621                0           0               0                          0
89630                0           0               0                          0
89668                0           0               0                          0
89727                0           0               0                          0
89778                0           0               0                          0
89852                0           0               0                          0
89856                0           0               0                          0
89881                0           0               0                          0
89962                0           0               0                          0
89969                0           0               0                          0
90001                0           0               0                          0
90031                0           0               0                          0
90065                0           0               0                          0
90167                0           0               0                          0
90206                0           0               0                          0
90239                0           0               0                          0
90327                0           0               0                          0

       Murder/Mystery  Music  Mythology  Napoleonic  Nautical  Negotiation  \
0                   0      0          0           0         0            1
1                   0      0          0           0         0            0
2                   0      0          0           0         0            0
3                   0      0          0           0         0            0
4                   0      0          0           0         0            0
5                   0      0          0           0         1            0
6                   0      0          0           0         0            0
7                   0      0          0           0         0            0
8                   0      0          0           0         0            0
9                   0      0          0           0         0            0
10                  0      0          0           0         0            1
11                  0      0          1           0         0            0
12                  0      0          0           0         0            1
13                  0      0          0           0         0            1
14                  0      0          0           0         0            1
15                  0      0          0           0         0            0
16                  0      0          0           0         0            0
17                  0      0          0           0         0            0
18                  0      0          0           0         0            0
```

```
19                  0      0          0           0         0            0
21                  0      0          0           0         0            0
22                  0      0          0           0         0            0
23                  0      0          0           0         0            1
24                  0      0          0           0         0            0
25                  0      0          0           0         0            0
26                  0      0          0           0         0            0
27                  0      0          0           0         0            1
28                  0      0          0           0         0            0
29                  0      0          0           0         0            0
30                  0      0          0           0         0            0
...               ...    ...        ...         ...       ...          ...
89496               0      0          0           0         0            0
89497               0      0          0           0         0            0
89498               0      0          0           0         0            0
89502               0      0          0           0         0            0
89505               0      0          0           0         0            0
89517               0      0          0           0         0            0
89521               0      0          0           0         0            0
89526               0      0          0           0         0            0
89536               0      0          0           0         0            0
89537               0      0          0           0         0            0
89547               0      0          0           0         0            0
89570               0      0          0           0         0            0
89574               0      0          0           0         0            0
89621               0      0          0           0         0            0
89630               0      0          0           0         1            0
89668               0      0          0           0         0            0
89727               0      0          0           0         0            0
89778               0      0          0           0         0            0
89852               0      0          0           0         0            0
89856               0      0          0           0         0            0
89881               0      0          0           0         0            0
89962               0      0          0           0         0            0
89969               0      0          0           0         0            0
90001               0      0          0           0         0            0
90031               0      0          0           0         0            0
90065               0      0          0           0         0            0
90167               0      0          0           0         0            0
90206               0      0          0           0         0            0
90239               0      0          0           0         0            0
90327               0      0          1           0         0            0

       Novel-based  Number  Party Game  Pike and Shot  Pirates  Political  \
0                0       0           0              0        0          1
1                0       0           0              0        0          0
2                0       0           0              0        0          0
3                0       0           0              0        0          0
```

```
4                0       0           0              0        0          0
5                0       0           0              0        0          0
6                0       0           0              0        0          0
7                0       0           0              0        0          0
8                0       0           0              0        0          0
9                0       0           0              0        0          0
10               0       0           0              0        0          0
11               0       0           0              0        0          0
12               0       0           0              0        0          0
13               0       0           0              0        0          0
14               0       0           0              0        0          0
15               0       0           0              0        0          0
16               0       0           0              0        0          0
17               0       0           0              0        0          0
18               0       0           0              0        0          0
19               0       0           0              0        0          0
21               0       0           0              0        0          0
22               0       0           0              0        0          1
23               0       0           0              0        0          1
24               0       0           0              0        0          0
25               0       0           0              0        0          0
26               0       0           0              0        0          1
27               0       0           0              0        0          1
28               0       0           0              0        0          0
29               0       0           0              0        0          0
30               0       0           0              0        0          0
...            ...     ...         ...            ...      ...        ...
89496            0       0           0              0        0          0
89497            0       0           0              0        0          0
89498            0       0           0              0        0          0
89502            0       0           0              0        0          0
89505            0       0           0              0        0          0
89517            0       0           0              0        0          0
89521            0       0           0              0        0          0
89526            0       0           0              0        0          0
89536            0       0           0              0        0          0
89537            0       1           0              0        0          0
89547            0       0           0              0        0          0
89570            0       0           0              0        0          0
89574            0       0           0              0        0          0
89621            0       0           0              0        0          0
89630            0       0           0              0        1          0
89668            0       0           0              0        0          0
89727            0       0           1              0        0          0
89778            0       0           0              0        0          0
89852            0       0           0              0        0          0
89856            0       0           0              0        1          0
89881            0       0           0              0        0          0
```

```
89962            0       0           1              0        0          0
89969            0       0           0              0        0          0
90001            0       0           0              0        0          0
90031            0       0           0              0        0          0
90065            0       0           0              0        0          0
90167            0       0           0              0        0          0
90206            0       0           0              0        0          0
90239            0       0           0              0        0          0
90327            0       0           0              0        0          0

       Post-Napoleonic  Prehistoric  Print & Play  Puzzle  Racing  Real-time  \
0                    0            0             0       0       0          0
1                    0            0             0       0       0          0
2                    0            0             0       0       0          0
3                    0            0             0       0       0          0
4                    0            0             0       0       0          0
5                    0            0             0       0       0          0
6                    0            0             0       0       0          0
7                    0            0             0       0       0          0
8                    0            0             0       0       0          0
9                    0            0             0       0       0          0
10                   0            0             0       0       0          0
11                   0            0             0       0       0          0
12                   0            0             0       0       0          0
13                   0            0             0       0       0          0
14                   0            0             0       0       0          0
15                   0            0             0       0       0          0
16                   0            0             1       0       0          0
17                   0            0             0       0       1          0
18                   0            0             0       0       0          0
19                   0            0             0       0       0          0
21                   0            0             0       0       0          0
22                   0            0             0       0       0          0
23                   0            0             0       0       0          0
24                   0            0             0       0       0          0
25                   0            0             0       0       0          0
26                   0            0             0       0       0          0
27                   0            0             0       0       0          0
28                   0            0             0       0       0          0
29                   0            0             0       0       0          0
30                   0            0             0       0       0          0
...                ...          ...           ...     ...     ...        ...
89496                0            0             0       0       0          0
89497                0            0             0       0       0          0
89498                0            0             0       0       0          0
89502                0            0             0       0       0          0
89505                0            0             0       0       1          0
89517                0            0             0       0       0          0
```

```
89521                0            0             0       0       0          0
89526                0            0             0       0       0          0
89536                0            0             0       0       0          0
89537                0            0             0       1       0          0
89547                0            0             0       0       0          0
89570                0            0             0       0       0          0
89574                0            0             0       0       0          0
89621                0            0             0       0       0          0
89630                0            0             0       0       0          0
89668                0            0             0       0       0          0
89727                0            0             0       0       0          0
89778                0            0             0       0       0          0
89852                0            0             0       0       0          0
89856                0            0             0       0       0          0
89881                0            0             0       0       1          0
89962                0            0             0       0       0          0
89969                0            0             0       0       0          0
90001                0            0             0       0       0          0
90031                0            0             0       0       0          0
90065                0            0             0       0       0          0
90167                0            0             0       0       0          0
90206                0            0             0       0       0          0
90239                0            0             0       1       0          0
90327                0            0             0       0       0          0

       Religious  Renaissance  Science Fiction  Space Exploration  \
0              0            0                0                  0
1              0            0                0                  0
2              0            0                0                  0
3              0            0                0                  0
4              0            0                0                  0
5              0            0                0                  0
6              0            0                0                  0
7              0            0                0                  0
8              0            0                0                  0
9              0            0                0                  0
10             0            0                0                  0
11             0            0                0                  0
12             0            0                0                  0
13             0            0                0                  0
14             0            0                1                  0
15             0            0                0                  0
16             0            0                0                  0
17             0            0                1                  0
18             0            0                0                  0
19             0            0                1                  0
21             0            0                0                  0
22             0            0                0                  0
```

```
23             0            0                1                  1
24             0            0                0                  0
25             0            1                0                  0
26             0            0                0                  0
27             0            0                0                  0
28             0            0                0                  0
29             0            0                0                  0
30             0            0                0                  0
...          ...          ...              ...                ...
89496          0            0                0                  0
89497          0            0                0                  0
89498          0            0                0                  0
89502          0            0                0                  0
89505          0            0                0                  0
89517          0            0                0                  0
89521          0            0                0                  0
89526          0            0                0                  0
89536          0            0                0                  0
89537          0            0                0                  0
89547          0            0                0                  0
89570          0            0                0                  0
89574          0            0                0                  0
89621          0            0                1                  0
89630          0            0                0                  0
89668          0            0                0                  0
89727          0            0                0                  0
89778          0            0                0                  0
89852          0            0                1                  1
89856          0            0                0                  0
89881          0            0                0                  0
89962          0            0                0                  0
89969          0            0                0                  0
90001          0            0                0                  0
90031          0            0                0                  0
90065          0            0                0                  0
90167          0            0                1                  0
90206          0            0                0                  0
90239          0            0                0                  0
90327          0            0                0                  0

       Spies/Secret Agents  Sports  Territory Building  Trains  \
0                        0       0                   0       0
1                        0       0                   0       0
2                        0       0                   0       0
3                        0       0                   0       0
4                        0       0                   0       0
5                        0       0                   0       0
6                        0       0                   0       0
```

7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
...	...	...	...	...
89496	0	0	0	0
89497	0	0	0	0
89498	0	0	0	0
89502	0	0	0	0
89505	0	0	0	0
89517	0	0	1	0
89521	0	0	0	0
89526	0	0	0	0
89536	0	0	0	0
89537	0	0	0	0
89547	0	0	0	0
89570	0	0	0	0
89574	0	0	0	0
89621	0	0	0	0
89630	0	0	0	0
89668	0	0	0	0
89727	0	0	0	0
89778	0	0	0	0
89852	0	0	0	0
89856	0	0	0	0
89881	0	0	0	0
89962	0	0	0	0
89969	0	0	0	0
90001	0	0	0	0

```
90031                    0       0                   0       0
90065                    0       0                   0       0
90167                    0       0                   0       0
90206                    0       0                   0       0
90239                    0       0                   0       0
90327                    0       0                   0       0

       Transportation  Travel  Trivia  Video Game Theme  Vietnam War  Wargame  \
0                   0       0       0                 0            0        0
1                   0       0       0                 0            0        0
2                   0       0       0                 0            0        0
3                   0       0       0                 0            0        0
4                   0       0       0                 0            0        0
5                   0       0       0                 0            0        0
6                   0       0       0                 0            0        0
7                   0       0       0                 0            0        0
8                   0       0       0                 0            0        0
9                   0       1       0                 0            0        0
10                  0       0       0                 0            0        0
11                  0       0       0                 0            0        0
12                  0       0       0                 0            0        0
13                  0       0       0                 0            0        0
14                  0       0       0                 0            0        0
15                  0       0       0                 0            0        0
16                  0       0       0                 0            0        0
17                  0       0       0                 0            0        0
18                  0       0       0                 0            0        0
19                  0       0       0                 0            0        0
21                  0       0       0                 0            0        0
22                  0       0       0                 0            0        1
23                  0       0       0                 0            0        1
24                  0       0       0                 0            0        1
25                  0       0       0                 0            0        0
26                  0       0       0                 0            0        1
27                  0       0       0                 0            0        0
28                  0       0       0                 0            0        0
29                  0       0       0                 0            0        0
30                  0       0       0                 0            0        0
...               ...     ...     ...               ...          ...      ...
89496               0       0       0                 0            0        0
89497               0       0       0                 0            0        0
89498               0       0       0                 0            0        0
89502               0       0       0                 0            0        0
89505               0       0       0                 0            0        0
89517               0       0       0                 0            0        0
89521               0       0       0                 0            0        0
89526               0       0       0                 0            0        0
89536               0       0       0                 0            0        0
```

```
89537               0       0       0                  0            0        0
89547               0       0       0                  0            0        0
89570               0       0       0                  0            0        0
89574               0       0       0                  0            0        0
89621               0       0       0                  0            0        0
89630               1       0       0                  0            0        0
89668               0       0       0                  0            0        0
89727               0       0       0                  0            0        0
89778               0       0       0                  0            0        0
89852               0       0       0                  0            0        0
89856               0       0       0                  0            0        0
89881               0       0       0                  0            0        0
89962               0       0       0                  0            0        0
89969               0       0       0                  0            0        0
90001               0       0       0                  0            0        0
90031               0       0       0                  0            0        0
90065               0       0       0                  0            0        0
90167               0       0       0                  0            0        0
90206               0       0       0                  0            0        0
90239               0       0       0                  0            0        0
90327               0       0       0                  0            0        0

       Word Game  World War I  World War II  Zombies
0              0            0             0        0
1              0            0             0        0
2              0            0             0        0
3              0            0             0        0
4              0            0             0        0
5              0            0             0        0
6              0            0             0        0
7              0            0             0        0
8              0            0             0        0
9              0            0             0        0
10             0            0             0        0
11             0            0             0        0
12             0            0             0        0
13             0            0             0        0
14             0            0             0        0
15             0            0             0        0
16             0            0             0        0
17             0            0             0        0
18             0            0             0        0
19             0            0             0        0
21             0            0             0        0
22             0            0             0        0
23             0            0             0        0
24             0            0             0        0
25             0            0             0        0
```

```
         26              0            0              0         0
         27              0            0              0         0
         28              0            0              0         0
         29              0            0              0         0
         30              0            0              0         0
         ...           ...          ...            ...       ...
         89496           0            0              0         0
         89497           0            0              0         0
         89498           0            0              0         0
         89502           0            0              0         0
         89505           0            0              0         0
         89517           0            0              0         0
         89521           0            0              0         0
         89526           0            0              0         0
         89536           0            0              0         0
         89537           0            0              0         0
         89547           0            0              0         0
         89570           0            0              0         0
         89574           0            0              0         0
         89621           0            0              0         0
         89630           0            0              0         0
         89668           0            0              0         0
         89727           0            0              0         0
         89778           0            0              0         0
         89852           0            0              0         0
         89856           0            0              0         0
         89881           0            0              0         0
         89962           0            0              0         0
         89969           0            0              0         0
         90001           0            0              0         0
         90031           0            0              0         0
         90065           0            0              0         0
         90167           0            0              0         0
         90206           0            0              0         0
         90239           0            0              0         0
         90327           0            0              0         0

         [17417 rows x 84 columns]

In [60]: s_cat_overivew = df_data4.iloc[:, 10:94].sum()

In [61]: df_cat_overivew = pd.Series.to_frame(s_cat_overivew)

In [62]: df_cat_overivew[0].describe()

Out[62]: count      84.000000
         mean      529.452381
         std       702.365820
         min         2.000000
```

```
25%       149.500000
50%       278.000000
75%       637.250000
max      4809.000000
Name: 0, dtype: float64
```

We see that across all the categories, the minimum number of board games per one category is two, and the maximum is 4809, with an average of approximately 529 to each category.

Board Game Mechanic

```
In [63]: #What are the first and last in the categories?
         print(mechs_selector[0])
         print(mechs_selector[-1])
```

```
Acting
Worker Placement
```

```
In [64]: #Get the column positions
         print(df_data4.columns.get_loc('Acting'))
         print(df_data4.columns.get_loc('Worker Placement')+1)
```

```
94
145
```

```
In [65]: df_data4.iloc[:, 94:145]
```

```
Out[65]:        Acting  Action / Movement Programming  Action Point Allowance System  \
         0           0                              0                              0
         1           0                              0                              0
         2           0                              0                              0
         3           0                              0                              1
         4           0                              0                              0
         5           0                              0                              0
         6           0                              0                              0
         7           0                              0                              0
         8           0                              0                              0
         9           0                              0                              0
         10          0                              0                              0
         11          0                              0                              0
         12          0                              0                              0
         13          0                              0                              0
         14          0                              0                              0
         15          0                              0                              0
         16          0                              0                              0
         17          0                              1                              0
         18          0                              0                              0
```

```
19          0                             0                              1
21          0                             1                              0
22          0                             0                              0
23          0                             0                              0
24          0                             0                              0
25          0                             0                              0
26          0                             0                              0
27          0                             0                              0
28          0                             0                              1
29          0                             0                              0
30          0                             0                              0
...       ...                           ...                            ...
89496       0                             0                              0
89497       0                             0                              0
89498       0                             0                              0
89502       0                             0                              0
89505       0                             0                              0
89517       0                             0                              0
89521       0                             0                              0
89526       0                             0                              0
89536       0                             0                              0
89537       0                             0                              0
89547       0                             0                              0
89570       0                             0                              0
89574       0                             0                              0
89621       0                             0                              0
89630       0                             0                              0
89668       0                             0                              0
89727       0                             0                              0
89778       0                             0                              0
89852       0                             0                              1
89856       0                             0                              0
89881       0                             0                              0
89962       0                             0                              0
89969       0                             0                              0
90001       0                             0                              0
90031       0                             0                              0
90065       0                             0                              0
90167       0                             0                              0
90206       0                             0                              0
90239       0                             0                              0
90327       0                             0                              0

       Area Control / Area Influence  Area Enclosure  Area Movement  \
0                                  1               0              0
1                                  0               0              0
2                                  1               0              0
3                                  1               0              0
```

4	0	0	0
5	0	0	0
6	0	1	0
7	0	0	0
8	1	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	1
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	1
30	0	0	0
...	...	...	...
89496	0	0	0
89497	0	0	0
89498	0	0	0
89502	0	0	0
89505	0	0	1
89517	1	0	0
89521	0	0	0
89526	0	0	0
89536	0	0	0
89537	0	0	0
89547	0	0	0
89570	1	0	0
89574	0	0	0
89621	0	0	0
89630	0	0	0
89668	0	0	0
89727	0	0	0
89778	0	0	0
89852	1	0	0
89856	0	0	0
89881	0	0	0

```
89962                              0               0              0
89969                              0               0              0
90001                              0               0              0
90031                              0               0              0
90065                              0               0              0
90167                              0               0              0
90206                              0               0              0
90239                              0               0              0
90327                              0               0              0

       Area-Impulse  Auction/Bidding  Betting/Wagering  \
0                 0                1                 0
1                 0                0                 0
2                 0                0                 0
3                 0                1                 0
4                 0                0                 0
5                 0                0                 0
6                 0                0                 0
7                 0                0                 0
8                 0                0                 0
9                 0                0                 0
10                0                0                 0
11                0                1                 0
12                0                0                 0
13                0                0                 0
14                0                0                 0
15                0                1                 0
16                0                0                 0
17                0                0                 0
18                0                0                 0
19                0                0                 0
21                0                0                 0
22                0                0                 0
23                0                0                 0
24                0                0                 0
25                0                1                 0
26                0                0                 0
27                0                0                 0
28                0                0                 0
29                0                0                 0
30                0                0                 0
...             ...              ...               ...
89496             0                0                 0
89497             0                0                 0
89498             0                0                 0
89502             0                0                 0
89505             0                0                 0
89517             0                0                 0
```

```
89521             0                0                 0
89526             0                0                 0
89536             0                0                 0
89537             0                0                 0
89547             0                0                 0
89570             0                0                 0
89574             0                0                 0
89621             0                0                 0
89630             0                1                 0
89668             0                0                 0
89727             0                0                 0
89778             0                0                 0
89852             0                0                 0
89856             0                0                 0
89881             0                0                 1
89962             0                0                 0
89969             0                0                 0
90001             0                0                 0
90031             0                0                 0
90065             0                0                 0
90167             0                0                 0
90206             0                0                 0
90239             0                0                 0
90327             0                0                 0

       Campaign / Battle Card Driven  Card Drafting  Chit-Pull System  \
0                                  0              0                 0
1                                  0              0                 0
2                                  0              0                 0
3                                  0              0                 0
4                                  0              0                 0
5                                  0              0                 0
6                                  0              0                 0
7                                  0              0                 0
8                                  0              0                 0
9                                  0              1                 0
10                                 0              0                 0
11                                 0              0                 0
12                                 0              0                 0
13                                 0              0                 0
14                                 0              0                 0
15                                 0              0                 0
16                                 0              0                 0
17                                 0              0                 0
18                                 0              0                 0
19                                 0              0                 0
21                                 0              0                 0
22                                 0              0                 0
```

```
23                                 0              0                 0
24                                 0              0                 0
25                                 0              0                 0
26                                 0              0                 0
27                                 0              1                 0
28                                 0              0                 0
29                                 0              0                 0
30                                 0              0                 0
...                              ...            ...               ...
89496                              0              0                 0
89497                              0              0                 0
89498                              0              0                 0
89502                              0              0                 0
89505                              0              1                 0
89517                              0              0                 0
89521                              0              0                 0
89526                              0              0                 0
89536                              0              0                 0
89537                              0              0                 0
89547                              0              0                 0
89570                              0              0                 0
89574                              0              0                 0
89621                              0              0                 0
89630                              0              0                 0
89668                              0              0                 0
89727                              0              0                 0
89778                              0              0                 0
89852                              0              0                 0
89856                              0              0                 0
89881                              0              1                 0
89962                              0              0                 0
89969                              0              0                 0
90001                              0              0                 0
90031                              0              0                 0
90065                              0              1                 0
90167                              0              0                 0
90206                              0              0                 0
90239                              0              0                 0
90327                              0              0                 0

       Co-operative Play  Commodity Speculation  Crayon Rail System  \
0                      0                      0                   0
1                      0                      0                   0
2                      0                      0                   0
3                      0                      0                   0
4                      0                      0                   0
5                      0                      0                   0
6                      0                      0                   0
```

7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	1	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
...	...	...	...
89496	0	0	0
89497	0	0	0
89498	0	0	0
89502	0	0	0
89505	0	0	0
89517	0	0	0
89521	0	0	0
89526	0	0	0
89536	0	0	0
89537	0	0	0
89547	0	0	0
89570	1	0	0
89574	0	0	0
89621	0	0	0
89630	0	1	0
89668	0	0	0
89727	1	0	0
89778	0	0	0
89852	0	0	0
89856	0	0	0
89881	0	0	0
89962	0	0	0
89969	0	0	0
90001	0	0	0

```
90031                  0                      1                   0
90065                  0                      0                   0
90167                  0                      0                   0
90206                  0                      0                   0
90239                  0                      0                   0
90327                  0                      0                   0

       Deck / Pool Building  Dice Rolling  Grid Movement  Hand Management  \
0                         0             1              0                1
1                         0             0              0                0
2                         0             0              0                1
3                         0             0              0                0
4                         0             0              0                1
5                         0             1              0                0
6                         0             0              0                0
7                         0             0              0                0
8                         0             0              0                0
9                         0             0              0                1
10                        0             0              0                1
11                        0             0              0                0
12                        0             1              0                1
13                        0             0              0                0
14                        0             0              0                1
15                        0             0              0                0
16                        0             1              0                0
17                        0             0              1                0
18                        0             0              0                0
19                        0             0              0                0
21                        0             0              0                0
22                        0             1              0                0
23                        0             1              0                0
24                        0             0              0                0
25                        0             0              0                0
26                        0             1              0                0
27                        0             1              0                0
28                        0             0              0                0
29                        0             0              0                0
30                        0             1              1                0
...                     ...           ...            ...              ...
89496                     0             0              0                0
89497                     0             1              0                0
89498                     0             0              0                0
89502                     0             0              1                0
89505                     1             0              1                0
89517                     0             1              0                1
89521                     0             0              0                1
89526                     0             0              0                1
89536                     0             0              0                0
```

```
89537                     0             0              0               0
89547                     1             1              0               0
89570                     0             1              0               0
89574                     0             0              0               0
89621                     0             0              0               1
89630                     0             0              0               1
89668                     0             1              0               0
89727                     0             0              0               0
89778                     0             1              0               0
89852                     0             1              0               1
89856                     0             0              0               1
89881                     0             0              0               0
89962                     0             0              0               0
89969                     0             1              0               0
90001                     1             0              0               0
90031                     0             0              0               0
90065                     0             0              0               1
90167                     0             0              0               0
90206                     0             0              0               1
90239                     0             0              0               0
90327                     1             0              0               1

       Hex-and-Counter  Line Drawing  Memory_mechanics  Modular Board  \
0                    0             0                 0              0
1                    0             0                 0              0
2                    0             0                 0              0
3                    0             0                 0              0
4                    0             0                 0              0
5                    0             0                 0              0
6                    0             0                 0              0
7                    0             0                 0              1
8                    0             0                 0              0
9                    0             0                 0              0
10                   0             0                 0              0
11                   0             0                 0              0
12                   0             0                 0              1
13                   0             0                 0              0
14                   0             0                 0              0
15                   0             0                 0              0
16                   0             0                 0              0
17                   0             0                 0              1
18                   0             0                 0              0
19                   0             0                 0              0
21                   0             0                 0              1
22                   1             0                 0              0
23                   1             0                 0              1
24                   0             0                 0              0
25                   0             0                 0              0
```

```
26                   0             0                 0              0
27                   0             0                 0              0
28                   0             0                 0              1
29                   0             0                 0              0
30                   0             0                 0              0
...                ...           ...               ...            ...
89496                0             0                 0              0
89497                0             0                 0              0
89498                0             0                 0              0
89502                0             0                 0              0
89505                0             0                 0              0
89517                0             0                 0              0
89521                0             0                 0              0
89526                0             0                 1              0
89536                0             0                 0              0
89537                0             0                 0              0
89547                0             0                 0              0
89570                0             0                 0              0
89574                0             0                 0              0
89621                0             0                 0              0
89630                0             0                 0              0
89668                0             0                 0              0
89727                0             0                 0              0
89778                0             0                 0              0
89852                0             0                 0              1
89856                0             0                 0              0
89881                0             0                 0              0
89962                0             0                 0              0
89969                0             0                 0              0
90001                0             0                 0              0
90031                0             0                 0              0
90065                0             0                 0              0
90167                0             0                 0              0
90206                0             0                 0              0
90239                0             0                 0              0
90327                0             0                 0              0

       Paper-and-Pencil  Partnerships  Pattern Building  Pattern Recognition  \
0                     0             0                 0                    0
1                     0             0                 0                    0
2                     0             0                 0                    0
3                     0             0                 0                    0
4                     0             0                 0                    0
5                     0             0                 0                    0
6                     0             0                 1                    1
7                     0             0                 0                    0
8                     0             0                 0                    0
9                     0             0                 0                    0
```

10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
...	...	...	...	...
89496	0	0	0	0
89497	0	0	0	0
89498	0	0	0	0
89502	0	0	0	0
89505	0	0	0	0
89517	0	0	0	0
89521	0	0	0	0
89526	0	0	0	0
89536	0	0	0	0
89537	0	0	0	0
89547	0	0	0	0
89570	0	0	0	0
89574	0	0	1	0
89621	0	0	0	0
89630	0	0	0	0
89668	0	0	0	0
89727	0	0	0	0
89778	0	0	0	0
89852	0	0	0	0
89856	0	1	0	0
89881	0	0	0	0
89962	0	0	0	0
89969	0	0	0	0
90001	0	0	0	0
90031	0	0	0	0
90065	0	0	0	0
90167	0	0	0	0

```
90206                 0              0                 0                    0
90239                 0              0                 0                    0
90327                 0              0                 0                    0

       Pick-up and Deliver  Player Elimination  Point to Point Movement  \
0                        0                   0                        0
1                        0                   0                        0
2                        0                   0                        0
3                        0                   0                        0
4                        0                   0                        0
5                        0                   0                        0
6                        0                   0                        0
7                        0                   0                        0
8                        0                   0                        0
9                        0                   0                        1
10                       0                   0                        0
11                       0                   0                        0
12                       0                   0                        0
13                       0                   0                        0
14                       0                   0                        0
15                       0                   0                        0
16                       0                   0                        0
17                       0                   0                        0
18                       0                   0                        0
19                       0                   0                        0
21                       0                   0                        0
22                       0                   0                        0
23                       0                   0                        0
24                       0                   0                        0
25                       0                   0                        0
26                       0                   0                        0
27                       0                   0                        0
28                       0                   0                        0
29                       0                   0                        0
30                       0                   0                        0
...                    ...                 ...                      ...
89496                    0                   0                        0
89497                    0                   0                        0
89498                    0                   0                        0
89502                    0                   0                        0
89505                    0                   0                        0
89517                    0                   0                        0
89521                    0                   0                        0
89526                    0                   0                        0
89536                    0                   0                        0
89537                    0                   0                        0
89547                    0                   0                        0
89570                    0                   0                        0
```

```
89574                    0                   0                        0
89621                    0                   0                        0
89630                    1                   0                        0
89668                    0                   0                        0
89727                    0                   0                        0
89778                    0                   0                        0
89852                    0                   0                        0
89856                    0                   0                        0
89881                    0                   0                        0
89962                    0                   0                        0
89969                    0                   0                        0
90001                    0                   0                        0
90031                    0                   0                        0
90065                    0                   0                        0
90167                    0                   0                        0
90206                    0                   0                        0
90239                    0                   0                        0
90327                    0                   0                        0

       Press Your Luck  Rock-Paper-Scissors  Role Playing  \
0                    0                    0             0
1                    0                    0             0
2                    0                    0             0
3                    0                    0             0
4                    0                    0             0
5                    0                    0             0
6                    0                    0             0
7                    0                    0             0
8                    0                    0             0
9                    0                    0             0
10                   0                    0             0
11                   1                    0             0
12                   0                    0             0
13                   0                    0             0
14                   0                    0             0
15                   0                    0             0
16                   1                    0             0
17                   0                    0             0
18                   0                    0             0
19                   0                    0             0
21                   0                    1             1
22                   0                    0             0
23                   0                    0             0
24                   0                    0             0
25                   0                    0             0
26                   0                    0             0
27                   0                    0             0
28                   0                    0             0
```

```
29                   1                    0             0
30                   0                    0             0
...                ...                  ...           ...
89496                0                    0             0
89497                1                    0             0
89498                0                    0             0
89502                0                    0             0
89505                0                    0             0
89517                0                    0             0
89521                0                    0             0
89526                0                    0             0
89536                0                    0             0
89537                0                    0             0
89547                0                    0             0
89570                0                    0             0
89574                0                    0             0
89621                0                    0             0
89630                0                    0             0
89668                0                    0             0
89727                0                    0             0
89778                0                    0             0
89852                0                    0             0
89856                0                    0             0
89881                0                    0             0
89962                0                    0             0
89969                1                    0             1
90001                0                    0             0
90031                0                    0             0
90065                0                    0             0
90167                0                    0             0
90206                0                    0             0
90239                0                    0             0
90327                0                    0             0

       Roll / Spin and Move  Route/Network Building  Secret Unit Deployment  \
0                         0                       0                       0
1                         0                       0                       0
2                         0                       0                       0
3                         0                       0                       0
4                         0                       0                       0
5                         0                       0                       0
6                         0                       0                       0
7                         0                       0                       0
8                         0                       0                       0
9                         0                       1                       0
10                        0                       0                       0
11                        0                       0                       0
12                        0                       1                       0
```

13	1	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	1	0
28	0	0	0
29	0	0	0
30	0	0	0
...	...	...	...
89496	0	0	0
89497	0	0	0
89498	0	0	0
89502	0	0	0
89505	0	0	0
89517	0	0	0
89521	0	0	0
89526	0	0	1
89536	0	0	0
89537	0	0	0
89547	0	0	0
89570	0	0	0
89574	0	0	0
89621	0	0	0
89630	0	0	0
89668	0	0	0
89727	0	0	0
89778	0	0	0
89852	0	0	0
89856	0	0	0
89881	0	0	0
89962	0	0	0
89969	0	0	0
90001	0	0	0
90031	0	0	0
90065	0	0	0
90167	0	0	0
90206	0	0	0
90239	0	0	0
90327	0	0	0

```
       Set Collection  Simulation  Simultaneous Action Selection  Singing  \
0                   0           0                              1        0
1                   0           0                              0        0
2                   1           0                              0        0
3                   1           0                              0        0
4                   0           0                              0        0
5                   0           0                              0        0
6                   0           0                              0        0
7                   0           0                              0        0
8                   0           0                              0        0
9                   0           0                              0        0
10                  1           0                              0        0
11                  1           0                              0        0
12                  0           0                              0        0
13                  1           0                              1        0
14                  0           0                              0        0
15                  0           0                              0        0
16                  0           0                              0        0
17                  0           0                              1        0
18                  0           0                              0        0
19                  0           0                              0        0
21                  0           0                              1        0
22                  0           0                              0        0
23                  0           0                              0        0
24                  0           0                              0        0
25                  0           0                              0        0
26                  0           0                              0        0
27                  0           0                              0        0
28                  0           0                              0        0
29                  0           0                              0        0
30                  0           0                              0        0
...               ...         ...                            ...      ...
89496               0           0                              0        0
89497               0           0                              0        0
89498               0           0                              0        0
89502               1           0                              0        0
89505               0           0                              0        0
89517               0           0                              0        0
89521               0           0                              0        0
89526               0           0                              0        0
89536               0           0                              0        0
89537               0           0                              1        0
89547               0           0                              0        0
89570               0           0                              0        0
89574               0           0                              0        0
89621               1           0                              0        0
89630               0           0                              0        0
```

```
89668               0           0                              0        0
89727               0           0                              0        0
89778               1           0                              0        0
89852               0           0                              0        0
89856               0           0                              0        0
89881               0           0                              0        0
89962               0           0                              0        0
89969               1           0                              0        0
90001               0           0                              0        0
90031               0           0                              1        0
90065               0           0                              0        0
90167               0           0                              0        0
90206               1           0                              0        0
90239               0           0                              0        0
90327               0           0                              0        0

       Stock Holding  Storytelling  Take That  Tile Placement  Time Track  \
0                  0             0          0               0           0
1                  0             0          0               0           0
2                  0             0          0               1           0
3                  0             0          0               0           0
4                  1             0          0               1           0
5                  0             0          0               0           0
6                  0             0          0               1           0
7                  0             0          0               0           0
8                  0             0          0               1           0
9                  0             0          0               0           0
10                 0             0          0               0           0
11                 0             0          0               0           0
12                 0             0          0               0           0
13                 0             0          0               0           0
14                 0             0          0               0           0
15                 0             0          0               0           0
16                 0             0          0               0           0
17                 0             0          0               0           0
18                 0             0          0               1           0
19                 0             0          0               0           0
21                 0             0          0               0           0
22                 0             0          0               0           0
23                 0             0          0               1           0
24                 0             0          0               0           0
25                 0             0          0               0           0
26                 0             0          0               0           0
27                 0             0          0               1           0
28                 0             0          0               0           0
29                 0             0          0               0           0
30                 0             0          0               0           0
...              ...           ...        ...             ...         ...
```

```
89496              0             0           0               0           0
89497              0             0           0               0           0
89498              0             0           0               1           0
89502              0             0           0               0           0
89505              0             0           0               0           0
89517              0             0           0               0           0
89521              0             0           0               0           0
89526              0             0           1               0           0
89536              0             0           0               0           0
89537              0             0           0               1           0
89547              0             0           0               0           0
89570              0             0           0               0           0
89574              0             0           0               0           0
89621              0             0           1               0           0
89630              1             0           1               0           0
89668              0             1           0               1           0
89727              0             0           0               0           0
89778              0             0           0               0           0
89852              0             0           0               0           0
89856              0             0           0               0           0
89881              0             0           0               0           0
89962              0             0           0               0           0
89969              0             0           0               0           0
90001              0             0           0               0           0
90031              0             0           0               0           0
90065              0             0           0               0           0
90167              0             0           0               0           0
90206              0             0           0               0           0
90239              0             0           0               1           0
90327              0             0           0               0           0

       Trading  Trick-taking  Variable Phase Order  Variable Player Powers  \
0            0             0                     0                       0
1            0             1                     0                       0
2            0             0                     0                       0
3            0             0                     0                       0
4            0             0                     0                       0
5            0             0                     0                       0
6            0             0                     0                       0
7            0             0                     0                       0
8            0             0                     0                       0
9            0             0                     0                       0
10           1             0                     0                       0
11           0             0                     0                       0
12           1             0                     0                       0
13           0             0                     0                       0
14           0             0                     0                       1
15           0             0                     0                       0
```

```
16           0             0                     0                      0
17           0             0                     0                      0
18           0             0                     0                      0
19           0             0                     0                      0
21           0             0                     0                      1
22           0             0                     1                      0
23           0             0                     0                      1
24           0             0                     0                      0
25           0             0                     0                      0
26           0             0                     0                      0
27           0             0                     0                      1
28           0             0                     0                      0
29           0             0                     0                      0
30           0             0                     0                      0
...        ...           ...                   ...                    ...
89496        0             0                     0                      0
89497        0             0                     0                      0
89498        0             0                     0                      0
89502        0             0                     0                      0
89505        0             0                     0                      0
89517        0             0                     0                      1
89521        0             0                     0                      0
89526        0             0                     0                      0
89536        0             0                     0                      0
89537        0             0                     0                      0
89547        0             0                     0                      1
89570        0             0                     0                      0
89574        0             0                     0                      0
89621        0             0                     0                      0
89630        0             0                     0                      1
89668        0             0                     0                      1
89727        0             0                     0                      0
89778        0             0                     0                      1
89852        0             0                     0                      1
89856        0             0                     0                      0
89881        0             0                     0                      1
89962        0             0                     0                      0
89969        0             0                     0                      0
90001        0             0                     0                      0
90031        0             0                     0                      0
90065        0             0                     0                      0
90167        0             0                     0                      0
90206        0             0                     0                      0
90239        0             0                     0                      0
90327        0             0                     0                      0

       Voting  Worker Placement
0           0                 0
```

```
1           0                  0
2           0                  0
3           0                  0
4           0                  0
5           0                  0
6           0                  0
7           0                  0
8           0                  0
9           0                  0
10          0                  0
11          0                  0
12          0                  0
13          0                  0
14          0                  0
15          0                  0
16          0                  0
17          0                  0
18          1                  0
19          0                  0
21          0                  0
22          0                  0
23          1                  0
24          0                  0
25          0                  0
26          0                  0
27          0                  0
28          0                  0
29          0                  0
30          0                  0
...        ...                ...
89496       0                  0
89497       0                  0
89498       0                  0
89502       0                  0
89505       0                  0
89517       0                  0
89521       0                  0
89526       0                  0
89536       0                  0
89537       0                  0
89547       0                  0
89570       0                  0
89574       0                  0
89621       0                  0
89630       0                  0
89668       0                  0
89727       0                  0
89778       0                  1
```

```
89852       0                 0
89856       1                 0
89881       0                 0
89962       0                 0
89969       0                 0
90001       0                 0
90031       0                 0
90065       0                 1
90167       0                 0
90206       0                 0
90239       0                 0
90327       0                 0

[17417 rows x 51 columns]
```

```
In [66]: s_mechs_overivew = df_data4.iloc[:, 94:145].sum()
```

```
In [67]: df_mechs_overview = pd.Series.to_frame(s_mechs_overivew)
```

```
In [68]: df_mechs_overview
```

```
Out[68]:                                    0
         Acting                           189
         Action / Movement Programming    244
         Action Point Allowance System    805
         Area Control / Area Influence   1044
         Area Enclosure                   174
         Area Movement                    883
         Area-Impulse                      72
         Auction/Bidding                  965
         Betting/Wagering                 319
         Campaign / Battle Card Driven    376
         Card Drafting                   1291
         Chit-Pull System                 165
         Co-operative Play                813
         Commodity Speculation            222
         Crayon Rail System                26
         Deck / Pool Building             429
         Dice Rolling                    3718
         Grid Movement                    576
         Hand Management                 3081
         Hex-and-Counter                 1962
         Line Drawing                      88
         Memory_mechanics                 823
         Modular Board                   1213
         Paper-and-Pencil                 201
         Partnerships                     648
         Pattern Building                 599
         Pattern Recognition              480
         Pick-up and Deliver            510
         Player Elimination             341
         Point to Point Movement        717
         Press Your Luck                504
         Rock-Paper-Scissors            141
         Role Playing                   380
         Roll / Spin and Move          1524
         Route/Network Building         394
         Secret Unit Deployment         461
         Set Collection                2114
         Simulation                     891
         Simultaneous Action Selection  947
         Singing                         47
         Stock Holding                  280
         Storytelling                   289
         Take That                      443
         Tile Placement                1385
         Time Track                      75
         Trading                        612
         Trick-taking                   304
         Variable Phase Order           256
         Variable Player Powers        1621
         Voting                         342
         Worker Placement               450
```

```
In [69]: df_mechs_overview[0].describe()
```

```
Out[69]: count      51.000000
         mean      714.392157
         std       734.973607
         min        26.000000
         25%       268.000000
         50%       461.000000
         75%       887.000000
         max      3718.000000
         Name: 0, dtype: float64
```

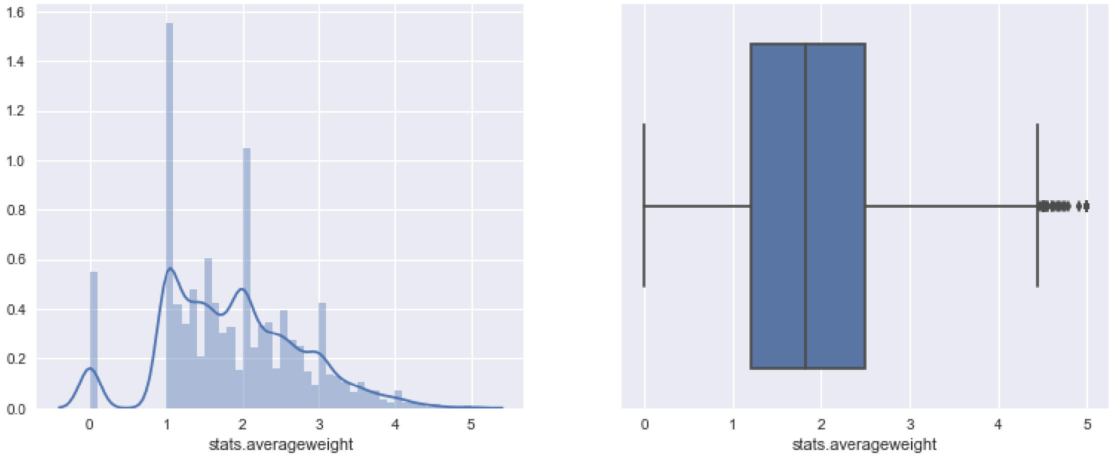
We see that across all the mechanics, the minimum number of board games per one mechanic is is 26, and the maximum is 3718, with an average of approximately 714 to each mechanic.

Average Weight

```
In [70]: analyze_feature(df_data4, "stats.averageweight")
```

```
count    17417.000000
mean         1.873099
std          0.899252
min          0.000000
25%          1.200000
```

```
50%            1.833300
75%            2.500000
max            5.000000
Name: stats.averageweight, dtype: float64
```



BoardGameGeek has five categorical variables for “weight” which answers the question: “How heavy (difficult/complex) is this game?” Light = 1, Medium Light = 2, Medium = 3, Medium Heavy = 4, and Heavy = 5. Consequently, any board games with a weight of less than 1 should be eliminated, and anything above 5 should be eliminated as well.

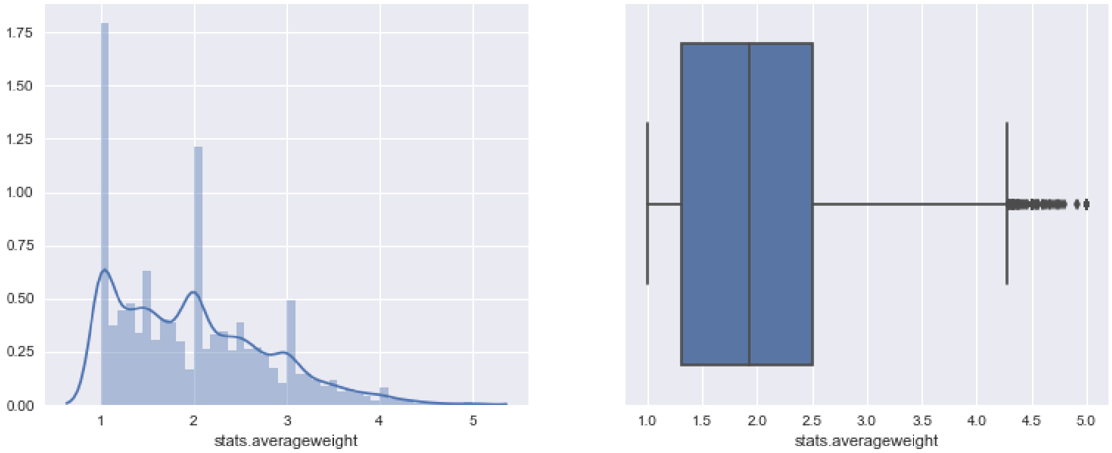
```
In [71]: df_data5 = df_data4[(df_data4['stats.averageweight']>=1)]
```

```
In [72]: df_data4['stats.averageweight'].count()-df_data5['stats.averageweight'].count()
```

```
Out[72]: 956
```

```
In [73]: analyze_feature(df_data5, "stats.averageweight")
```

```
count    16461.000000
mean         1.981882
std          0.800007
min          1.000000
25%          1.318200
50%          1.933300
75%          2.500000
max          5.000000
Name: stats.averageweight, dtype: float64
```

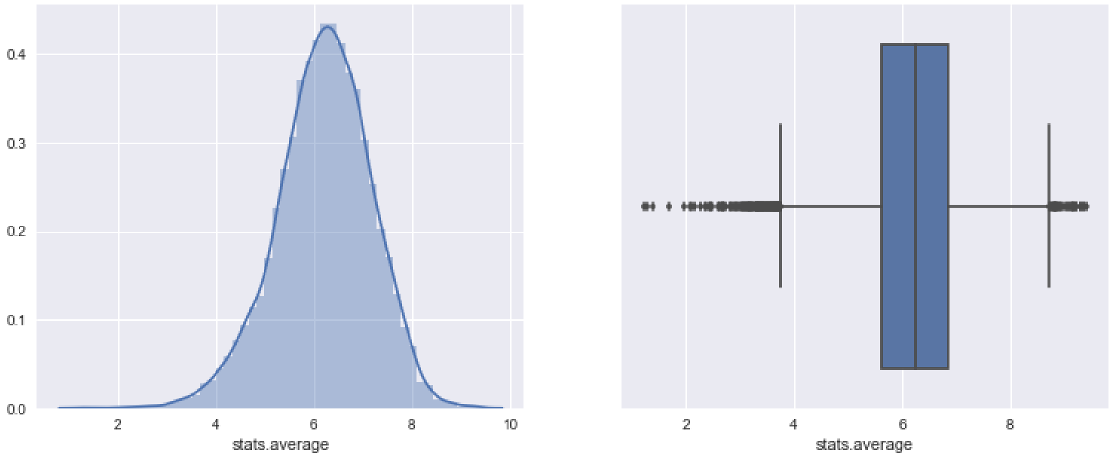


We removed 956 games from our record and now have 16461.

Average Score

```
In [74]: analyze_feature(df_data5, "stats.average")
```

```
count    16461.000000
mean         6.200449
std          0.959954
min          1.226530
25%          5.609620
50%          6.241110
75%          6.855570
max          9.411770
Name: stats.average, dtype: float64
```

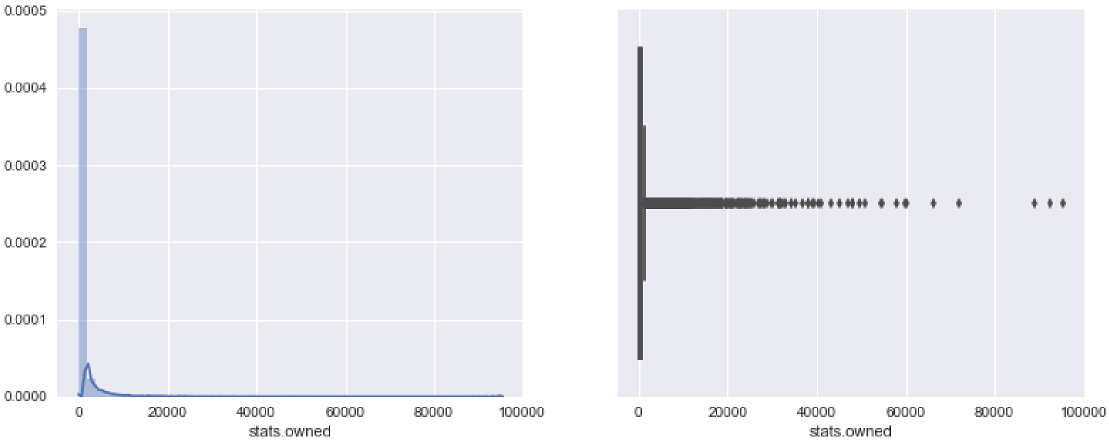


Scores can range from 1 to 10, and from investigating the data, we see a small left-skew, but no data to be concerned about.

Average Owned

```
In [75]: analyze_feature(df_data5, "stats.owned")
```

```
count    16461.000000
mean       882.566065
std       3172.514864
min          1.000000
25%         67.000000
50%        176.000000
75%        542.000000
max      95401.000000
Name: stats.owned, dtype: float64
```



```
In [76]: df_data.loc[df_data['stats.owned']==95401]
```

```
Out[76]:   details.name  details.maxplayers  details.minage  details.minplayers  \
        12        Catan                 4.0            10.0                 3.0

            details.playingtime  details.yearpublished  stats.averageweight  \
        12                120.0                 1995.0               2.3603

            stats.average  stats.owned  stats.stddev  Abstract Strategy  \
        12        7.26569      95401.0       1.44842                  0

            Action / Dexterity  Adventure  Age of Reason  American Civil War  \
        12                   0          0              0                   0
```

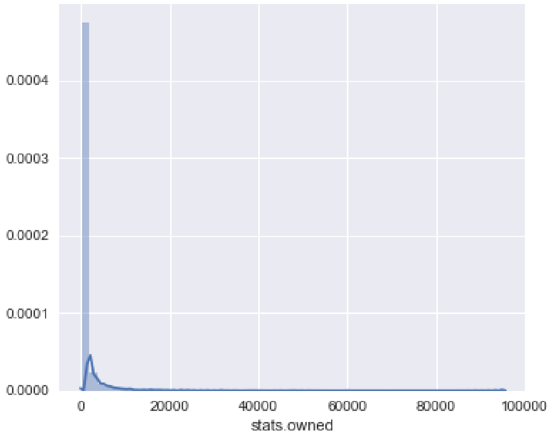
```
    American Indian Wars  American Revolutionary War  American West  Ancient  \
12                     0                           0              0        0

    Animals  Arabian  Aviation / Flight  Bluffing  Book  Card Game  \
12        0        0                  0         0     0          0

    Children's Game  City Building  Civil War  Civilization  \
12                0              0          0             0

    Collectible Components  Comic Book / Strip  Deduction  Dice  Economic  \
12                       0                   0          0     0         0

    Educational  Electronic  Environmental  Expansion for Base-game  \
12            0           0              0                        0

    Exploration  Fan Expansion  Fantasy  Farming  Fighting  Game System  \
12            0              0        0        0         0            0

    Horror  Humor  Industry / Manufacturing  Korean War  Mafia  Math  \
12       0      0                         0           0      0     0

         ...        Area Control / Area Influence  Area Enclosure  \
12       ...                                    0               0

    Area Movement  Area-Impulse  Auction/Bidding  Betting/Wagering  \
12              0             0                0                 0

    Campaign / Battle Card Driven  Card Drafting  Chit-Pull System  \
12                              0              0                 0

    Co-operative Play  Commodity Speculation  Crayon Rail System  \
12                  0                      0                   0

    Deck / Pool Building  Dice Rolling  Grid Movement  Hand Management  \
12                     0             1              0                1

    Hex-and-Counter  Line Drawing  Memory_mechanics  Modular Board  \
12                0             0                 0              1

    Paper-and-Pencil  Partnerships  Pattern Building  Pattern Recognition  \
12                 0             0                 0                    0

    Pick-up and Deliver  Player Elimination  Point to Point Movement  \
12                    0                   0                        0

    Press Your Luck  Rock-Paper-Scissors  Role Playing  Roll / Spin and Move  \
12                0                    0             0                     0
```

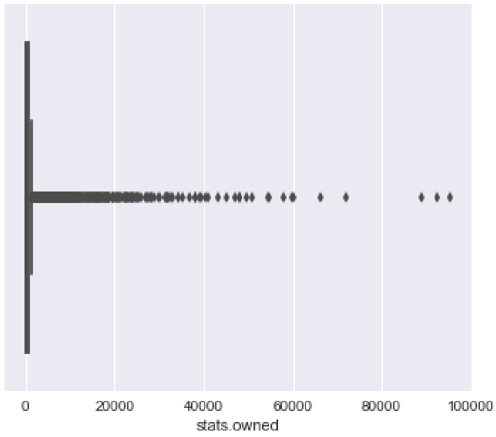
```
    Route/Network Building  Secret Unit Deployment  Set Collection  \
12                       1                       0               0

    Simulation  Simultaneous Action Selection  Singing  Stock Holding  \
12           0                              0        0              0

    Storytelling  Take That  Tile Placement  Time Track  Trading  \
12             0          0               0           0        1

    Trick-taking  Variable Phase Order  Variable Player Powers  Voting  \
12             0                     0                       0       0

    Worker Placement  binned.average  binary.success
12                 0             7.0               1

[1 rows x 147 columns]
```

Without a sufficent enough sample size of games being owned, statistics and data derived from these data may not be robust. Consequently we will limit the minimum number of games that are "owned" to a lower limit of 30.

```
In [77]: df_data6 = df_data5[(df_data5['stats.owned']>=30)]

In [78]: df_data5['stats.owned'].count()-df_data6['stats.owned'].count()

Out[78]: 1199

In [79]: analyze_feature(df_data6, "stats.owned")
```

```
count    15262.000000
mean       950.305334
std       3285.209893
min         30.000000
25%         83.000000
50%        202.500000
75%        600.000000
max      95401.000000
Name: stats.owned, dtype: float64
```



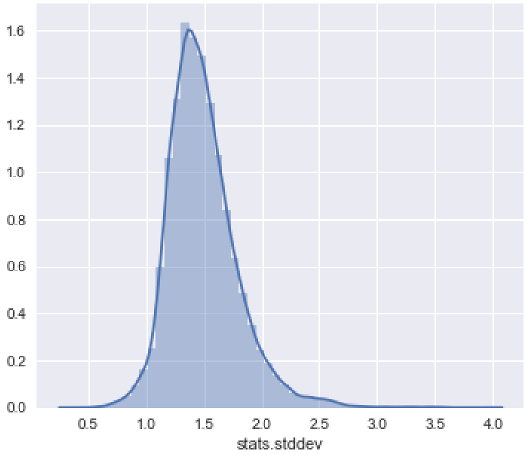


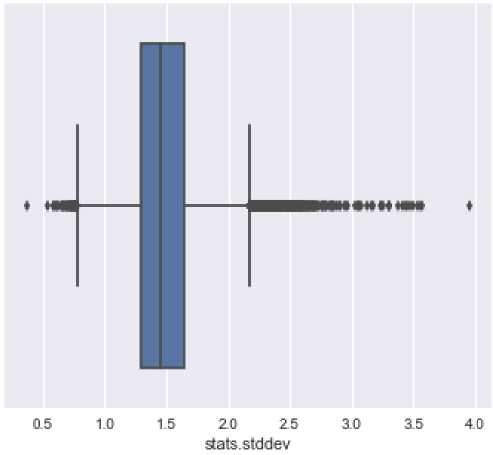
We observe we removed 1199 games because they were owned less than 30 times. Our record set is 15262.

Average Score St.Dev

```
In [80]: analyze_feature(df_data6, "stats.stddev")
```

```
count    15262.000000
mean         1.495717
std          0.301227
min          0.369966
25%          1.297735
50%          1.454630
75%          1.646840
max          3.958430
Name: stats.stddev, dtype: float64
```





Average Score St.dev does not need to be changed too significantly, because there are no errors or supsicious data.

1.5 Creating Data Sets

In order to properly design and validate our learning models, we will need three sets of data: - Training Data - Development Data - Test Data

First, though, we want to filter our game data by publishing year. As discussed above, we're interested in the shift in board game design in recent years. So, we'll create two data sets: one from 2000 to present, and one from 1980 to 1995.

```
In [81]: new_games_df = df_data6[(df_data6['details.yearpublished'] > 2000)]

         old_games_df = df_data6[(df_data6['details.yearpublished'] > 1980) &
                                 (df_data6['details.yearpublished'] < 1995)]

         print("New games shape: " + str(new_games_df.shape) + "; Old games shape: " + str(old_
```

```
New games shape: (10084, 147); Old games shape: (2260, 147)
```

Now we can create the training, dev, and test sets.
We'll use a We'll use a split of 70% / 10% / 20% for the new games, since we'll be developing models based on these games. Each will be randomly selected from the dataframe of entries.
For the old games, we'll separate only a training set and a test set. (We won't do model development with the old games; we'll simply apply the model developed for the newer games.)

```
In [82]: #Split the new/old game DF into features and outcomes:
         new_games_df_features = new_games_df.drop(["stats.average", "binned.average",
                                                    "stats.stddev", "stats.owned", "details.nam
         new_game_df_outcomes = new_games_df[["stats.average", "binned.average", "stats.stddev"
         old_games_df_features = old_games_df.drop(["stats.average", "binned.average",
                                                    "stats.stddev", "stats.owned", "details.nam
         old_games_df_outcomes = old_games_df[["stats.average", "binned.average", "stats.stddev
```

```
In [83]: # create a random arrangement of the data sets
         # New Games
         np.random.seed(0)
         shuffle_new = np.random.permutation(np.arange(new_games_df_features.shape[0]))
         shuffle_old = np.random.permutation(np.arange(old_games_df_features.shape[0]))
         #Convert all data frames into Nump Arrays:
         new_games_df_feat = new_games_df_features.values
         new_games_df_out = new_game_df_outcomes.values
         old_game_df_feat = old_games_df_features.values
         old_game_df_out = old_games_df_outcomes.values
```

```
In [84]: # create a random arrangement of the data sets

         shuffled_new_feat = new_games_df_feat[shuffle_new]
```

```
shuffled_new_out = new_games_df_out[shuffle_new]

shuffled_old_feat = old_game_df_feat[shuffle_old]
shuffled_old_out = old_game_df_out[shuffle_old]

print(shuffled_new_feat.shape) #we expect to still see 10084 rows and 141 features
print(shuffled_new_out.shape) #we expect to still see 10084 rows and 5 features
print(shuffled_old_feat.shape) #we expect to still see 2260 rows and 141 features
print(shuffled_old_out.shape) #we expect to still see 2260 rows and 5 features
```

```
(10084, 141)
(10084, 5)
(2260, 141)
(2260, 5)
```

```
In [85]: #Splitting into Training, Dev, and Test Sets - Note: won't include a dev set for Old 

         #Get the number of Records
         n_new_games = shuffled_new_feat.shape[0]
         n_old_games = shuffled_old_feat.shape[0]
         print(n_new_games)
         print(n_old_games)

         #Split:
```

```
10084
2260
```

```
In [86]: #New Game data sets

         new_split1 = int(np.floor(.7*n_new_games)) # 70% for training
         new_split2 = new_split1 + int(np.floor(.1*n_new_games)) + 1  # 10% for dev

         print(new_split1, new_split2)

         new_train_data = shuffled_new_feat[:new_split1]
         new_train_labels = shuffled_new_out[:new_split1]

         new_dev_data = shuffled_new_feat[new_split1:new_split2]
         new_dev_labels = shuffled_new_out[new_split1:new_split2]

         new_test_data = shuffled_new_feat[new_split2:]
         new_test_labels = shuffled_new_out[new_split2:]

         print("Training shape: " + str(new_train_data.shape) + "; Dev shape: " + str(new_dev_
         print(np.ma.size(new_train_data,0)+np.ma.size(new_dev_data,0)+np.ma.size(new_test_data
7058 8067
Training shape: (7058, 141); Dev shape: (1009, 141); Test shape: (2017, 141)
10084
```

```
In [87]: # Old game data sets
         old_split1 = int(np.floor(.7*n_old_games)) # 70% for training


         old_train_data = shuffled_old_feat[:old_split1]
         old_train_labels = shuffled_old_out[:old_split1]

         old_test_data = shuffled_old_feat[old_split1:]
         old_test_labels = shuffled_old_out[old_split1:]

         print("Training shape: " + str(old_train_data.shape) + "; Test shape: " + str(old_tes
         print(np.ma.size(old_train_data,0)+np.ma.size(old_test_data,0))
```

```
Training shape: (1582, 141); Test shape: (678, 141)
2260
```

1.6 Modeling - kNN

The first model we are attempting is a k-Nearest-Neighbors model. This will find board games similar to the one in question, and use them to predict the rating of the unknown game. This seems similar to how real life works - players use similar games to decide whether to buy a new game - so it's worth a shot here!

```
In [88]: from sklearn.neighbors import KNeighborsClassifier


         k_values = [1,3,5,7,9]

         for k in k_values:
             ## MODEL USING BINARY SUCCESS (TWO CATEGORIES FOR OUTCOME)
             binary_kNN = KNeighborsClassifier(n_neighbors = k)
             binary_kNN.fit(new_train_data, new_train_labels[:,4]) # binary_success is in colu
             # take a stab at the dev set
             y_pred = binary_kNN.predict(new_dev_data)
             # accuracy
             binary_acc = round(sum(y_pred == new_dev_labels[:,4])/new_dev_labels.shape[0],3)*
             print("\nThe binary classifier with k=" + str(k) + " had an accuracy of " + str(b

             ## MODEL USING STAR RATING, 0-10 (TEN CATEGORIES FOR OUTCOME)
             ten_kNN = KNeighborsClassifier(n_neighbors = k)
             ten_kNN.fit(new_train_data, new_train_labels[:,1]) # binned star rating is in col
             # take a stab at the dev set
             y_pred = ten_kNN.predict(new_dev_data)
```

```
    # accuracy
    ten_acc = round(sum(y_pred == new_dev_labels[:,1])/new_dev_labels.shape[0],3)*100
    # what if you consider +/- 1 star to be still "accurate"?
    ten_acc2 = round((
        sum(y_pred == new_dev_labels[:,1]) +
        sum(y_pred == new_dev_labels[:,1]-1) + sum(y_pred == new_dev_labels[:,1]+1)
        )/new_dev_labels.shape[0],3)*100
    print("The 1-10 scale classifier with k=" + str(k) + " had an accuracy of "
          + str(ten_acc) + "% (and a +/-1 star accuracy of " + str(ten_acc2) + "%)." )

# print the binary values the model gets wrong
print("\nThe ratings misclassified by the binary classifier were: ")
y_pred = binary_kNN.predict(new_dev_data)
binary_errors = new_dev_labels[y_pred != new_dev_labels[:,4],:]
print(str(binary_errors[0:15,1]) + "-- actual values")

# print the binned values the model gets wrong
print("\nThe ratings misclassified by the binned 0-10 classifier were: ")
y_pred = ten_kNN.predict(new_dev_data)
ten_errors = new_dev_labels[y_pred != new_dev_labels[:,1],:]
print(str(ten_errors[0:15,1]) + "-- actual values")
print(str(y_pred[y_pred != new_dev_labels[:,1]][0:15]) + "-- predicted values")
```

```
The binary classifier with k=1 had an accuracy of 77.3%.
The 1-10 scale classifier with k=1 had an accuracy of 39.2% (and a +/-1 star accuracy of 88.8%

The binary classifier with k=3 had an accuracy of 79.2%.
The 1-10 scale classifier with k=3 had an accuracy of 39.3% (and a +/-1 star accuracy of 87.8%

The binary classifier with k=5 had an accuracy of 79.2%.
The 1-10 scale classifier with k=5 had an accuracy of 42.9% (and a +/-1 star accuracy of 92.6%

The binary classifier with k=7 had an accuracy of 79.4%.
The 1-10 scale classifier with k=7 had an accuracy of 44.1% (and a +/-1 star accuracy of 93.0%

The binary classifier with k=9 had an accuracy of 78.9%.
The 1-10 scale classifier with k=9 had an accuracy of 44.4% (and a +/-1 star accuracy of 92.9%

The ratings misclassified by the binary classifier were:
[ 6.  7.  7.  6.  6.  7.  6.  7.  6.  7.  6.  7.  6.  7.  7.]-- actual values

The ratings misclassified by the binned 0-10 classifier were:
[ 6.  5.  7.  6.  7.  5.  6.  5.  8.  6.  7.  8.  6.  5.  6.]-- actual values
[ 5.  4.  6.  7.  6.  6.  7.  6.  7.  5.  6.  7.  5.  6.  7.]-- predicted values
```

The kNN model works reasonably well! We are able to achieve about 80% accuracy categorizing games into binary 'success' (rating > 7 stars) and 'failure' (rating < 7 stars) categories. We can see from the printed error values that most of the errors occur in the 6-7 star range, which is right on the border of “success”.

If we maintain the full spread of the 10 binned star-rating categories (integer values 1,2,3. . . 10), we are able to achieve only about 45% accuracy. However, if we concede that plus-or-minus one star is still an “accurate” prediction of rating, we are able to get an impressive accuracy above 90%! The output immediately above shows the true star rating listed above the star values predicted by the model. We can see that again, the mid-scale (5-8 star) range is the issue.

Based on our trials with the development data, we can see that the parameter k=5 creates the best kNN model. We’ll save the k=5 models for evaluation on our test data later.

```
In [89]: # Keep k=5 models
         binary_kNN = KNeighborsClassifier(n_neighbors = k)
         binary_kNN.fit(new_train_data, new_train_labels[:,4]) # binary_success is in column 4

         ten_kNN = KNeighborsClassifier(n_neighbors = k)
         ten_kNN.fit(new_train_data, new_train_labels[:,1]) # binned star rating is in column

         print("kNN models saved!")
```

```
kNN models saved!
```

1.7 Modeling - Naive Bayes

Next, we’ll attempt a Naive Bayes model to classify the games. Since our features are multi-valued, we’ll use the MultinomialNB option. Naive Bayes assumes that all features are conditionally independent and predicts the probability of each label given the feature values. We know that at least some of our features are not independent (for example, gameplay mechanics likely have some effect on playing time), so the naive assumption is certainly not entirely accurate. However, we’ll explore this model anyway.

```
In [90]: from sklearn.naive_bayes import MultinomialNB

         ## BINARY SUCCESS MODEL
         # Create and train the model
         binary_NBmodel = MultinomialNB()
         binary_NBmodel.fit(new_train_data, new_train_labels[:,4]) # binary success, column 4

         # Predict values for dev data
         y_pred = binary_NBmodel.predict(new_dev_data)
         acc = round(sum(y_pred == new_dev_labels[:,4])/len(new_dev_labels), 3)*100
         print("The Naive Bayes classifier predicted binary success with " + str(acc) + "% accu

         ## BINNED SCALE MODEL
         # Create and train the model
         ten_NBmodel = MultinomialNB()
         ten_NBmodel.fit(new_train_data, new_train_labels[:,1]) # binned 0-10 success, column

         # Predict values for dev data
```

```
        y_pred = ten_NBmodel.predict(new_dev_data)
        acc = round(sum(y_pred == new_dev_labels[:,1])/len(new_dev_labels), 3)*100
        # what if you consider +/- 1 star to be still "accurate"?
        acc2 = round((
            sum(y_pred == new_dev_labels[:,1]) +
            sum(y_pred == new_dev_labels[:,1]-1) + sum(y_pred == new_dev_labels[:,1]+1)
            )/new_dev_labels.shape[0],3)*100
        print("and predicted the 1-10 binned star rating with " + str(acc) +
              "% accuracy (+/-1 star with " + str(acc2) + "%). \n")
```

```
The Naive Bayes classifier predicted binary success with 73.6% accuracy
and predicted the 1-10 binned star rating with 34.1% accuracy (+/-1 star with 84.2%).
```

Well, Naive Bayes didn't achieve accuracy as high as kNN. Still, there is one benefit - Naive Bayes is a generative model, so we could actually use this model to "create" a new board game. The model can tell us the ideal playtime, number of players, mechanic, etc. Then it would be up to us to design a story and title to fit that mold!
In that spirit, let's take a look at which game mechanics and themes are the most likely to create a successful game.

```
In [91]: # feature probabilities for SUCCESS (outcome category 1)
         probs = np.exp(binary_NBmodel.feature_log_prob_[1,:])
         coefs = binary_NBmodel.coef_

         # game themes are in columns 6 through 89
         new_games_df_features.columns.tolist()[6:90]
         top_feat_inds = np.fliplr([np.argsort(probs[6:90])[-5:]])[0]

         for i in top_feat_inds:
             print("The theme " + new_games_df_features.columns.tolist()[6:90][i] +
                   " has a probability of " +  str(round(probs[6:90][i],5)*100) + "% in a succe

         print("\n")

         # game mechanics are in columns 91 through the end
         new_games_df_features.columns.tolist()[90:]
         top_feat_inds = np.fliplr([np.argsort(probs[90:])[-5:]])[0]

         for i in top_feat_inds:
             print("The mechanic " + new_games_df_features.columns.tolist()[90:][i] +
                   " has a probability of " +  str(round(probs[90:][i],5)*100) + "% in a succes
```

```
The theme Wargame has a probability of 0.012% in a successful game.
The theme Card Game has a probability of 0.011% in a successful game.
The theme Fantasy has a probability of 0.008% in a successful game.
The theme Economic has a probability of 0.006% in a successful game.
The theme Science Fiction has a probability of 0.005% in a successful game.
The mechanic Dice Rolling has a probability of 0.015% in a successful game.
The mechanic Hand Management has a probability of 0.012% in a successful game.
The mechanic Variable Player Powers has a probability of 0.01% in a successful game.
The mechanic Area Control / Area Influence has a probability of 0.007% in a successful game.
The mechanic Card Drafting has a probability of 0.006% in a successful game.
```

Looks like the more successful modern games have themes of wargames, card games, fantasy, economy, and science fiction. That certainly matches what we know from experience! The preferred mechanics are dice rolling, hand management, variable player powers, area control, and card drafting (aka deck building). Again, that is what we have seen in our favorite games!

1.8 Modeling - Linear Regression

Finally, we'll try a linear regression model for board game rating. This time, we'll use the full continous scale of rating (1-10, with decimal values included), since the model doesn't have to assign outcomes to countable categories.

```
In [92]: from sklearn.linear_model import LinearRegression

         # linear regression model
         Regmodel = LinearRegression()
         Regmodel.fit(new_train_data, new_train_labels[:,0]) # raw star values are in column 0

         print("The linear regression model achieves an R2 value of " + str(Regmodel.score(new_

         y_pred = Regmodel.predict(new_dev_data)
         print("At worst, the predicted score was off by " + str(round(np.max(y_pred - new_dev_
```

```
The linear regression model achieves an R2 value of 0.460947761954
At worst, the predicted score was off by 3.058 stars.
```

This linear regression model achieved an R2 of less than 0.5, and star ratings predicted within about 3 stars of the true value. Not the best performance - our kNN model is still winning. However, linear regression is wonderfully interpretable - the model here tells us the most important features in predicting success of a game.

```
In [93]: # what are the most important features?
         coefs = Regmodel.coef_
         top_feat_inds = np.fliplr([np.argsort(coefs)[-7:]])[0]
         bottom_feat_inds = np.argsort(coefs)[0:7]

         # features that bring rating up
         for i in top_feat_inds:
             print("The feature " + new_games_df_features.columns.tolist()[i] +
                   " has a coefficient of " +  str(coefs[i]))
         print("\n")
         # features that bring rating down
         for i in bottom_feat_inds:
             print("The feature " + new_games_df_features.columns.tolist()[i] +
                   " has a coefficient of " +  str(coefs[i]))
```

```
The feature Vietnam War has a coefficient of 0.491231458653
The feature American Indian Wars has a coefficient of 0.465557998552
The feature Napoleonic has a coefficient of 0.462687194417
The feature Crayon Rail System has a coefficient of 0.456555073874
The feature Game System has a coefficient of 0.427079240971
The feature Book has a coefficient of 0.412035099255
The feature stats.averageweight has a coefficient of 0.410222939636


The feature Roll / Spin and Move has a coefficient of -0.331455259955
The feature Movies / TV / Radio theme has a coefficient of -0.285456798849
The feature Mature / Adult has a coefficient of -0.284711811953
The feature Singing has a coefficient of -0.183744475696
The feature Number has a coefficient of -0.181778425733
The feature Zombies has a coefficient of -0.162301453659
The feature Trading has a coefficient of -0.146409417658
```

Looks like having a game themed on a historical war (Vietnam, American Indian, or Napoleonic) brings success, as does having a book theme. The "stats.averageweight" feature corresponds to gameplay difficulty; seems like more complex games help increase the player satisfaction rating!
On the other hand, having a game that requires rolling/spinning and moving (like traditional Monopoly or Life), singing, or trading all decrease satisfaction. Having mature/adult content, a movie/TV/radio theme, or a zombie theme also spells doom for game reception.

2 Evaluation of Models on Test Data

This section passes the test data through the three model types we built above. As we saw with the dev data, the kNN model performs the best.

```
In [94]: ## kNN MODELS
             # BINARY - evaluate the test data
         y_pred = binary_kNN.predict(new_test_data)
             # accuracy
         acc = round(sum(y_pred == new_test_labels[:,4])/new_test_labels.shape[0],3)*100
         print("\nThe binary kNN classifier had an accuracy of " + str(acc) + "%." )

             # BINNED - evaluate the test data
         y_pred = ten_kNN.predict(new_test_data)
             # accuracy
         acc = round(sum(y_pred == new_test_labels[:,1])/new_test_labels.shape[0],3)*100
             # what if you consider +/- 1 star to be still "accurate"?
         acc2 = round((
             sum(y_pred == new_test_labels[:,1]) +
             sum(y_pred == new_test_labels[:,1]-1) + sum(y_pred == new_test_labels[:,1]+1)
             )/new_test_labels.shape[0],3)*100
         print("The binned 1-10 scale kNN classifier had an accuracy of "
               + str(acc) + "%, or " + str(acc2) +  "% if you allow for +/-1 star.")
```

```
The binary kNN classifier had an accuracy of 80.6%.
The binned 1-10 scale kNN classifier had an accuracy of 48.4%, or 93.5% if you allow for +/-1 s
```

```
In [95]: ## Naive Bayes MODELS
             # BINARY - evaluate the test data
         y_pred = binary_NBmodel.predict(new_test_data)
             # accuracy
         acc = round(sum(y_pred == new_test_labels[:,4])/new_test_labels.shape[0],3)*100
         print("\nThe binary Naive Bayes classifier had an accuracy of " + str(acc) + "%." )

             # BINNED - evaluate the test data
         y_pred = ten_NBmodel.predict(new_test_data)
             # accuracy
         acc = round(sum(y_pred == new_test_labels[:,1])/new_test_labels.shape[0],3)*100
             # what if you consider +/- 1 star to be still "accurate"?
         acc2 = round((
             sum(y_pred == new_test_labels[:,1]) +
             sum(y_pred == new_test_labels[:,1]-1) + sum(y_pred == new_test_labels[:,1]+1)
             )/new_test_labels.shape[0],3)*100
         print("The binned 1-10 scale Naive Bayes classifier had an accuracy of "
               + str(acc) + "%, or " + str(acc2) +  "% if you allow for +/-1 star.")
```

```
The binary Naive Bayes classifier had an accuracy of 76.4%.
The binned 1-10 scale Naive Bayes classifier had an accuracy of 35.1%, or 84.9% if you allow fo
```

```
In [96]: ## Linear Regression model
         print("The linear regression model achieves an R2 value of " + str(Regmodel.score(new_
         y_pred = Regmodel.predict(new_test_data)
         print("On average, the predicted score was off by " + str(round(np.average(np.abs(y_pr
         print("At worst, the predicted score was off by " + str(round(np.max(y_pred - new_test
```

```
The linear regression model achieves an R2 value of 0.437876935045
On average, the predicted score was off by 0.509 stars.
At worst, the predicted score was off by 4.966 stars.
```

3 Analysis of "Old" Games

Now that we understand what features make a modern board game successful, we can analyze games from 1980 through 1995 to see how things have changed. We'll use the Naive Bayes approach to explore the most important features, since it had a better accuracy than Linear Regression in our experiments.

```
In [97]: ## BINARY SUCCESS MODEL
         # Create and train the model
         binary_NBmodel = MultinomialNB()
         binary_NBmodel.fit(old_train_data, old_train_labels[:,4]) # binary success, column 4

         # Predict values for dev data
         y_pred = binary_NBmodel.predict(old_test_data)
         acc = round(sum(y_pred == old_test_labels[:,4])/len(old_test_labels), 3)*100
         print("The Naive Bayes classifier predicted binary success with " + str(acc) + "% accu

         ## BINNED SCALE MODEL
         # Create and train the model
         ten_NBmodel = MultinomialNB()
         ten_NBmodel.fit(old_train_data, old_train_labels[:,1]) # binned 0-10 success, column 

         # Predict values for dev data
         y_pred = ten_NBmodel.predict(old_test_data)
         acc = round(sum(y_pred == old_test_labels[:,1])/len(new_dev_labels), 3)*100
         # what if you consider +/- 1 star to be still "accurate"?
         acc2 = round((
             sum(y_pred == old_test_labels[:,1]) +
             sum(y_pred == old_test_labels[:,1]-1) + sum(y_pred == old_test_labels[:,1]+1)
             )/old_test_labels.shape[0],3)*100
         print("and predicted the 1-10 binned star rating with " + str(acc) +
               "% accuracy (+/-1 star with " + str(acc2) + "%). \n")
```

```
The Naive Bayes classifier predicted binary success with 78.0% accuracy
and predicted the 1-10 binned star rating with 17.2% accuracy (+/-1 star with 75.1%).
```

```
In [98]: # feature probabilities for SUCCESS (outcome category 1)
         probs = np.exp(binary_NBmodel.feature_log_prob_[1,:])
         coefs = binary_NBmodel.coef_

         # game themes are in columns 6 through 89
         old_games_df_features.columns.tolist()[6:90]
         top_feat_inds = np.fliplr([np.argsort(probs[6:90])[-5:]])[0]

         for i in top_feat_inds:
             print("The theme " + old_games_df_features.columns.tolist()[6:90][i] +
                   " has a probability of " +  str(round(probs[6:90][i],5)*100) + "% in a succe
```

```
print("\n")

# game mechanics are in columns 91 through the end
old_games_df_features.columns.tolist()[90:]
top_feat_inds = np.fliplr([np.argsort(probs[90:])[-5:]])[0]

for i in top_feat_inds:
    print("The mechanic " + old_games_df_features.columns.tolist()[90:][i] +
          " has a probability of " +  str(round(probs[90:][i],5)*100) + "% in a succes
```

```
The theme Wargame has a probability of 0.031% in a successful game.
The theme World War II has a probability of 0.014% in a successful game.
The theme Science Fiction has a probability of 0.005% in a successful game.
The theme Miniatures has a probability of 0.005% in a successful game.
The theme Modern Warfare has a probability of 0.004% in a successful game.



The mechanic Hex-and-Counter has a probability of 0.022% in a successful game.
The mechanic Dice Rolling has a probability of 0.015% in a successful game.
The mechanic Simulation has a probability of 0.011% in a successful game.
The mechanic Variable Player Powers has a probability of 0.004% in a successful game.
The mechanic Action Point Allowance System has a probability of 0.003% in a successful game.
```

Looks like things have in fact changed a bit in the last 25 years! Wargames and Science Fiction were popular back then (and still are). However, the other front-running themes were World War II, Mineatures, and Modern Warfare. Perhaps that makes sense, considering that 1980 was still feeling the impact of American involvement in World War II and Vietnam.
As for mechanics, dice rolling and variable player powers were popular - and still are today. Otherwise, hex-and-counter, simulation, and action point allowance games were the trends of the last millenium.

4 Summary

In this analysis, we constructed three types of models to explore the features that make modern board games successful. * A k-Nearest-Neighbors approach gave us the best results, with the ability to predict the 0-10 star rating with over 90% accuracy (allowing +/-1 star margin) * Naive Bayes modeling helped us understand the themes and gameplay mechanics that most correspond to high ratings * Linear Regression models explored the full, continuous rating scale and helped us understand which features most strongly predict success - and failure!

We learned that dice-rolling and variable player power games are perennial favorites, as are games with Science Fiction and Wargame themes. However, modern games have pivoted some, and new mechanics such as hand management, card drafting, and area control have replaced the old world of miniatures and simulation.