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Department of Ingegneria Informatica, del
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Master of Science in INGEGNERIA INFORMATICA
(COMPUTER ENGINEERING)

Master's Thesis

**Project and implementation of a
multifaceted score system for
online gaming**



Adviser:

Prof. Giovanni Malnati

Candidate

Lina Maria Correa Cogua

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To my family, I will be forever in their debt.

"Sé valiente. Toma riesgos. Nada puede sustituir la experiencia"
Paulo Coelho

Summary

Nowadays, [Gamification](#) is a very effective technique used for any kind of business that seeks to maintain the interest and motivation of its members over time. Typically this concept applies to business that looks for keeping customers nearly from the business even they donât have to. This technique can encourage people to use a system in a voluntary and fun way, in which they can experience it in a game-like environment. Unfortunately, the implementation of the game design processes are complex and are not integrated in the software development processes of the organizations.

This work proposes the enrichment of the actual [MAK07](#) system thanks to the integration of the [Gamification](#) technique on software development methodologies and designing of point system and levels. Additionally the classification of the input data by clusterization which is a data mining technique.

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List of Abbreviations

Gamification Gamification

Gamification Gamification

Chapter 1

Introduction

The first best known mobile game is Snake (1997) which was preinstalled in all devices of Nokia that arrives to 350 million. The limitations of that times are related to hardware, the game was shown on a screen of monochrome dot matrix and one single channel tone. since this point the evolution of mobile games grows in parallel with the improvement of the smartphone technology.

The **Gamification** technique [3] is widely used in contexts other than games in which it seeks to create changes in user behavior in front of a system, either for external or internal purposes of an organization. It is usually used to take advantage of human psychology behaviors against the game systems creating a sense of engagement or hooking of people experiencing the system as a game[3].

The use of **Gamification** has been growing rapidly in numerous software developments due to its efficiency, examples such as Facebook [8], Foursquare [9], LinkedIn [10] use elements of **Gamification** in their systems and it is how they have achieved great acceptance in all the world [7] [3].

Gamification can be present in any aspect of life for example Social media the 3 most popular are Facebook 78.804.144 , Instagram 67.932.248 ,Youtube 26.645.304, sports the 3 most popular are Nike+ Run Club 721.116, InstaFit 4.382, Runtastic 834.595, RunKeeper 504.407 Endomondo 570.057. The most popular Language learning apps are Duolingo 6.436.766, Memrise 1.126.271, Babbel 280.306, Rosetta Stone 175.891. Educational Games like Math Games 1.868, Maestro de matematicas 4.817, Mental calculation 775, Mental 17.296, Math games 40.760, Brain training 119.896, MathMaster 4.731, Math Master â Brain Quizzes Math Puzzles 4.083, Ruzzle 336.012 [1].

Nowadays everyone can develop mobile applications and sell or distribute it on a market like Play store for android or App store for iOS. At the time you create the product, you must know the type of customers target that the application

wants to have. the most used are:

1. Buy and play it all: User buy the game on the market in order to get it.
 2. Advertisement income: Games that accept adds that generate money every time a user play and visualize them.
 3. F2P or free to play: Game played for free, payment of some booster or additional elements can be done with real money.
- [2][4]

1.1 Scope of the thesis

1.1.1 Context description

is a game developed by Tonic Minds s.r.l. This game allows to the user to Combine the 7 numbers of a scheme using the four basic operations (addition, multiplication, subtraction and division) in order to get 0 as the final result. The idea with this thesis is to design a solution using elements of [Gamification](#) a new version of taking in count previous constraints and necessities of the client and game in order to increase downloads and generate incomes.

1.1.2 Actual achievements of MAK07

In v1 of the user was allow to play and know the score done by each schema, In v2 of the score was keep by the system, v3 of was develop the challenge mode game in which the user is allow to challenge another player to solve as much schemas as possible in certain time. v4 of was develop the chat. On v5 of was develop the tournaments.

1.1.3 Actual drawbacks of MAK07

has 43 users on play store and App Store is 500 which is not too much and also the application is free and has any mobile gaming business model in order to earn money. The points system is poor and the input combination and permutation of numbers are not classified in a way to classified them as easy medium or hard to play.

is classified as a math game and not many users has interest of this kind of games compared to adventure or strategy games.

1.1.4 Problem to solve

How to improve the number of downloads and generate some income with [Gamification](#) in a multifaceted score system for online gaming?

1.1.5 Justification

As many mobile applications in the world, the number of downloads, rating and feedback are important to improve and somehow earn money. [6] [11] the objectives are:

1. Incorporate elements of [Gamification](#) into [MAK07](#) taking in count the already developed system
2. Improve the point system of [MAK07](#)
3. Establish the Level system of [MAK07](#)
4. Classify the input combination and permutation numbers of [MAK07](#) in order to assign schema according with the level of difficulty and level of the player.
5. Improve the number of downloads of [MAK07](#).

1.1.6 Impact expected

[MAK07](#) users will download and play voluntary, fun and in a continue way. All kinds of players will play and discover elements of [Gamification](#) that supply their interest.

The documentation of [MAK07](#) about analysis and design will be complete and it can remain as a reference material and as a deliverable for the client

Chapter 2

State of art

2.1 Gamification

Gamification is the use of game elements and game design techniques in non-game contexts [3] . Although it seems simple, **Gamification** is much more than its elements, since the game design techniques are not easy, much less obvious, a technical and strategic approach is needed to achieve the success of its implementation [3] [18] [12] . **Gamification** arose in the study of business from the need to find methods to motivate customers or employees of an organization using new techniques due to the high competitiveness and the changing context of the companies. Since the games are really effective in using human psychology to "hook" (better known as Engagement) to players [3] [7] using elements such as: Points, levels, rewards, progress bars, avatars, badges, social systems, among others; Many companies began to implement this series of elements to motivate customers or their employees in their businesses [3].

2.2 Benefits of gamification

Each business that wants to have employees or developed products that wants to have happy users should use **Gamification**. Following I describe 3 main reasons why **Gamification** can improve the business and product results.

2.3 Engagement

The objective of **Gamification** is to get engagement of users[7][3]. Being a game designer is thinking about how to get your target audience engaged by taking advantage of the elements of the games and managing to change the behavior of the target audience. Many times we have felt a certain addictive feeling towards a game, however simple it may be, since the games provide some pleasure and **Gamification** takes advantage of this quality of the games to use it in contexts that are not games [3].

Gamification can offer a powerful set of tools to develop challenges for customers, employees, user, player, for example some stores give points for making purchases and reward them with discounts with certain limit of redeemable points, or airlines have a system of miles for their clients, examples like these are pure **Gamification** and they produce an increase in Engagement and loyalty of people towards the business, achieving high profits and productivity results in many organizations.

2.4 Experimentation

A second aspect of the game based on motivation is to open the space of experimentation, since to master the challenges presented in a game is all about experimentation for the player. For a player to feel a failure or loss is not so discouraging because you can always start from scratch and you will feel motivated to continue playing to improve your game experimentation. If the game is correctly designed, the player can not always lose, the game will lead him to strive to improve his skills and win [3] [7]. In systems with gamification, it is important to provide an environment of experimentation, not very complex or too easy, that produces motivation in the target audience to overcome a challenge. Gamification elements of real life that achieve experimentation are the levels, the medals, teams, challenges, among others [3] [7].

2.5 Results

The results is the third reason why Gamification is a valuable technique to use in numerous contexts other than games. Currently Gamification has taken great strength [3] [7] in organizations, which have obtained great results by incorporating game elements into their Business processes such as Nike [?], Facebook [8],

American Express [20], Microsoft [21], Samsung [22], among others. The results that can be achieved with gamification are to maintain the motivation and interest of the users over time [3]. Organizations that have incorporated gamification have obtained great results [7] [23] translated into an increase in the number of clients, higher sales, advertising with voice to voice, customer loyalty, among many others.

2.6 Related works

In market there are many games related to education focused on maths operations, the following table describe the relation between level points and time after have played several times in order to find their gamification point system.

In addition, the devices' specifications are shown in table 2.1 2.2 2.3 2.4.

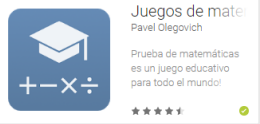
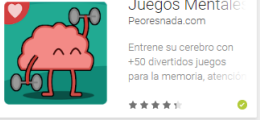
Game name	Formula found to assign points			Image
Math Games /Juegos de Matemáticas	Level	Points	Time	
	1 - 10	20	10	
	11 - 20	40	8	
	21 - 30	60	6	
	31 - ..	80	4	
Juegos Mentales: Entrenamiento Cerebral / Mental	Points	Hearts	Reaction	
	Number of correct questions - wrong questions done	(Number of correct questions * 100)/Total of questions	Milliseconds sends on gaming	

Table 2.1: Related Works

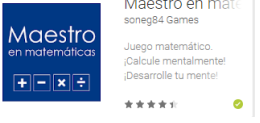
Game name	Formula		Images
MathMaster / Maestro en Matematicas	Points	Starts	
	$7500 - (250 * \text{number of penalties})$	Max 3	

Table 2.2: Related Works cont. 2


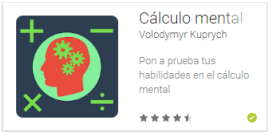
Game name	Formula		Images
Math Master - Brain Quizzes and Math Puzzles	Level	Range	
	1	0 - 250000	
	2	0 - 250000	
	3	0 - 250000	
	4	0 - 250000	
	5	0 - 250000	
	6	0 - 250000	
	7	0 - 250000	
	8	0 - 250000	
	9	0 - 250000	
	10	0 - 250000	
Mental Calculation	Points	Hearts	
	$(100 * \text{Number of hearts}) + (-0,0491 * (\text{Time in seconds}) * \text{EXP}(2) + 21,585 * (\text{Time in seconds}) + 3853,5)$	5 Hearts which means 0 errors	
		4 hearts which means 1 error	
		3 Hearts which means 2 errors	
		2 Hearts which means 3 errors	
		1 Heart which means 4 errors	
		0 Hearts which means 5 errors	

Table 2.3: Related Works cont. 3


Game name	Formula found to assign points			Image
Maestro de Matematicas	Level	Coins	+Points	
	1	5	Time (Milliseconds) + 100 * (Number of shields)	
	2 - 6	6		
	7- 13	7		
	14 - 19	8		
	20 - 25	9		
	26 - 31	10		
	32 - 37	11		
	38 - 43	12		
	44 - 49	13		
	50 - 54	14		
	55	15		

Table 2.4: Related Works cont. 4

develop the challenge mode game in which the user is allow to challenge another player to solve as much schemes as possible in certain time. v4 of MAK07 was develop the chat. On v5 of MAK07 was develop the tournaments. This is a navigation map of version 1 of MAK07 [figure 3.3].

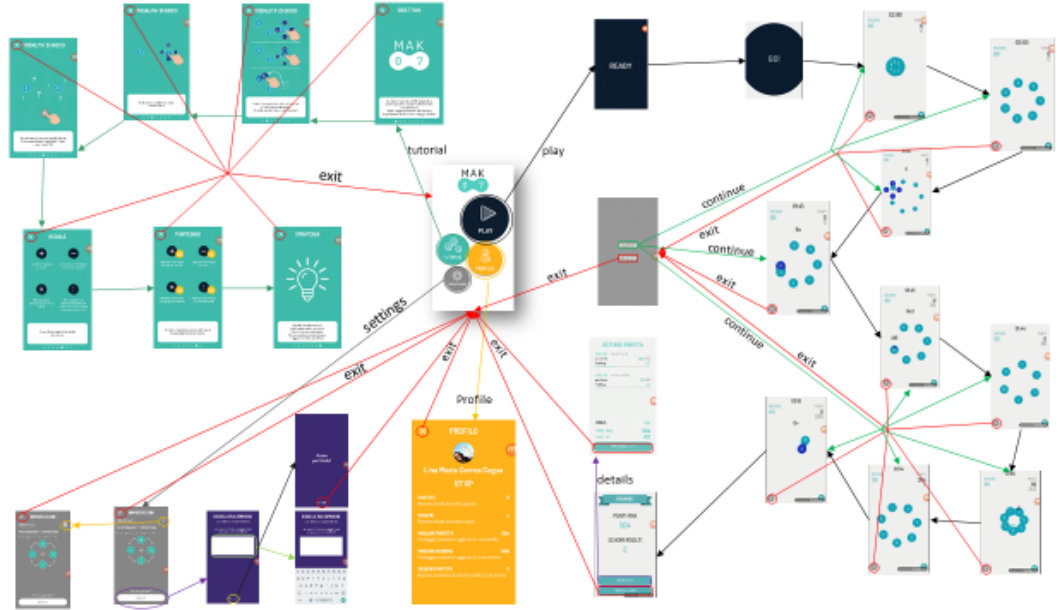


Figure 3.2: MAK07 version 1

The following image [figure 3.3] shows the progression of MAK07, notice that gamification components (orange lines) will be present and complement previous implementations.

Each of the following images will represent the gamified flow using all the gamification components inserted on MAK07 [figures 3.4, 3.5, 3.6, 3.7].

3.2 Analysis and design

3.2.1 User cases MAK07

gaming mak07.JPG

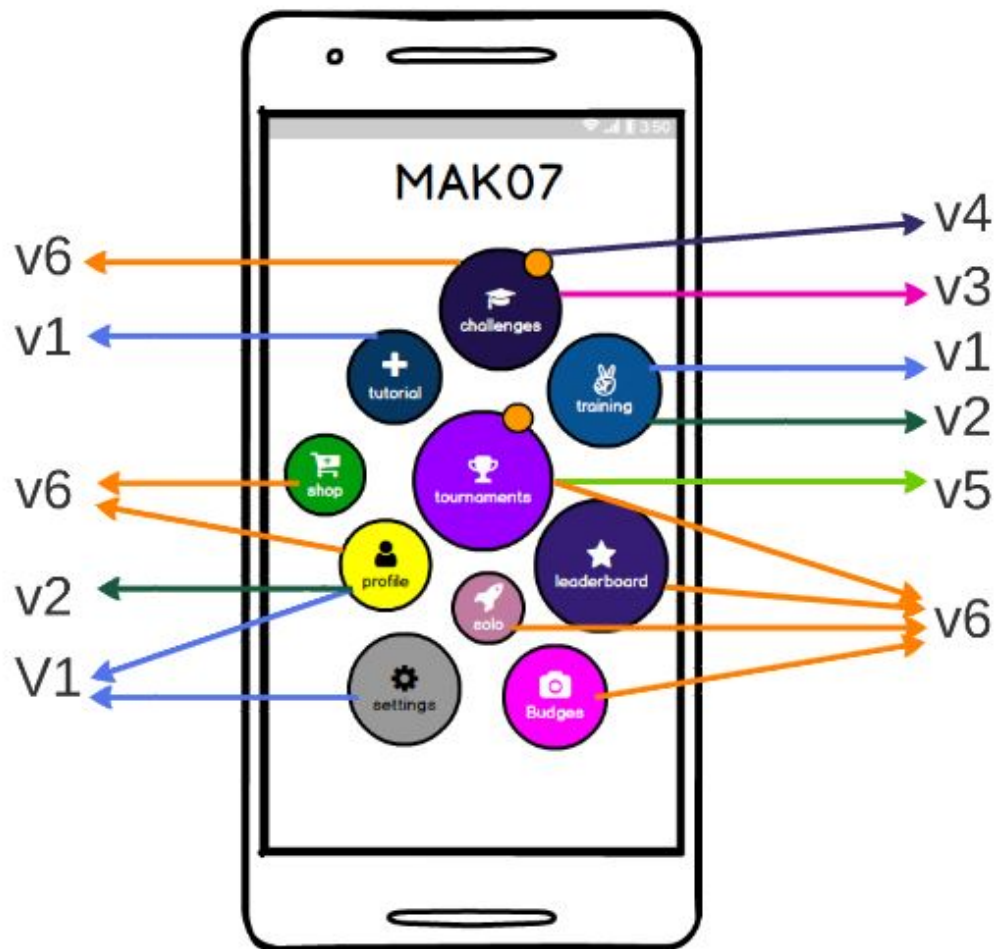


Figure 3.3: MAK07 visioning evolution

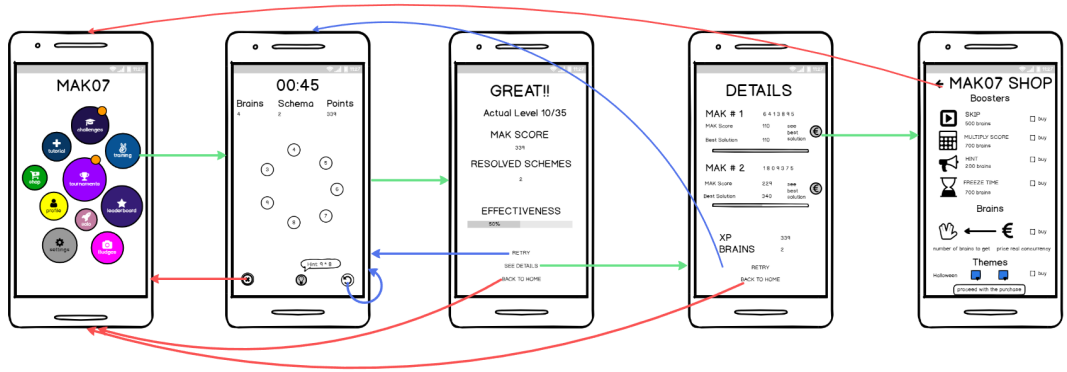


Figure 3.4: Training

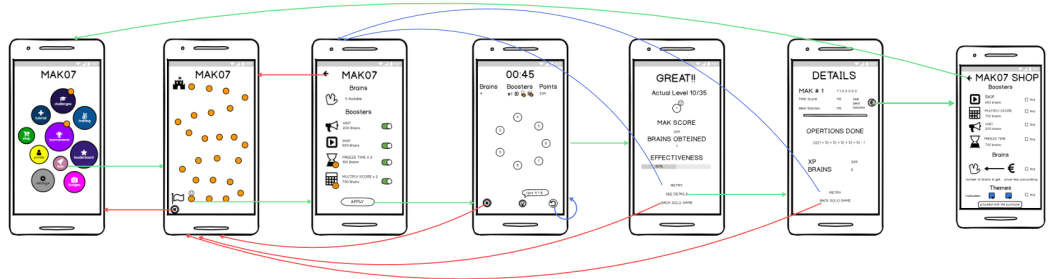


Figure 3.5: Solo Game

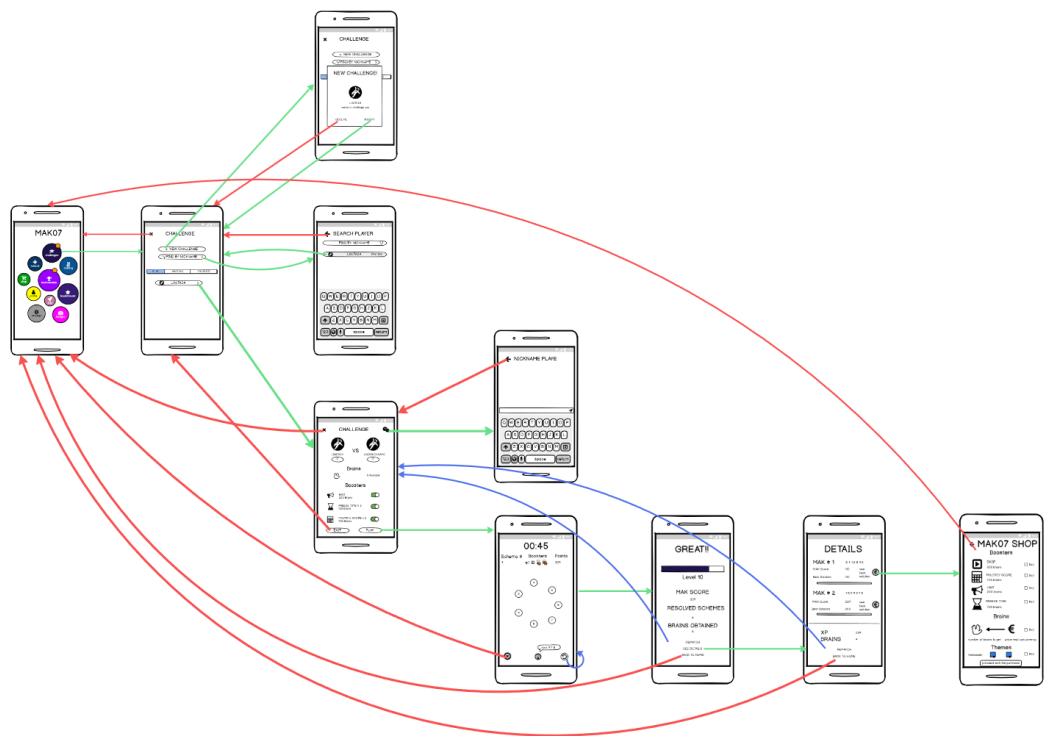


Figure 3.6: Challenge

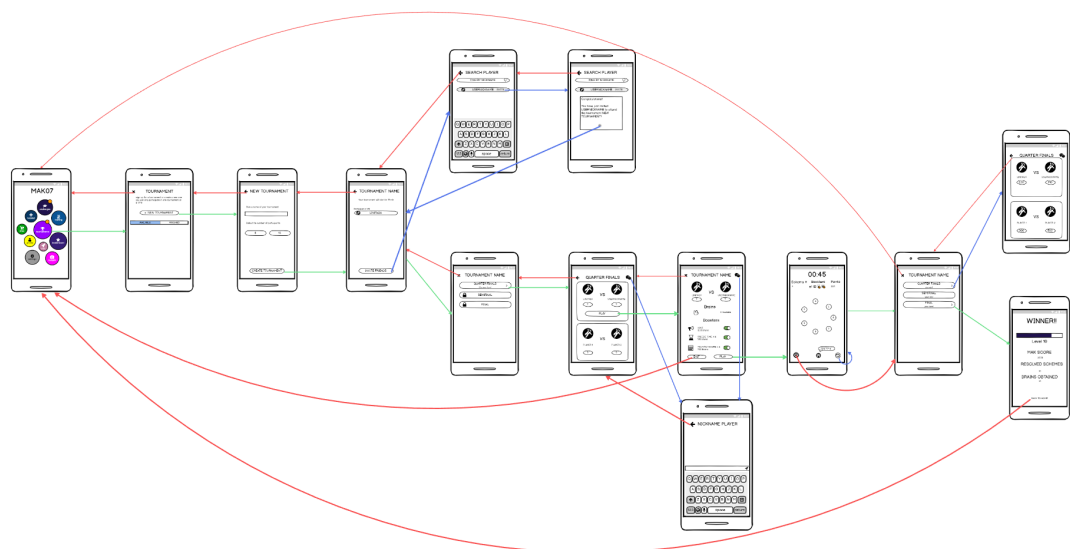


Figure 3.7: Tournament

User cases are classified in the following groups:

- UCH that represents Home and general user cases [figures 3.8,3.9,3.10, 3.11,3.12,3.13,3.14,3.15,3.16, 3.17,??,3.19,??,3.21,??,3.23,??, 3.25,??,3.27,??,3.29,??]
- UCS that represents Settings user cases [figures 3.31,3.32,3.33,3.34,3.35,3.36,3.37,3.38,3.39,3.40,3.41,3.42,3.43,3.44,3.45,3.46,3.47,3.48,3.49,3.50,3.51,3.52,3.53,3.54,3.55,3.56,3.57,3.58,3.59,3.60,3.61,3.62,3.63,3.64,3.65,3.66,3.67,3.68,3.69,3.70,3.71,3.72,3.73,3.74,3.75,3.76,3.77,3.78,3.79,3.80,3.81,3.82,3.83,3.84,3.85,3.86,3.87,3.88,3.89,3.90,3.91,3.92,3.93,3.94,3.95,3.96,3.97,3.98,3.99,4.00,4.01,4.02,4.03,4.04,4.05,4.06,4.07,4.08,4.09,4.10,4.11,4.12,4.13,4.14,4.15,4.16,4.17,4.18,4.19,4.20,4.21,4.22,4.23,4.24,4.25,4.26,4.27,4.28,4.29,4.30,4.31,4.32,4.33,4.34,4.35,4.36,4.37,4.38,4.39,4.40,4.41,4.42,4.43,4.44,4.45,4.46,4.47,4.48,4.49,4.50,4.51,4.52,4.53,4.54,4.55,4.56,4.57,4.58,4.59,4.60,4.61,4.62,4.63,4.64,4.65,4.66,4.67,4.68,4.69,4.70,4.71,4.72,4.73,4.74,4.75,4.76,4.77,4.78,4.79,4.80,4.81,4.82,4.83,4.84,4.85,4.86,4.87,4.88,4.89,4.90,4.91,4.92,4.93,4.94,4.95,4.96,4.97,4.98,4.99,5.00,5.01,5.02,5.03,5.04,5.05,5.06,5.07,5.08,5.09,5.10,5.11,5.12,5.13,5.14,5.15,5.16,5.17,5.18,5.19,5.20,5.21,5.22,5.23,5.24,5.25,5.26,5.27,5.28,5.29,5.30,5.31,5.32,5.33,5.34,5.35,5.36,5.37,5.38,5.39,5.40,5.41,5.42,5.43,5.44,5.45,5.46,5.47,5.48,5.49,5.50,5.51,5.52,5.53,5.54,5.55,5.56,5.57,5.58,5.59,5.60,5.61,5.62,5.63,5.64,5.65,5.66,5.67,5.68,5.69,5.70,5.71,5.72,5.73,5.74,5.75,5.76,5.77,5.78,5.79,5.80,5.81,5.82,5.83,5.84,5.85,5.86,5.87,5.88,5.89,5.90,5.91,5.92,5.93,5.94,5.95,5.96,5.97,5.98,5.99,6.00,6.01,6.02,6.03,6.04,6.05,6.06,6.07,6.08,6.09,6.10,6.11,6.12,6.13,6.14,6.15,6.16,6.17,6.18,6.19,6.20,6.21,6.22,6.23,6.24,6.25,6.26,6.27,6.28,6.29,6.30,6.31,6.32,6.33,6.34,6.35,6.36,6.37,6.38,6.39,6.40,6.41,6.42,6.43,6.44,6.45,6.46,6.47,6.48,6.49,6.50,6.51,6.52,6.53,6.54,6.55,6.56,6.57,6.58,6.59,6.60,6.61,6.62,6.63,6.64,6.65,6.66,6.67,6.68,6.69,6.70,6.71,6.72,6.73,6.74,6.75,6.76,6.77,6.78,6.79,6.80,6.81,6.82,6.83,6.84,6.85,6.86,6.87,6.88,6.89,6.90,6.91,6.92,6.93,6.94,6.95,6.96,6.97,6.98,6.99,7.00,7.01,7.02,7.03,7.04,7.05,7.06,7.07,7.08,7.09,7.10,7.11,7.12,7.13,7.14,7.15,7.16,7.17,7.18,7.19,7.20,7.21,7.22,7.23,7.24,7.25,7.26,7.27,7.28,7.29,7.30,7.31,7.32,7.33,7.34,7.35,7.36,7.37,7.38,7.39,7.40,7.41,7.42,7.43,7.44,7.45,7.46,7.47,7.48,7.49,7.50,7.51,7.52,7.53,7.54,7.55,7.56,7.57,7.58,7.59,7.60,7.61,7.62,7.63,7.64,7.65,7.66,7.67,7.68,7.69,7.70,7.71,7.72,7.73,7.74,7.75,7.76,7.77,7.78,7.79,7.80,7.81,7.82,7.83,7.84,7.85,7.86,7.87,7.88,7.89,7.90,7.91,7.92,7.93,7.94,7.95,7.96,7.97,7.98,7.99,8.00,8.01,8.02,8.03,8.04,8.05,8.06,8.07,8.08,8.09,8.10,8.11,8.12,8.13,8.14,8.15,8.16,8.17,8.18,8.19,8.20,8.21,8.22,8.23,8.24,8.25,8.26,8.27,8.28,8.29,8.30,8.31,8.32,8.33,8.34,8.35,8.36,8.37,8.38,8.39,8.40,8.41,8.42,8.43,8.44,8.45,8.46,8.47,8.48,8.49,8.50,8.51,8.52,8.53,8.54,8.55,8.56,8.57,8.58,8.59,8.60,8.61,8.62,8.63,8.64,8.65,8.66,8.67,8.68,8.69,8.70,8.71,8.72,8.73,8.74,8.75,8.76,8.77,8.78,8.79,8.80,8.81,8.82,8.83,8.84,8.85,8.86,8.87,8.88,8.89,8.90,8.91,8.92,8.93,8.94,8.95,8.96,8.97,8.98,8.99,9.00,9.01,9.02,9.03,9.04,9.05,9.06,9.07,9.08,9.09,9.10,9.11,9.12,9.13,9.14,9.15,9.16,9.17,9.18,9.19,9.20,9.21,9.22,9.23,9.24,9.25,9.26,9.27,9.28,9.29,9.30,9.31,9.32,9.33,9.34,9.35,9.36,9.37,9.38,9.39,9.40,9.41,9.42,9.43,9.44,9.45,9.46,9.47,9.48,9.49,9.50,9.51,9.52,9.53,9.54,9.55,9.56,9.57,9.58,9.59,9.60,9.61,9.62,9.63,9.64,9.65,9.66,9.67,9.68,9.69,9.70,9.71,9.72,9.73,9.74,9.75,9.76,9.77,9.78,9.79,9.80,9.81,9.82,9.83,9.84,9.85,9.86,9.87,9.88,9.89,9.90,9.91,9.92,9.93,9.94,9.95,9.96,9.97,9.98,9.99,10.00,10.01,10.02,10.03,10.04,10.05,10.06,10.07,10.08,10.09,10.10,10.11,10.12,10.13,10.14,10.15,10.16,10.17,10.18,10.19,10.20,10.21,10.22,10.23,10.24,10.25,10.26,10.27,10.28,10.29,10.30,10.31,10.32,10.33,10.34,10.35,10.36,10.37,10.38,10.39,10.40,10.41,10.42,10.43,10.44,10.45,10.46,10.47,10.48,10.49,10.50,10.51,10.52,10.53,10.54,10.55,10.56,10.57,10.58,10.59,10.60,10.61,10.62,10.63,10.64,10.65,10.66,10.67,10.68,10.69,10.70,10.71,10.72,10.73,10.74,10.75,10.76,10.77,10.78,10.79,10.80,10.81,10.82,10.83,10.84,10.85,10.86,10.87,10.88,10.89,10.90,10.91,10.92,10.93,10.94,10.95,10.96,10.97,10.98,10.99,11.00,11.01,11.02,11.03,1

3.2.2 Description of players of MAK07

Given that different types of players are found in the system, it is necessary to segment them so that the system is appropriate for more than one subgroup of players and to be able to offer them various game options according to the Bartles Classification [figure 3.61]:

1. Killer: they like to impose themselves against others typically to beat them. MAK07 count the number of times a user win consecutively (challenge, solo, tournament) and award them with a medal.
2. Achiever: They like the thrill of leveling up or winning a medal. MAK07 give a different types of medals for actions that can be differentiated by the others.
3. Socializer: They like to socialize with friends. MAK07 count with a chat in which can be shared a great game. Also motivate other users to join MAK07 sending Facebook invitations and ranking MAK07 on shop.
4. Explorer: They want to find new content. Unlocking some functionalities of MAK07 progressively help to users to keep interested on MAK07. When they discover the medals unlocked that are available only if they completed some task also that generates attention and attraction to do it.

MAK07 has 3416 users, 599 female, 1779 male, 922 unknown. Since many years ago when the first game was developed, female gender hasn't been represented in characters, that causes less interest from woman point of view. Even throw new games that personificate beautiful woman in a video game, the culture and the tradition about playing is more for man than woman [13] [14] [15] [16].

3.2.3 Requirements of MAK07

The following are the non functional requirements [figure ??].

3.3 Architectural Analysis

3.3.1 Logic view of architecture of MAK07

MongoDB is a non relational database offering a flexible schema and designed in such a way that changes or updates could be handled easily. The following


UCH01		Consult Home	
Target of Use case	User can consult the home interface of MAK07.		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	Display the initial home or the unblocked home.		
Basic flow			
No	User	No	System
1	User start navigate to MAK07 functionalities		
		2	The system must display the unblocked or blocked home interface of MAK07
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCH02, UCH03, UCH04, UCH05, UCH6, UCH07, UCH08, UCH09, UCH10, UCH11, UCH12, UCH13, UCH14, UCH15, UCH21, UCH22.		

Figure 3.8: Use Case UCH01

graphs are showing the AsIs database model and ToBe data base model, thinking that non relational data structures are difficult to represent.

AsIs MAK07 without gamification

This was the database for version 1 of MAK07 [figure 3.63].



UCH02		UNBLOCK FUNCTIONALITIES OF HOME	
Target of Use case		Unblock all functionalities (challenge, tournament, leaderboard, solo game, badges and shop) of home	
Inputs		User must already play the first tutorial and first training	
Outputs		Home interface functionalities will be unblocked	
Basic flow			
No	User	No	System
1	User play the tutorial game		
2	User play a training		
		3	System unblock challenge, tournament, leaderboard, solo game, badges and shop functionalities
Interface view			
FROM		TO	
Alternative flow 1:		UCH21: Exit from MAK07	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH02, UCH03, UCH04, UCH05, UCH6, UCH07, UCH08, UCH09, UCH10, UCH11, UCH12, UCH13, UCH14, UCH15, UCH21, UCH22.	

Figure 3.9: Use Case UCH02

ToBe MAK07 with gamification

The following graph shows the modifications and additions to do in order to implement gamifications, the purple classes are new implementations and blue classes are ones needed to support gamification components [figure 3.64].


UCH03		Consult tutorial	
Target of Use case		Consult the tutorial of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		User visualize the tutorial interface	
Basic flow			
No	User	No	System
1	User select the tutorial from home		
		2	System shows the tutorial instructions
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCTU01	

Figure 3.10: Use Case UCH03

3.3.2 Logic view MAK07 gamified

Levels

After an extensive study of timing and reaction of player for each movement of MAK07, that consist on tabulate the timing on seconds and milliseconds and results (points and actual bonus point) for each

movement, I could define the boundaries of each level. Each level can have a list of requirements that must be complete in order to move to the next level. Following there is define the list of requirements associate with the quantity of points that must be done and achieve as minimum for each level.

Level definitions: 0 Level

- 0 points Exp, user that have download the game without play any game or


UCH04		Consult profile	
Target of Use case		Consult user profile of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		User visualize his profile of MAK07	
Basic flow			
No	User	No	System
1	User select profile from home		
		2	System shows the user profile
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCP01, UCP02, UCP03, UCP04, UCP05, UCP06, UCP07, UCP08, UCP09, UCP10, UCP11, UCP12, UCP13, UCP14, UCP15	

Figure 3.11: Use Case UCH04

start a game but never finishes

- Input game difficulty 1
- Time 72000 milliseconds or 1,2 min or 72 seconds

1 Level:

- From 17 Points Exp
- 1 Solo Game Played or 1 challenge Game Played
- Input game difficulty 1


UCH05		Consult settings	
Target of Use case		Consult the settings of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		User visualize the setting interface of MAK07	
Basic flow			
No	User	No	System
1	User select settings from home		
		2	System shows the settings
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCS01, UCS02, UCS03, UCS04, UCS05, UCS06, UCS07, UCS08	

Figure 3.12: Use Case UCH05

- Time 72000 milliseconds or 1,2 min or 72 seconds

2 Level:

- From 102 Points Exp
- 6 Solo Games Played or 6 challenge Games played
- Input game difficulty 1
- Time 72000 milliseconds or 1,2 min or 72 seconds

3 Level:

- From 323 Points Exp


UCH06		Consult shop	
Target of Use case		Consult the shop of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		User visualize the shop of MAK07	
Basic flow			
No	User	No	System
1	User select shop from home		
		2	System shows the shop
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCSH01, UCSH02, UCSH03	

Figure 3.13: Use Case UCH06

- 19 Solo Games Played or 19 Battle Games played
- Input game difficulty 1
- Time 72000 milliseconds or 1,2 min or 72 seconds

4 Level:

- From 782 Points Exp
- 46 Solo Games Played or 46 Battle Games
- Input game difficulty 1
- Time 72000 milliseconds or 1,2 min or 72 seconds


UCH07		Consult budges	
Target of Use case	Consult the collection of budges that a user has in MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows the collection of budges of MAK07		
Basic flow			
No	User	No	System
1	User select budges		
		2	System shows the list of budges that a user has collected until that time, some are in gray which means are blocked and others has their authentic colors.
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCB01, UCB02, UCB03, UCB04		

Figure 3.14: Use Case UCH07

5 Level:

- From 1547 Points Exp
- From 91 Solo Games Played or 91 Battle Games Played
- Input game difficulty 1
- Time 72000 milliseconds or 1,2 min or 72 seconds

6 Level:

- From 21888 Points Exp


UCH08		Play solo game	
Target of Use case	Play the solo game of MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows the solo game interface with a starting and finish point and path game, pointing where the user is over the path		
Basic flow			
No	User	No	System
1	User play solo game		
		2	System shows the interface of solo game
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCSOLO01, UCSOLO02, UCSOLO03, UCSOLO05		

Figure 3.15: Use Case UCH08

- From 171 Solo Games Played and 5 battle games played or from 171 Battle Games played and 5 Solo Games played
- Input game difficulty 2
- Time 78000 milliseconds or 1,3 min or 78 seconds

7 Level:

- From 39808 Points Exp
- From 311 solo Games Played and 70 Battle Game played or from 311 Battle Games played and 70 Solo Game played


UCH09		Play tournament	
Target of Use case		Play the tournament of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		System shows the tournament interface	
Basic flow			
No	User	No	System
1	User play tournament		
		2	System shows the interface of tournament
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCTOUR01, UCTOUR02, UCTOUR03	

Figure 3.16: Use Case UCH09

- Input game difficulty 2
- Time 78000 milliseconds or 1,3 min or 78 seconds

8 Level:

- From 62720 Points Exp
- From 490 Solo Games Played and 120 Battle Game played or from 490 Battle Games played and 120 Solo Game played
- Input game difficulty 2
- Time 78000 milliseconds or 1,3 min or 78 seconds

9 Level:


UCH10		Play challenge	
Target of Use case		Play the challenge of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		System shows the challenge interface	
Basic flow			
No	User	No	System
1	User play challenge		
		2	System shows the interface of challenge
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCC01, UCC04, UCC05	

Figure 3.17: Use Case UCH10

- From 88320 Points Exp
- From 690 Solo Games Played and 180 Battle Game played or from 690 Battle Games played and 180 Solo Game played
- Input game difficulty 2
- Time 78000 milliseconds or 1,3 min or 78 seconds

10 Level:

- From 102400 Points Exp
- From 800 Solo Games Played and 240 Battle Game played or from 800 Battle Games played and 240 Solo Game played


UCH11		Consult leaderboard	
Target of Use case	Consult the player leaderboard of MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows the user leaderboard interface		
Basic flow			
No	User	No	System
1	User select leaderboard from home		
		2	System shows the interface of leaderboard
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCLEAD01, UCP01, UCP2, UCP3, UCP4		

Figure 3.18: Use Case UCH11

- Input game difficulty 2
- Time 78000 milliseconds or 1,3 min or 78 seconds

11 Level:

- From 41000 Points Exp
- From 1000 Battle Games played and 350 Solo Game Played and 1 tournament played
- Input game difficulty 3
- Time 84000 milliseconds or 1,4 min or 84 seconds

12 Level:


UCH12		Play training	
Target of Use case	Play the training of MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows the training interface		
Basic flow			
No	User	No	System
1	User select training from home		
		2	System shows the interface of training
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCTR01, UCTR02, UCTR03, UCTR04, UCH16, UCH17		

Figure 3.19: Use Case UCH12

- From 57400 Points Exp
- From 1400 Battle Game played and 360 solo Games Played and 6 tournaments played
- Input game difficulty 3
- Time 84000 milliseconds or 1,4 min or 84 seconds

13 Level:

- From 82000 Points Exp
- From 2000 Battle Game played and 400 solo Games Played and 20 tournaments played


UCH13		Show notification	
Target of Use case	Show notification of MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows the notifications of MAK07		
Basic flow			
No	User	No	System
1	User has done an activity that trigger the system to show a notification. An activity can be chat message, alert for remember to play, alert for challenge, alert for tournament.		
		2	System shows the notification of the activity of MAK07
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCH114, UCH15, UCC02, UCC10, UCH18, UC3-6P05, UCH20, UCB01		

Figure 3.20: Use Case UCH13

- Input game difficulty 3
- Time 84000 milliseconds or 1,4 min or 84 seconds

14 Level:

- From 106600 Points Exp
- From 2600 Battle Game played and 450 solo Games Played and 40 tournaments played


UCH14		Show number of new chat messages on challenge	
Target of Use case	Show the number of new chat messages on challenge of MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows the number of new chat messages on challenges of MAK07		
Basic flow			
No	User	No	System
1	User start chatting with a friend		
		2	System shows the number of new chat messages for an open challenge
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCC10, UCC11, UCB08		

Figure 3.21: Use Case UCH14

- Input game difficulty 3
- Time 84000 milliseconds or 1,4 min or 84 seconds

15 Level:

- From 127100 Points Exp
- From 3100 Battle Game played and 500 solo Games Played and 70 tournaments played
- Input game difficulty 3
- Time 84000 milliseconds or 1,4 min or 84 seconds


UCH15		Show number of new chat messages on tournament	
Target of Use case	Show the number of new chat messages on tournament of MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows the number of new chat messages on tournaments of MAK07		
Basic flow			
No	User	No	System
1	User start chatting with a friend		
		2	System shows the number of new chat messages for an open tournament
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCTOUR24, UCB08		

Figure 3.22: Use Case UCH15

16 Level:

- From 159900 Points Exp
- From 3900 Battle Game played and 550 solo Games Played and 120 tournaments played
- Input game difficulty 3
- Time 84000 milliseconds or 1,4 min or 84 seconds

17 Level:

- From 192700 Points Exp


UCH16		Restart schema	
Target of Use case		Restart a schema of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		System shows the same schema that was previously played	
Basic flow			
No	User	No	System
1	User select restart to play the same schema		
		2	System shows the same schema previously played
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UC3-6P01, UC3-6P02, UC3-6P03, UC3-6P04, UCH08, UCH09, UCH10, UCH12, UCTR01, UCTR02, UCTR03, UCTR04, UCTR05, UCSOLO10, UCSOLO11, UCSOLO12, UCC08, UCC09, UCC12, UCTOUR30, UCTOUR31, UCTOUR32	

Figure 3.23: Use Case UCH16


UCH17		Exit to home	
Target of Use case	Exit to return home of MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows home interface		
Basic flow			
No	User	No	System
1	User select X button, back to home button or back arrow.		
		2	System shows home interface of MAK07
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UC3-6P01, UC3-6P02, UC3-6P03, UC3-6P04, UCH08, UCH09, UCH10, UCH12, UCTR01, UCTR02, UCTR03, UCTR04, UCTR05, UCSOLO10, UCSOLO11, UCSOLO12, UCC08, UCC09, UCC12, UCTOUR30, UCTOUR31, UCTOUR32	

Figure 3.24: Use Case UCH17

- From 4700 Battle Game played and 600 solo Games Played and 190 tournaments played


UCH18		Show new badge	
Target of Use case		Show the new badge won in MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		System shows home interface	
Basic flow			
No	User	No	System
1	User has completed some requirements to get the new badge		
		2	System shows the new badge won by the user on MAK07
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UC3-6P05, UCB01, UCB01, UCB03, UCB04, UCB05, UCB06, UCB08, UCB10, UCB11, UCH19, UCH20	

Figure 3.25: Use Case UCH18

- Input game difficulty 3
- Time 84000 milliseconds or 1,4 min or 84 seconds

18 Level:

- From 246000 Points Exp
- From 6000 Battle Game played and 650 solo Games Played and 270 tournaments played
- Input game difficulty 3


UCH19		Check requirements of player has reach new level	
Target of Use case	Check the requirements of next level of plater in order to see if a player has <u>reach</u> a new level		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows unblocked badge of new level in case user have complete all requirements		
Basic flow			
No	User	No	System
1	User has completed all requirements to get new level		
		2	System shows the new badge won by the user on MAK07
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCB01, UCB01, UCB03, UCB04, UCB05, UCB06, UCB08, UCB10, UCB11, UCH20		

Figure 3.26: Use Case UCH19

- Time 84000 milliseconds or 1,4 min or 84 seconds

19 Level:

- From 282900 Points Exp
- From 6900 Battle Game played and 700 solo Games Played and 360 tournaments played
- Input game difficulty 3


UCH20		Notify a player have reach new level	
Target of Use case		Notify a player that have reach a new level of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		System shows unblocked badge of new level in case user have complete all requirements	
Basic flow			
No	User	No	System
1	User has completed all requirements to get new level		
		2	System shows the new badge won by the user on MAK07
		3	System save the new level and new badge won on DB
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCB01, UCB01, UCB03, UCB04, UCB05, UCB06, UCB08, UCB10, UCB11, UCH19	

Figure 3.27: Use Case UCH20

- Time 84000 milliseconds or 1,4 min or 84 seconds

20 Level:

- From 494100 Points Exp
- From 8100 Battle Game played and 800 solo Games Played and 500 tournaments played
- Input game difficulty 4

UCH21		Exit from MAK07	
Target of Use case		The user <u>want</u> to exit from MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		MAK07 is closed with all data saved until this point	
Basic flow			
No	User	No	System
1	User exit from MAK07		
		2	System save the information on DB
		3	System close the application MAK07
Interface view			

Figure 3.28: Use Case UCH21

- Time 90000 milliseconds or 1,5 min or 90 seconds

21 Level:

- From 549000 Points Exp
- From 9000 Battle Game played and 850 solo Games Played and 700 tournaments played
- Input game difficulty 4
- Time 90000 milliseconds or 1,5 min or 90 seconds

22 Level:


UCH22		Switch application run in background MAK07	
Target of Use case	Switch application allowing to run in background MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System runs in background MAK07 and display another application installed on device		
Basic flow			
No	User	No	System
1	User has switched the application from MAK07 to other installed on device		
		2	System save the information in DB
		3	System display the interface of the other application and run in background MAK07
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Extensions	UCH21, UCH01, UCH23		

Figure 3.29: Use Case UCH22

- From 732000 Points Exp
- From 12000 Battle Game played and 900 solo Games Played and 800 tournaments played
- Input game difficulty 4
- Time 90000 milliseconds or 1,5 min or 90 seconds

23 Level:

- From 854000 Points Exp


UCH23		Resume MAK07	
Target of Use case	Allow the user to resume the previous state on MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	System shows home interface or previous interface where the user was before		
Basic flow			
No	User	No	System
1	User has switched the application to MAK07		
		2	System display the interface of MAK07 where the user was before
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Extensions	UCH21, UCH01, UCH22, UCS(01-08), UCP(01-15), UCTU01, UC3-6P(01-05), UCSOLO(01,02,05,07,08,09), UCTR(01-10), UCH(03-15), UCC(01,04,05,06,07,10), UCTOUR(01-06,09,10), UCLEAD(01-03), UCB(01-06)		

Figure 3.30: Use Case UCH23

- From 14000 Battle Game played and 950 solo Games Played and 900 tournaments played
- Input game difficulty 4
- Time 90000 milliseconds or 1,5 min or 90 seconds

24 Level:

- From 1220000 Points Exp
- From 20 000 Battle Game played and 1000 solo Games Played and 1000 tournaments played

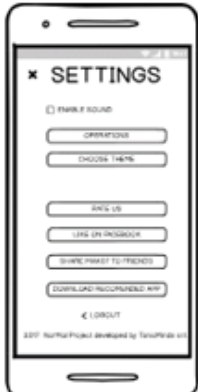
UCS01		Enable sound	
Target of Use case		Allow the user to enable the sound of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings	
Outputs		The sound of MAK07 is enable.	
Basic flow			
No	User	No	System
1	User has enabled the sound of MAK07		
		2	System enable the sound of MAK07
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Alternative flow 3:		UCH17: Exit to Home	
Extensions		UCH05, UCS09, UCS10	

Figure 3.31: Use Case UCS01

- Input game difficulty 4
- Time 90000 milliseconds or 1,5 min or 90 seconds

25 Level:

- From 1550000 Points Exp
- From 30 000 Battle Game played and 2000 solo Games Played and 2000 tournaments played

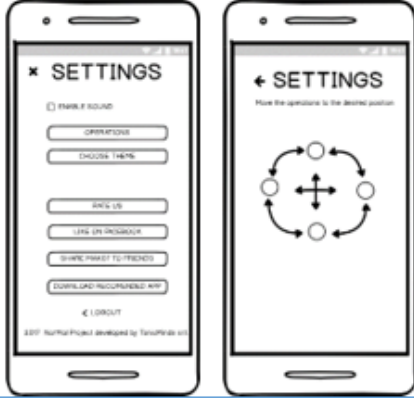
UCS02		Set operations	
Target of Use case		Allow the user to set the operations of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings	
Outputs		The system displays the interface for setting the operations position of MAK07	
Basic flow			
No	User	No	System
1	User has set the position of operations for playing MAK07		
		2	System displays the interface for setting the operations position of MAK07
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Alternative flow 3:		UCH17: Exit to Home	
Alternative flow 4:		UCS09: Return to settings	
Extensions		UCH05, UCS (09,11-15)	

Figure 3.32: Use Case UCS02

- Input game difficulty 5
- Time 96000 milliseconds or 1,6 min or 96 seconds

26 Level:

- From 1600000 Points Exp

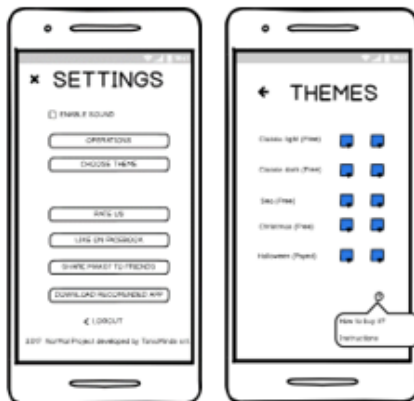
UCS03		Choose theme	
Target of Use case		Allow the user to choose the theme of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings	
Outputs		The system displays the interface for set the theme of MAK07	
Basic flow			
No	User	No	System
1	User has click on choose theme of MAK07		
		2	System displays the interface for choose the theme of MAK07
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Alternative flow 3:		UCH17: Exit to Home	
Alternative flow 4:		UCS09: Return to settings	
Extensions		UCH05, UCS16, UCS17, UCS09, UCSH01	

Figure 3.33: Use Case UCS03

- From 50 000 Battle Game played and 3000 solo Games Played and 3000 tournaments played
- Input game difficulty 5
- Time 96000 milliseconds or 1,6 min or 96 seconds

27 Level:

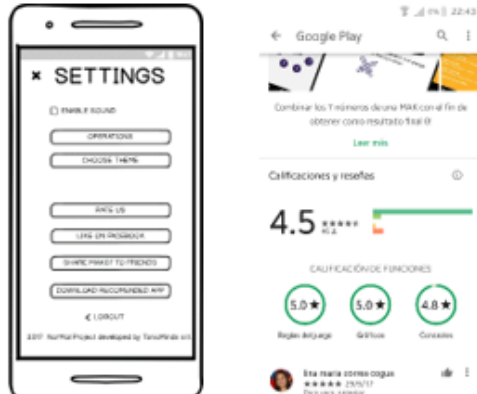
UCS04		Rate us	
Target of Use case	Allow the user to rate MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings		
Outputs	The system displays the interface of MAK07 on apple store or play store		
Basic flow			
No	User	No	System
1	User has click on rate us button		
		2	The system saves the configuration and data on DB
		3	MAK07 runs in background
		4	The system displays the interface of MAK07 on apple store or play store
Interface view			
			
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCH22		

Figure 3.34: Use Case UCS04

- From 1700000 Points Exp
- From 60 000 Battle Game played and 4000 solo Games Played and 4000 tournaments played
- Input game difficulty 5
- Time 96000 milliseconds or 1,6 min or 96 seconds

28 Level:


UCS05		Like on Facebook	
Target of Use case	The user like the application on MAK07 official Facebook web page		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings		
Outputs	The system displays the MAK07 official Facebook web page		
Basic flow			
No	User	No	System
1	User clicks on rate us		
		2	The system displays the MAK07 official Facebook web page
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Alternative flow 3:	UCH17: Exit to Home		
Alternative flow 4:	UCS09: Return to settings		
Extensions	UCS22		

Figure 3.35: Use Case UCS05

- From 1900000 Points Exp
- From 80 000 Battle Game played and 6000 solo Games Played and 6000 tournaments played
- Input game difficulty 5
- Time 96000 milliseconds or 1,6 min or 96 seconds

29 Level:



UCS06		Share MAK07 to friends	
Target of Use case	The user share MAK07 to friends using MAK07 chat or another device application installed		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	MAK07 is shared on a chat or on another application installed in the device		
Basic flow			
No	User	No	System
1	User share MAK07		
		2	MAK07 is shared on a chat or on another application installed in the device
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Alternative flow 3:	UCH17: Exit to Home		
Alternative flow 4:	UCS09: Return to settings		
Extensions	UCH05, UCS09		

Figure 3.36: Use Case UCS06

- From 2200 000 Points Exp
- From 90 000 Battle Game played and 7000 solo Games Played and 7000 tournaments played
- Input game difficulty 5
- Time 96000 milliseconds or 1,6 min or 96 seconds

30 Level:

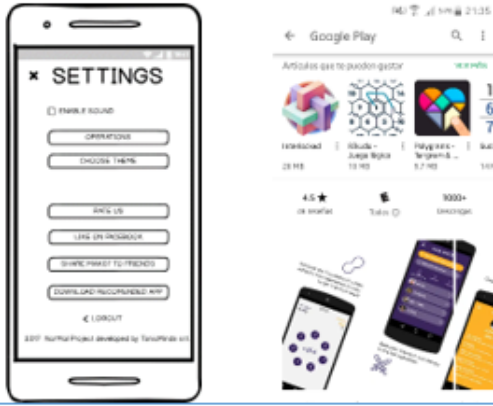
UCS07		Download recommended app	
Target of Use case	The user downloads a recommended application from MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	Apple store or play store is opened with the application recommended interface		
Basic flow			
No	User	No	System
1	User select the button to download the recommended app		
		2	Apple store or play store is opened with the application recommended interface
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Alternative flow 3:	UCH17: Exit to Home		
Alternative flow 4:	UCS09: Return to settings		
Extensions	UCH05, UCS09		

Figure 3.37: Use Case UCS07

- From 3300 000 Points Exp
- From 100 000 Battle Game played and 9 000 solo Games Played and 9000 tournaments played
- Input game difficulty 6
- Time 102000 milliseconds or 1,7 min or 102 seconds

UCS08		Logout	
Target of Use case	The user logout from MAK07		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	MAK07 is closed		

Basic flow			
No	User	No	System
1	User select the button to logout from MAK07		
		2	The system saves the configuration and data on DB
		3	MAK07 is closed

Interface view

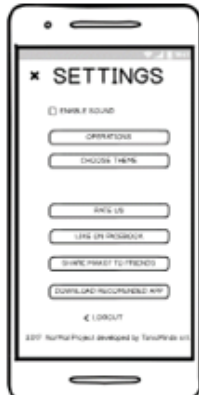


Figure 3.38: Use Case UCS08

31 Level:

- From 4400 000 Points Exp
- From 300 000 Battle Game played and 120 000 solo Games Played and 120 000 tournaments played
- Input game difficulty 6
- Time 102000 milliseconds or 1,7 min or 102 seconds

32 Level:

- From 5500 000 Points Exp

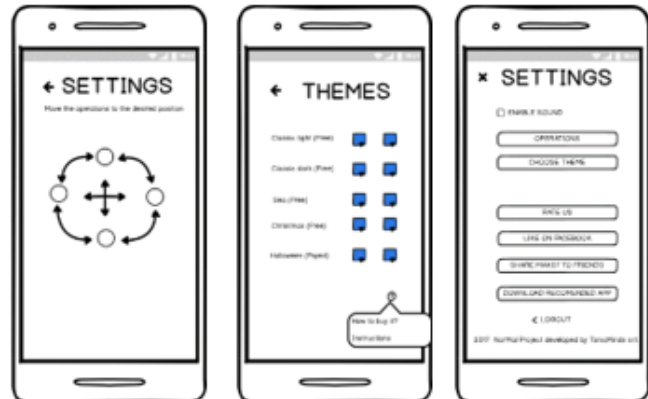
UCS09		Return to settings	
Target of Use case		The user returns to settings of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		The system shows the settings interface	
Basic flow			
No	User	No	System
1	User select the button left arrow to comeback to settings		
		2	The system shows the settings interface
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH05	

Figure 3.39: Use Case UCS09

- From 600 000 Battle Game played and 170 000 solo Games Played and 170 000 tournaments played
- Input game difficulty 6
- Time 102000 milliseconds or 1,7 min or 102 seconds

33 Level:

- From 9800 000 Points Exp
- From 800 000 Battle Game played and 300 000 solo Games Played and 300 000 tournaments played

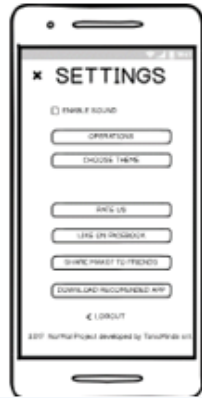
UCS10		Disable sound	
Target of Use case		Allow the user to disable the sound of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings	
Outputs		The sound of MAK07 is disable.	
Basic flow			
No	User	No	System
1	User has disabled the sound of MAK07		
		2	System disable the sound of MAK07
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Alternative flow 3:		UCH17: Exit to Home	
Extensions		UCH05, UCS01	

Figure 3.40: Use Case UCS10

- Input game difficulty 6
- Time 102000 milliseconds or 1,7 min or 102 seconds

34 Level:

- From 1600 000 Points Exp
- From 1200 000 Battle Game played and 700 000 solo Games Played and 700 000 tournaments played

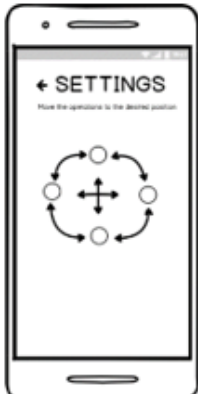
UCS11		Set + operation position	
Target of Use case		Allow the user to set the +operation to up, down, left or right	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings	
Outputs		The system displays the interface for setting the + operation position with the new position wanted by the user	
Basic flow			
No	User	No	System
1	User has set the position of + operation for playing MAK07 to (up, down, left or right)		
		2	The system displays the interface for setting the + operation position with the new position wanted by the user
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Alternative flow 3:		UCS09: Return to settings	
Extensions		UCS(12-15)	

Figure 3.41: Use Case UCS11

- Input game difficulty 6
- Time 102000 milliseconds or 1,7 min or 102 seconds

35 Level:

- From 7 000 000 Points Exp

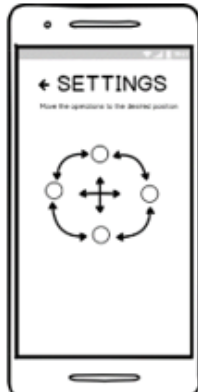
UCS12		Set - operation position	
Target of Use case	Allow the user to set the - operation to up, down, left or right		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings		
Outputs	The system displays the interface for setting the - operation position with the new position wanted by the user		
Basic flow			
No	User	No	System
1	User has set the position of - operation for playing MAK07 to (up, down, left or right)		
		2	The system displays the interface for setting the - operation position with the new position wanted by the user
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Alternative flow 3:	UCS09: Return to settings		
Extensions	UCS(11,13-15)		

Figure 3.42: Use Case UCS12

- From 5 000 000 Battle Game played and 1 000 000 solo Games Played and 1 000 000 tournaments played
- Input game difficulty 7
- Time 120 000 milliseconds or 2 min or 120 seconds

For each Mathematician there is an association with a level [tables 3.1, 3.2].

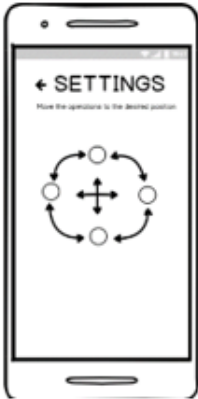
UCS13		Set * operation position	
Target of Use case	Allow the user to set the * operation to up, down, left or right		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings		
Outputs	The system displays the interface for setting the * operation position with the new position wanted by the user		
Basic flow			
No	User	No	System
1	User has set the position of * operation for playing MAK07 to (up, down, left or right)		
		2	The system displays the interface for setting the * operation position with the new position wanted by the user
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Alternative flow 3:	UCS09: Return to settings		
Extensions	UCS(11,12,14,15)		

Figure 3.43: Use Case UCS13

Points

Mak07 will have 2 systems of points, Experience points that are the ones that the user gets for each interaction with the game, the other kind is the brain points which are the ones that are hard to get and Will be the concurrency of the game. If the user wants to buy brains, they can do it by paying with real money

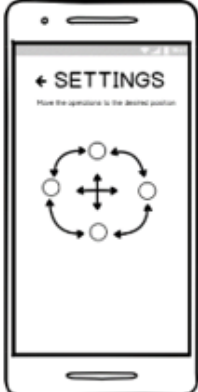
UCS14		Set (/ :) operation position	
Target of Use case	Allow the user to set the (/ :) operation to up, down, left or right		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings		
Outputs	The system displays the interface for setting the (/ :) operation position with the new position wanted by the user		
Basic flow			
No	User	No	System
1	User has set the position of (/ :) operation for playing MAK07 to (up, down, left or right)		
		2	The system displays the interface for setting the (/ :) operation position with the new position wanted by the user
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Alternative flow 3:	UCS09: Return to settings		
Extensions	UCS(11-13,15)		

Figure 3.44: Use Case UCS14

(euros, pounds, dollars). After many test, the following formula is the best one to calculate the experience points.

$$\text{Experience Points} = \left\{ \sum \left(\frac{\text{NoSchemeCompleted}}{(1 + (\text{lefttimeonmilliseconds} * \text{weight}))} + \text{PointsOp} \right) + 1 \right\} \text{ or } 0 \text{ if no left time and 0 scenario Completed}$$

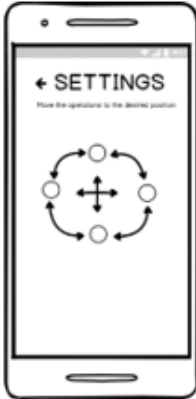
UCS15		Save new configuration of position operation controls	
Target of Use case		Save new configuration of position operation controls	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings	
Outputs		Playing any challenge, tournament, solo game or training game the operations are in the order that the user saved them	
Basic flow			
No	User	No	System
1	User has set the position operations		
		2	The system displays the order of position operations as they saved them
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Alternative flow 3:		UCS09: Return to settings	
Extensions		UCS(09,11-14)	

Figure 3.45: Use Case UCS15

Awards

MAK07 will have a list of medals, the following table will show the details of each [table 3.3].

Boosters

MAK07 will have a list of boosters, the following table will show the details of each [Tables 3.11, 3.12].


UCS16		Select one theme	
Target of Use case		Select one theme of MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07 User must already have access to settings	
Outputs		The system displays the interface with the theme of MAK07 chosen	
Basic flow			
No	User	No	System
1	User has chosen a theme of MAK07		
		2	System displays the interface of the chosen theme of MAK07
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Alternative flow 3:		UCH17: Exit to Home	
Alternative flow 4:		UCS09: Return to settings	
Extensions		UCH05, UCS16, UCS17, UCS09, UCSH01	

Figure 3.46: Use Case UCS16

Dynamics, mechanics, components of gamification

The following table will describe the different dynamics related to MAK07 [Tables 3.13, 3.14, 3.15].

Mechanics: process to generate engagement

The Mechanics of MAK07 will be shown on the table Mechanics: the process to generate engagement [Tables 3.16].


UCS17		Provide information how to buy	
Target of Use case	Provide information about how to buy an item		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	The system displays the information about how to buy an item		
Basic flow			
No	User	No	System
1	User has click in the ? button		
		2	System displays the information needed of how to buy an item
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Alternative flow 3:	UCH17: Exit to Home		
Alternative flow 4:	UCS09: Return to settings		
Extensions	UCH05		

Figure 3.47: Use Case UCS17

Components: Specific instance of dynamics and mechanics

The Components of MAK07 will be shown on the table Components: Specific instance of dynamics and mechanics [Tables 3.17].

3.3.3 Deployment view

Mak07 has been developed with a mobile environment architecture, focused as the majority of mobile applications on Android and iOS operating systems [figure

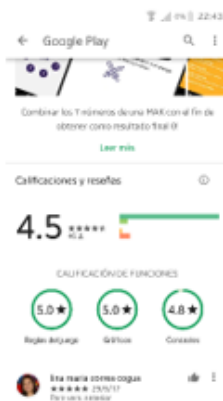
UCS18		Open store on device	
Target of Use case	Open apple store or play store on device MAK07 profile		
Inputs	User must already have an account associated to MAK07 User must already have login to MAK07		
Outputs	The system displays the interface of MAK07 on apple store or play store		
Basic flow			
No	User	No	System
		1	The system displays the interface of MAK07 on apple store or play store
Interface view			
			
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCH22		

Figure 3.48: Use Case UCS18

3.65]. Typically mobile applications need to connect to internet to exchange information about user progress, authentication and synchronization [25]. The [figure 3.66] shows the MAK07 client server architecture in which the server back end works with REST functionalities and it exposed outside their services throw an API connected by clients with HTTP methods. The API invocation is the principal method achieved for the client server communications, but also the Websocket mechanism in which users has been track into the system in a way that players have the game application in execution even if they are not playing any challenge. For notifications was used Google firebase.

Technological dependencies

MAK07 count with few limitations to develop:


UCS19		Open MAK07 profile on Facebook	
Target of Use case		Open MAK07 profile on official Facebook web page	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		The system displays the MAK07 official Facebook web page	
Basic flow			
No	User	No	System
		1	System displays the MAK07 official Facebook web page
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Alternative flow 3:		UCH17: Exit to Home	
Alternative flow 4:		UCS09: Return to settings	
Extensions		UCH22	

Figure 3.49: Use Case UCS19

- Online multiplayer gaming
- Screen limitation of smart phones are until 7 balls for screen space
- Android version upper than 4.4
- iOS version upper than 9.0
- Users need wifi connection to play
- Users need to create a profile or use a Facebook or Google account to play


UCS20		Generate petition to share MAK07	
Target of Use case		Generate petition to share MAK07 in to <u>other</u> app installed on device	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		MAK07 is shared on a chat or on another application installed in the device	
Basic flow			
No	User	No	System
		1	MAK07 save the user data on DB
		2	Create a link to share the MAK07
		3	The system opens the multiple applications where the link can be shared.
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH05, UCS09, UCS06	

Figure 3.50: Use Case UCS20

- Operative system of server: Linux kernel 3.13.0 and Ubuntu 14.04.5
- Database motor: MongoDB 2.6.11 port 27017
- GameServer: Spring Boot 1.5.7 and Apache Tomcat 8.5.20
- Google Firebase used for notifications
- RabbitMQ message broker in charge of sending the output messages to the correct message queue and forwarding the input messages to the correct messages endpoints

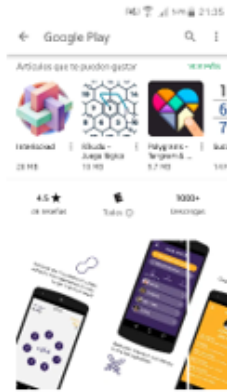
UCS21		Open store on recommended app	
Target of Use case		Open apple store or play store on a recommended application associated to MAK07	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		Apple store or play store is opened with the application recommended interface	
Basic flow			
No	User	No	System
		1	Apple store or play store is opened with the application recommended interface
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH05, UCS09, UCS07	

Figure 3.51: Use Case UCS21

- Docker Hub Engine: Docker 0.9 libvirt, LXC o systemd-nspawn. port 443 to 8443
- Mak07 works with 4 containers but can be grow depending on future functionalities
- Server Domain: game.mak07.com
- Server CPU: Intel(R) Xeon(R) CPU E5-2620 v2 @2.10GHz
- Server memory: 40GB


UCLOG01		Give user and password	
Target of Use case		Give user and password for login	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		The user is authenticated	
Basic flow			
No	User	No	System
1	The user fills up a form giving user and password		
		2	MAK07 has login the user
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH04, UCLOG(02,03,07)	

Figure 3.52: Use Case UCLOG01

- Server IP: 91.250.83.69


UCLOG02		Link Facebook	
Target of Use case		Link Facebook to Login	
Inputs		User must already have an account on Facebook	
Outputs		The user is authenticated	
Basic flow			
No	User	No	System
1	Click on login with Facebook button		
		2	MAK07 has login the user
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH04, UCLOG(01,03,07)	

Figure 3.53: Use Case UCLOG02


UCLOG03		Link Google	
Target of Use case	Link Google to Login		
Inputs	User must already have an account on Google		
Outputs	The user is authenticated		
Basic flow			
No	User	No	System
1	Click on login with Google button		
		2	MAK07 has login the user
Interface view			
			
Alternative flow 1:	UCH21: Exit from MAK07.		
Alternative flow 2:	UCH22: Switch application on device in which MAK07 will continue run in background.		
Extensions	UCH04, UCLOG(01,02,07)		

Figure 3.54: Use Case UCLOG03


UCLOG04		Create nickname	
Target of Use case		Create a nickname	
Inputs			
Outputs		The user has a nickname for MAK07	
Basic flow			
No	User	No	System
1	User type a nickname		
		2	The system checks the email and the nickname verifying the uniqueness account
		3	The system saves the nickname of a user
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH04, UCLOG(01,02,03)	

Figure 3.55: Use Case UCLOG04


UCLOG05		Check unique account	
Target of Use case		Check uniqueness of account	
Inputs		User has an account	
Outputs		The system only has one account linked with the email	
Basic flow			
No	User	No	System
1	User type an email to link with		
		2	The system checks the email and the nickname verifying the uniqueness account
		3	The system saves the nickname and email of a user
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH04, UCLOG(01,02,03,04)	

Figure 3.56: Use Case UCLOG05


UCLOG06		Save user information	
Target of Use case		Save in MAK07 system the user information given by the user	
Inputs		User has an account	
Outputs		The system only has one account linked with the email	
Basic flow			
No	User	No	System
1	User type an email to link with		
		2	The system checks the email and the nickname verifying the uniqueness account
		3	The system saves the nickname and email of a user
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH04, UCLOG(01,02,03,04,05)	

Figure 3.57: Use Case UCLOG06


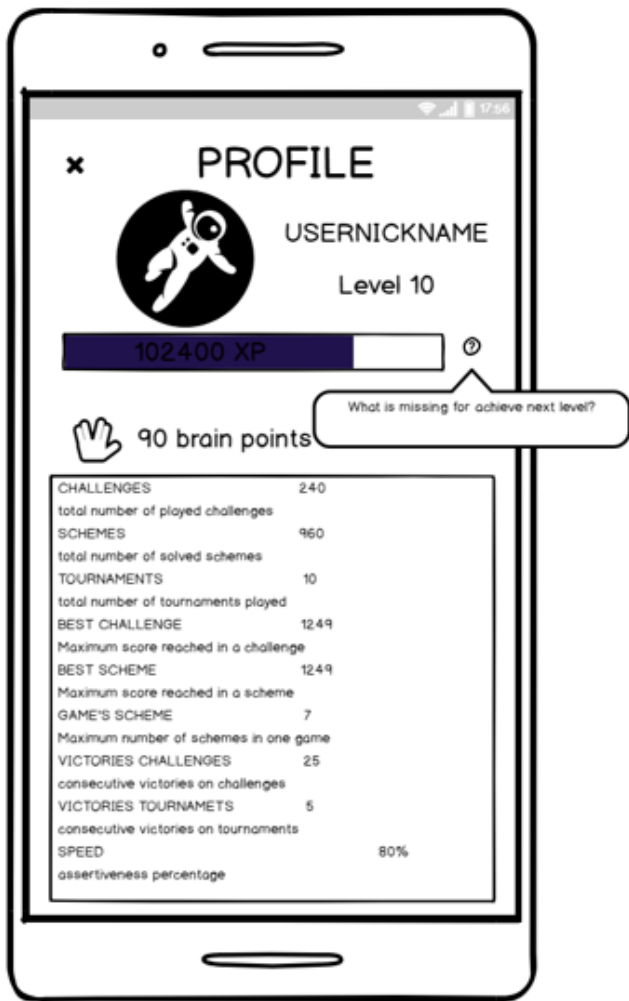
UCLOG07		Login	
Target of Use case		Login into MAK07	
Inputs		User must already have an account associated to MAK07	
Outputs		The system login a user and shows home interface	
Basic flow			
No	User	No	System
1	User type email and password		
		2	The system login a user
		3	The system shows home interface
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH04, UCLOG(01,02,03,04,05,06)	

Figure 3.58: Use Case UCLOG07

UCP01		Show nickname	
Target of Use case		Show the nickname of a user	
Inputs		User must already have an account associated to MAK07 User must already have login to MAK07	
Outputs		The system shows the nickname of the user	
Basic flow			
No	User	No	System
1	User consult his profile		
		2	The system shows the nickname of the user
Interface view			
			
Alternative flow 1:		UCH21: Exit from MAK07.	
Alternative flow 2:		UCH22: Switch application on device in which MAK07 will continue run in background.	
Extensions		UCH04, UCP (02-15)	

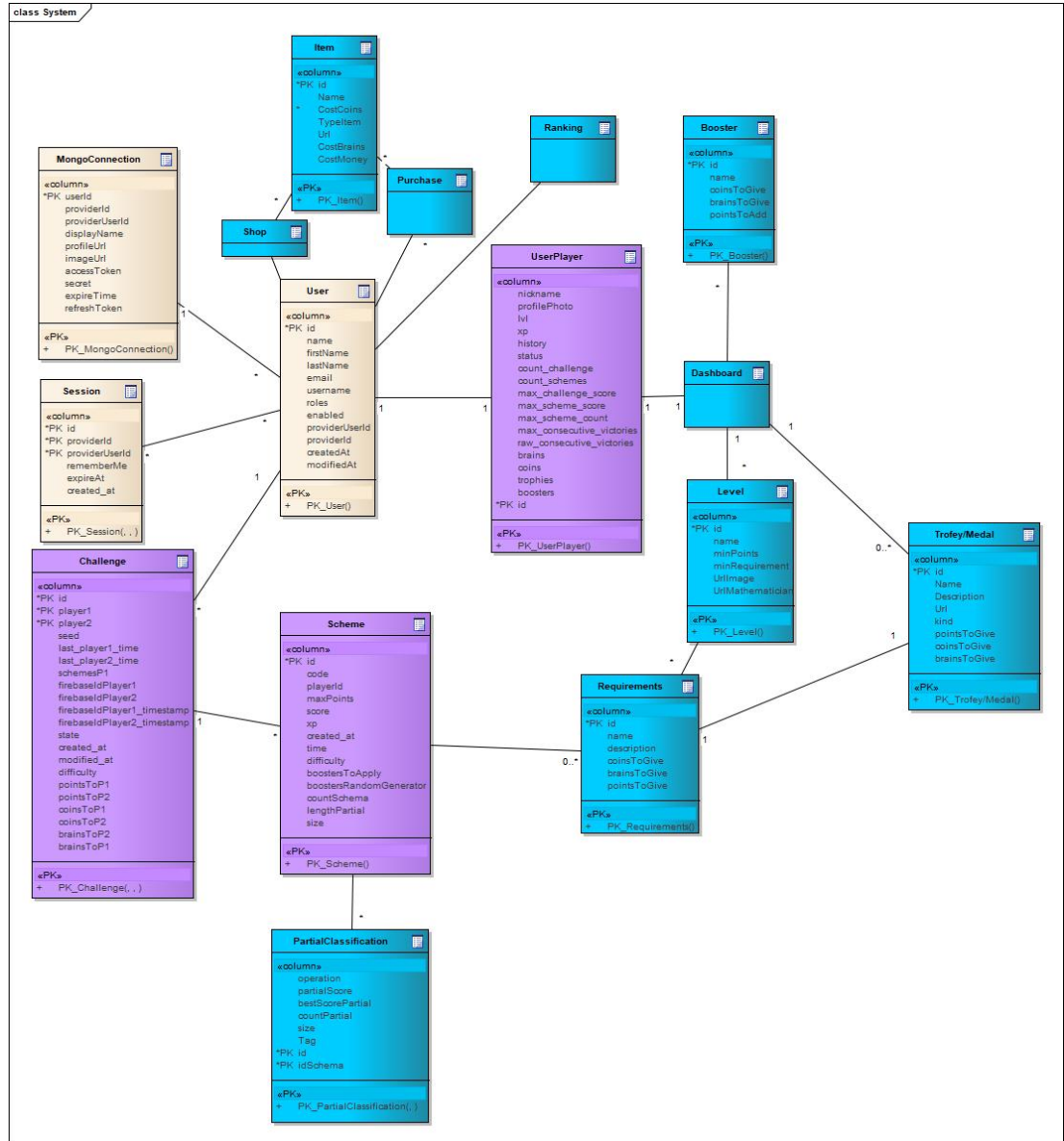


Figure 3.64: AS IS Database Model

Web reference	Thetoptens.com [17]	Fabpedigree.com [24]
1st	Leonarhard Euler	Isaac Newton
2nd	Isaac Newton	Archimedes
3er	Srinivasa Ramanujan	Carl F. Gauss
4th	Aryabhatta	Leonard Euler
5th	Archimedes	Bernhard Riemann
6th	Euclid of Alexandria	Henri Poincare
7th	Gottfried W. Leibniz	Joseph-Louis Lagrange
8th	John Von Neumann	Euclid of Alexandria
9th	Rene Descartes	David Hilbert
10th	Bernhard Riemann	Gottfried W. Leibniz

Table 3.1: Matematicians

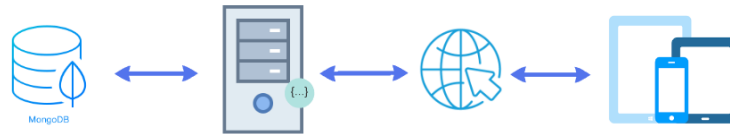


Figure 3.65: Architecture

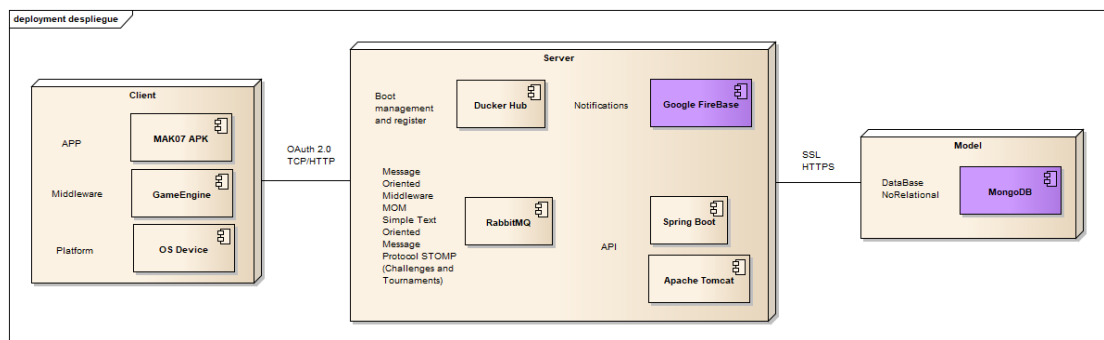


Figure 3.66: Deployment diagram

Web reference	Thetoptens.com [17]	Fabpedigree.com [24]
11th	Augustin Cauchy	Alexandre Grothendieck
12th	Pierre Simone laplace	Pierre de Fermat
13th	Pythagoras	Evariste Galois
14th	Bhascar Acharya	John von Neumann
15th	Henri Poincare	Niels Abel
16th	Muhammad Al-Khowarizmi	Karl W. T Weierstrass
17th	Georg Cantor	Rene Descartes
18th	Chris Winterburn	Peter G. L. Dirichlet
19th	Alan Turing	Srinivasa Ramanujan
20th	Carl Friedrich Gauss	Carl G. J. Jacobi
21th	Blaise Pascal	Brahmagupta
22th	Pierre De Fermat	Georg Cantor
23er	Joshep Louis Lagrange	Augustin Cauchy
24th	Bertrand Russell	Hermann K. H. Weyl
25th	Alexandre Grothendieck	Arthur Cayley
26th	Niles Abel	Emmy Noether
27th	Evariste Galois	Pythagoras of Samos
28th	Kurt Godel	Aryabhata
29th	David Hilbert	Leonardo ‘Fibonacci’
30th	Liu Hui	William R. Hamilton
31th	Maryam Mirzakhani	Apollonius of Perga
32th	Sir Andrew Wiles	Charles Hermite
33th	Brahmagupta	Diophantus of Alexandria
34th	Peter G. L. Dirichlet	Pierre-Simon Laplace
35th	Nicolai Lobachevsky	Carl Ludwig Siegel

Table 3.2: Matematicians cont. 2

Type	Trophy	Description
Perseverance	Challenge of the day x 3	Play at least 1 challenge each day for 3 days consecutive
	Challenge of the day x 5	Play at least 1 challenge each day for 5 days consecutive
	Challenge of the day x 10	Play at least 1 challenge each day for 10 days consecutive
	Challenge of the day x 25	Play at least 1 challenge each day for 25 days consecutive
	Challenge of the day x 50	Play at least 1 challenge each day for 50 days consecutive
Athletic	Training of the day x 3	Play at least 1 training game each day for 3 days consecutive
	Training of the day x 5	Play at least 1 training game each day for 5 days consecutive
	Training of the day x 10	Play at least 1 training game each day for 10 days consecutive
	Training of the day x 25	Play at least 1 training game each day for 25 days consecutive
	Training of the day x 50	Play at least 1 training game each day for 50 days consecutive
Warrior	Tournament player x 3	Play at least 1 tournament each day for 3 days consecutive
	Tournament player x 5	Play at least 1 tournament each day for 5 days consecutive
	Tournament player x 10	Play at least 1 tournament each day for 10 days consecutive
	Tournament player x 25	Play at least 1 tournament each day for 25 days consecutive
	Tournament player x 50	Play at least 1 tournament each day for 50 days consecutive

Table 3.3: Medals/Trophy

Type	Trophy	Description
Invincible	Winner challenge x 3	Play 3 consecutive challenge without being defeated
	Winner challenge x 5	Play 5 consecutive challenge without being defeated
	Winner challenge x 10	Play 10 consecutive challenge without being defeated
	Winner challenge x 25	Play 25 consecutive challenge without being defeated
	Winner challenge x 50	Play 50 consecutive challenge without being defeated
	Winner tournament x 3	Play 3 consecutive tournament without being defeated
	Winner tournament x 5	Play 5 consecutive tournament without being defeated
	Winner tournament x 10	Play 10 consecutive tournament without being defeated
	Winner tournament x 25	Play 25 consecutive tournament without being defeated
	Winner tournament x 50	Play 50 consecutive tournament without being defeated
Challenges	Hard player x 100	Play 100 challenge overall
	Hard player x 500	Play 500 challenge overall
	Hard player x 1000	Play 1000 challenge overall
	Hard player x 5000	Play 5000 challenge overall
	Hard player x 1000 000	Play 1000 000 challenge overall
	Hard player x 7 000 000	Play 7000 000 challenge overall
Tournaments	Invincible x 100	Play 100 tournament overall
	Invincible x 500	Play 500 tournament overall
	Invincible x 1000	Play 1000 tournament overall
	Invincible x 5000	Play 5000 tournament overall
	Invincible x 1000 000	Play 1000 000 tournament overall
Level	1 to 35	When an user reach new level, unblock a trophy associated to that level

Table 3.4: Medals/Trophy cont. 2

Type	Trophy	Description
Chronometry	Less than 10119 milliseconds	Solve a schema of difficulty 1 (level from 1- 5) in less than 10119 milliseconds or 0,16856 seconds
	Less than 11135 milliseconds	Solve a schema of difficulty 2 (level from 6 - 10) in less than 11135 milliseconds or 0,1855833 seconds
	Less than 10489 milliseconds	Solve a schema of difficulty 3 (level from 11 â 19) in less than 10489 milliseconds or 0,17481667 seconds
	Less than 8570 milliseconds	Solve a schema of difficulty 4 (level from 20 â 24) in less than 8570 milliseconds or 0,1428333 seconds
	Less than 11591 milliseconds	Solve a schema of difficulty 5 (level from 25 â 29) in less than 11591 milliseconds or 0,19318333 seconds
	Less than 9881 milliseconds	Solve a schema of difficulty 6 (Level from 30 - 34) in less than 9881 milliseconds or 0,1646833 seconds
	Less than 10211 milliseconds	Solve a schema of difficulty 7 (Level 35) in less than 10211 milliseconds or 0,17018333 seconds
High quality	1 Scheme In a challenge	Solve 1 scheme with the maximum points in a challenge
	2 Scheme in a challenge	Solve 2 scheme with the maximum points in the same challenge
	3 Scheme in a challenge	Solve 3 scheme with the maximum points in the same challenge
	4 Scheme in a challenge	Solve 4 scheme with the maximum points in the same challenge
	5 Scheme in a challenge	Solve 5 scheme with the maximum points in the same challenge
draw	draw	First draw in a challenge
Social	Share	Share the app to friends
	rank	Rank the app

Table 3.5: Medals/Trophy cont. 3

Type	Trophy	Description
Solo game	Champion x 100	Play 100 solo game overall
	Champion x 500	Play 500 solo game overall
	Champion x 1000	Play 1000 solo game overall
	Champion x 5000	Play 5000 solo game overall
	Champion x 1000 000	Play 1000 000 solo game overall
Daring	Daring challenge x 5	Win 5 challenge against a higher-level player
	Daring challenge x 10	Win 10 challenge against a higher-level player
	Daring challenge x 25	Win 25 challenge against a higher-level player
	Daring challenge x 50	Win 50 challenge against a higher-level player
Boosters	Freeze	First time using freeze booster
	skip	First time using skip booster
	Multiply score	First time using multiply score booster
	hint	First time using hint booster
	poison	First time using poison booster

Table 3.6: Medals/Trophy cont. 4

Type	Trophy	Description
speed	3 x 72	Solve 3 scheme in 72000 milliseconds on a challenge
	4 x 72	Solve 4 scheme in 72000 milliseconds on a challenge
	5 x 72	Solve 5 scheme in 72000 milliseconds on a challenge
	6 x 72	Solve 6 scheme in 72000 milliseconds on a challenge
	3 x 78	Solve 3 scheme in 78000 milliseconds on a challenge
	4 x 78	Solve 4 scheme in 78000 milliseconds on a challenge
	5 x 78	Solve 5 scheme in 78000 milliseconds on a challenge
	6 x 78	Solve 6 scheme in 78000 milliseconds on a challenge
	4 x 84	Solve 4 scheme in 84000 milliseconds on a challenge
	5 x 84	Solve 5 scheme in 84000 milliseconds on a challenge
	6 x 84	Solve 6 scheme in 84000 milliseconds on a challenge
	7 x 84	Solve 7 scheme in 84000 milliseconds on a challenge

Table 3.7: Medals/Trophy cont. 5

Type	Trophy	Description
speed	4 x 90	Solve 4 scheme in 90000 milliseconds on a challenge
	5 x 90	Solve 5 scheme in 90000 milliseconds on a challenge
	6 x 90	Solve 6 scheme in 90000 milliseconds on a challenge
	7 x 90	Solve 7 scheme in 90000 milliseconds on a challenge

Table 3.8: Medals/Trophy cont. 6

Type	Trophy	Description
Time	Morning 3 days in a row	Play Mak07 in the morning, between 8am and 10 am for 3 days consecutive
	Morning 5 days in a row	Play Mak07 in the morning, between 8am and 10 am for 5 days consecutive
	Morning 10 days in a row	Play Mak07 in the morning, between 8am and 10 am for 10 days consecutive
	Morning 25 days in a row	Play Mak07 in the morning, between 8am and 10 am for 25 days consecutive
	Morning 50 days in a row	Play Mak07 in the morning, between 8am and 10 am for 50 days consecutive
	Afternoon 3 days in a row	Play Mak07 in the afternoon, between 3pm and 5pm for 3 days consecutive
	Afternoon 5 days in a row	Play Mak07 in the afternoon, between 3pm and 5pm for 5 days consecutive
	Afternoon 10 days in a row	Play Mak07 in the afternoon, between 3pm and 5pm for 10 days consecutive
	Afternoon 25 days in a row	Play Mak07 in the afternoon, between 3pm and 5pm for 25 days consecutive
	Afternoon 50 days in a row	Play Mak07 in the afternoon, between 3pm and 5pm for 50 days consecutive
	Evening 3 days in a row	Play Mak07 in the evening, between 7pm to 9pm for 3 days consecutive
	Evening 5 days in a row	Play Mak07 in the evening, between 7pm to 9pm for 5 days consecutive
	Evening 10 days in a row	Play Mak07 in the evening, between 7pm to 9pm for 10 days consecutive

Table 3.9: Medals/Trophy cont. 7

Type	Trophy	Description
Time	Evening 25 days in a row	Play Mak07 in the evening, between 7pm to 9pm for 25 days consecutive
	Evening 50 days in a row	Play Mak07 in the evening, between 7pm to 9pm for 50 days consecutive
	Night 3 days in a row	Play Mak07 in the night, between 11pm to 1am for 3 days consecutive
	Night 5 days in a row	Play Mak07 in the night, between 11pm to 1am for 5 days consecutive
	Night 10 days in a row	Play Mak07 in the night, between 11pm to 1am for 10 days consecutive
	Night 25 days in a row	Play Mak07 in the night, between 11pm to 1am for 25 days consecutive
	Night 50 days in a row	Play Mak07 in the night, between 11pm to 1am for 50 days consecutive

Table 3.10: Medals/Trophy cont. 8

Name	Type	Description	Price on shop	Level in which is given to users
Skip		Skip the schema shown and replace it for another one of the same level	500 Brains	5, 10, 15, 20, 25, 30
Hint		Give a suggestion to finish the game with great score	200 Brains	1, 10, 20, 29, 34

Table 3.11: Boosters

Name	Type	Description	Price on shop	Level in which is given to users
Freeze	X 2 Seconds	Addition of 2 seconds more	100 Brains	3
	X 3 Seconds	Addition of 3 seconds more	500 Brains	6
	X 4 Seconds	Addition of 4 seconds more	600 Brains	9
	X 5 Seconds	Addition of 5 seconds more	700 brains	12
Multiply	X 2	Multiply the score gotten by 2	700 Brains	7,11,17
	X 3	Multiply the score gotten by 3	800 Brains	8, 16, 24, 32
	X 4	Multiply the score gotten by 4	900 Brains	13, 26, 33
Poison	1 / 4	Take 1/4 of opponent points	700 Brains	7, 14,21
	1 / 3	Take 1/3 of opponent points	800 Brains	17,27
	1 / 2	Take 1/3 of opponent points	900 Brains	31,32,33,34,35

Table 3.12: Boosters cont. 2

Dynamic	Description	Dynamics in system
Narration	Tutorial	A short tutorial is available for the user where the mechanic of the game explanation is and how to achieve the points.
Popup Awards	Popup when a user has achieved a new reward	New medal/trophy.
		New level.
		New booster.

Table 3.13: Dynamics, mechanics, components of gamification

Dynamic	Description	Dynamics in system
Relationships	Social interactions	A player can share the app using different apps installed on the device.
		A player can ranking the app.
		A player can give a review or feedback of the app.
		A player can install other apps suggested by recommendations.
		A player can follow the official web page of the app.
		User can share a battle/results of a battle to other friends.
Progression	Evolution of players	The progress bar will tell the player its own status on the game, how far is the player to achieve the next level. It is shown in the profile of the player.
		On each game results will also see a progress bar that shows the relationship between its answer and the best solution so far.
		Level of experience will be differentiate by colours and names.
		Ranking will position the player in comparison with world player or his own friends.
		Dashboard will resume all the medal/trophy that a player has achieved so far.
Notification	Notification appear on the screen after some actions done	Having a new challenge.
		Challenge completed from opponent.
		After do not have playing for a while (1 day, a week)
		Having a new message in chat.
		Having a new challenge to do.
		Having an invitation of tournament to participate.

Table 3.14: Dynamics, mechanics, components of gamification cont. 2

Dynamic	Description	Dynamics in system
Limitations	System restrictions	Users only can play installing the app on the device.
		User maximum will play with 7 digits because of the size of the screen and business logic
		Multiplayer battle only can be played with an internet connection
Emotions	Suggested emotions to players	Motivation of a player in order of improve, learn, or review math techniques.
		Competitiveness of a player in order to obtain and achieve points, medals/trophy, levels, brains or be in a better position in the ranking.
		Customization of the app.

Table 3.15: Dynamics, mechanics, components of gamification cont. 3

Mechanics	Description	Game mechanics
Challenge	Task that requires some effort to solve	Challenge of the battle game.
		Challenge of be part of the top 3 ranking (global and friends)
		Constant challenge of respond correctly to operations
feedback	Information about what the player is doing	Each operation will show at the end and can buy a booster in order to know one of the best solution operation .
		Is possible to write to developers in order to suggest/complain about the game.
Competition	A player win or lose	With the ranking can show the position in the world or with friends
Rewards	Rewards achieve with an action or purchase	Depends on the boosters.

Table 3.16: Mechanics: process to generate engagement

Component	Description	Component of the game
Points	Numeric representation of game progress	Show points
Medal/trophy	Graphic representation of achievements	Show all medal/trophy that the user have won
Levels	Levels defined for the progress of the player	Show the level of the experience
Ranking	Position between player (global or friends)	Show the position on the ranking
Dashboard	Medal/trophy achieved	Gallery of medal/trophy achieved
Leader board	Graphical representation of progress and performance	Progress bar

Table 3.17: Mechanics: process to generate engagement

Chapter 4

Results

4.1 Designing solo game, starting from 3 ball until 7 ball

Gamification look forward to generate engagement loops and progression stairs to users in a way that MAK07 give motivations to user throw activities then user give a feedback response.

The main idea of solo game is to teach and training users to understand strategies of solving math operations while the difficult increase adding a new ball every time starting from 3 balls until 7 balls.

The 4.1 is the analysis of the user behaviour when they face a progression game starting with 3 balls until 7 balls using and testing the different formulas for pointing system.

4.1.1 3 balls

The 4.1 shows the progression that a player can have solving in 20 seconds 2 schemes as minimum and 5 schemes as maximum. Notice that there is a drop down in the graph in which the behavior expected is different from the real one 4.2.

4.1.2 4 balls

The behaviour of players with 4 balls are more progressive 4.3. Increment of points are directly proportional to increment of schemes done in a 26 seconds 4.4.

4 – Results

	scenarios done																			
	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5				
Formula 1	14188.5	11692.25	22063.5	27319	30585.1	22100.7	25738.1	25546.7	41860	42706	31290.75	36072	36681	45925	33511.8					
Formula 2	14199.5	11705.25	22107.5	27333	30617.1	22100.7	25780.1	25590.7	41909	42789	31319.75	36121	36767	46074	33688.8					
Formula 3	18.0004511	22.0005025	42.001356	30.0007792	42.0006865	14.0012294	50.000815	50.0008111	52.0009627	64.0009322	38.0016225	37.0014158	50.0013146	68.0019083	70.0024423					
Formula 4	0.00323569	0.00406774	0.00973744	0.00373852	0.0049373	0.0028629	0.00697295	0.00706217	0.00584079	0.00763321	0.00672073	0.00667801	0.00781622	0.0101253	0.01236187					
Formula 5	203550	258906.5	520522	508047.2	759489.6	170719.1	775956.8	767203.2	1127282	1442220	614645	791722.5	1090804	1863371	1838180.9					
Formula 6	11544.6429	15370.75	17928.3889	67240.1667	20428.5893	69091.0833	15257.2778	12956.7083	39155.5179	37296.3214	122605.233	60246.5833	30956.8333	47145.5222	269998.046					
Formula 7	0.00041021	0.00036047	0.00057341	0.00038635	0.00056802	0.00026446	0.00063738	0.00074451	0.00065587	0.00077292	0.00049097	0.00033577	0.00059207	0.00063202	0.00064395					
Formula 8	9796.85714	13555.2917	10236.1667	26942.625	9948.10119	30134.6806	8216.51042	7087.56944	16377.5238	18534.3214	57446.8444	31468.7778	19633.1806	26148.8806	117317.862					
Formula 9	0.00069606	0.00063566	0.00107756	0.00060632	0.00091114	0.00035742	0.00113153	0.00134203	0.00121939	0.00167501	0.00078214	0.0007857	0.00162505	0.00201982	0.00231014					
Formula 10	445110.405	575608.735	1024437.65	1153748.04	1397783.9	637488.998	1436569.57	1315034.27	1762380.81	1906743.76	1408574.83	1364556.66	1347830.25	1935198.73	1775253.39					
Formula 11	445110.405	575608.735	1024437.65	1153748.04	1397783.9	637488.998	1436569.57	1315034.27	1762380.81	1906743.76	1408574.83	1364556.66	1347830.25	1935198.73	1775253.39					
Formula 12	445111.405	575609.485	1024438.9	1153749.34	1397785.3	637490.398	1436570.87	1315035.67	1762382.81	1906745.76	1408576.33	1364558.31	1347832.25	1935201.13	1775255.34					
Formula 13	445110.405	575608.735	1024437.65	1153748.04	1397783.9	637488.998	1436569.57	1315034.27	1762380.81	1906743.76	1408574.83	1364556.66	1347830.25	1935198.73	1775253.39					
Formula 14	237719.905	269624.985	418874.404	526763.643	542296.597	400150.398	497404.369	458541.872	701363.312	715379.257	675534.575	708479.159	614504.247	813786.929	760597.285					
Formula 15	-28185.997	-31957.9408	-49582.6596	-62544.1283	-64292.2596	-47585.3532	-58875.1472	-54238.1472	-83158.7691	-84715.1004	-80210.2159	-84134.4549	-72799.5472	-96373.9442	-90003.4161					
Formula 16	0.01155595	0.01184033	0.02325216	0.01091949	0.01623828	0.00620835	0.02181374	0.02422343	0.02077791	0.02909643	0.01562979	0.01639884	0.02905567	0.03768704	0.04437976					
Formula 17	614.259418	492.402922	545.600038	1315.83595	556.480915	1649.30448	431.229235	400.253452	955.950971	1105.21089	1994.86662	1595.18952	1204.07809	1385.20366	3541.25744					

Figure 4.1: 3 balls

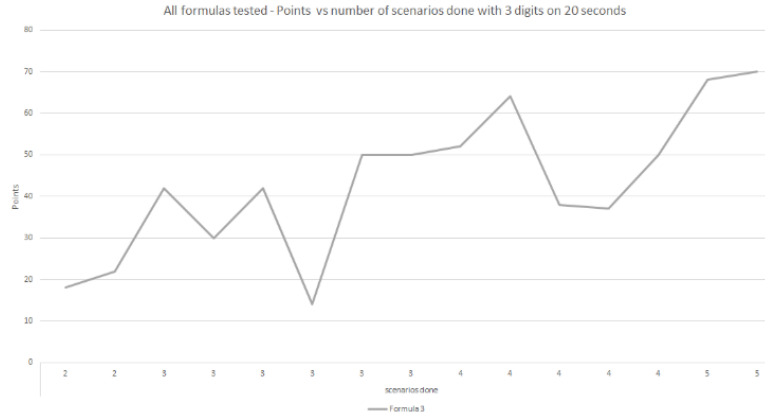


Figure 4.2: 3 balls graph

4.1.3 5 balls

The behaviour of players with 5 balls are more progressive 4.5. increment of points are directly proportional to increment of schemes done in a 26 seconds 4.6.

4 – Results

	scenarios done															
	6	6	7	7	7	7	7	8	8	8	8	8	8	9	9	
Formula 1	25288.69	22792.44	33204.89	33167.69	38423.19	36842.29	36650.89	41689.29	47789.19	52969.19	53815.19	36073	42399.94	57037.19	44623.99	
Formula 2	26302.69	22848.44	34438.89	41132.69	39671.19	38118.29	37928.89	42955.29	49340.19	54486.19	55390.19	48703.19	43900.94	58882.19	46496.99	
Formula 3	253.03707	257.03713	249.04441	277.04454	265.04396	285.044	285.04399	277.04387	285.05105	287.05083	299.0508	272.05144	273.05164	303.05821	305.05874	
Formula 4	0.8994701	0.9003022	0.905655	0.9125295	0.9065306	0.9097651	0.9098543	0.9077294	0.917166	0.9153203	0.9171081	0.9163118	0.9163531	0.9260327	0.9282693	
Formula 5	1477500.7	1532857.2	1758890.6	2108693.5	2096218.7	2364128.3	2355374.7	2347661.1	2993196.2	3060506.2	3568416.2	2725799.2	2545347.2	4079984	4054793.9	
Formula 6	75237.493	79063.6	148687.15	97524.451	146836.23	94853.34	92552.771	100024.65	126456.11	142362.79	133937.45	162004.52	225182.01	158548.01	381400.53	
Formula 7	0.0021432	0.0020935	0.0017345	0.0020435	0.0018564	0.0021074	0.0022146	0.0020381	0.00187	0.001923	0.0019779	0.0016004	0.0017572	0.0017629	0.0017749	
Formula 8	25704.361	29462.796	46043.222	26144.708	42851.167	24125.052	22996.111	25856.643	35542.76	32287.603	34443.972	47378.802	73356.924	42059.498	133228.48	
Formula 9	0.0105994	0.010539	0.0102558	0.0109759	0.0105047	0.0110299	0.0112404	0.0108095	0.0115184	0.0111128	0.0115683	0.0106791	0.0106755	0.0119082	0.0121986	
Formula 10	2504914.9	2635413.3	2697294.2	3084242.8	3213553.2	3496374.8	3374839.5	3457589.1	3407636.1	3822187.2	3966550.1	3424362.8	3468380.9	3995005.3	3835059.9	
Formula 11	4157187.9	4287686.3	4349567.2	4736515.8	4865826.2	5148647.8	5027112.5	5109862.1	5059909.1	5474460.2	5618823.1	5076635.8	5120653.9	5647278.3	5487332.9	
Formula 12	2504917.3	2635415.4	2697296.9	3084245.4	3213555.9	3496377.4	3374842.2	3457591.8	3407639.5	3822190.5	3966553.5	3424365.8	3468383.8	3995009	3835063.2	
Formula 13	2504917.8	2635416.2	2697297.8	3084246.4	3213556.8	3496378.3	3374843.1	3457592.7	3407640.4	3822191.4	3966554.4	3424367	3468385.2	3995010.2	3835064.9	
Formula 14	700720.88	732625.96	863214.91	881938.91	989828.15	960468.88	921606.38	1005361.1	1077632.3	1164493.4	1178521.3	1171609.5	1138664.6	1259641.5	1206451.9	
Formula 15	-81283.21	-85055.15	-100619	-102616.3	-115577.8	-111908.8	-107271.8	-117325.9	-125769.7	-136126.9	-137671.2	-137102.3	-133178.3	-149280.5	-142910	
Formula 16	0.8013498	0.8016342	0.8158686	0.8329124	0.8205797	0.831474	0.8338836	0.8258985	0.8585822	0.8504342	0.8594987	0.8460852	0.8452976	0.8870799	0.8937727	
Formula 17	856.64195	734.78545	1882.3773	778.67285	1548.9088	664.30205	633.32627	789.55373	1453.5618	1182.3457	1351.2742	1838.9443	2237.8719	1612.8185	3768.8723	

Figure 4.3: 4 balls

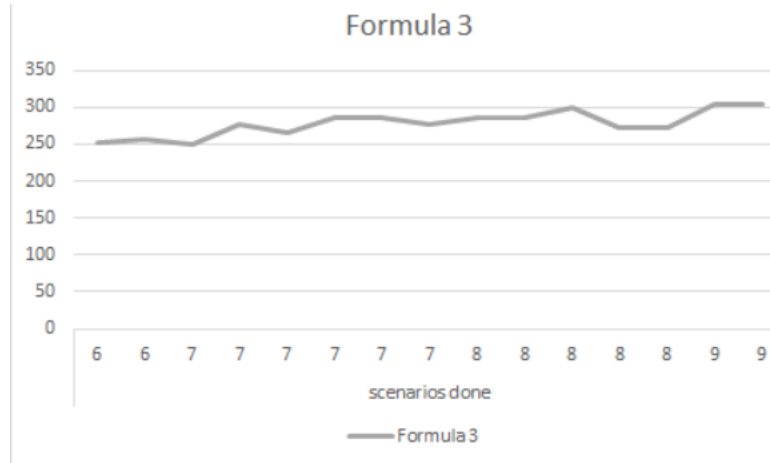


Figure 4.4: 4 balls graph

This is the pseudo code of how the input data of MAK07 was found.

Algorithm 1: Algorithm to find input values of MAK07

```

1 while Combinatorial Of Number Of Digits do
2   if hasSolution then
3     | saveIt;
4   else
5     | descarted it;
6   end
7 end
8 while all solutions found do
9   | Find Best Solution And Save it;
10 end

```

4 – Results

	scenarios done															
	12	12	13	13	13	13	13	13	13	14	14	14	14	14	15	15
Formula 1	33876.825	30366.575	42040.425	41849.025	40978.825	46234.325	41016.025	49500.425	55837.325	61017.325	61863.325	50448.075	55229.325	65322.325	52909.125	52909.125
Formula 2	33876.825	30422.575	45929.425	45740.025	48943.825	47482.325	42250.025	50766.425	57388.325	62534.325	63438.325	51949.075	56751.325	67167.325	54782.125	54782.125
Formula 3	1048.08946	1052.08951	1126.6021	1126.6021	1118.60264	1106.60207	1090.60252	1118.60197	1173.11488	1175.11466	1187.11463	1161.11547	1160.11527	1237.62776	1239.62829	1239.62829
Formula 4	8231.53755	8231.53838	8278.05357	8278.05366	8278.05634	8278.05034	8278.04946	8278.05154	8324.56567	8324.56485	8324.56664	8324.56588	8324.56584	8371.08129	8371.08352	8371.08352
Formula 5	2076772.91	2132129.41	3025620.3	3016866.7	2770185.5	2757710.7	2420382.6	3009153.1	3716908.09	3784218.09	4292128.09	3269059.09	3449511.09	4865915.67	4840725.57	4840725.57
Formula 6	26894268.8	26898094.9	30501082	30498781.4	30503753.1	30553064.9	30554915.8	30506253.3	34119882.1	34135788.8	34127363.5	34218608	34155430.5	37739171.4	37962023.9	37962023.9
Formula 7	0.29784693	0.29779719	0.27506463	0.27517175	0.27500065	0.27481359	0.27469171	0.27499526	0.25533023	0.25538321	0.25543809	0.25521735	0.25506061	0.23832573	0.23833767	0.23833767
Formula 8	3613394.96	3617153.39	3611879.73	3613415.73	3613899.39	3630605.85	3633797.9	3613611.32	3623361.52	3620106.36	3622262.73	3661175.69	3635197.56	3629942.34	3721111.32	3721111.32
Formula 9	0.2835994	0.283539	0.26453327	0.26474377	0.2644793	0.26400806	0.26375916	0.26431288	0.24812475	0.24771907	0.24817465	0.24728182	0.24728538	0.2337296	0.23401992	0.23401992
Formula 10	6873064.54	7003562.87	7864524.52	7742989.22	7452392.6	7581702.99	7065443.95	7825738.85	7775786.01	8190337.07	8334700.02	7836530.84	7792512.67	8363155.3	8203209.96	8203209.96
Formula 11	13983671.5	14114169.9	14975131.5	14853596.2	14562999.6	14692310	14176050.9	14936345.8	14886393	15300944.1	15445307	14947137.8	14903119.7	15473762.3	15313817	15313817
Formula 12	6873067.3	7003565.38	7864527.58	7742992.38	7452395.61	7581706.05	7065447.11	7825742	7775789.76	12558491.1	8334703.78	7836534.09	7792516.08	8363159.46	8203213.66	8203213.66
Formula 13	6873070.07	7003568.4	7864530.99	7742995.69	7452399.07	7581709.46	7065450.42	7825745.32	7775793.42	12558497.5	8334707.43	7836538.25	7792520.09	8363163.66	8203218.32	8203218.32
Formula 14	2561563.63	2593468.71	2821455.07	2782454.19	2742786.72	2850675.96	2724062.72	2866208.91	2938485.16	4886199.09	3039374.17	2999517.49	3032462.32	3120499.44	3067309.8	3067309.8
Formula 15	-301166.822	-304938.766	-331776.73	-327154.43	-322484.243	-335445.712	-320486.936	-337193.843	-345621.889	-575831.32	-357523.442	-353030.557	-356954.546	-369117.044	-362746.516	-362746.516
Formula 16	1347.75349	1347.75378	1358.42892	1358.43133	1358.43036	1358.41802	1358.41331	1358.42334	1369.10133	2737.33593	1369.10225	1369.08804	1369.08883	1379.77513	1379.78182	1379.78182
Formula 17	9027.17186	8905.31537	8769.36322	8738.38744	8883.73403	9653.96994	9987.43847	8894.6149	9494.359	17263.9401	9392.07142	10278.6691	9879.74148	9590.52016	11746.5739	11746.5739

Figure 4.5: 5 balls

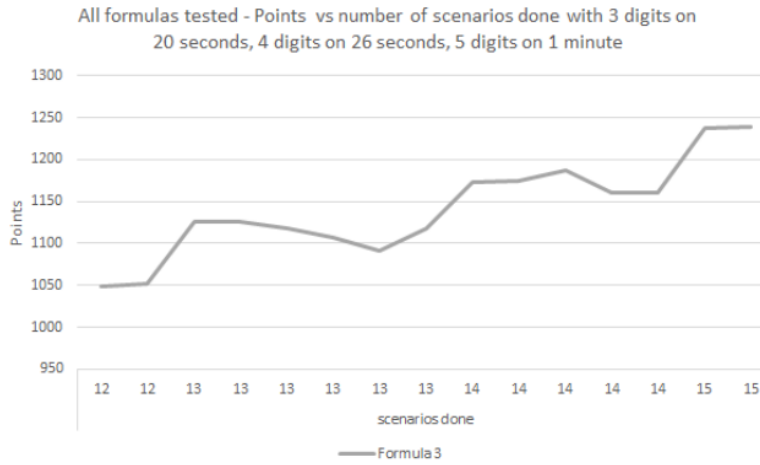


Figure 4.6: 5 balls graph

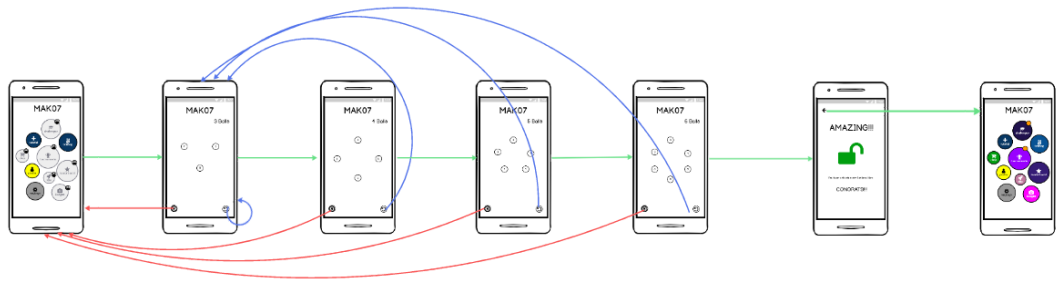


Figure 4.7: 3-7 balls

4.2 Classification of input game

The figure 4.8 will illustrate the 3 criteria of classification, each has different weight to assign that will increase the difficulty of each schema combination.

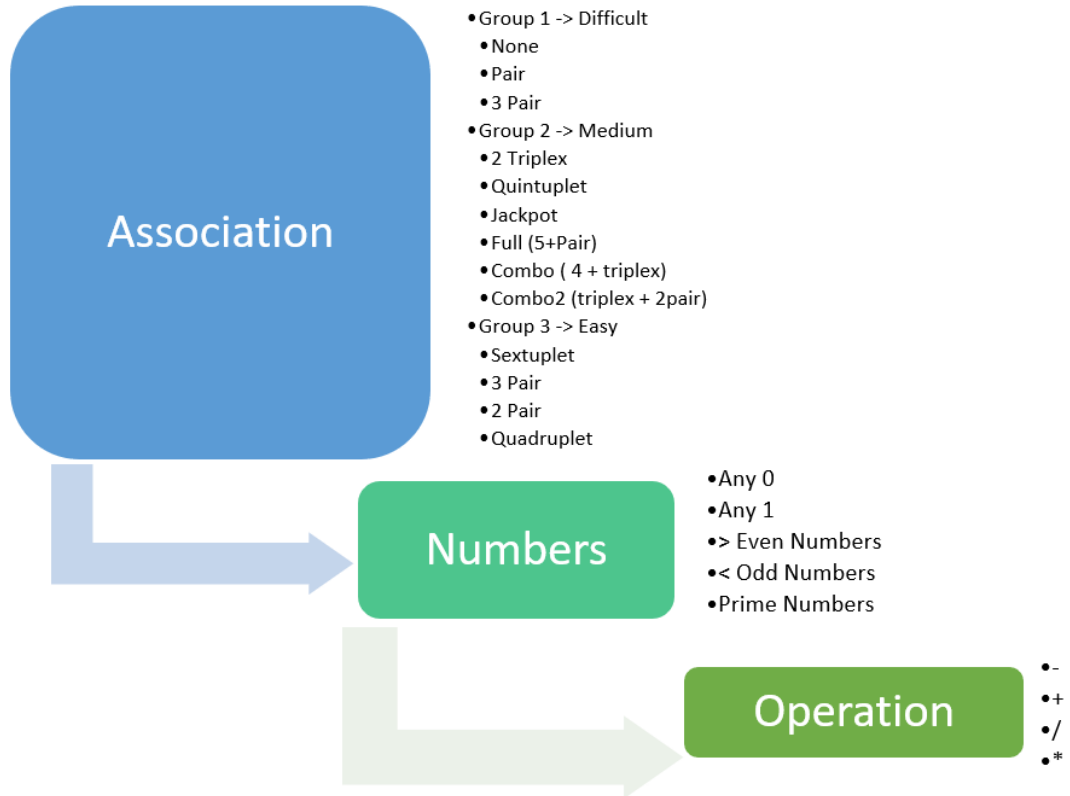


Figure 4.8: Classification criteria

4.2.1 Aspects to take in count

If the initial number (7 digits) is composed of a sextuplet, example 2222229 then the weight will be increase by 4.

If the initial number (7 digits) is composed of a quintuple and a pair, example 2222233 then the weight will be increase by 4.

If the initial number (7 digits) is composed of a quintuple, example 2222213 then the weight will be increase by 4.

If the initial number (7 digits) is composed of a quadruple, example 2222345 then the weight will be increase by 4.

If the initial number (7 digits) is composed of a pair and a triplet, example 2233345 then the weight will be increase by 4.

If the initial number (7 digits) is composed of 2 pair only that has same number, example 11223456 then the weight will be increase by 8 OR If the initial number (7 digits) is composed by 4 digits of the same number, example 2222456 then the weight will be increase by 8.

If the initial number (7digits) is composed of 3 pair that has the same number only, example 1122334 then the weight will be increase by 14.

If the initial number (7 digits) is composed of 1 pair only of same number, example 2234578, the weight will be increase by 14.

4.2.2 Subcategory of 1 level to take in count

If the initial number (7 digits) is composed of any 0 then weight will be + 1.

If the initial number (7 digits) is composed of any 1 then weight will be + 1.

4.2.3 Subcategory of 2 level to take in count

For each number from op check if it is composed by a number bigger than 9 and between 100 then the weight will be multiplied by 10.

For each number from op check if it is composed by a number bigger than 99 and between 1000 then the weight will be multiplied by 100.

4.2.4 Subcategory of 2 level to take in count

If the op is a - then increment +1.

If the op is a + increment +4.

If the op is a / increment +8.

If the op is * increment +12.

4.2.5 Process description

The [4.9](#) shows the data process done for doing the clusterization.

1. The initial input data was done in java and was visualized as a Json objects in which has the following structure:

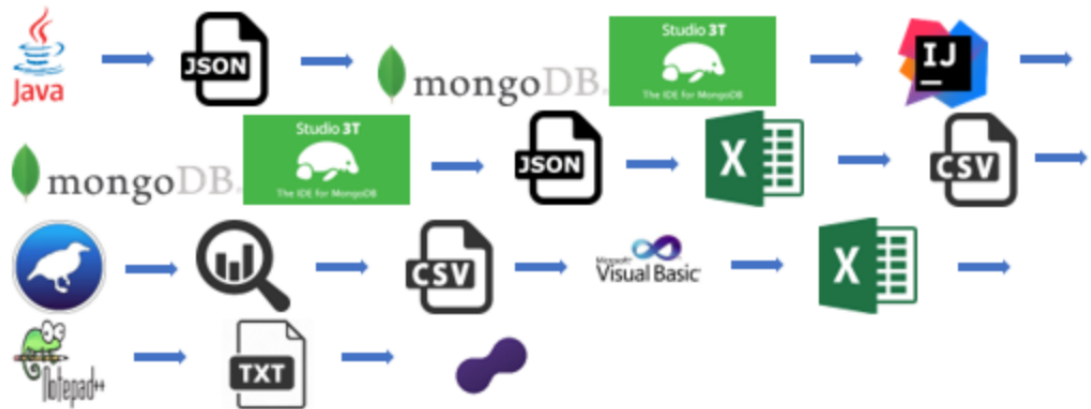


Figure 4.9: Process Description

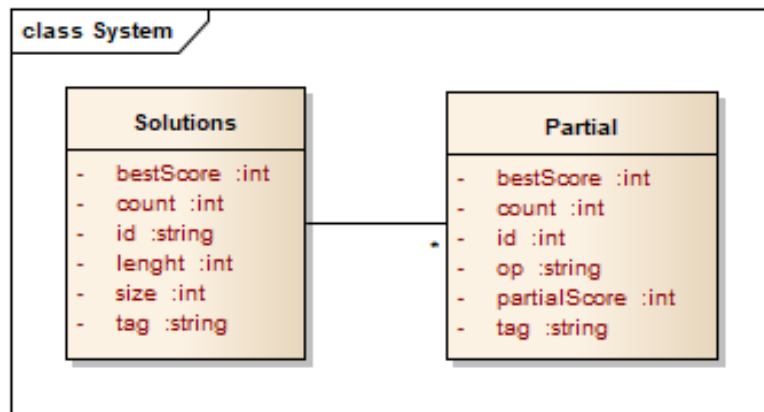


Figure 4.10: Json Objects

2. Migration of this data to mongoDB In order to generate 2 new objects to

consider for the classification.

Algorithm 2: Algorithm clusterization

```

1  for each solutions of 7 digits sol do
2      initialize flags anyZero, Prime, Odd, Even, anyOne;
3      initialize array ops;
4      for each PartialSolution do
5          | add on ops each operation symbol;
6      end
7      declare and initialized the flag ToVerify = true;
8      String rev="";
9      Integer review=-1;
10     for each PartialSolution par do
11         rev = par.operation + par.BestScore;
12         review=par.Count;
13         for each PartialSolution aux do
14             | if rev == (aux.Operation + aux.BestScore) then
15                 | if review!=aux.Count then
16                     | ToVerify=false;
17                 | end
18             | end
19         end
20         if review then
21             | add on parcialcounting hashmap <par.operation, par.count>;
22             | add on bestScorePartials hashmap <par.Operation, par.BestScore>;
23         end
24         review=-1;
25         rev="";
26         ToVerify=true;
27         ... MediaCalculation;
28         standardDeviation;
29         weightAssign;
30         ...
31     end
32 end

```

Algorithm 3: Algorithm for calculate the media and the standard deviation

```
1 declare and give memory to HashMap distance;
2 declare an Iterator iteradistance;
3 while iteradistance has next do
4     declare string save operator read;
5     if operator is equal to - then
6         sum= abs(1-media) and val = Math.pow(2,sum) and save in distance HashMap the key and
        val;
7     end
8     if operator is equal to + then
9         sum= abs(1-media) and val = Math.pow(2,sum) and save in distance HashMap the key and
        val;
10    end
11    if operator is equal to * then
12        sum= abs(1-media) and val = Math.pow(2,sum) and save in distance HashMap the key and
        val;
13    end
14    if operator is equal to / then
15        sum= abs(1-media) and val = Math.pow(2,sum) and save in distance HashMap the key and
        val;
16    end
17 end
```

Algorithm 4: Algorithm media calculation and weightAssign

```

1  int weight=0;
2  float media =0.0;
3  for each partialSolutions, count the repetitions of the same operation and give weight for each
   operation do
4      if - then
5          | current weight + 1;
6      end
7      if + then
8          | current weight + 10;
9      end
10     if * then
11         | current weight + 30;
12     end
13     if / then
14         | current weight + 20;
15     end
16     add the weight to sol.
17 end
18 media = weight / internalOperations.Size;
19 calculate the media and the standard deviation;
20 if Associate numbers classifying 3 groups by searching single pairs, double pairs, triple pairs, single
   triplex, double triplex, jackpot, quadruplet, quintuplet, sextuplet, full, combo1 or combo 2 then
21     if group 1 then
22         | current weight + 40;
23     end
24     if group 2 then
25         | current wight + 100;
26     end
27     if group 3 then
28         | current weight + 200;
29     end
30     and analyze the number composition;
31     if any prime then
32         | current weight + 40;
33     end
34     if any 0 and odd then
35         | current weight + 10 else + 30;
36     end
37     if any 1 and even then
38         | current weight + 1 else + 20;
39     end
40 end
41 clear variables;

```

3. Mapping data from mongoDB to java on IntelliJ IDA [Figure 4.11].

4. Generate new object on mongo that represents Probability object. 5. Export probability object to json file. 6. From excel read the json file and make a csv file. In order to do not lose floating digits each number of probability was multiplied by 10.000.000 7. On weka take as input the csv file. On weka was applied the algorithm no supervised of clustering k-means, simpleKmeans, distance function of EuclideanDistance. In order to see the results, first weka let you analyze each of values that represent the criteria for found the best classification clusters.

Algorithm 5: Algorithm of Combo 2

```

1  int countPair = 0, countTriple = 0, firstPair=-1, triple =-1;
2  boolean countSndPair=false, foundTripOnJack=false;
3  Create a list of integers positionReferenced;
4  for i=0; i<data.length;i++ do
5      for j=0; j<data.length;j++ do
6          if data[i]==data[j] i != j then
7              countTriple++ and save position referenced j ;
8              if countTriple == 2 then
9                  foundTripOnJack=true and i is saved on positionReferenced and triple=data[j] and
                     break;
10             end
11         end
12         if j==data.length-1 then
13             clear positionReferenced and make countTriple =0;
14         end
15     end
16     if foundTripOnJack then
17         break;
18     end
19 end
20 for i=0; i<data.length;i++ do
21     if positionReferenced not contains i then
22         for j=0; j<data.length;j++ do
23             if data[i]==data[j] i != j positionReferenced not contains j triple!= data[j] then
24                 countPair++ and j is saved on positionReferenced;
25                 if countPair==1 then
26                     i is saved on positionReferenced and countSndPair = true and firstpair =
                        data[j];
27                 end
28             end
29         end
30     end
31     if countSndPair then
32         break;
33     end
34 end
35 countPair=0;
36 declare terzo = false;
37 for i=0; i<data.length;i++ do
38     if positionReferenced not contains i then
39         for j=0; j<data.length;j++ do
40             if data[i]==data[j] i != j positionReferenced not contains j firstpair!=j triple!=
                data[j] firstpair!=triple then
41                 countPair++ and j is saved on positionReferenced;
42                 if countPair==1 then
43                     i is saved on positionReferenced;
44                     if countSndPair foundTripOnJack then
45                         return true;
46                     end
47                 end
48             end
49         end
50     end
51 end
52 return false;

```

Algorithm 6: Algorithm of Combo

```
1  int count4= 0, countTriple = 0;
2  boolean foundTripOnJack=false;
3  Create a list of integers positionReferenced;
4  for i=0; i<data.length;i++ do
5      for j=0; j<data.length;j++ do
6          if data[i]==data[j]  i != j then
7              countTriple++ and save position referenced j ;
8              if countTriple == 3 then
9                  foundTripOnJack=true and i is saved on positionReferenced and triple=data[j] and
                     break;
10             end
11         end
12         if j==data.length-1 then
13             clear positionReferenced and make countTriple =0;
14         end
15     end
16     if foundTripOnJack then
17         break;
18     end
19 end
20 for i=0; i<data.length;i++ do
21     if positionReferenced not contains i then
22         for j=0; j<data.length;j++ do
23             if data[i]==data[j]  i != j  positionReferenced not contains j then
24                 count4++ and j is saved on positionReferenced;
25                 if count4==2 then
26                     i is saved on positionReferenced and return foundTripOnJack;
27                 end
28             end
29         end
30     end
31 end
32 return false;
```

Algorithm 7: Algorithm of full

```

1 int countPair= 0, count5 = 0;
2 boolean foundTripOnJack=false;
3 Create a list of integers positionReferenced;
4 for i=0; i<data.length;i++ do
5     for j=0; j<data.length;j++ do
6         if data[i]==data[j] i != j then
7             count5++ and save position referenced j ;
8             if count4 == 4 then
9                 foundTripOnJack=true and i is saved on positionReferenced and triple=data[j] and
                    break;
10            end
11        end
12        if j==data.length-1 then
13            clear positionReferenced and make count5 =0;
14        end
15    end
16    if foundTripOnJack then
17        break;
18    end
19 end
20 for i=0; i<data.length;i++ do
21     if positionReferenced not contains i then
22         for j=0; j<data.length;j++ do
23             if data[i]==data[j] i != j positionReferenced not contains j then
24                 countPair++ and j is saved on positionReferenced;
25                 if countPair==1 then
26                     i is saved on positionReferenced and return foundTripOnJack;
27                 end
28             end
29         end
30     end
31 end
32 return false;

```

Algorithm 8: Algorithm of sextuplet

```

1 int count= 0;
2 for i=0; i<data.length;i++ do
3     for j=0; j<data.length;j++ do
4         if data[i]==data[j] i != j then
5             count++;
6             if count==5 then
7                 return true;
8             end
9         end
10        if j==data.length-1 then
11            make count = 0;
12        end
13    end
14 end
15 return false;

```

Algorithm 9: Algorithm of quintuplet

```
1 int count= 0;
2 for i=0; i<data.length;i++ do
3     for j=0; j<data.length;j++ do
4         if data[i]==data[j] i != j then
5             count++;
6             if count==4 then
7                 return true;
8             end
9         end
10        if j==data.length-1 then
11            make count = 0;
12        end
13    end
14 end
15 return false;
```

Algorithm 10: Algorithm of quadruplet

```
1 int count= 0;
2 for i=0; i<data.length;i++ do
3     for j=0; j<data.length;j++ do
4         if data[i]==data[j] i != j then
5             count++;
6             if count==3 then
7                 return true;
8             end
9         end
10        if j==data.length-1 then
11            make count = 0;
12        end
13    end
14 end
15 return false;
```

Algorithm 11: Algorithm of jackpot

```
1  int countPair = 0, countTriple = 0, numRefPair=-1, numRefTrip =-1;
2  boolean foundTripOnJack=false;
3  Create a list of integers positionReferenced;
4  for i=0; i < data.length;i++ do
5      for j=0; j < data.length;j++ do
6          if data[i]==data[j] i != j then
7              countTriple++ and save position referenced j ;
8              if countTriple == 2 then
9                  foundTripOnJack=true and i is saved on positionReferenced and break;
10             end
11         end
12         if j==data.length-1 then
13             clear positionReferenced and make countTriple =0;
14         end
15     end
16     if foundTripOnJack then
17         break;
18     end
19 end
20 for i=0; i<data.length;i++ do
21     if positionReferenced not contains i then
22         for j=0; j<data.length;j++ do
23             if data[i]==data[j] i != j positionReferenced not contains j then
24                 countPair++ and j is saved on positionReferenced;
25                 if countPair==1 then
26                     i is saved on positionReferenced and return foundTripOnJack;
27                 end
28             end
29         end
30     end
31 end
32 return false;
```

Algorithm 12: Algorithm of DoubleTriplex

```
1  int positionRef = -1, numRef1=-1, numRef2 =-1, countFirstTriplex=0,countSecondTriplex=0;
2  boolean foundfirstTriplex=false;
3  Create a list of integers positionReferenced;
4  for i=0; i < data.length;i++ do
5      for j=0; j < data.length;j++ do
6          if data[i]==data[j] then
7              countFirstTriplex++ and save position referenced j ;
8              if countFirstTriplex == 3 then
9                  numRef1 = data[i] and foundFirstTriplex = true and positionRef = j and i is saved
                     on positionReferenced;
10                 if j==data.length-1 then
11                     | make countFirstTriplex = 0;
12                     end
13                     break;
14                 end
15             end
16             if j==data.length-1 then
17                 | make countFirstTriplex = 0;
18             end
19         end
20         if foundTripOnJack then
21             | break;
22         end
23     end
24     for i=0; i<data.length;i++ do
25         if positionReferenced not contains i then
26             for j=0; j<data.length;j++ do
27                 if data[i]==data[j] positionReferenced not contains j positionReferenced not contains i
                     then
28                     if numRef2!=data[i] then
29                         countSecondTriplex++;
30                         if countSecondTriplex == 3 then
31                             | numRef2=data[i] and return foundFirstTriplex;
32                         end
33                     end
34                 end
35             end
36             if j==data.length-1 then
37                 | countSecondddTriplex=0;
38             end
39         end
40     end
41     return false;
```

Algorithm 13: Algorithm of SingleTriplex

```
1 int count3=0;
2 for i=0; i < data.length;i++ do
3     for j=0; j < data.length;j++ do
4         if data[i]==data[j] i!=j then
5             count3++;
6             if count3 == 2 then
7                 return true;
8             end
9         end
10        if j==data.length-1 then
11            make count3 = 0;
12        end
13    end
14 end
15 return false;
```

Algorithm 14: Algorithm of TriplePair

```

1  int countFirstPair=0,countSecondPair=0, countThirdPair=0, refFirstPair = -1, refSecondPair=-1;
2  boolean foundFirstPair = false, foundSecondPair=false; whole=false;
3  Create a list of integers positionReferenced;
4  for i=0; i < data.length;i++ do
5      for j=0; j < data.length;j++ do
6          if data[i]==data[j] i!=j then
7              countFirstPair++ and j is saved on positionReferenced;
8              if countFirstPair == 1 then
9                  refFirstPair=data[i] and i is saved on positionReferenced and foundFirstPair = true
                     and break;
10             end
11         end
12     end
13     if foundFirstPair then
14         break;
15     end
16 end
17 for i=0; i < data.length;i++ do
18     if i is not on positionReferenced then
19         for j=0; j < data.length;j++ do
20             if data[i]==data[j] i!=j j is not on positionReferenced then
21                 countSecondPair++ and j is saved on positionReferenced;
22                 if countSecondPair == 1 then
23                     refSecondPair=data[i] and i is saved on positionReferenced and
                       foundSecondPair = true and break;
24                 end
25             end
26         end
27     end
28     if foundSecondPair then
29         break;
30     end
31 end
32 for i=0; i < data.length;i++ do
33     if i is not on positionReferenced then
34         for j=0; j < data.length;j++ do
35             if j!=i j is not on positionReferenced then
36                 if data[i]==data[j] j!=i then
37                     countThirdPair++ and j is saved on positionReferenced;
38                     if countThirdPair == 1 then
39                         whole = (foundFirstPair foundSecondPair) and i is saved on
                           positionReferenced;
40                     end
41                 end
42             end
43         end
44     end
45 end
46 return whole;

```

Algorithm 15: Algorithm of DoublePair

```
1 int countFirstPair=0,countSecondPair=0, refFirstPair = -1;
2 boolean foundFirstPair = false;
3 Create a list of integers positionReferenced;
4 for i=0; i < data.length;i++ do
5     for j=0; j < data.length;j++ do
6         if data[i]==data[j] i!=j then
7             countFirstPair++ and j is saved on positionReferenced;
8             if countFirstPair == 1 then
9                 refFirstPair=data[i] and i is saved on positionReferenced and foundFirstPair = true
10                and break;
11            end
12        end
13    if foundFirstPair then
14        break;
15    end
16 end
17 for i=0; i < data.length;i++ do
18     if i is not on positionReferenced then
19         for j=0; j < data.length;j++ do
20             if data[i]==data[j] i!=j j is not on positionReferenced then
21                 countSecondPair++ and j is saved on positionReferenced;
22                 if countSecondPair == 2 then
23                     return foundFirstPair;
24                 end
25             end
26         end
27     end
28 end
29 return false;
```

Algorithm 16: Algorithm of SinglePair

```
1 int count=0;
2 for i=0; i < data.length;i++ do
3     for j=0; j < data.length;j++ do
4         if data[i]==data[j] i!=j then
5             count++;
6             if count == 2 then
7                 return true;
8             end
9         end
10    end
11 end
12 return false;
```

Algorithm 17: Algorithm of AnyZero

```
1 boolean foundAny=false;
2 for  $i=0; i < data.length; i++$  do
3   if  $i==0$  then
4     foundAny=true;
5   end
6 end
7 return foundAny;
```

Algorithm 18: Algorithm of AnyOne

```
1 boolean foundAny=false;
2 for  $i=0; i < data.length; i++$  do
3   if  $i==1$  then
4     foundAny=true;
5   end
6 end
7 return foundAny;
```

Algorithm 19: Algorithm of EvenNumbers

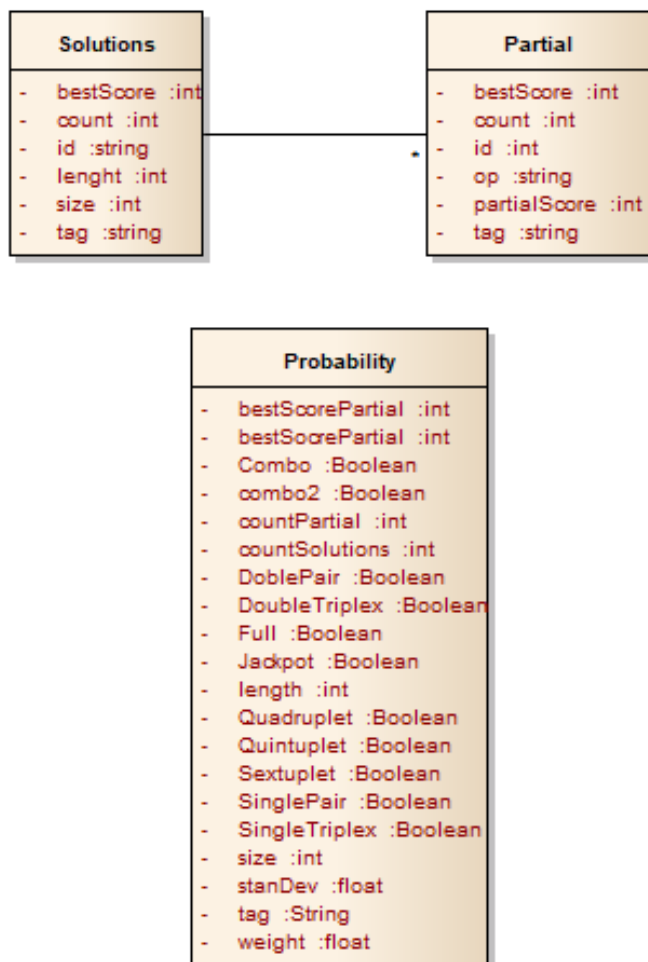
```
1 boolean foundAny=false;
2 int count=0;
3 for each number do
4   if  $i \% 2 == 0$  then
5     count++;
6   end
7 end
8 if  $count \geq 4$  then
9   foundAny=true;
10 end
11 return foundAny;
```

Algorithm 20: Algorithm of OddNumbers

```
1 boolean foundAny=false;
2 int count=0;
3 for each number do
4   if  $i \% 2 != 0$  then
5     count++;
6   end
7 end
8 if  $count \geq 4$  then
9   foundAny=true;
10 end
11 return foundAny;
```

Algorithm 21: Algorithm of OddNumbers

```
1  boolean foundAny=false, filter1=true, filter2=true;
2  int count=0;
3  for each number num do
4      if num > 2 num % 2 == 0 num!=0 num!= 1 then
5          |   filter1=false;
6      end
7      int top = Math.sqrt(num)+1;
8      for i=3; i < top; i+=2 do
9          |   if num % 1 == 0 num!=0 num!= 1 then
10             |   filter2=false;
11         end
12     end
13     if filter2 filter1 then
14         |   count++ and filter1=true and filter2=true;
15     end
16     filter1=true and filter2=true;
17 end
18 if count >= 4 then
19     |   foundAny=true;
20 end
21 return foundAny;
```



Data MongoDB.png

Figure 4.11: Mapping data MongoDB

The configuration on weka was the following:

=== Run information ===

Scheme:weka.clusterers.SimpleKMeans -init 0 -max-candidates 100 -periodic-pruning 10000 -min-density 2.0 -t1 -1.25 -t2 -1.0 -N 7 -A "weka.core.EuclideanDistance -R first-last" -I 500 -num-slots 1 -S 10

Relation:NoDuplicatesBestScoreWeight

Instances: 10850

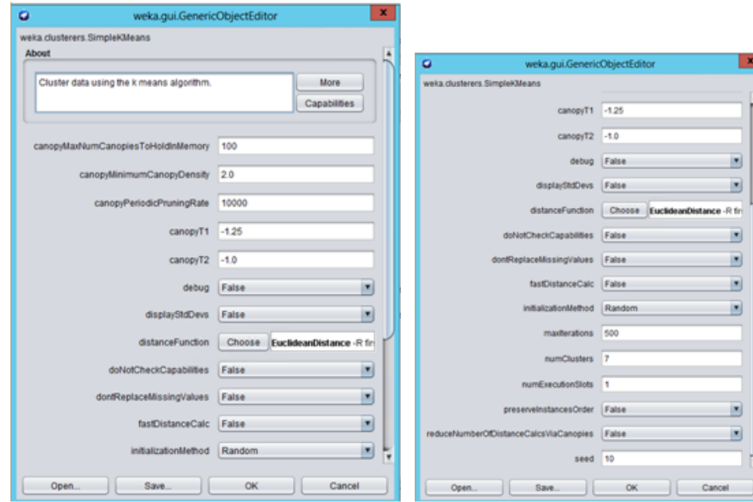


Figure 4.12: Weka Configuration

Attributes: 20: tag, bestScore, countSolutions, length, countPartial, bestScorePartial, SinglePair, DoublePair, SingleTriplex, DoubleTriplex, Jackpot, Quadruplet, Quintuplet, Sextuplet, Full, Combo, Combo2, size, weight, stanDev.

Test mode: evaluate on training data

=== Clustering model (full training set) ===

kMeans =====

Number of iterations: 15

Within cluster sum of squared errors: 15775.41157711805

Initial starting points (random):

Cluster 0: '0,1,5,5,9,9,9', 940, 160880, 7, 8556, 940, TRUE, TRUE, TRUE, FALSE, TRUE, FALSE, FALSE, FALSE, FALSE, FALSE, 32, 487, 42.148838.

Cluster 1: '0,1,2,3,5,6,9', 436, 1347404, 7, 8256, 436, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, 95, 1421, 53.23016.

Cluster 2: '4,6,6,7,7,9,9', 1596, 208870, 7, 3626, 1596, TRUE, TRUE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, 41, 699, 98.911835.

Cluster 3: '0,2,2,2,2,6,9', 224, 82408, 7, 3724, 224, TRUE, TRUE, TRUE, FALSE, FALSE, TRUE, FALSE, FALSE, FALSE, FALSE, 24, 347, 32.62138.

Cluster 4: '3,3,3,5,5,6,7', 1094, 252291, 7, 8826, 1094, TRUE, TRUE, TRUE, FALSE, TRUE, FALSE, FALSE, FALSE, FALSE, FALSE, 39, 678, 94.31635.

Cluster 5: '0,3,3,5,5,7,7', 1330, 541164, 7, 19136, 1330, TRUE, TRUE, FALSE,

FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, 34, 490, 38.76335.

Cluster 6: '1,2,4,5,5,6,8', 1246, 1642540, 7, 15600, 1246, TRUE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, 88, 1516, 104.57286.

Missing values globally replaced with mean/mode Final cluster centroids:

Attribute	Full Data (10850.0)	Cluster 0 (1438.0)	Cluster 1 (120.0)	Cluster 2 (1979.0)	Cluster 3 (1477.0)	Cluster 4 (2070.0)	Cluster 5 (1294.0)	Cluster 6 (2472.0)
tag	0,0,0,0,0,1,1	0,0,0,0,0,2,2	0,1,2,3,4,5,6	0,0,1,1,2,3,6	0,0,0,0,0,1,1	0,1,1,6,6,6,7	0,0,0,1,2,5,8	0,0,0,1,2,3,4
bestScore	1003.644	364.662	906.3083	1284.4068	1057.0169	1579.4232	457.534	927.1383
count Solutions	402336.5409	99585.2768	1771114.95	597236.7196	100607.2221	233813.2903	306530.9946	727524.7144
length	7	7	7	7	7	7	7	7
countPartial	10808.6914	6861.758	16734.7	13657.2577	6398.9045	9374.5246	11128.5595	14204.8596
bestScore Partial	1003.644	364.662	906.3083	1284.4068	1057.0169	1579.4232	457.534	927.1383
SinglePair	T	T	F	T	T	T	T	T
DoublePair	T	T	F	T	T	T	T	F
Single Triplex	T	T	F	F	T	T	F	F
Double Triplex	F	F	F	F	F	F	F	F
Jackpot	F	T	F	F	F	T	F	F
Quadruplet	F	F	F	F	T	F	F	F
Quintuplet	F	F	F	F	F	F	F	F
Sextuplet	F	F	F	F	F	F	F	F
Full	F	F	F	F	F	F	F	F
Combo	F	F	F	F	F	F	F	F
Combo2	F	F	F	F	F	F	F	F
size	41.6718	19.9645	98.9417	55.7665	25.2322	35.3903	33.7736	59.4523
weight	579.5288	290.9159	1535.775	929.8454	421.1266	612.2227	441.7303	559.9474
stanDev	69.9799	35.9138	67.0109	92.8821	82.0734	94.5385	28.0141	65.7829

Table 4.1: Weka results

Time taken to build model (full training data) : 1.64 seconds.

=== Model and evaluation on training set ===

Clustered Instances

Difficulty	Cluster	Instances	Percentage
2	0	1438	(13%)
7	1	120	(1%)
5	2	1979	(18%)
1	3	1477	(14%)
6	4	2070	(19%)
4	5	1294	(12%)
3	6	2472	(23%)

Table 4.2: Weka results 2

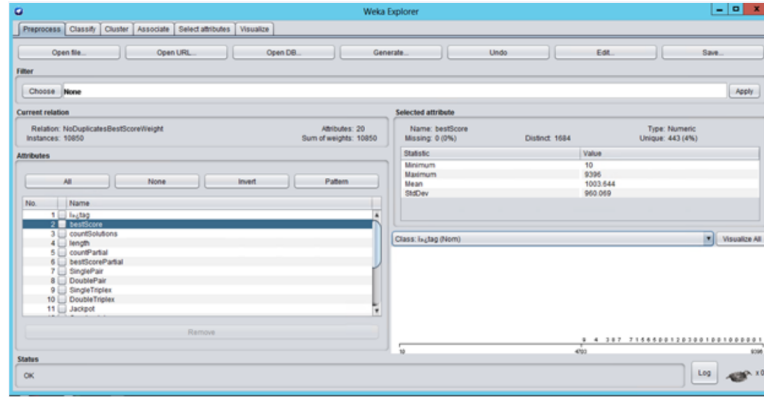


Figure 4.13: Tag Weka Configuration

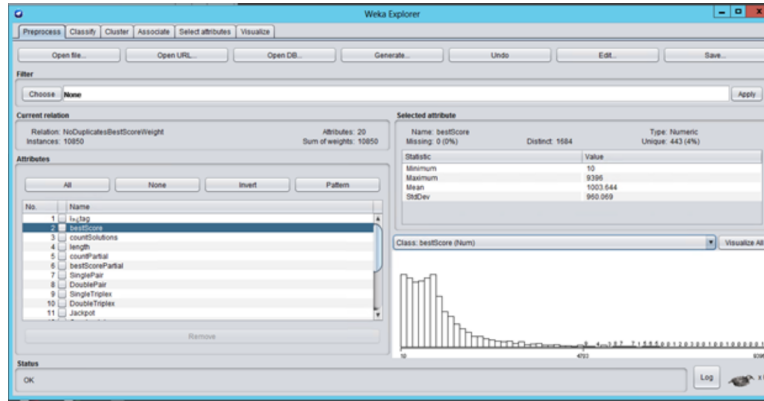


Figure 4.14: bestScore Weka Configuration

4.3 Design of point system and levels

For each difficulty was created an .apk in order to search the timing and speed of users on solving a schema related to the difficulty. The process consist on tabulate the results of different games, the data tabulated was related to number of games done, points get on each schema, experience points given with the previous point system, tag given random from the input separated by difficulty, operation done by the user, points gotten, bonus given, time in milliseconds left, time in seconds left, time in milliseconds spend, time in seconds spend.

Then for each schema solved, I had test 17 different formulas in order to find the best one. Those are the 17 formulas tested:

$$1. \text{ Points} = \sum((\text{leftTimeonmillisenconds} * \%weight) + \text{ScenarioCompleted} +$$

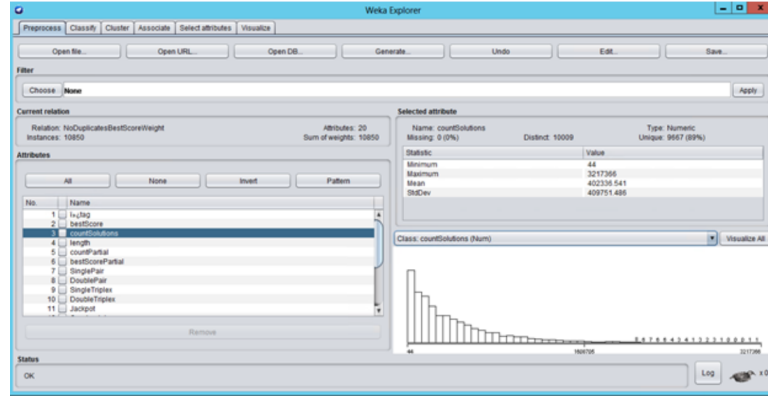


Figure 4.15: countSolutions Weka Configuration

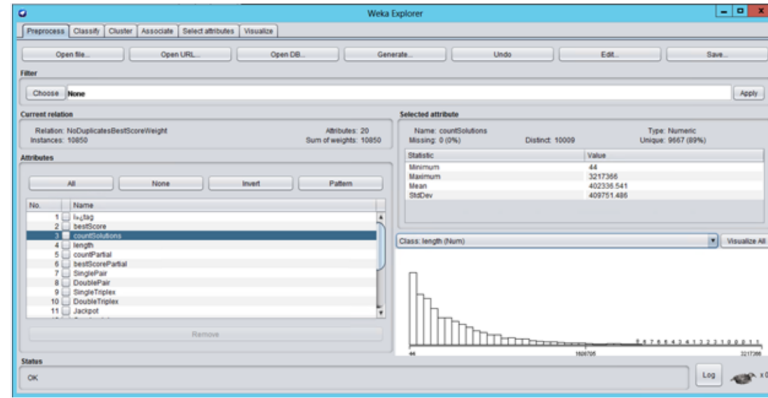


Figure 4.16: Length Weka Configuration

PointsOp)

$$2. \text{Points} = \sum((\text{leftTimeonmilliseconds} * \%weight) + (\text{ScenarioCompleted} * \text{PointsOp}))$$

$$3. \text{Points} = \sum\left(\frac{\#scenarioCompleted}{1 + (\text{leftTimeonmilliseconds} * \%Weight)} + \text{PointsOp}\right) + 1 \text{ or } 0 \text{ if no leftTime and 0 ScenarioCompleted}$$

$$4. \text{Points} = \sum\left(\frac{\#scenarioCompleted + \text{PointsOp}}{1 + (\text{leftTimeonmilliseconds} * \%Weight)}\right)$$

$$5. \text{Points} = \sum((\text{leftTime} * \#scenario) * (\text{PointsOp} * \%Weight)) + 1 \text{ or } 0 \text{ if no leftTime and 0 scenarioCompleted}$$

$$6. \text{Points} = \sum\left(\frac{\text{leftTimeonmilliseconds} * \#scenarioCompleted}{1 + (\text{PointsOp} * \%Weight)}\right)$$

$$7. \text{Points} = \sum\left(\frac{\text{PointsOp} * \%Weight}{1 + (\text{leftTimeonmilliseconds} * \#scenarioCompleted)}\right)$$

$$8. \text{Points} = \sum\left(\frac{\text{leftTimeonmilliseconds} + \#scenarioCompleted}{1 + (\text{PointsOp} * \%Weight)}\right)$$

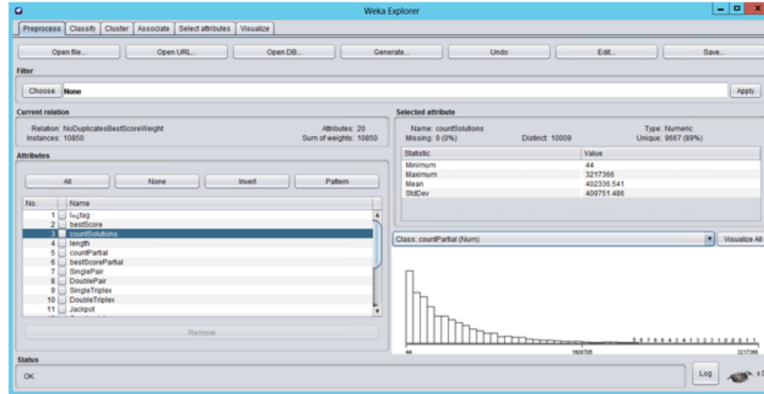


Figure 4.17: CountPartial Weka Configuration

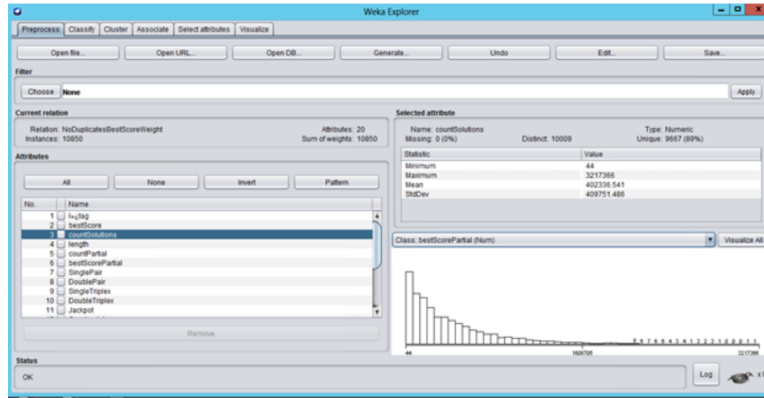


Figure 4.18: Best Score Partial Weka Configuration

9. $Points = \sum \left(\frac{PointsOp * \%Weight}{1 + (leftTimeonmilliseconds + \#scenarioCompleted)} \right)$
10. $Points = \sum (leftTimeonmilliseconds^2 + PointsOp * leftTimeonmilliseconds + \#scenarioCompleted)$
11. $Points = \sum (leftTimeonmilliseconds^2 + PointsOp * leftTimeonmilliseconds * difficulty + \#scenarioCompleted * \%Weight)$
12. $Points = \sum (leftTimeonmilliseconds^2 + PointsOp * leftTimeonmilliseconds + ((\#scenarioCompleted + difficulty)) * \%Weight)$
13. $Points = \sum (PointsOp^2 + (PointsOp * leftTimeonmilliseconds) + (\#scenarioCompleted * difficulty * \%Weight))$

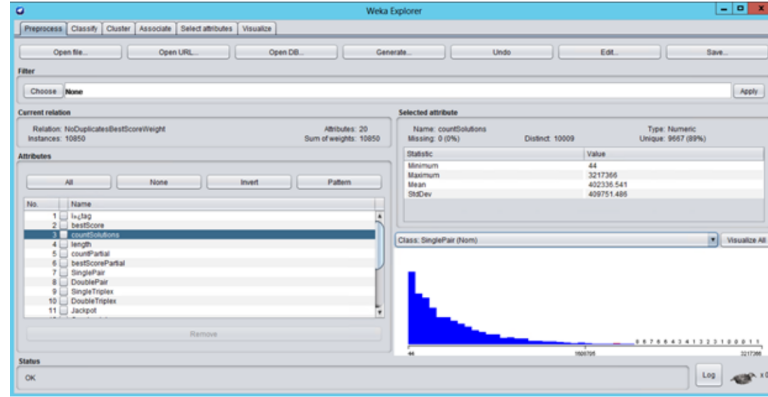


Figure 4.19: Single Pair Weka Configuration

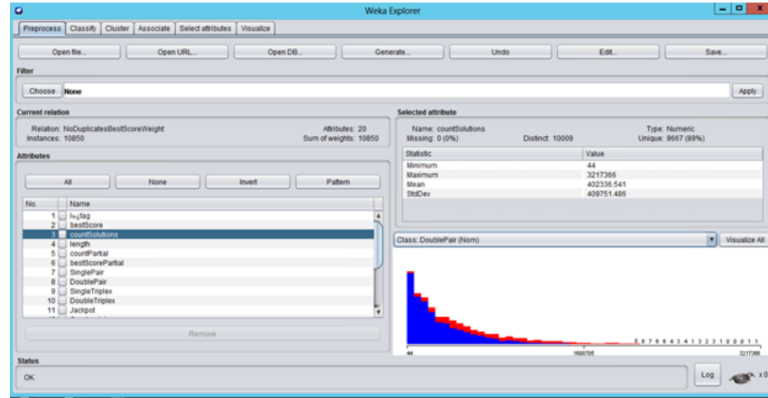


Figure 4.20: Double Pair Weka Configuration

14. $Points = \sum (PointsOp^2 + (PointsOp * \#scenarioCompleted * difficulty * \%Weight) + leftTimeonmilliseconds)$
15. $Points = \sum (PointsOp^2 + (PointsOp * \#scenarioCompleted * difficulty * \%Weight) - leftTimeonmilliseconds)$
16. $Points = \sum \left(\frac{PointsOp^2 + (PointsOp * \#scenarioCompleted * difficulty * \%Weight)}{1 + leftTimeonmilliseconds} \right)$
17. $Points = \sum \left(\frac{leftTimeonmilliseconds}{1 + (PointsOp^2 + (PointsOp * \#scenarioCompleted * difficulty * \%Weight))} \right)$

The red formula was discarded immediately because generate negative values. the formula number 3 was the chosen one.

Also for Brains points were proposed 6 different ways to obtain them on each game.

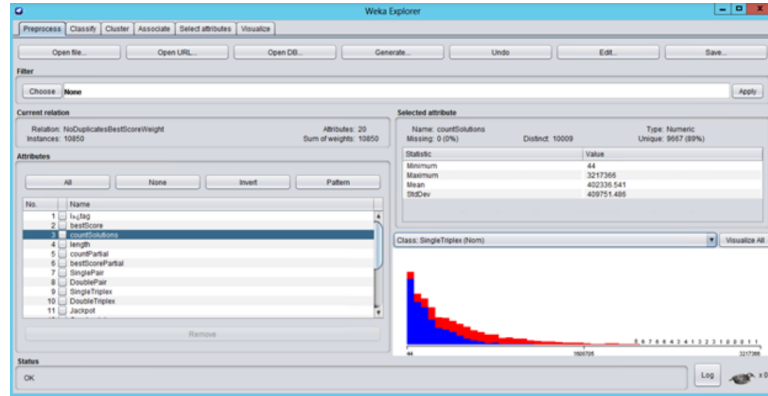


Figure 4.21: Single Triplex Weka Configuration

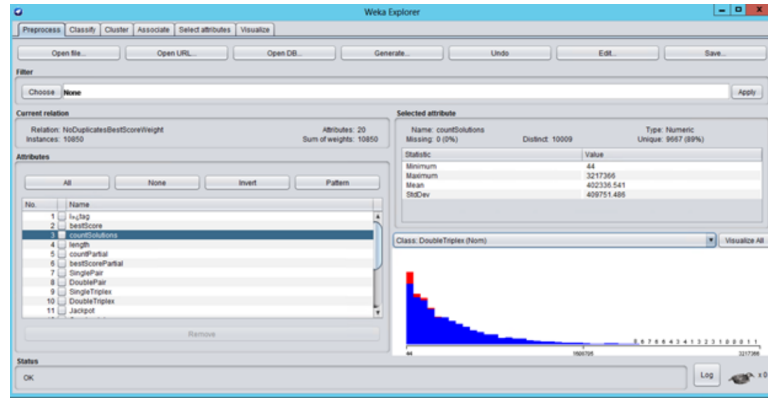


Figure 4.22: Double Triplex Weka Configuration

1. Brains = PointsOp (more understandable for players)
2. Brains = possiblePointsOp
3. Brains = $\sum(lefttime)Brains = (\#scenariosolved)$
4. Brains = bonus calculated on previous version
5. Brains = $\#scenario\ solved * difficulty\ of\ the\ input$

Mak07 will have a database that will keep the pre calculated values of wight and standard deviation for each tag.

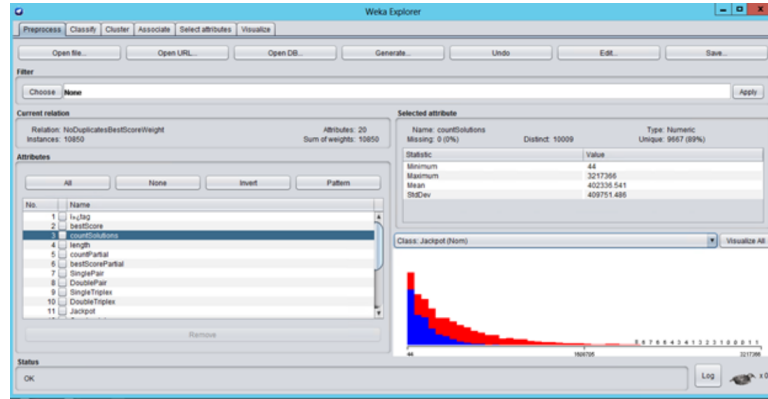


Figure 4.23: Jackpot Weka Configuration

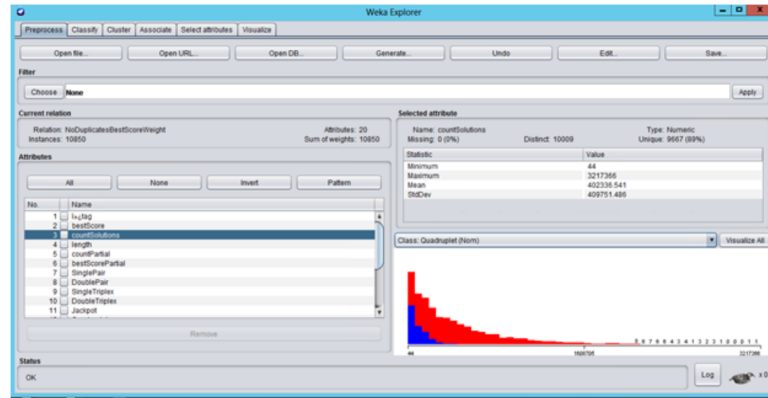


Figure 4.24: Quadruplet Weka Configuration

4.3.1 Difficulty 1

The following table is the data obtained by playing the difficulty 1 found by clustering.

Each color represent the number of schemas done in 1 game [figure 4.36]. In this case the users played 11 games, but they had solve different number of schemas each time.

After of having all the data tabulated, I summarized the data grouped by number of games and number of schemas solved on each game in order to graphic the results[figure 4.37].

Data Graphically shows in this case that the number or schemas solved in one game of 2 seconds are 3 [figure 4.38].

This is the behaviour of players playing a game of difficulty 1 [figure 4.39].

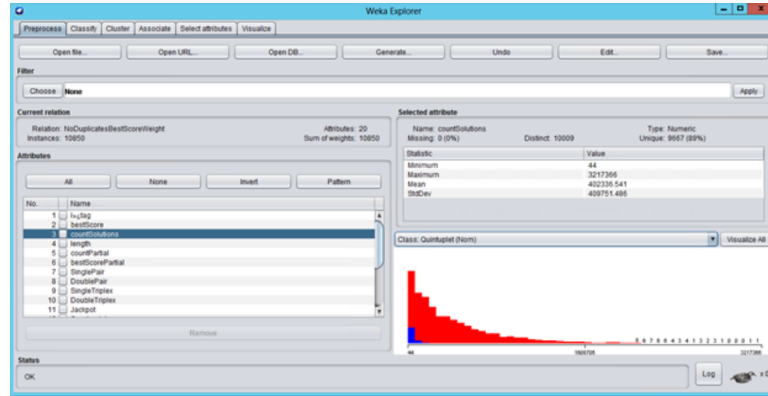


Figure 4.25: Quintuplet Weka Configuration

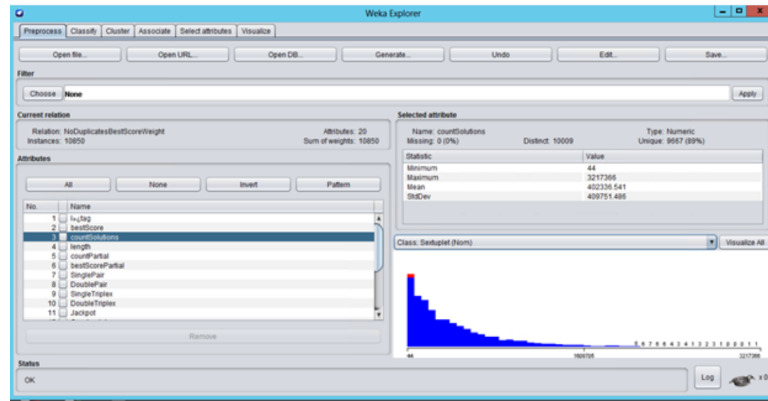


Figure 4.26: Sextuplet Weka Configuration

The chosen formula have a incremental behaviour [figure 4.40] [figure 4.41].

The following graph shows the relationship between games and points obtained by the new point system, Formula 3 the chosen one [figure 4.42].

The following image represents the relationship between games vs time average: 261526 Total games: 11 [figure 4.43].

The following is a pivot table that shows points vs total of points for each game. the ? value means that the user did a mistake but the time was count for the test [figure 4.44].

4.3.2 Difficulty 2

The following table is the data obtained by playing on the difficulty 2 found by clustering [figure 4.45]. Each color represent the number of schemas done in 1

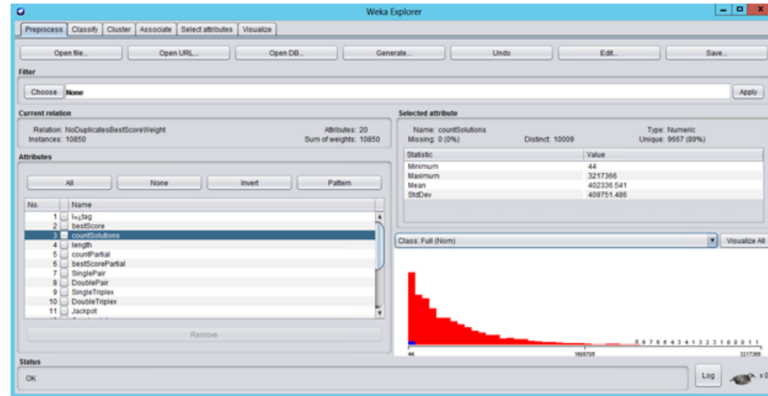


Figure 4.27: Full Weka Configuration

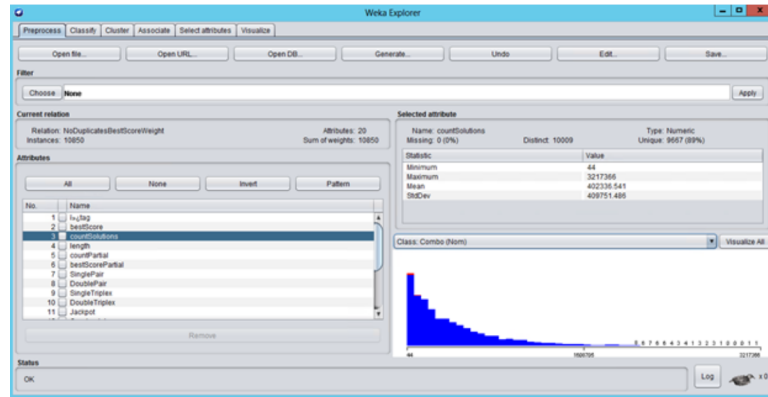


Figure 4.28: Combo Weka Configuration

game. In this case the users played 15 games, but they had solve different number of schemas each time.

After of having all the data tabulated, I summarized the data grouped by number of games and number of schemas solved on each game in order to graphic the results [figure 4.46].

Data Graphically shows in this case that the number or schemas solved in one game of 2 seconds is 2 [figure 4.47].

This is the behaviour of players playing a game of difficulty 2 [figure 4.48].

The chosen formula have 2 picks with 2 and 3 schemas solved, in the other hand 4 and 5 schemas solved present a incremental behaviour [figure 4.49] [figure 4.50].

The following graph shows the relationship between games and points obtained by the new point system, Formula 3 the chosen one [figure 4.51].

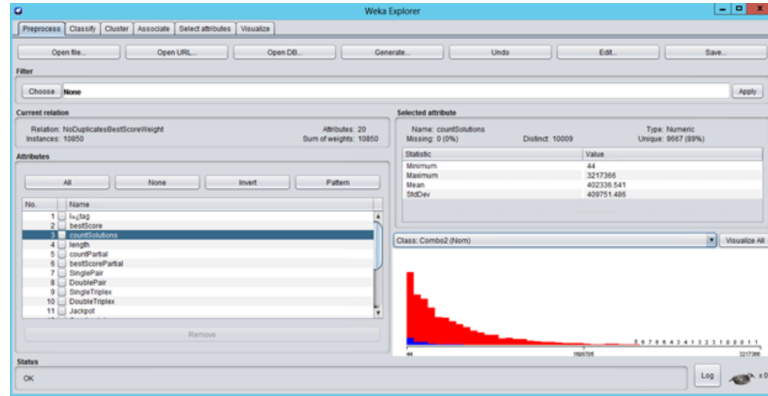


Figure 4.29: Combo2 Weka Configuration

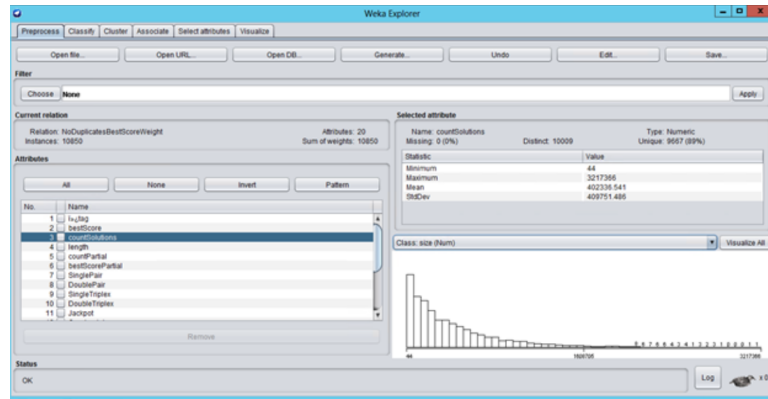


Figure 4.30: Size Weka Configuration

The following image represents the relationship between games vs time Average: 149527 Total games: 15 [figure 4.52].

The following is a pivot table that shows points vs total of points for each game. the ? value means that the user did a mistake but the time was count for the test [figure 4.53].

4.3.3 Difficulty 3

The following table is the data obtained by playing on the difficulty 3 found by clustering [figure 4.54]. Each color represent the number of schemas done in 1 game. In this case the users played 22 games, but they had solve different number of schemas each time.

After of having all the data tabulated, I summarized the data grouped by

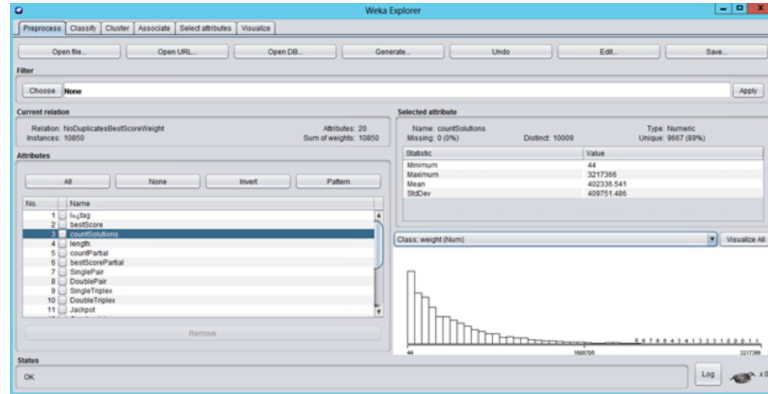


Figure 4.31: Weight Weka Configuration

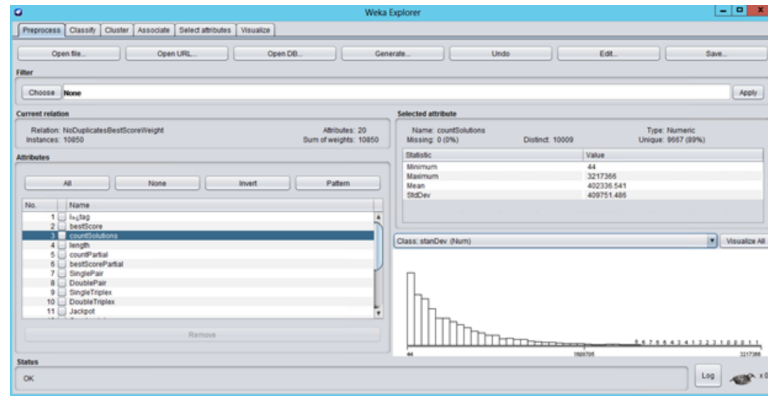


Figure 4.32: Standard Deviation Weka Configuration

number of games and number of schemas solved on each game in order to graphic the results [figure 4.55].

Data Graphically shows in this case that the number or schemas solved in one game of 2 seconds is 2 [figure 4.56].

This is the behaviour of players playing a game of difficulty 3 [figure 4.57].

The chosen formula have a non exponential or sequential behaviour. [figure 4.58] [figure 4.59].

The following graph shows the relationship between games and points obtained by the new point system, Formula 3 the chosen one [figure 4.60].

The following image represents the relationship between games vs time Average: 2471783 Total games: 22 [figure 4.61].

The following is a pivot table that shows points vs total of points for each game. the ? value means that the user did a mistake but the time was count for

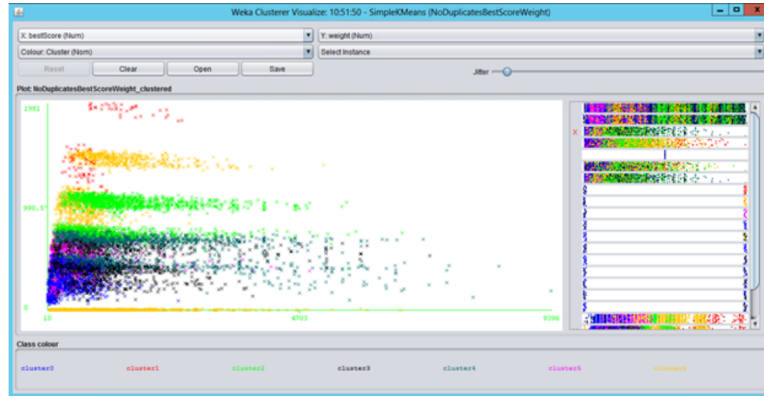


Figure 4.33: Results after apply algorithm

the test [figure 4.62].

4.3.4 Difficulty 4

The following table is the data obtained by playing on the difficulty 4 found by clustering [figure 4.63]. Each color represent the number of schemas done in 1 game. In this case the users played 19 games, but they had solve different number of schemas each time.

After of having all the data tabulated, I summarized the data grouped by number of games and number of schemas solved on each game in order to graphic the results [figure 4.64].

Data graphically shows in this case that the number or schemas solved in one game of 2 but in order to let players play we will take in count as maximum 3 in 2 seconds [figure 4.65].

This is the behaviour of players playing a game of difficulty 4 [figure 4.66].

The chosen formula have a non exponential or sequential behaviour but has a pick which means that the user was enthusiastic and it could solve some schemas with good score and good speed [figure 4.67] [figure 4.68].

The following graph shows the relationship between games and points obtained by the new point system, Formula 3 the chosen one [figure 4.69].

The following image represents the relationship between games vs time Average: 171705 Total games: 19 [figure 4.70].

The following is a pivot table that shows points vs total of points for each game. the ? value means that the user did a mistake but the time was count for the test [figure 4.71].

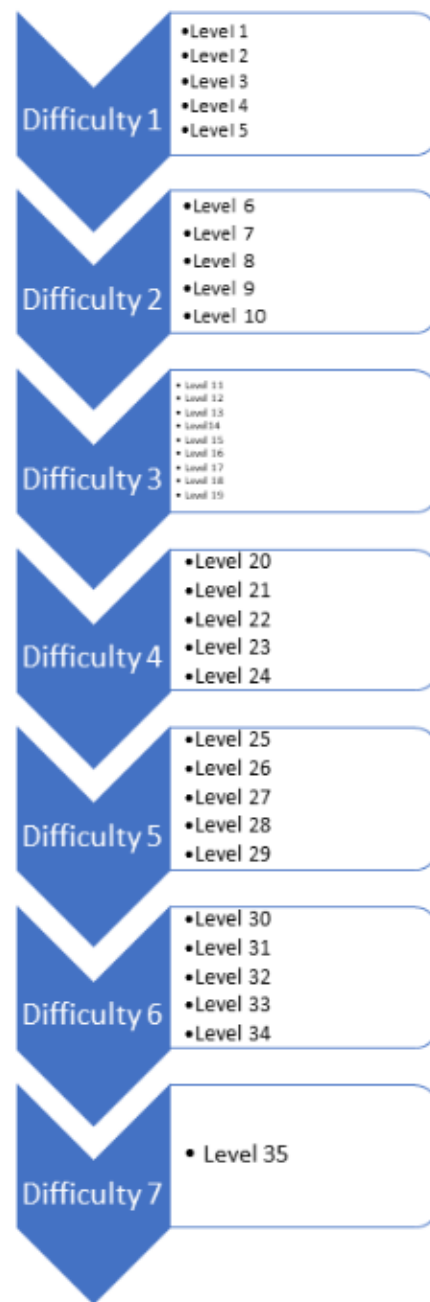


Figure 4.34: Subdivision

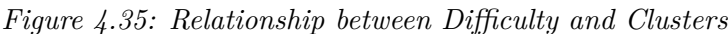


Figure 4.36: Data obtained by playing difficult 1 found by clustering

The following table is the data obtained by playing on the difficulty 5 found by clustering [figure 4.72]. Each color represent the number of schemas done in 1

IF1	IF2	IF3	IF4	IF5	IF6	IF7	IF8	IF9	IF10	IF11	IF12	IF13	IF14	IF15	IF16	IF17	games	time	exp
22966552	3678942	25	0.00000179	75325518	19	0.695	9	0.761	1063460	5668784	108157	783580	194932	193656	5.86	0.831	2	40668	23
93253680	18228474	11	0.00000172	594867284	9271	0.049	35762	0.1742	2342244	412280	2262951	355303	377349	-162757	4.59	95930.30	4	260353	7
58935708	153935740	12	0.000000430	655326767	387	0.040	171	0.0634	2408334	6778842	2422348	752399	285360	-88396	0.78	13.23	3	226878	9
367425839	307425857	18	0.000000658	262767898	293395	0.037	19729	0.1746	4142501	8909149	416164	338551	777645	-123023	6.13	197104.21	6	450334	12
24914195	24914199	7	0.000001891	319442676	80793	0.053	50341	0.876	1881366	2695714	1807623	237662	276562	-18540	3.93	59204.61	4	223246	3
163703041	163703083	26	0.000000640	69407670	483	0.186	274	0.4593	2559625	6823005	2577531	773110	435196	-59012	14.09	27.59	5	247104	23
437757173	437757183	28	0.000000410	295372883	444436	0.185	188339	0.7029	4648596	6984670	4065570	905345	987562	105376	31.28	85032.40	7	435233	21
39198305	39198302	19	0.000001030	607096593	16500	0.273	5754	0.2726	1887396	5979412	1093745	810018	142438	37028	1.91	5748.52	2	52705	17
132313354	132313363	14	0.0000003476	457873845	80134	0.122	89737	0.5816	2190471	4002285	2210771	368539	387869	-103919	18.75	89535.00	5	254234	9
18804823	18804821	12	0.000000279	850793791	115	0.054	143	0.0919	2199625	6762823	248474	737071	197310	-102162	1.24	11.80	3	229361	8
335282729	335282747	18	0.000001427	1679338783	295035	0.028	200795	0.939	4164024	6934240	4194688	898417	654916	-253076	3.29	200601.31	6	453946	12

Figure 4.37: Data summarized by playing difficult 1 found by clustering

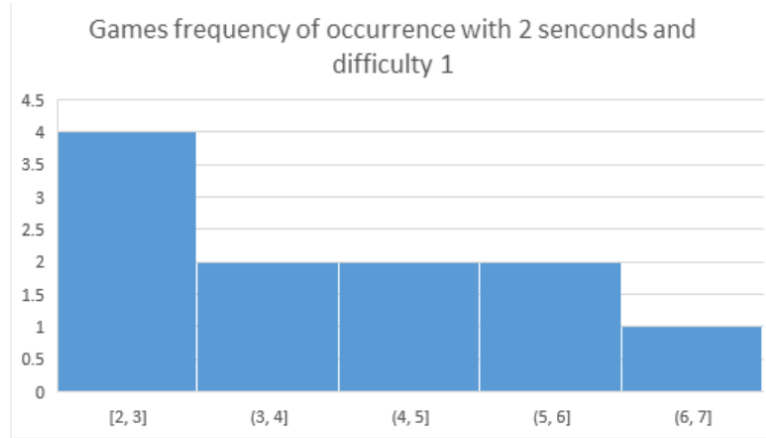


Figure 4.38: Games frequency of occurrence with 2 seconds and difficulty 1

game. In this case the users played 25 games, but they had solve different number of schemas each time.

After of having all the data tabulated, I summarized the data grouped by number of games and number of schemas solved on each game in order to graphic the results [figure 4.73].

Data graphically shows in this case that the number or schemas solved in one game of 2 but in order to let players play we will take in count as maximum 6 in 2 seconds [figure 4.74].

This is the behaviour of players playing a game of difficulty 5 [figure 4.75].

The chosen formula have a pick which means that the user was enthusiastic and it could solve some schemas with good score and good speed [figure 4.76] [figure 4.77].

The following graph shows the relationship between games and points obtained by the new point system, Formula 3 the chosen one [figure 4.78].

The following image represents the relationship between games vs time Average: 157933 Total games: 25 [figure 4.79].

The following is a pivot table that shows points vs total of points for each game. the ? value means that the user did a mistake but the time was count for the test [figure 4.80].

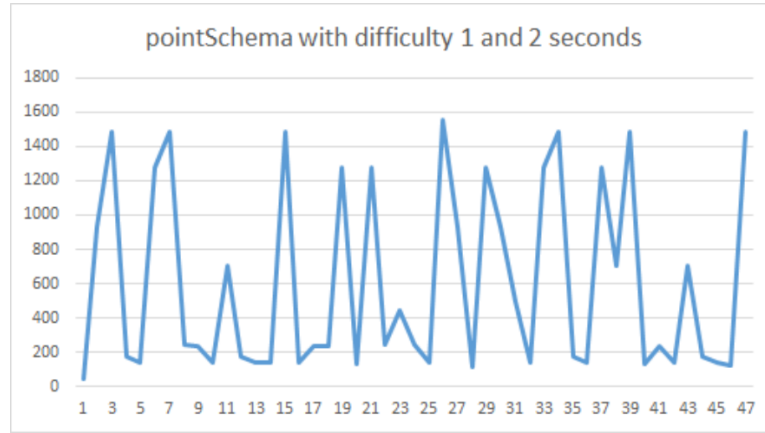


Figure 4.39: pointSchema with difficulty 1 and 2 seconds

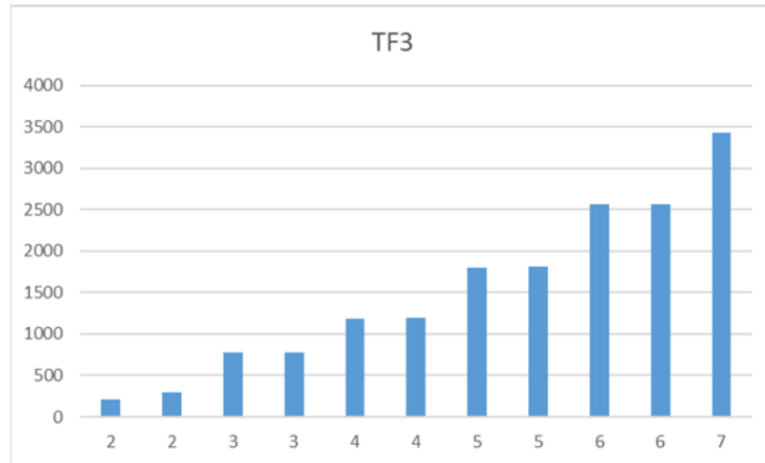


Figure 4.40: Graph of formula 3

4.3.6 Difficulty 6

The following table is the data obtained by playing on the difficulty 6 found by clustering [figure 4.81]. Each color represent the number of schemas done in 1 game. In this case the users played 11 games, but they had solve different number of schemas each time.

After of having all the data tabulated, I summarized the data grouped by number of games and number of schemas solved on each game in order to graphic the results [figure 4.82].

Data graphically shows in this case that the number or schemas solved in one game is 3 in 2 seconds [figure 4.83].

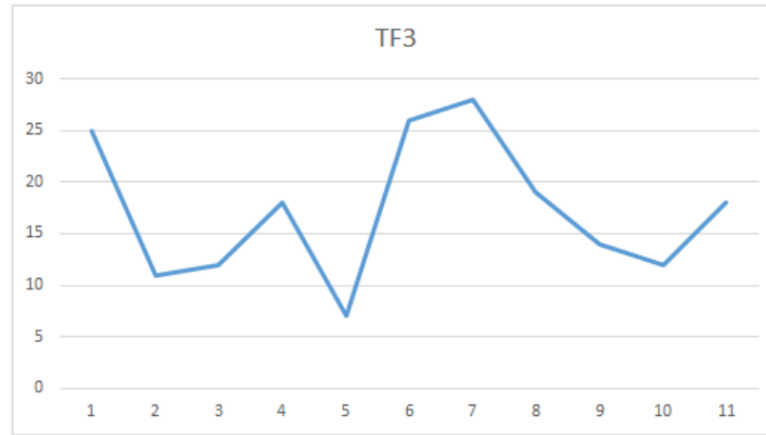


Figure 4.41: Graph of formula 3 line

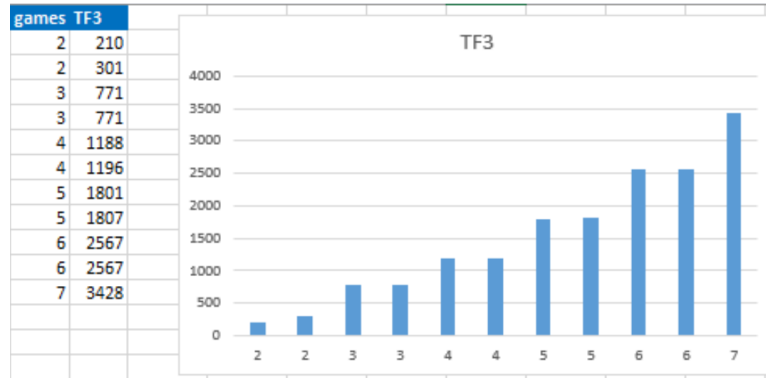


Figure 4.42: Relationship between games and points of formula 3

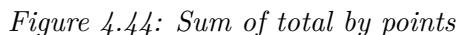
This is the behaviour of players playing a game of difficulty 6 [figure 4.84].

The chosen formula have 2 pick which means that the user was enthusiastic and it could solve some schemas with good score and good speed [figure 4.85] [figure 4.86].

The following graph shows the relationship between games and points obtained by the new point system, Formula 3 the chosen one [figure 4.87].

The following image represents the relationship between games vs time Average: 20535 Total games: 11 [figure 4.88].

The following is a pivot table that shows points vs total of points for each game. the ? value means that the user did a mistake but the time was count for the test [figure 4.89].



4 – Results

TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	TF9	TF10	TF11	TF12	TF13	TF14	TF15	TF16	TF17	games	time	exp
50172680	50172762	137	0.000054	2706551982	3	1	2	2	4078977	25716237	4086488	3615692	557126	429490	20	0	2	63818	135
23755726	23755725	46	0.000002	1069005601	10	0	10	0	5296140	32589900	5297785	4550938	175446	-26730	1	1	1	101088	45
138853298	138853315	37	0.000001	2493484902	35	0	20	0	4064469	21087999	4075046	2849736	365888	34190	2	2	2	165849	35
30114533	30114532	85	0.000003	2529613633	0	3	0	3	2657533	17307805	2664785	2449585	638857	580721	21	0	1	29068	84
51291573	51291571	180	0.000049	4015385903	7	2	6	5	7540793	47291885	7549928	6643843	1224202	977044	83	1	3	123579	177
93508348	93508355	93	0.000002	4191287672	15	0	9	0	10162864	64040734	10172377	8996781	507027	187401	4	1	2	159813	91
56765345	56765400	148	0.000023	3685057311	11	1	7	2	8266202	51713096	8273531	7255401	758391	481449	28	1	3	138471	145
14745048	14745047	67	0.000005	973168747	12	0	12	0	7785177	49792461	7786150	7002675	170785	-41373	1	2	1	106079	66
73606220	73606799	263	0.000050	7709237832	89	1	64	6	15189759	93838881	15204424	13164721	2490353	1929045	188	8	5	280654	258
135012485	135012518	106	0.000002	9268013298	7	1	4	1	8811558	55567806	8823612	7808652	970521	695335	11	0	2	137593	104
33376460	33376459	128	0.000004	4238794165	0	6	0	6	3516491	23448125	3525423	3331809	1161459	1109145	43	0	1	26157	127
96121548	96121808	112	0.000012	5393816923	104	1	98	4	6505935	33558497	6524597	4545392	2122834	1575910	136	9	5	273462	107
245368784	245369297	190	0.000036	12644955191	56	2	27	7	6951042	38899290	6986294	5421212	3394422	2957900	191	2	5	218261	185
77114905	77115165	224	0.000035	8458574968	104	7	51	26	18194738	115911740	18207429	16325600	2108102	1592970	706	4	4	257566	220
110012905	110013024	117	0.000010	5928222580	36	1	13	2	6439646	37887074	6456726	5280237	1173868	850970	29	1	4	161449	113

Figure 4.46: Summary obtained difficulty 2 by clustering

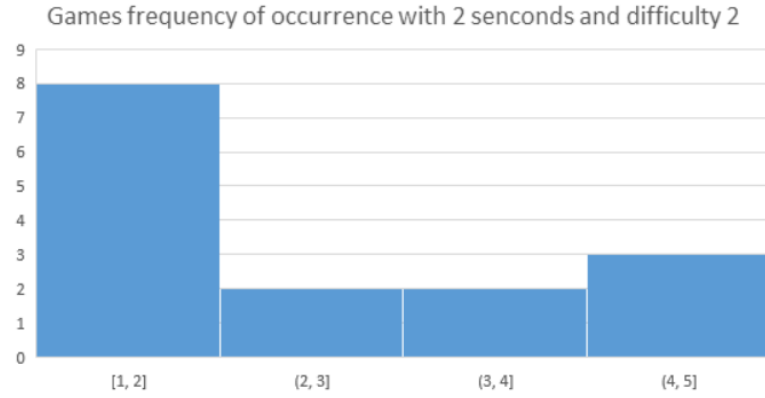


Figure 4.47: Games frequency of occurrence with 2 seconds and difficult 2

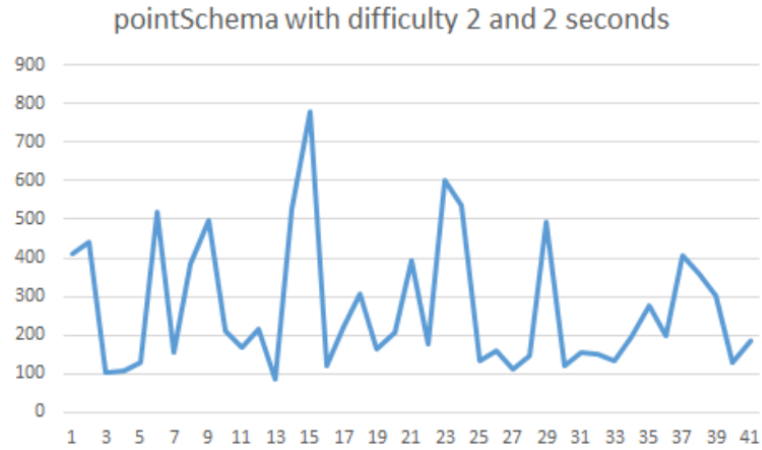


Figure 4.48: PointSchema with difficult 2 and 2 seconds

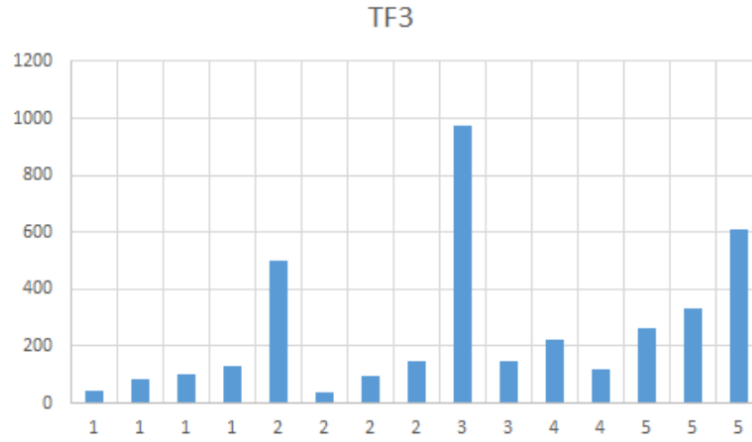


Figure 4.49: Formula 3 difficult 2

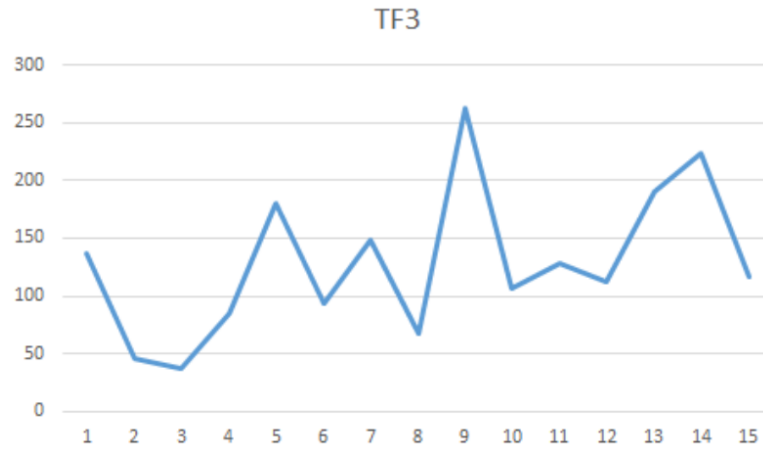


Figure 4.50: Formula 3 difficult 2 Line

4.3.7 Difficulty 7

The following table is the data obtained by playing on the difficulty 7 found by clustering [figure 4.90]. Each color represent the number of schemas done in 1 game. In this case the users played 36 games, but they had solve different number of schemas each time.

After of having all the data tabulated, I summarized the data grouped by number of games and number of schemas solved on each game in order to graphic the results [figure 4.91].

Data graphically shows in this case that the number or schemas solved in one

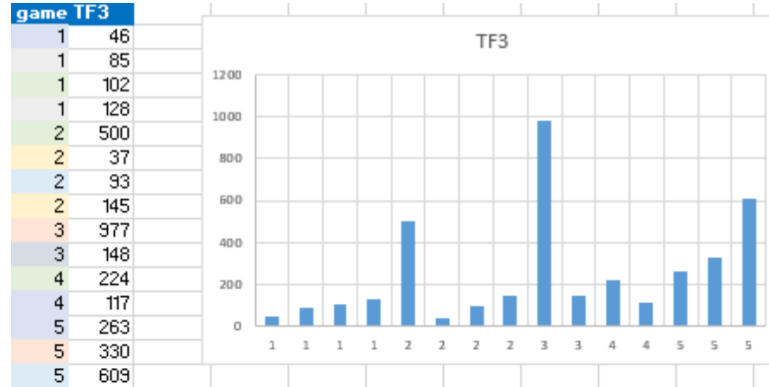


Figure 4.51: Games vs Formula 3 difficult 2

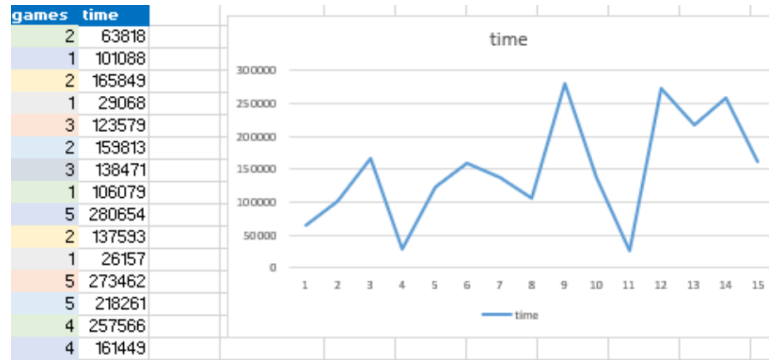


Figure 4.52: Games vs time difficult 2

game is 1 but to let players play we will take in count as maximum 2 in 2 seconds [figure 4.92].

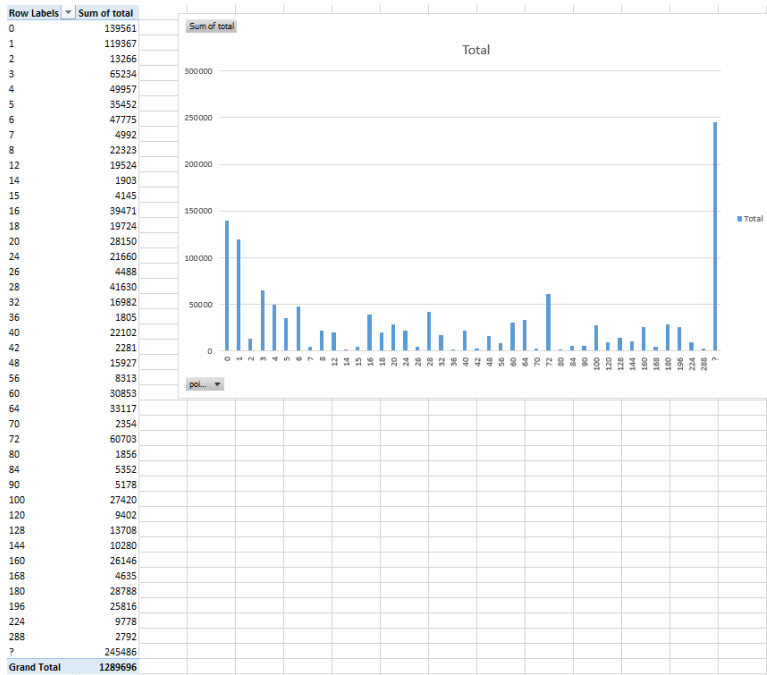
This is the behaviour of players playing a game of difficulty 7 [figure 4.93].

The chosen formula have a non exponential or sequential behaviour but has 5 picks which means that the user was enthusiastic and it could solve some schemas with good score and good speed [figure 4.94] [figure 4.95].

The following graph shows the relationship between games and points obtained by the new point system, Formula 3 the chosen one [figure 4.96].

The following image represents the relationship between games vs time Average: 148840 Total games: 36 [figure 4.97].

The following is a pivot table that shows points vs total of points for each game. the ? value means that the user did a mistake but the time was count for the test [figure 4.98].

[illegible]

The boundaries of each level were calculated by the study of each level behaviour in which the point of attention was time and number of schemas solved in one game. Error played an important role for this study. Many of the players have done mistakes and this represents less time to be consumed.

After having defined all the levels and the requirements, the next step was thinking about boosters and how them must be related to the levels. As we know, boosters can be given to users for free in a random period of the game, after had achieved some tasks or had pass some difficult levels, users seem them

4 – Results

TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	TF9	TF10	TF11	TF12	TF13	TF14	TF15	TF16	TF17	games	time	esp
4340362	4340361	18	4.14657E-07	737958849	5.152	0.19	5.152	0.194	1504559	7793800	1509486	1053291	145563	22241	1	0.735	1	61661	17
1140044	1140043	12	1.04522E-06	136289163	2.106	0.47	2.106	0.475	300532.1	1783821	305521	844397	70537	37961	3	0.300	1	93308	11
22486589	22486600	17	6.89737E-07	1324890227	67.43	0.21	39.64	0.466	1598722	6156842	2023103	737531	396524	46826	9	3.811	3	175849	14
71418739	71418738	7	9.80195E-06	428512383	11.09	0.09	11.09	0.09	9240374	3405769	931289	420918	112433	-25381	1	1.583	1	68937	6
10956772	10956771	6	5.50922E-07	54483831	112.6	0.01	112.6	0.009	3711967	3323197	972340	292390	63296	-73492	0	15.909	1	70394	5
24512963	24511074	84	5.6838E-06	549082379	30.1	1.14	16.9	2.891	4819675	24880573	4842467	3385662	1E+06	897486	57	1.489	3	159777	81
175060084	175060086	9	3.13722E-07	843107763	9134	0.1	91282	0.249	1526823	3175119	1551050	327218	305012	-31868	5	91275.042	3	188440	6
165316155	165316153	44	2.11049E-06	7288600433	1391	0.24	555.2	0.805	5163779	21845433	5176979	2639330	1E+06	516786	21	48.547	5	323756	39
16540373	16540372	47	4.45881E-06	404852537	11.86	0.08	11.86	0.084	4048945	245791029	4048918	3489577	120532	-30736	1	1.682	1	78634	46
129103528	129103525	9	1.78619E-07	771715870	40392	0.1	20203	0.103	1395536	5024294	141006	626853	169166	-44014	1	20192.381	2	106550	7
97384069	97384074	18	1.02019E-06	867476426	10.46	0.59	3.416	1.055	1321494	5432694	1337402	709195	276784	105484	14	1.268	2	69500	16
36404234	36404233	2	5.40402E-06	36404233	41.43	0.02	41.43	0.024	327405.5	5800115	333985	15482.4	45482	-32950	0	5.326	1	38916	1
62757601	62757600	1	1.59343E-06	163200	0	63201	0	4678813	4678813	474932	6951	63200	-63200	0	63200.000	1	63200	0	
14047513	14047512	29	2.06443E-06	393329553	0.308	3.25	0.308	3.245	390874.1	2240388	398806	317391	281312	238294	23	0.044	1	1009	28
75122865	75122932	53	7.66398E-06	749413328	83.16	0.22	80.69	0.418	2278270	11412012	2286461	1534494	273537	63233	6	11.348	2	102122	51
83270454	83270453	10	1.20091E-07	749434357	5.682	0.18	5.682	0.176	1070809	4594795	1079741	596330	145714	15196	1	0.811	1	65259	9
168193740	168193772	97	1.14789E-06	1.082E+10	6.581	0.76	4.183	0.974	10146905	63054965	1E+07	8838389	1E+06	673906	10	0.427	2	179466	95
74711126	74711119	50	3.04954E-06	1855632012	5.355	1	3.344	1.247	2057234	11427302	2070723	1578944	457518	324028	12	0.334	2	66745	48
127673712	127673764	86	2.04693E-06	6370945100	4.261	0.97	3.394	1.549	5507879	33087053	5524955	4616743	394261	748343	19	0.423	2	122959	84
138274033	138274033	105	1.20395E-06	9504433254	36.08	1.08	18.52	1.108	10575777	67676661	1E+07	9537546	872418	586560	8	1.390	2	142329	103
236190401	236190429	74	6.54897E-07	1.1656E+0	5.173	0.3	3.405	1.177	7493368	44900194	7508667	6263899	1E+06	810167	12	0.359	2	161986	72
78604281	78604339	115	4.2223E-05	3021850689	15.31	6.18	10.37	18.01	6162364	36485268	6173593	5077381	1E+06	730764	375	1.087	3	149566	112

Figure 4.55: Summary obtained difficulty 3 by clustering

Games frequency of occurrence with 2 seconds and difficulty 3

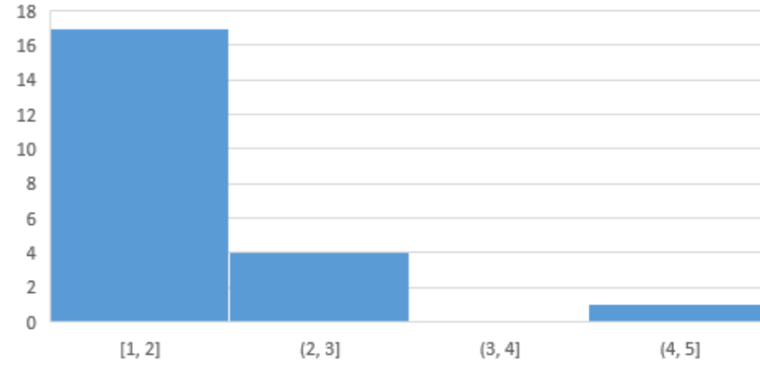


Figure 4.56: Games frequency of occurrence with 2 seconds and difficult 3

pointSchema with difficulty 3 and 2 seconds

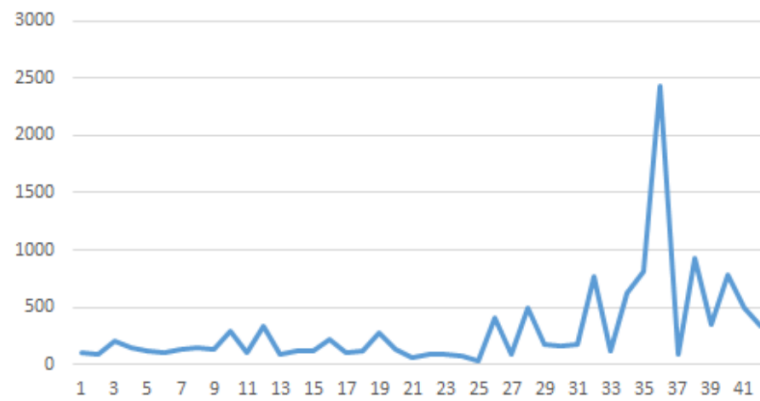


Figure 4.57: PointSchema with difficult 3 and 2 seconds

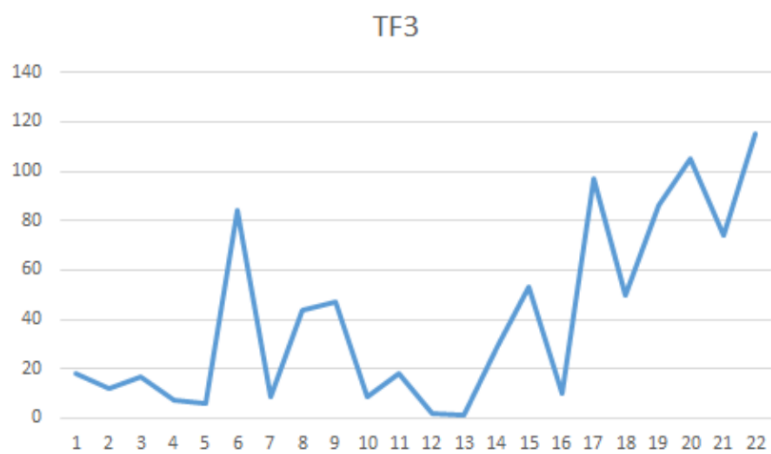


Figure 4.58: Formula 3 difficult 3 Line

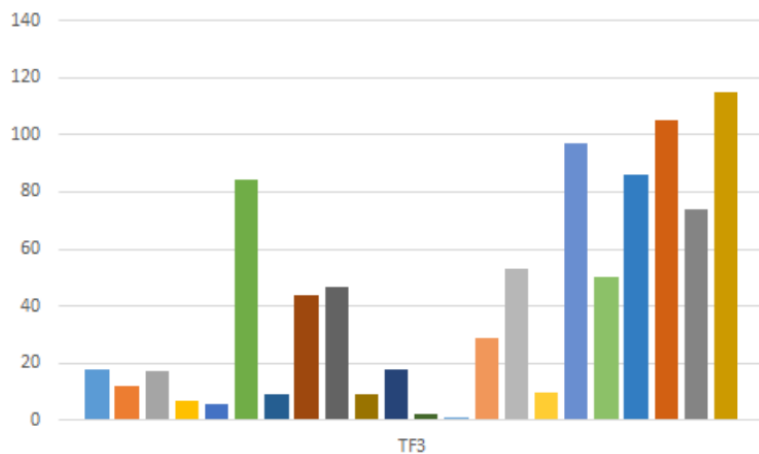


Figure 4.59: Formula 3 difficult 3

as a reward.

Reward in MAK07 are going to be shown as a medal, the following are examples of the image representation of them.

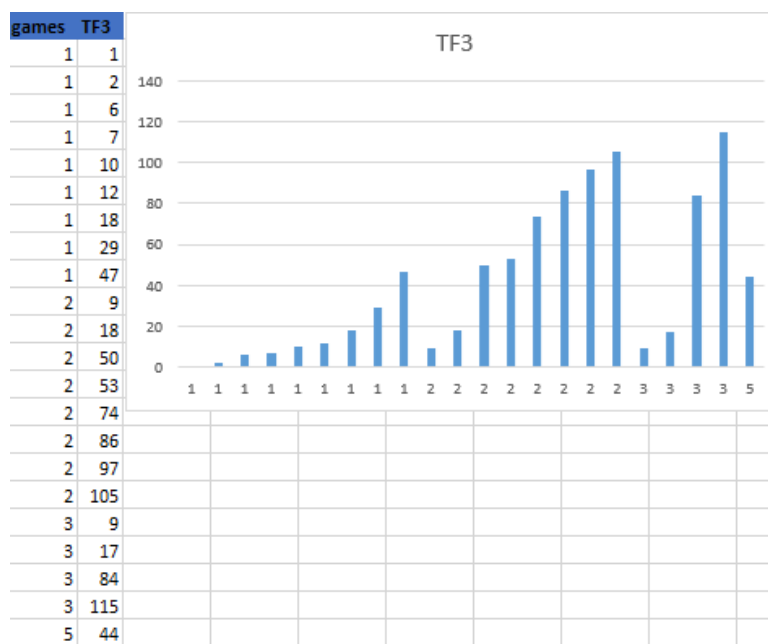


Figure 4.60: Games vs Formula 3 difficult 3

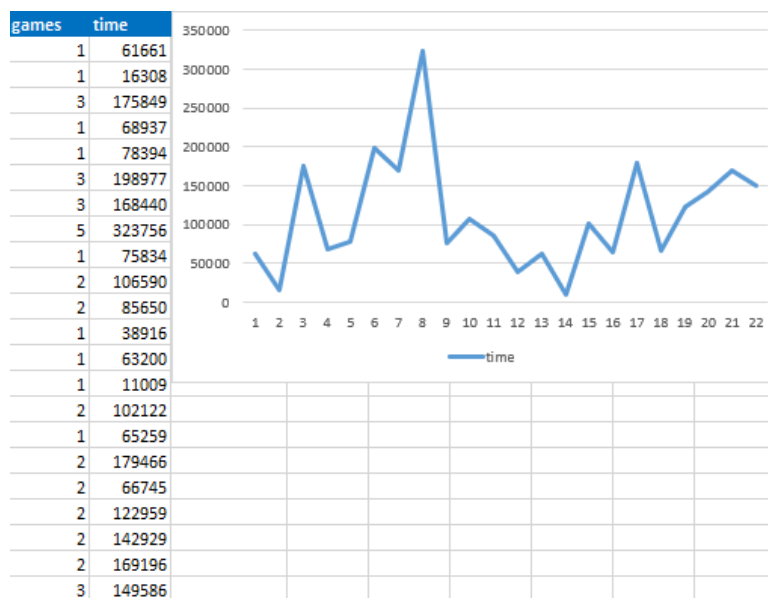
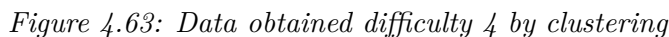
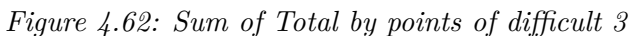


Figure 4.61: Games vs time difficult 3



4 – Results

	T16	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	games	date	cup
256758323	256758354	32	4.09711679E-07	563226885	52	0.199986	51	0.427065	4546747	17896725	4188755	2338287	789513	289291	7	3.222089	250161	20	
73889089	73889094	13	1.43939803E-06	314329676	115	0.055136	68	0.06395	1490666	5168204	1498990	621876	153123	82119	1	6.209945	118621	11	
99808822	99808821	4	4.05221403E-08	299604915	38	0.020205	28	0.026204	2111805	3036991	2118343	237341	126563	47291	0	5.443124	109927	3	
126829445	126829448	30	6.16604450E-07	196496470	27	0.158037	19	0.117184	3785586	38212990	3797640	2952427	940014	122136	2	2.044738	163939	28	
205933387	20593428	56	5.52280995E-07	1012121774	11	0.472569	9	0.819116	3755305	3253321	3752186	4492558	1037242	694768	11	1.257277	171237	54	
104324963	10432504	84	5.43484855E-05	3094324936	17	0.051899	10	1.505199	4323991	23902482	4333147	3578361	477375	217733	20	0.97123	129621	81	
46008204	4600837	71.00001	3.30260788E-05	1455542434	242	5.828923	153	23.01151	4467530	21465308	4479297	2871938	887563	446621	646	15.53798	220471	70	
47386057	47386056	49	1.09404740E-06	2274537185	5	0.201489	5	0.201487	3885422	36484846	3888544	510381	256439	43963	1	0.707322	106248	48	
278617024	278617041	49	5.44892092E-07	6661746323	43	0.354483	20	0.505576	6374343	32935055	6387245	4474830	797326	272146	6	1.153576	262480	46	
121881079	121881132	58	1.96502033E-06	3719279933	39	0.510918	33	1.843747	5223328	28189678	5241745	3870404	749016	372902	26	4.275844	188057	55	
2688527	2688524	63	3.22914439E-06	1461725180	2878	2.265548	14441	2.265458	1827874	11031676	1836057	1544248	438835	359683	16	14439.06	39586	61	
34241561	34241611	266	1.13834242E-05	3441923264	89	1.683508	23	4.381462	20347611	125493797	20188502	17679482	4958625	4200209	128	0.175454	179208	219	
17792470	177922513	91	1.10860671E-06	10965081742	6	0.713112	4	1.011712	9233257	56685295	9247047	7929659	1092860	755120	11	0.1461347	178870	89	
57955061	57955077	25	1.54807154E-06	120308191	127	0.346509	120	0.853327	1480246	6717642	1696489	880574	407287	181119	15	16.66337	112984	22	
146762174	146762190	60	2.59564679E-06	5712271376	52	0.481464	27	0.021786	6731409	3947987	6743314	5462070	559128	122374	4	2.073521	173377	58	
3081142	3081141	68	2.20702190E-05	206431959	2	0.420129	2	0.42011	1649047	1059779	1650020	1486990	87862	49320	3	0.357448	22166	67	
224078230	224078458	125	8.12148358E-08	1016363108	260	0.374928	82	1.32986	10745874	39443338	10773062	8214192	1751197	1043387	41	5.08389	154005	119	
89431670	89431669	4	4.46017709E-08	257500999	31	0.05049	31	0.03049	95678	200980	962116	282137	111335	72263	0	4.4796	91899	3	
163279919	163279926	17	1.56938560E-06	891408929	161	0.077851	86	0.138787	2299328	7551062	2314798	904911	296555	87749	2	7.496884	192152	14	

Figure 4.64: Summary obtained difficulty 4 by clustering

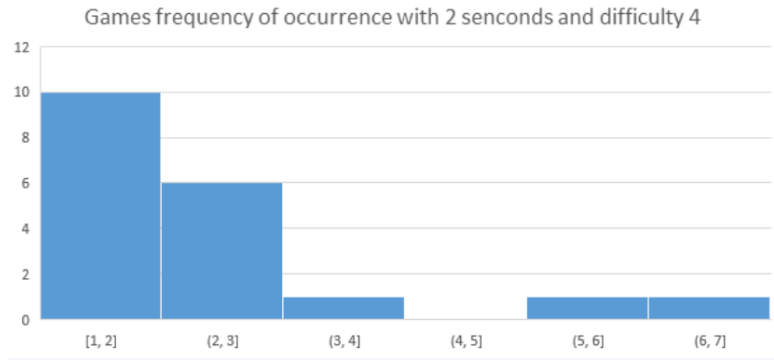


Figure 4.65: Games frequency of occurrence with 2 seconds and difficult 4

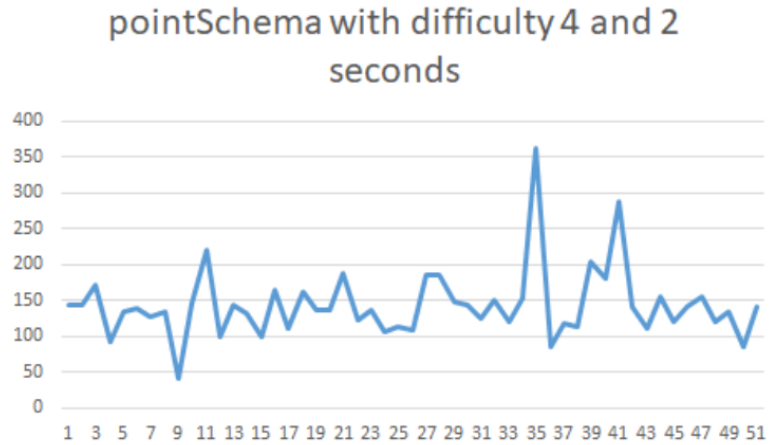


Figure 4.66: PointSchema with difficult 4 and 2 seconds

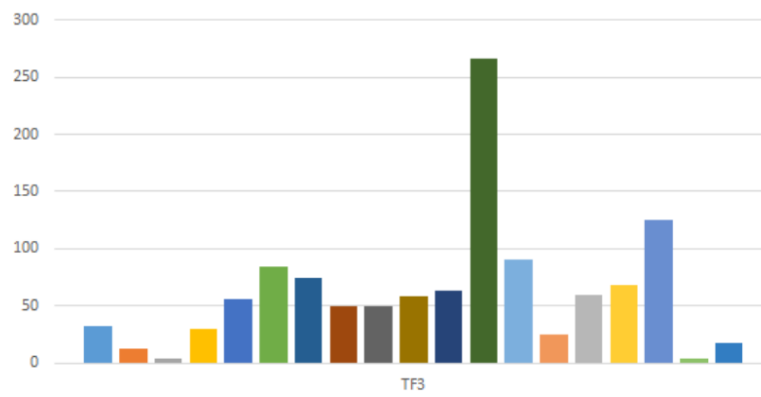


Figure 4.67: Formula 3 difficult 4

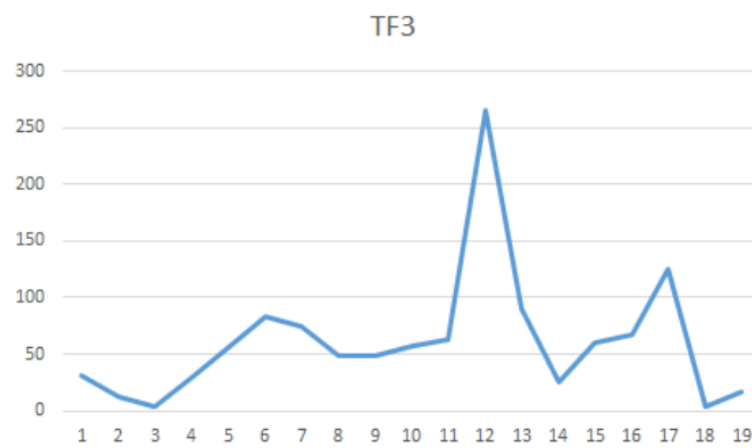


Figure 4.68: Formula 3 difficult 4 Line

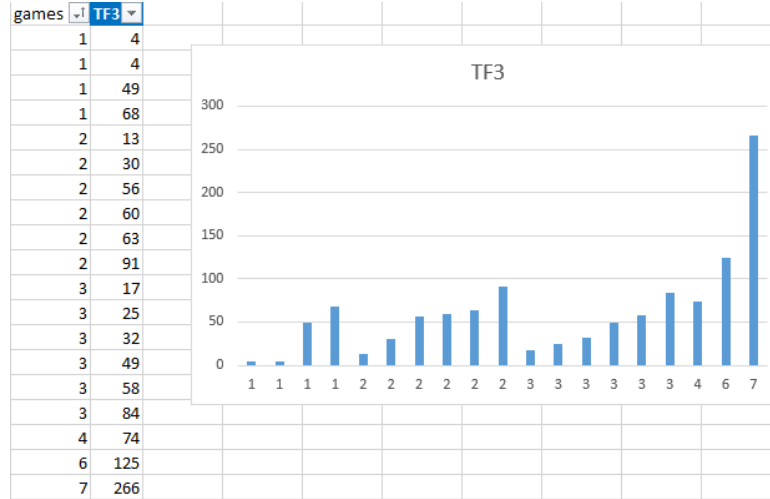


Figure 4.69: Games vs Formula 3 difficult 4

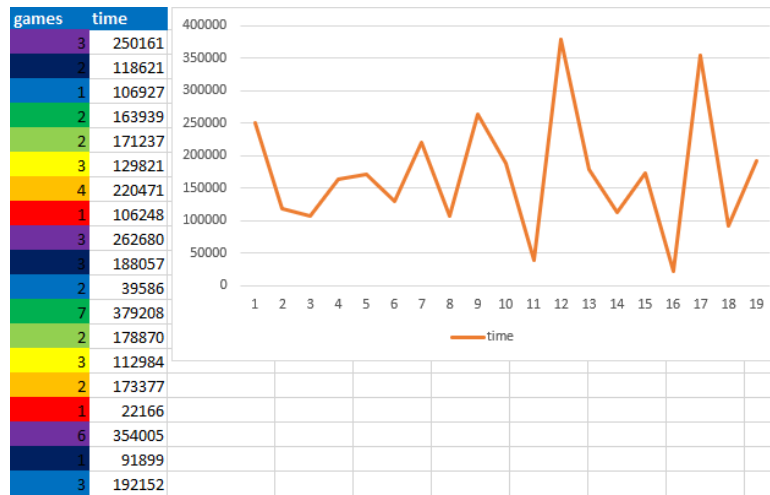


Figure 4.70: Games vs time difficult 4

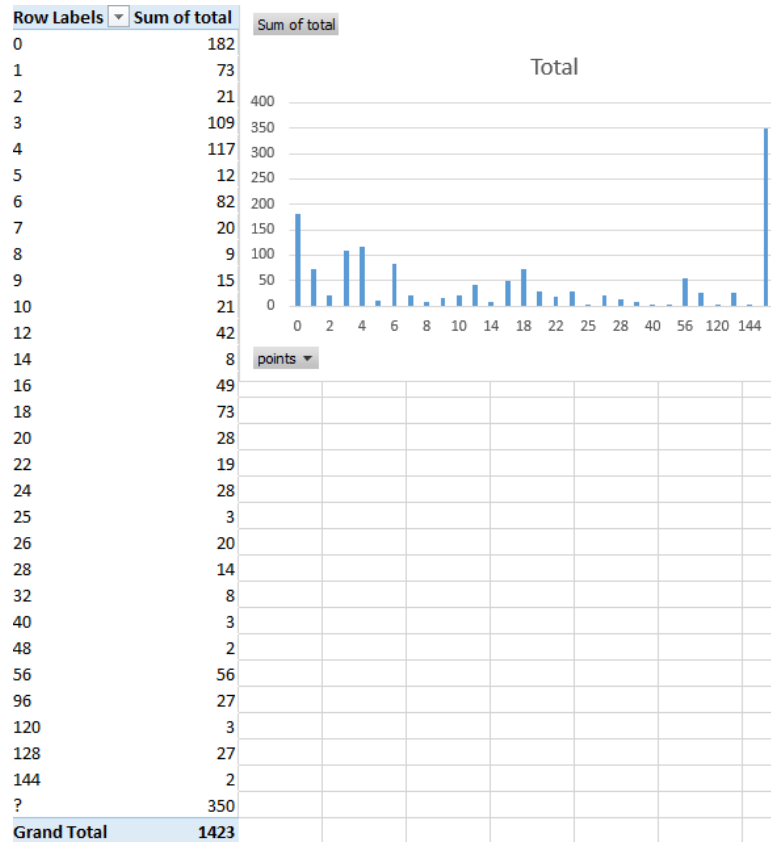


Figure 4.71: Sum of Total by points of difficult 4

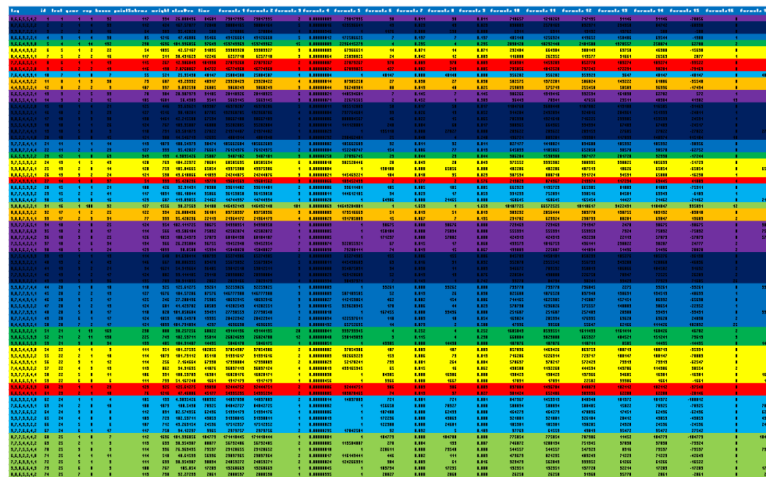


Figure 4.72: Data obtained difficulty 5 by clustering

4 – Results

TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	TF9	TF10	TF11	TF12	TF13	TF14	TF15	TF16	TF17	games	time	exp
79017336	79017335	2	0	79017335	90	0	90	0	710657	1218263	717195	91146	91146	-78056	0	13	84601	1	
51402171	51402168	6	0	122536642	12129	0	693	0	836314	2584774	846163	308120	851300	-45126	0	594	75428	4	
43126661	43126660	5	0	172506635	7	0	7	0	405140	1256324	413652	150406	89544	-1388	1	1	35466	4	
159743963	159743962	15	0	2236415273	4	0	4	0	2090128	10292140	2101580	1378557	258074	62788	2	1	97643	14	
40241038	40241037	6	0	92997476	38	0	26	0	408485	927857	419727	101411	72949	-13613	2	3	43281	4	
43848228	43848227	5	0	94173082	805	0	592	0	1646756	3271808	1650011	275005	193555	-176885	0	468	186120	3	
25084588	25084587	1	0	1	48147	0	48148	0	356282	356282	359929	3647	48147	-48147	0	48147	48147	0	
38388672	38388671	7	0	124236239	106	0	66	0	755674	1948000	762282	207725	97422	-52982	1	7	75202	5	
33788071	33788070	9	0	165271166	9	1	8	1	422714	1398356	440249	191401	111166	41874	24	1	34646	7	
339463898	339463929	25	0	2242872480	135518	0	27184	0	3594269	9766739	3631796	1149033	662382	-27384	13	27035	344883	19	
181786980	181786978	4	0	257911350	246	0	169	0	1472276	2523086	1486738	196563	196563	-153707	0	19	175135	2	
3487102	3487101	9	0	27896745	23	0	23	0	386204	1590380	387177	201728	32930	-17244	0	3	25087	8	
134326558	134326556	10	0	147967648	130233	0	6511	0	1845352	4688998	1860178	504042	236575	-131081	1	65059	184828	7	
15681563	15681562	9	0	109452433	2	1	2	1	213023	874367	219974	117234	69445	41889	4	0	13778	8	
84508849	84508845	6	0	178223587	64605	0	21607	0	1154286	2048458	1189274	180897	167300	-103556	1	21490	135428	3	
146432149	146432148	101	0	14643204801	1	2	1	2	10107728	68572525	10118617	942431	1194047	993831	12	0	94138	100	
111722509	111722509	7	0	311301672	66	0	59	0	1135011	5886367	1148502	279036	173039	-63401	2	8	118220	5	
166829583	166829590	12	0	402056035	420237	0	230884	0	2337781	1752945	2361365	314834	380630	-185240	4	230847	282935	7	
202388576	202388587	17	0	1058346605	311	0	212	1	2398307	5771369	2429996	659792	480492	-12700	31	25	248596	12	
291782195	291782196	16	0	1171714019	267332	0	13003	1	3312960	6199662	3394274	612920	627311	-131705	29	132763	380588	9	
81815073	81815078	33	0	1523882439	43118	0	14446	0	2373803	11671235	2387537	1574441	334103	111961	5	14436	111071	30	
260018482	260018473	12	0	785053123	95994	0	19120	0	2729898	5014284	2764380	499957	415128	-218114	2	18676	315621	6	
87379987	87379985	4	0	142315216	980	0	343	0	1219229	2089271	1230018	164521	164521	-125693	0	46	145007	2	
201890925	201890909	8	0	31880394	640107	0	209217	0	2456685	5066427	2466123	115250	345921	-280945	8	208579	313433	2	
326371349	326371329	10	0	354005583	450178	0	188794	0	3035043	4143285	3072262	318072	428786	-337560	1	198482	383173	3	

Figure 4.73: Summary obtained difficulty 5 by clustering

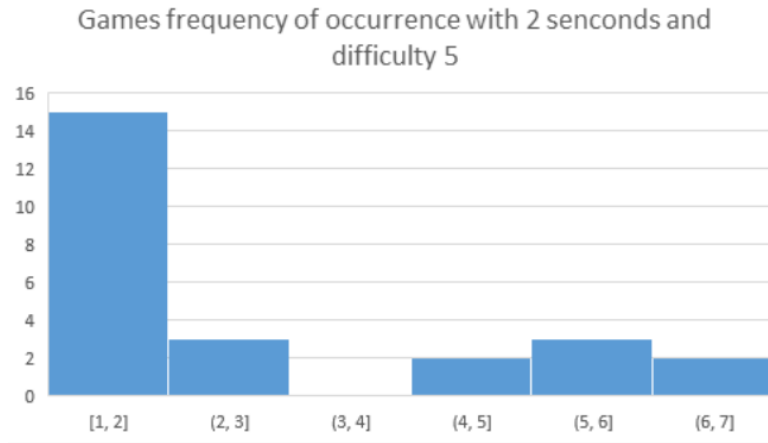


Figure 4.74: Games frequency of occurrence with 2 seconds and difficult 5

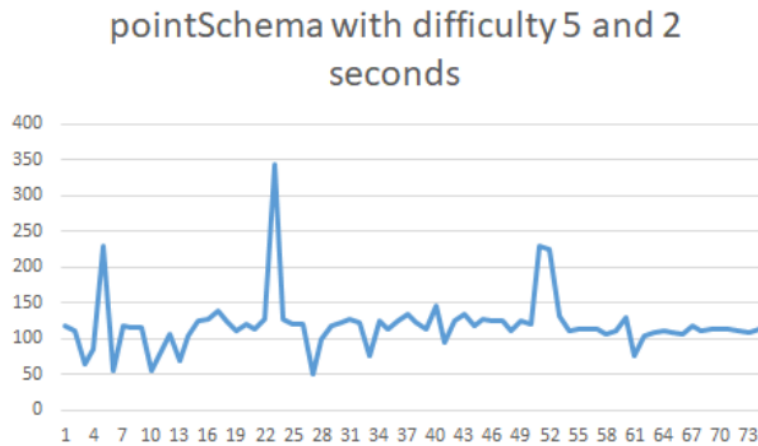


Figure 4.75: PointSchema with difficult 5 and 2 seconds

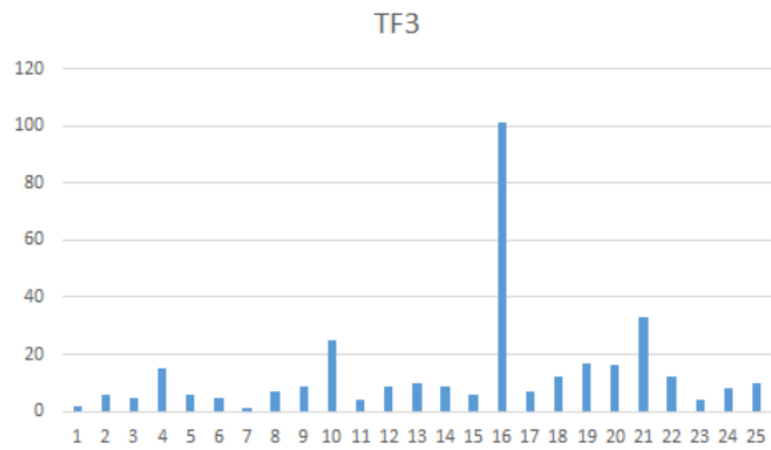


Figure 4.76: Formula 3 difficult 5

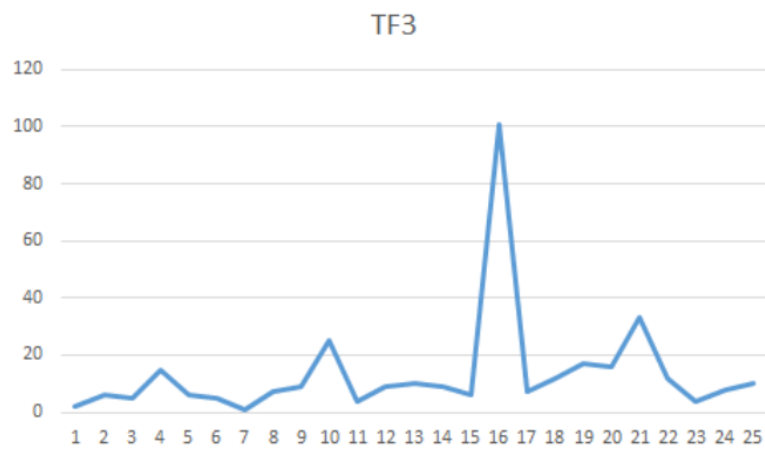


Figure 4.77: Formula 3 difficult 5 Line

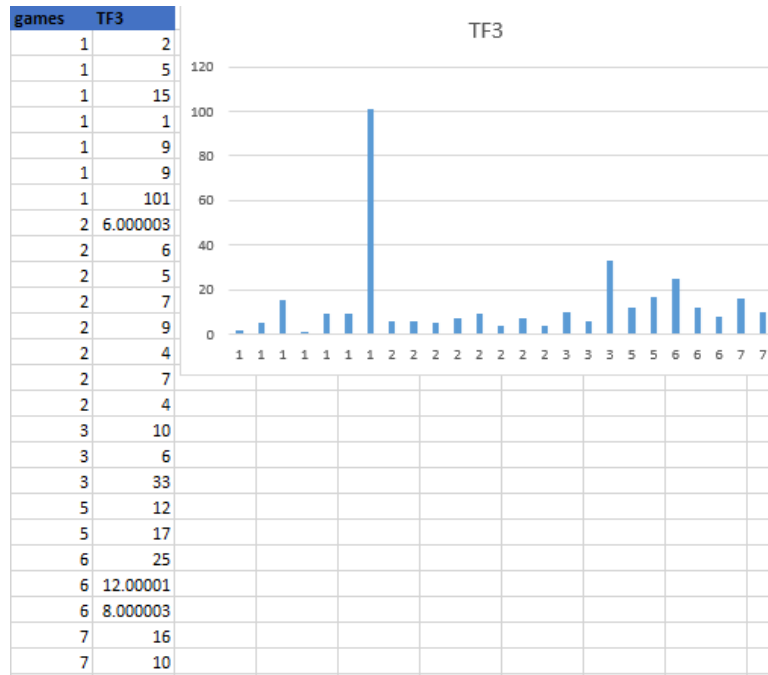


Figure 4.78: Games vs Formula 3 difficult 5

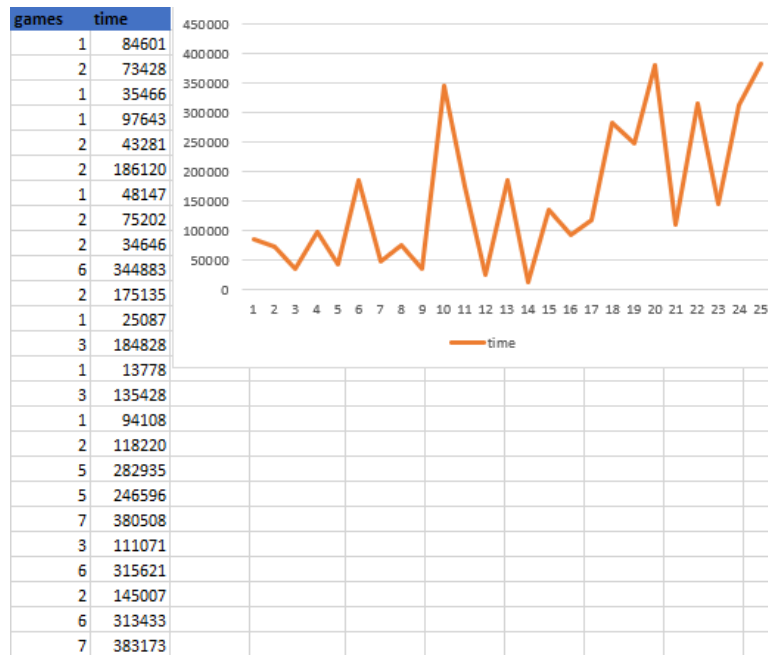


Figure 4.79: Games vs time difficult 5



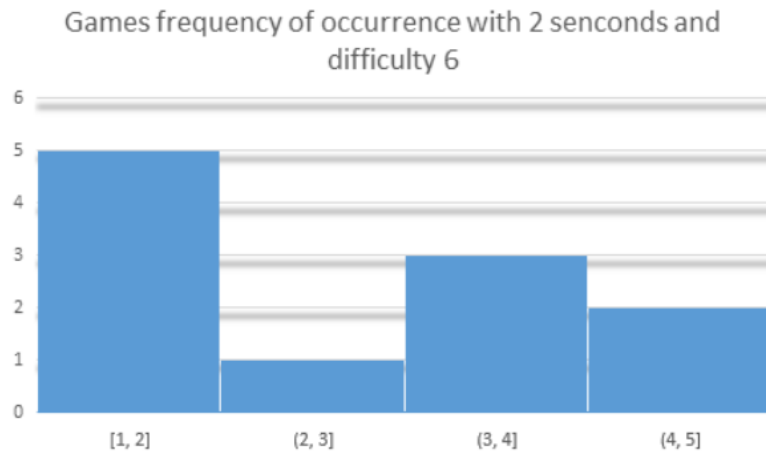


Figure 4.83: Games frequency of occurrence with 2 seconds and difficult 6

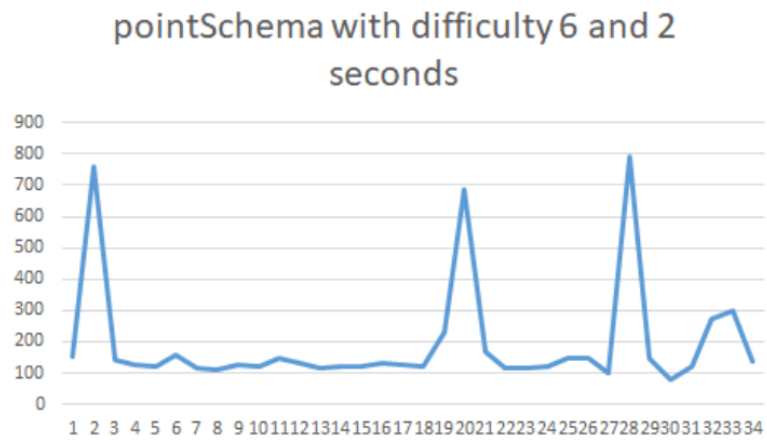


Figure 4.84: PointSchema with difficult 6 and 2 seconds

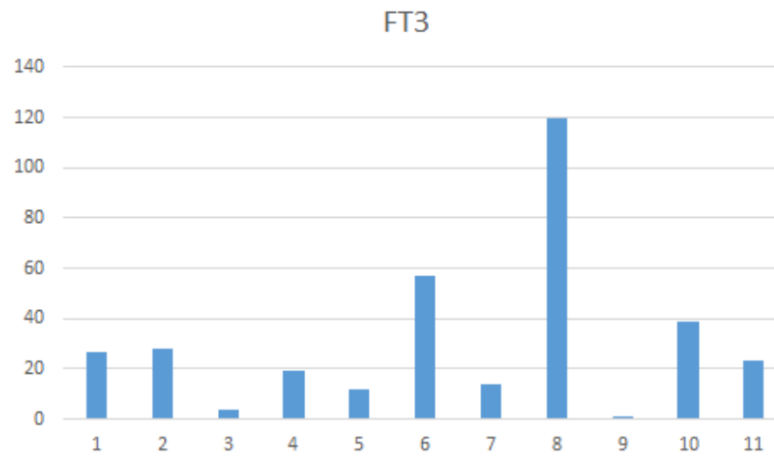


Figure 4.85: Formula 3 difficult 6

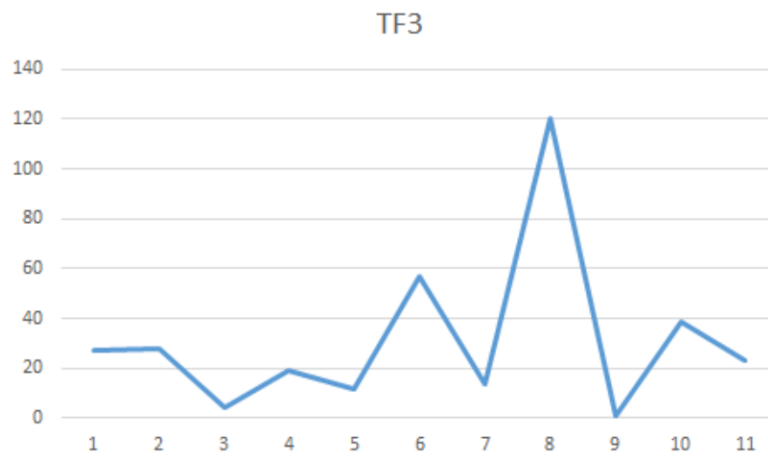


Figure 4.86: Formula 3 difficult 6 Line

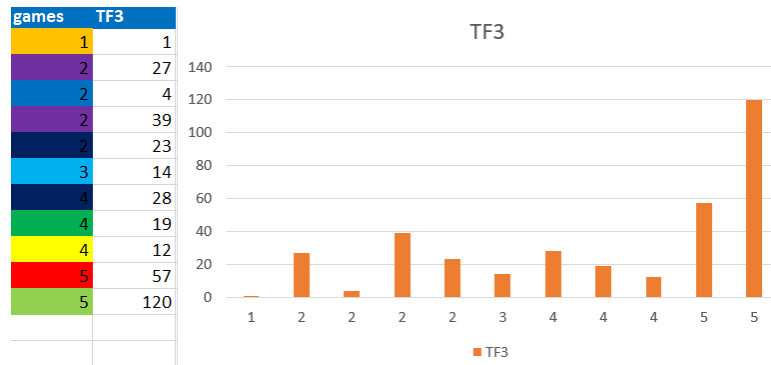


Figure 4.87: Games vs Formula 3 difficult 6

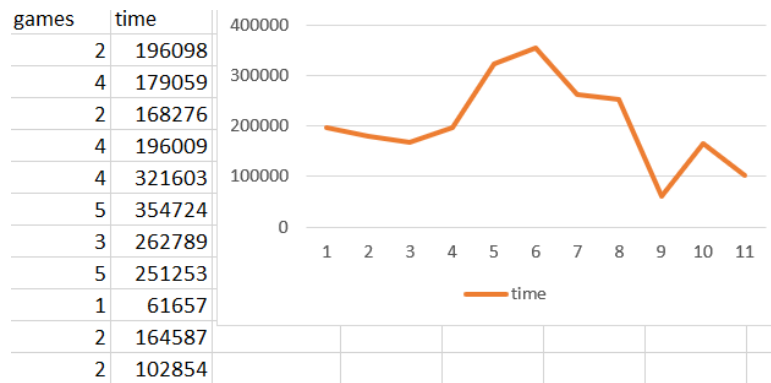


Figure 4.88: Games vs time difficult 6

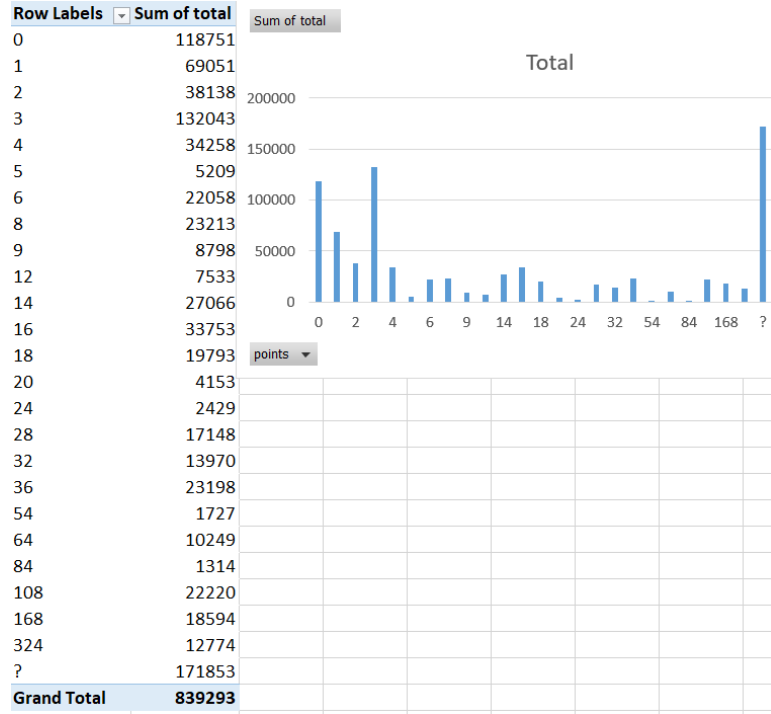


Figure 4.89: Sum of Total by points of difficult 6

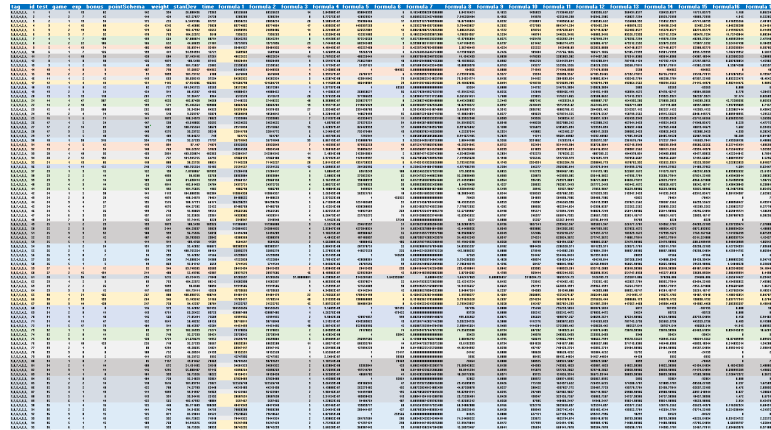
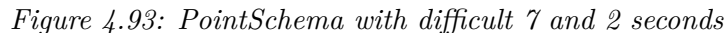


Figure 4.90: Data obtained difficulty 7 by clustering

Figure 4.91: Summary obtained difficulty 7 by clustering

Figure 4.92: Games frequency of occurrence with 2 seconds and difficult 7



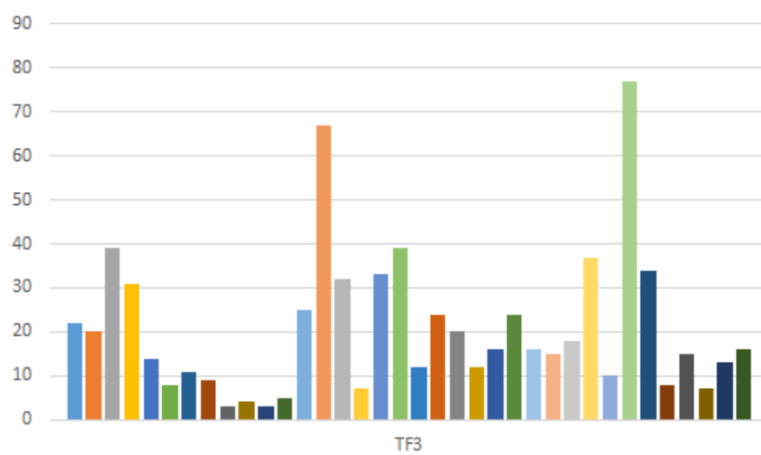


Figure 4.94: Formula 3 difficult 7

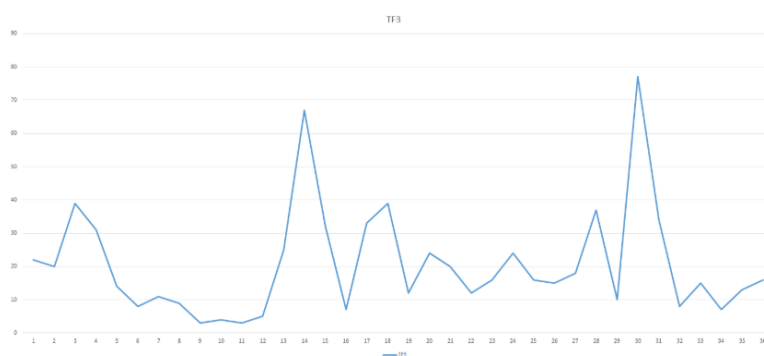


Figure 4.95: Formula 3 difficult 7 Line

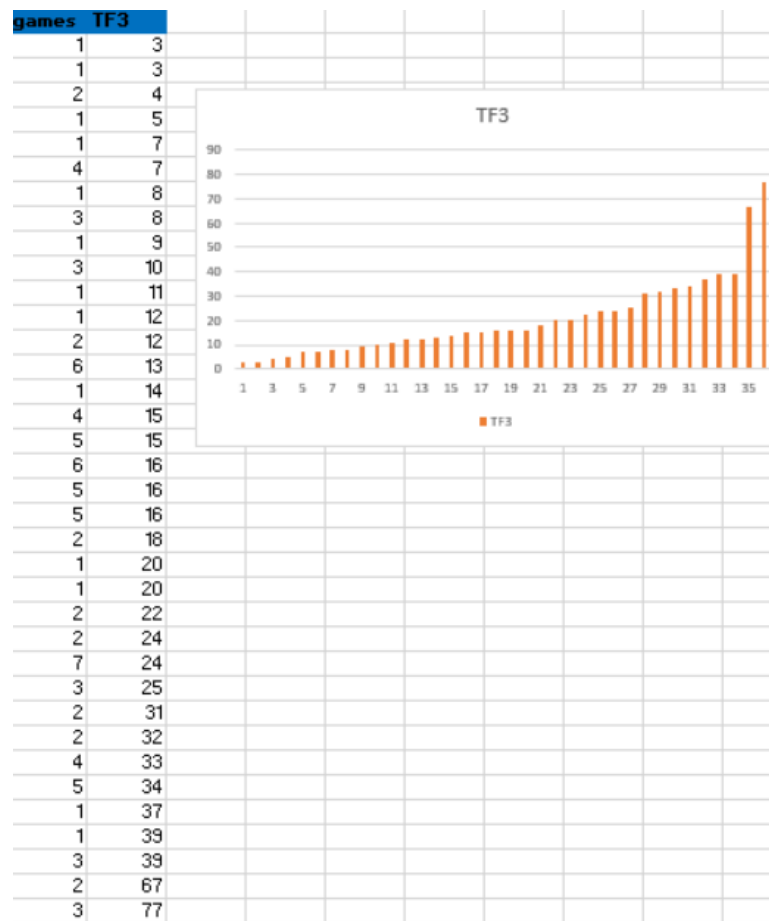


Figure 4.96: Games vs Formula 3 difficult 7

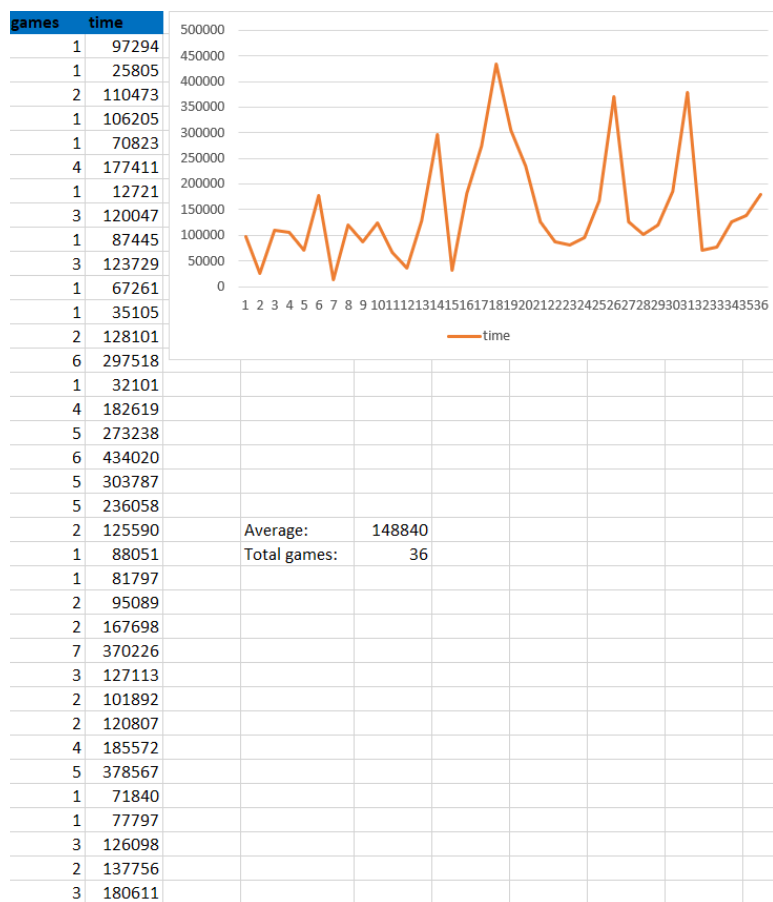


Figure 4.97: Games vs time difficult 7

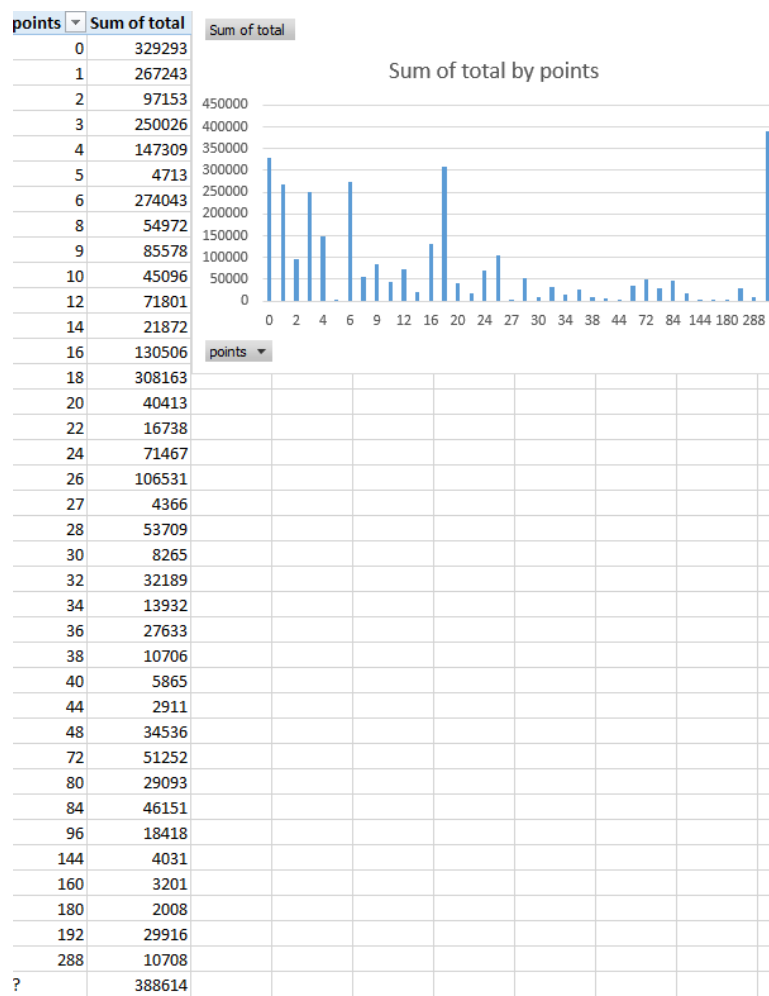


Figure 4.98: Sum of Total by points of difficult 7

TYPE	TROPHY	Graphic Representation
LEVEL	1 to 35	
TIME	Morning 3 days in a row	
	Morning 5 days in a row	
	Morning 10 days in a row	

Figure 4.99: Table of trophies and graphical representation

	Morning 25 days in a row	
	Morning 50 days in a row	
	Afternoon 3 days in a row	
	Afternoon 5 days in a row	

Figure 4.100: Table of trophies and graphical representation cont. 2

	Afternoon 10 days in a row	
	Afternoon 25 days in a row	
	Afternoon 50 days in a row	
	Evening 3 days in a row	

Figure 4.101: Table of trophies and graphical representation cont. 3



Figure 4.102: Table of trophies and graphical representation cont. 4

	Night 3 days in a row	
	Night 5 days in a row	
	Night 10 days in a row	
	Night 25 days in a row	

Figure 4.103: Table of trophies and graphical representation cont. 5



	Night 50 days in a row	
Perseverance	Challenge of the day x 3	
	Challenge of the day x 5	
	Challenge of the day x 10	

Figure 4.104: Table of trophies and graphical representation cont. 6





	Challenge of the day x 25	
	Challenge of the day x 50	
Athletic	Training of the day x 3	
	Training of the day x 5	

Figure 4.105: Table of trophies and graphical representation cont. 7




	Training of the day x 10	
	Training of the day x 25	
	Training of the day x 50	
Warrior	Tournament player x 3	
	Tournament player x 5	
	Tournament player x 10	
	Tournament player x 25	
	Tournament player x 50	

Figure 4.106: Table of trophies and graphical representation cont. 8

Invincible	Winner challenge x 3	
	Winner challenge x 5	
	Winner challenge x 10	
	Winner challenge x 25	

Figure 4.107: Table of trophies and graphical representation cont. 9



	Winner challenge x 50	
	Winner tournament x 3	
	Winner tournament x 5	
	Winner tournament x 10	
	Winner tournament x 25	
	Winner tournament x 50	
Challenges	Hard player x 100	
	Hard player x 500	
	Hard player x 1000	
	Hard player x 5000	
	Hard player x 1000 000	
	Hard player x 7 000 000	
Tournaments	Invincible x 100	

Figure 4.108: Table of trophies and graphical representation cont. 10

	Invincible x 500	
	Invincible x 1000	
	Invincible x 5000	
	Invincible x 1000 000	
Solo game	Champion x 100	
	Champion x 500	
	Champion x 1000	
	Champion x 5000	

Figure 4.109: Table of trophies and graphical representation cont. 11

Chapter 5

Conclusion

3 main topics were covered with this thesis. the first one was the point system of MAK07 that was the door which opens the design of gamification components cross over the full system which was done with test and simulations of different formulas according to the normal behavior of users of MAK07. The second one was the classification of inputs that allows the design of levels of MAK07 and the definitions of requirements for each level. This classification was done thanks to applying a technique of clusterization of the input data finding groups of similar characteristics. The third one was the design and test simulation of a progressive game using an increasing combination of numbers in order to make the game difficulty more progressive.

The design of gamification on MAK07 from a high level point of view was enriched by documenting several use cases, list of requirements, user interfaces and definition of the components.

5.1 Future work

The gamification components designed in this thesis will be integrated in the main game and deploy on the store as soon as possible. As the theory of gamification says about feedback loop, the game will be constantly monitored in order to understand the new motivations and to manage feedbacks of users.

Levels can be increased over the time as well in solo game the stops on the path can be added in order to give more challenges to MAK07 users.

From the architectural point of view, the structure of MAK07 gives the possibility to scale in horizontal way thanks to the technologies of MongoDB and Docker.

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Glossary

Gamification Use of game elements in a non-game context, use of game thinking and game mechanics to solve problems and engage audiences that are not exactly new, use of game elements in a non-game system to improve the user experience, is an informal term for the use of video game elements in a non-game system to improve the user experience and create hitch, integration of game dynamics in a site, service, community, content or campaign, in order that derives participation, is the interaction of game mechanics in a non-game environment to increase the engagement of audience with loyalty and fun . [iii](#), [1–5](#)

MAK07 Math game composed by 7 balls, each ball has a number and have the target of arrive to 1 unique ball with value 0 using basic operations like addition, subtraction multiplication and division. [iii](#), [3](#)

