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Social Network Gaming Trends

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Social Network Gaming Trends

Abstract

The purpose of this project was to determine how long the social network game Scratch-Offs, created by game development company Spice Rack Media, will remain financially viable. The game Scratch-Offs is a freeware game (users pay nothing for the actual software) and is funded through micro transactions (users must pay small amounts of money to play actual games). This implies a relationship between total games played and revenue earned. Using data provided by Spice Rack, we were able to develop an exponential equation that accurately depicts usage trends over time. This equation was used to determine the date Scratch-Offs will no longer be profitable.

Keywords

Social Networking Game, Exponential Regression, Forecasting

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PROBLEM STATEMENT

Using the provided data, find an equation that accurately models the relationship between total games played and time. Use the equation to determine when Scratch-Offs will no longer be financially profitable.

MOTIVATION

Few software companies are able to release products on a "when it's done" timetable. Most software is developed in a fixed amount of time during which definite milestones must be reached (planning stages, alpha build, beta build, debugging, release date etc.). While milestones and release dates are determined by multiple factors, the primary concern is usually budgetary. If a company knows the usage trends of currently at-market-software, they can accurately predict when operating/development costs will exceed revenue intake. With this knowledge, a company can determine the optimum time to release new products in order to maximize profit or off-set expected revenue loss.

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MATHEMATICAL DESCRIPTION AND SOLUTION APPROACH

The data, provided by Spice Rack Media, listed the total games played per day from January 3, 2010 to April 24, 2010 (Table 1, Appendix) which is graphed below as Figure 1. This data was input into Excel to create a graph of the total games played per week over a 16 week period (Table 2, Appendix) and is also graphed below as Figure 2.

In order to forecast the decline in games per week, we attempt both exponential and linear interpolation. Beginning with exponential interpolation, we attempt to express the weekly data as a decreasing exponential function of the type:

$$f(t) = y = be^{at} \tag{1}$$

where a and b are constants. To find the a and b which best approximates the weekly data, we consider half the sum of squares between our desired function and our data, i.e.

$$F(a,b) = \tfrac{1}{2}\textstyle\sum_{k=1}^{16}(be^{a\,k} - y_k)^2. \tag{2}$$

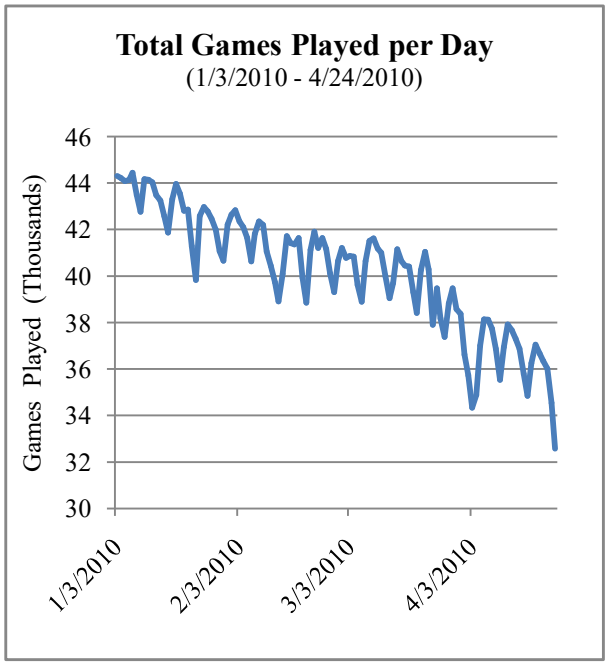

Figure 1: See Table 1 in the Appendix for values.

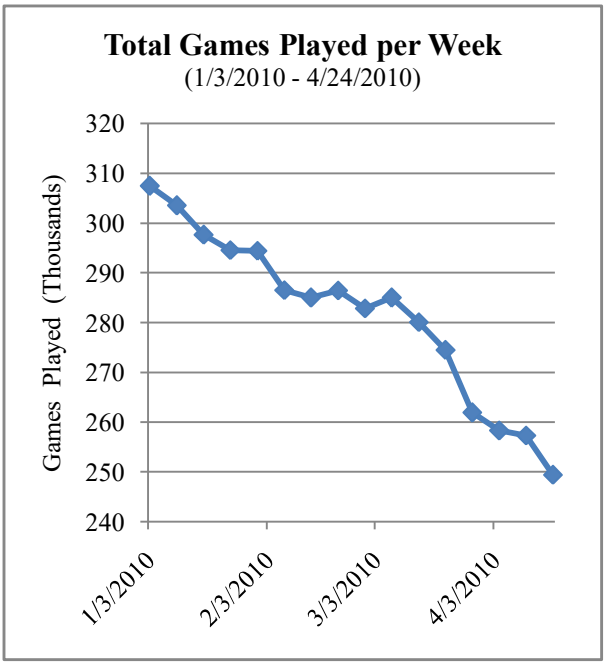

Figure 2: See Table 2 in the Appendix for values.

Note that y_k in (2) represents the total number of games played in week k. Minimizing (2) yields the best approximation for our data and was accomplished by equating the partial derivatives with respect to a and b to zero:

$$F_a = \sum_{k=1}^{16}(be^{ak} - y_k)\,(kbe^{ak}) = 0 \tag{3}$$

$$F_b = \sum_{k=1}^{16}(be^{ak} - y_k)\,(e^{ak}) = 0. \tag{4}$$

These equations enabled us to solve for our unknown a and b, namely $a = -0.0123$ and $b = 312{,}064$. Thus (1) becomes

$$f(t) = 312{,}064\, e^{-0.0123\, t}. \tag{5}$$

Similarly, found the optimal linear form

$$g(t) = c\, t + d \tag{6}$$

by considering the sum

$$G(c,d) = \tfrac{1}{2}\sum_{k=1}^{16}\big((c\, k + d) - y_k\big)^2 \tag{7}$$

whose partial derivatives were

$$G_c = \tfrac{1}{2}\sum_{k=1}^{16}\big((c\, k + d) - y_k\big)(k) = 0 \tag{8}$$

$$G_d = \tfrac{1}{2}\sum_{k=1}^{16}\big((c\, k + d) - y_k\big) = 0 \tag{9}$$

and yielded the solution

$$\begin{cases} c = -3{,}489 \\ d = 311{,}194 \end{cases} \tag{10}$$

which implies that (6) is in fact

$$g(t) = -3{,}489\, t + 311{,}194. \tag{11}$$

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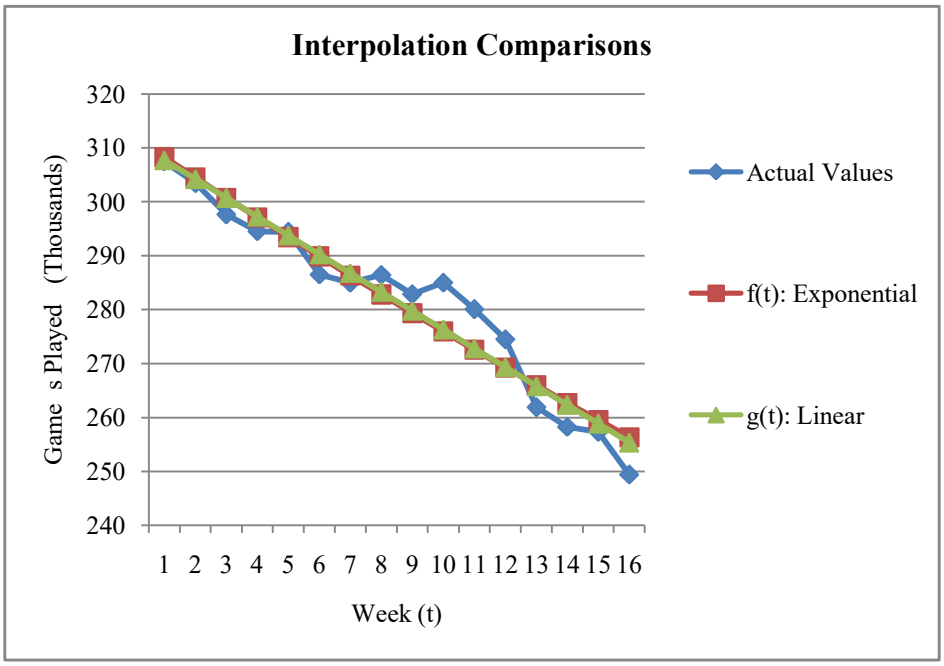

Figure 3: See Table 3 in the Appendix for values.

With equations (5) and (11) we created the above comparison between our data, $f(t)$ and $g(t)$ (see Figure 3). From the figure, it was hard to tell whether $f(t)$ or $g(t)$ is the better approximation of our data. Fortunately, equations (2) and (7) measure the discrepancy between each approximation and the actual data. After plugging in the actual data values we got

$$\begin{cases} F(a,b) = 1.55 \times 10^8 \\ G(c,d) = 1.39 \times 10^8 \end{cases} \tag{12}$$

meaning that $f(t)$ had a higher error and the linear approximation $g(t)$ was the better fit of the two.

DISCUSSION

According to Spice Rack Media, Scratch-Offs needs to average 112,000 games played a week to remain profitable. Using model (5) to forecast our data, we predicted the number of week before it will take to reach a weekly total of 112,000 games by solving the following:

$$312{,}064\, e^{-0.0123\, t} = 112{,}000. \tag{13}$$

From this we found that

$$t = 83.3 \text{ weeks}. \tag{14}$$

Similarly, the linear model (11) suggests the breakeven point will occur at

$$t = 57.1 \text{ weeks}. \tag{15}$$

Note that (12) suggests that (15) is a better forecast than (14). Thus if this trend holds, in 41 to 68 more weeks Scratch-Offs will no longer be profitable. A graphical representation of the projected weekly games of versus the minimum number of games to remain profitable is pictured below (see Figure 4).

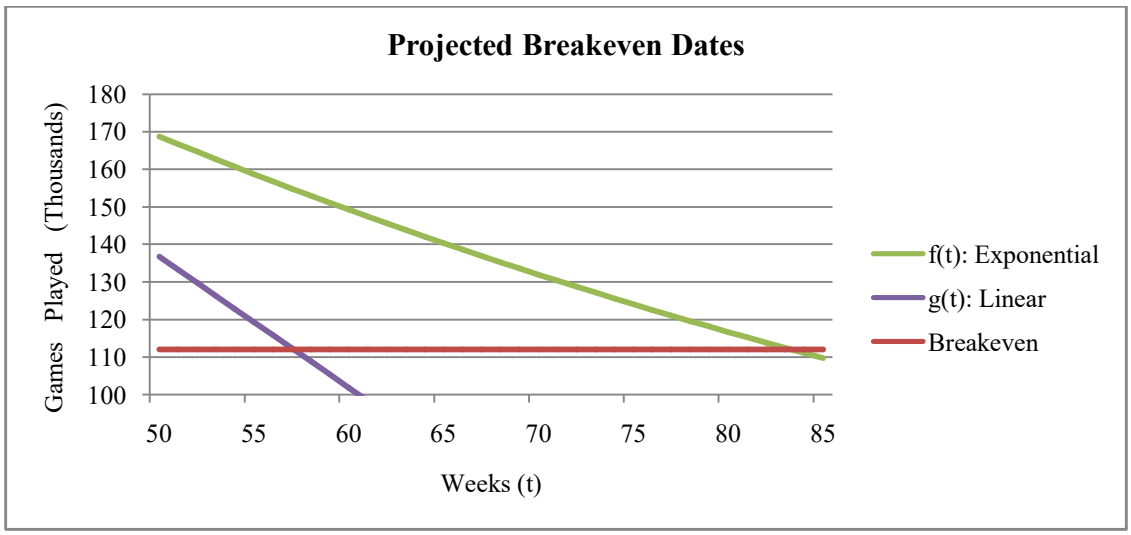

Figure 4: The linear model predicts that Scratch-Offs will no longer be profitable at week 57 while the exponential model predicts week 84.

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Since our original data begins on January 3, 2010 (Table 1) we know this date to be somewhere between January 30, 2011 and August 14, 2011.

CONCLUSION AND RECOMMENDATIONS

By applying calculus to our sample data we found both a linear and exponential equation that accurately modeled the total games played in a week as a function of time. This equation enabled us to pinpoint the date, roughly 12 to 19 months from the first date of the sample data, at which Scratch-Offs would no longer be profitable. This knowledge should help Spice Rack Media to effectively implement a development cycle for the release of their next game.

In terms of creating a business model based on this data, there are two important issues that need to be addressed. First, clearly the number of games played over time was trending downward. It may be possible to offset or delay this movement by advertising "free game" days towards the latter half of the game's lifecycle (allowing a certain number of free games per user to be played on a particular day). This would generate renewed interest in the game and possibly attract former users to play again. Furthermore, this is an inexpensive way to help to extend the game's financial sustainability.

Secondly, the 12 to 19 month window should be used to develop two new games instead of one. Continuing this process over the course of several years would lead to a business model based on multiple games – all at different points in their life cycle. Such a strategy would create a level revenue stream as opposed to the constantly decreasing one demonstrated by the data.

The equations developed in this research are only as accurate as the data allowed. Spice Rack Media was somewhat hesitant about providing us with too much data about their game. By obtaining a significantly larger sample (a year or more) and more accurate financial data, the predictions would be significantly more precise. New equations could be used to estimate, not only the number of games played in a week, but the exact amount of money earned on or in any given day/week/month. These are important details to consider for researchers conducting similar studies.

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APPENDIX

TABLE 1 – TOTAL GAMES PLAYED DAILY

Date	Games
1/3/2010	44310
1/4/2010	44224
1/5/2010	44083
1/6/2010	44128
1/7/2010	44440
1/8/2010	43494
1/9/2010	42761
1/10/2010	44156
1/11/2010	44140
1/12/2010	44024
1/13/2010	43473
1/14/2010	43252
1/15/2010	42581
1/16/2010	41873
1/17/2010	43307
1/18/2010	43961
1/19/2010	43547
1/20/2010	42810
1/21/2010	42862
1/22/2010	41299
1/23/2010	39834
1/24/2010	42580
1/25/2010	42968
1/26/2010	42786
1/27/2010	42466
1/28/2010	41992
1/29/2010	41064
1/30/2010	40656
1/31/2010	42204
2/1/2010	42629
2/2/2010	42841
2/3/2010	42346
2/4/2010	42098
2/5/2010	41647
2/6/2010	40621
2/7/2010	41822
2/8/2010	42353
2/9/2010	42185
2/10/2010	41057
2/11/2010	40440
2/12/2010	39728
2/13/2010	38912
2/14/2010	40087
2/15/2010	41718
2/16/2010	41417
2/17/2010	41359
2/18/2010	41634
2/19/2010	39920
2/20/2010	38851
2/21/2010	41119
2/22/2010	41913
2/23/2010	41194
2/24/2010	41628
2/25/2010	41156
2/26/2010	40119
2/27/2010	39316
2/28/2010	40636
3/1/2010	41202
3/2/2010	40782
3/3/2010	40864
3/4/2010	40840
3/5/2010	39614
3/6/2010	38892
3/7/2010	40637
3/8/2010	41513
3/9/2010	41620
3/10/2010	41172
3/11/2010	41003
3/12/2010	39991
3/13/2010	39035
3/14/2010	39691
3/15/2010	41142
3/16/2010	40640
3/17/2010	40450
3/18/2010	40403
3/19/2010	39306
3/20/2010	38414
3/21/2010	40257
3/22/2010	41039
3/23/2010	40286
3/24/2010	37897
3/25/2010	39470
3/26/2010	38174
3/27/2010	37377
3/28/2010	38826
3/29/2010	39476
3/30/2010	38571
3/31/2010	38367
4/1/2010	36611
4/2/2010	35717
4/3/2010	34318
4/4/2010	34888
4/5/2010	37002
4/6/2010	38128
4/7/2010	38111
4/8/2010	37733
4/9/2010	36867
4/10/2010	35527
4/11/2010	36934
4/12/2010	37918
4/13/2010	37660
4/14/2010	37293
4/15/2010	36876
4/16/2010	35782
4/17/2010	34845
4/18/2010	36246
4/19/2010	37046
4/20/2010	36662
4/21/2010	36350
4/22/2010	36010
4/23/2010	34539
4/24/2010	32570

TABLE 2 – TOTAL GAMES PLAYED WEEKLY

Week	Days	Games
1	1/03/2010 – 1/09/2010	307440
2	1/10/2010 – 1/16/2010	303449
3	1/17/2010 – 1/23/2010	297620
4	1/24/2010 – 1/30/2010	294512
5	1/31/2010 – 2/06/2010	294386
6	2/07/2010 – 2/13/2010	286497
7	2/14/2010 – 2/20/2010	284986
8	2/21/2010 – 2/27/2010	286445
9	2/28/2010 – 3/06/2010	282830
10	3/07/2010 – 3/13/2010	284971
11	3/14/2010 – 3/20/2010	280046
12	3/21/2010 – 3/27/2010	274500
13	3/28/2010 – 4/03/2010	261886
14	4/04/2010 – 4/10/2010	258256
15	4/11/2010 – 4/17/2010	257308
16	4/18/2010 – 4/24/2010	249423

TABLE 3 – INTERPOLATION COMPARISON OF WEEKLY GAMES

Week	Games	Interpolation	
		$f(t)$: Exponential	$g(t)$: Linear
1	307440	308250	307705
2	303449	304482	304216
3	297620	300760	300727
4	294512	297084	297238
5	294386	293453	293749
6	286497	289866	290260
7	284986	286323	286771
8	286445	282823	283282
9	282830	279366	279793
10	284971	275952	276304
11	280046	272579	272815
12	274500	269247	269326
13	261886	265956	265837
14	258256	262705	262349
15	257308	259494	258860
16	249423	256323	255371

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