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| School of Computing  Faculty of Engineering |

Replacing the obsolete ABSP ratings system with an interactive online database

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Submitted in accordance with the requirements for the degree of  
BSc Information Technology

2014/2015

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*<As an example>*

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Type of Project: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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# Summary

Concise statement of the problem you intended to solve and main achievements (no more than one A4 page).

# Acknowledgements

Myself…

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# Background

## Problem

Currently all Scrabble players who are based in the United Kingdom are responsible for collating their own records from matches they have played and from tournaments they have attended. These records are then sent to the ABSP where they are added to the existing records. Player ratings are calculated using a bespoke piece of software which must be manually extracted and uploaded to the website by the records officer.

The player ratings list is the only meaningful information which is published to the website from all of the records that are stored.

The ABSP requires a new system to replace the current obsolete process of calculating player ratings manually. They propose adapting the existing website to dynamically generate player ratings. This new system must also provide players the opportunity to browse their own player record online.

Finally as part of an ongoing effort by the ABSP to keep records as complete and accurate as possible, the new system must also allow users to supply missing records of their own match results using the website.

## Proposed solution

The solution proposed, will be a series of web pages that will read an online records database. The pages will then manage the player ratings list. This solution will also produce pages that will provide users with the ability to interrogate their own records.

The webpages will also make use of the record information that is currently being collected by the ABSP by producing various supplementary views that player’s may find interesting or useful.

The solution will also feature a method whereby a player will be able to submit missing match records to the database using a series of secure web forms.

## Objectives

To achieve the proposed solution the following objectives have been identified:

* Select and adopt an appropriate methodology for developing the software product
* Design a suitable software solution by acquiring knowledge from researching potential approaches to solving the problem
* Design an appropriate user interface for the solution by examining established web development conventions and user interface design principles
* Create a high-fidelity prototype of the proposed solution, which will be supplied with test data to develop functionality and demonstrate the user interface
* Perform a user study to measure the perceived effectiveness of the solution from a presentation and usability standpoint
* Investigate the solution’s adherence to web accessibility guidelines and common user interface conventions
* Evaluate the solution and determine to what extent the requirements of the problem were addressed

## Related modules

Modules that have been studied which are relevant to this project are:

**COMP3442 Usability Design** – The module taught design fundamentals in regards to responsible design practices. The deliverable produced in this project will adhere to strict standards expected of by a professional software release in terms of usability. The deliverable will also comply with modern accessibility requirements.

**FOEN9001 Industrial Placement Year** – This module provided practical experience of working alongside clients to provide software deliverables within tight deadlines. It has also given the opportunity to learn specific technical knowledge of topics relevant to this proposed solution. Namely, front-end development for the web, working with PHP and MySQL databases. Another skill that has been acquired from this module is writing reports tailored for various levels of perceived knowledge. This included non-technical members of the public and senior business managers. This will be invaluable in keeping the report to a correct tone and level of detail.

**COMP2745 Requirements and Evaluation** – The module aided the project in how to identify requirements effectively and will continue to be useful in determining how to evaluate the project deliverable in terms of suitability and adherence to the requirements.

**COMP1745 Web Development** – Web development has provided a good foundation of knowledge for creating responsible content for the web. This includes accessibility needs of users and common practices and approaches. Knowledge gained in this module can be directly applied to producing a deliverable that is of a professional standard.

**COMP1551 Core Programming** – Core programming has provided exposure to a plethora of programming languages and approaches to developing software to provide solutions to numerous diverse problems. The experienced gained from this module will be helpful in understanding how to develop and implement an efficient and effective solution to the problem.

## Scrabble

Scrabble is an American family board game, which was trademarked in 1948 and is currently owned by Hasbro. However the game has gone through much iteration and was originally invented in 1933 by Alfred Mosher Butts under the name of Lexico and later Criss Cross Words.

It wasn’t until Butts met an entrepreneur called James Brunot that the game’s rules and design were refined. It was also then that the name Scrabble was trademarked and the game was widely distributed.

The game uses anagrams created in a crossword puzzle format and is played between two and four players. Players take turns spelling dictionary words on a game board using letter tiles, which are placed either vertically (top to bottom) or horizontally (left to right). Each letter tile also features a numerical value, which determines how many points a letter is worth. Letter tiles values are assigned in a way so that the less frequently a letter is used in the language of the game that is being played then the higher that tile is worth. For example, in the English language the letters Z and Q are examples of the least frequently occurring letters used in words and both reflect this as being worth 10 points in the English language version of Scrabble.

A player receives the sum total of the values of each letter tile used in the construction of a word. The aim of the game is to finish the game with the highest possible score, which is achieved by creating words that either use a large number of letters or that use the tiles that are of a high value.

At the start of the game each player is assigned seven random letter tiles, which they must use to create a word on the board during their turn. Each time a player uses letter tiles to create a word they receive the same number of letter tiles at random at the end of that turn to ensure every player starts their turn with seven tiles. This process continues until there are no more tiles remaining in reserve.

With the exception of the first word played on the board at the start of a match, each new word constructed must contain at least one of the existing letter tiles on the game board. In addition to this, any contact that a player’s letter tiles make with any additional letter tiles must spell a valid word. At no point in a match must an invalid word be created from any move.

Scrabble is sold throughout the world in many formats including the classic board game, junior edition, travel edition and electronic games. In the United States, three out of five homes contain at least one of these iterations. (Scrabble, 2015)

## The Association of British Scrabble Players

The Association of British Scrabble Players (ABSP) is a no-for-profit association formed in 1987 that works to promote the playing of Scrabble. The ABSP is responsible for the provision of a player ratings system for all of its members (Absp.org.uk, 2015).

They also coordinate tournaments for Scrabble players in the United Kingdom. Other focuses of the association are providing support and information for its members and tournament representatives.

The ABSP operates a website which they use to disseminate information to their community such as news articles, tournament timetables, contact details and general content related to the game of Scrabble.

## Competitive Matches

Members of the ABSP take part in sanctioned Scrabble tournaments in which they play competitive one-on-one matches against opponents. It is the outcome of these competitive (or rated) matches that is used to determine a player’s rating within the ABSP. Figure X illustrates the entities that are associated with this and the relationships that are present.

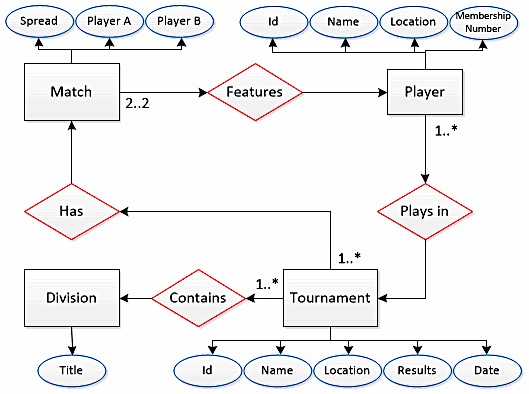


Figure X. Entity relationship diagram representing a Scrabble tournament

For a member of the ABSP to begin to have an official rating they must compete in at least one competitive match at a sanctioned tournament. Once they have taken part in a match they can be considered a player.

A tournament is organized by the ABSP and must contain at least one division. A division is used to separate a large tournament on the basis of certain criteria (see 1.9.2). Also a valid tournament must contain at least one match that each feature exactly two opponents. Competitive rated Scrabble matches are always played between two players.

## Tournament records

The ABSP is responsible for storing and organizing all of their members’ tournament record information. In order to provide a suitable solution for the problem, it is important to understand what types of data is collected and for what purpose.

Every competitive match that takes place at an ABSP sanctioned tournament is recorded including the two players that participated and their respective scores, tournament in which the match took place and a unique identifier.

Each tournament’s is also recorded with a unique identifier, name, date, list of divisions and location. In addition to this a roster of all players that are registered for the tournament is created and a seed number is assigned to each player based on their respective ratings with the highest rated player receiving the seed number of one and the next highest receiving two. This continues until the each player with the seed increasing each time. The order of each player’s finishing position within a tournament is also stored. The performances of players are used to determine their player ratings.

## Player ratings

A player rating is a calculated score that is derived from a player’s performances in competitive one-on-one Scrabble matches at tournaments that have been officially sanctioned by the ABSP. These ratings are essential to the associations operations and will need to be generated using the new system.

### Player rank

Players are ordered by their player ratings in descending order with the highest rating receiving the highest rank of 1 and each subsequent player rating receiving the next rank in increments of 1.

In the event of two or more players having identical player ratings all players would be assigned the rank they would have been assigned had their players ratings been distinct and share the rank. The rank assigned to the player with the next highest rating would skip the rating numbers that would have been assigned to the players with identical player ratings had their player ratings been distinct (e.g. if Player A and Player B are both assigned the joint rank of 5 and Player C was the next highest rated player then Player C would receive the rank of 7).

Player ratings are primarily used to determine the rank order of all of ABSP members based on their most recent form. In addition to this, player ratings serve other important functions.

### Tournament divisions

Tournaments that feature a large pool of participants are split into divisions to ensure that each player participates in a reasonable number of games. The player ratings are used to determine certain entry criteria for divisions. This can include, a minimum player rating, a maximum player rating and also a player rating between to numbers.

In the event of a multi-divisional tournament it is prudent to make every effort to ensure that players of similar ability are assigned to the same division. Scheduling a novice player to face a high-ranking opponent would provide no benefit to either individual in terms of development and in all likelihood not prove a competitive match.

### Award considerations

Player ratings are also used in identifying whether a member of the ABSP has achieved a level of excellence, which qualifies them for a title. The two possible titles are Expert and Grandmaster. To first register for consideration a player must play at least 30 rated Scrabble matches during a calendar year.

To attain the status of Expert they must satisfy one of the following three conditions throughout a five-year period:

* Achieve player rating of 180+ on three separate occasions
* Achieve player rating of 170+ on five separate occasions
* Maintain an average of 175+

For them to reach the status of Grandmaster a player must satisfy one of the following three conditions throughout a five-year period:

* Achieve player rating of 190+ on three separate occasions
* Achieve player rating of 180+ on five separate occasions
* Maintain an average of 185+

The Most Improved Player award is presented to the player who achieves the greatest positive difference between their player rating at the start the year and their player rating at years end. To be eligible for the award a player must play at least 30 rated matches during that given year.

Finally, the Highest Rated Player trophy is awarded to the ABSP member with the highest player rating at the end of each year.

### World Scrabble Championships

Player rating is a contributing factor in whether a player can be considered for a nomination to attend the World Scrabble Championships, as a rating is a direct interpretation of how well an individual has performed in their most recent matches. And as only leading scrabble players are given the opportunity to enter the event, the player rating is an important indicator of a player’s suitability.

## Calculating player ratings

Since January 2011 the ABSP has employed a Weighted Rolling System to calculate its members player ratings. This system is the culmination of a long process of periodic improvements. The steps of the calculation process have been refined over time to produce player ratings that place increased significance on a player’s most recent match form and in turn are affected less by older match results.

### Pre-1999

The first iteration of this system was used up until January 1999. This initial process formed the foundation, which all other improvements have built upon (Absp.org.uk, 2015).

A player’s rating is calculated by first examining every on of their match results from each tournament they attended for the current calendar year and award them score of rating points for each record based on the outcome of each match. Each match outcome results in one of the following scores being awarded to the player:

* If the player is victorious against their opponent they receive an amount of rating points equal to that of the rating of their opponent at the time of the match plus fifty
* If the player is defeated by their opponent they receive an amount of rating points equal to that of the rating of their opponent at the time of the match minus fifty
* If the result of the match is a draw the player receives an amount of rating points equal to that of the rating of their opponent at the time of the match

One further consideration must to be taken into account when performing this step of the calculation. Whereby, if the distance between the player’s and their opponent’s ratings at the time of the match exceeds plus or minus forty, the opponents rating will be raised or lowered to ensure the distance between the player’s and the opponent’s rating never exceeds plus or minus 40. The player then receives their opponents altered rating as rating points.

An example of this would be Player A has a rating of 140 and Opponent B has a rating of 90. As the distance between the players is 50, Opponent B’s rating would be raised to 100 to ensure that the distance does not exceed plus or minus forty. Player A would then receive 100 rating points instead of 90.

The final step of the process is to sum all of the rating points awarded from each match result. That number is then divided by the total number of match records, which produces the player rating for that individual.

Although this system provided a fair indication of a player’s performance it lacked the ability to show that the most recent form of a player should hold more significance. In addition to this, often calculating a player’s rating could be needlessly inefficient as some players amass hundreds of match records over the course of a year and the system would examine every record from that period (Absp.org.uk, 2015).

### 1999-Present

From 1999 it was decided that the ABSP would adopt the Weighted Rolling System, which uses the same processes as the previous system along with new features that addressed previous systems shortcomings.

Firstly, the match records, which are used in the calculations of a player’s rating, were limited to the 150 latest to emphasize the focus on recent form being a key factor in determining ratings. This change helps to remove the dependency of an entire year’s worth of records for calculations. This number was originally changed to 100 latest matches. This was increased to 150 in 2011 following a revision of the process.

The second change saw the calculation process augmented to incorporate a weighted sum. A player’s 150 latest records were processed in the same fashion as the old system and rating points were assigned based on the outcomes of the matches.

Weights were then added to match records starting with 225 being assigned to the most recent record and continuing, decreasing in number by one for each record until the oldest record is assigned 76. These weights place more importance on the most recent matches and an ever-diminishing importance on matches that happened further in the player’s record history.

The next step of the new system was to group all match records by tournament venue and combine all rating points for each grouping. Then for each tournament grouping the combined rating points are then multiplied by the average of all the weights assigned to those matches giving the number of weighted rating points for those tournaments.

The sum of all weighted rating points is then divided by the sum of all weights (which will always be 22,575 when all 150 records are available), which produces the player rating which is then rounded to the nearest whole number.

# Requirements

The requirements that the software solution will aim to satisfy are as follows:

* Implement an online records database to replace the current offline solution
* Calculate player ratings using the online records database
* Produce a series of webpages to be displayed on the ABSP website that will read the online records database records and display meaningful information to users
* Provide a secure means by which a player can provide match results using the ABSP website. This includes new results and amendments to existing records.

# Project management

To ensure that the development of the software solution is conducted and controlled effectively it requires project management. Project management is a growing field and as the filed has grown, so too has the amount of diverse ways in which it can be applied (Meredith and Mantel, 1995).

Project management employs methodologies, which have been developed across many business domains. A methodology can be explained as a model, which is used in the management of a project’s processes.

Broadly speaking, models can be classified as belonging to one of three categories. The first is linear, which is a sequential model that focuses on the completion of stages that lead to the next stage. The second category is often called iterative. This is characterized by constant revisiting of stages throughout a projects life cycle, which promotes constant improvement. The final category is an amalgamation of the two previous categories. The main focus of which is that development takes place much like and iterative approach yet is organized in a way, which processes can be halted at certain points as is with a linear approach (Ruparelia, 2010). This software development process will adopt the most suitable methodology by analyzing prominent approaches.

## Linear

Waterfall is the most common linear approach. Sometimes referred to as cascade method, it operates by breaking the development of a project into discrete stages which are undertaken in a specific order where each stage is dependent on the completion of the previous stage (Ruparelia, 2010).

The main benefit of this approach is that it is highly structured and the linear approach can greatly improve the organization of a project as it is separated into separate reasoned stages. This can help with identifying milestones that help with tracking progress of development (Hughey, 2015).

A drawback of this approach is as each stage of the project is dependent on the completion of the previous stage it does not accommodate returning to a previous stage. Each stage should have completion dates associated with them. Any revisiting of a stage after its completion date could be viewed as a delay in the project.

## Iterative

An advantage of an iterative approach is that it allows for constant improvement of the project as the whole processes is repeated constantly. Each one of these iterations can be thought of as a mini-project each with its own complete set of phases (Mantei and Teorey, 1988). In a software project, this can allow for features or functionality to be introduced as and when they are completed.

On the other hand, constantly seeking to improve the product could lead to a delay in the overall span of the project if not properly managed.

## Incremental

Incremental delivery can be described as offering the strict planning and processes of the Waterfall model incrementally (Pressman, 2005). This approach allows for advantages of both linear and iterative methods, as the structured approach to processes is present throughout the development and improvements can be made due to multiple iterations.

This method requires a great amount of planning and design to implement so therefore may not be appropriate for small or short projects. As it incorporates Waterfall into its process it requires all the planning of the overall system to be in place prior to the start of development. As many software projects have changing requirements it cannot always be applied (Kostigoff, 2015).

## Methodology selection

An incremental approach to project management will be adopted for this project’s development as it adopts the positive aspects of both linear and iterative approaches.

This project will benefit from the structure of a linear methodology as the requirements of the project have already identified which will allow for clear planning. The iterative aspects of the approach will allow for further refining of the features of the solution. As the development of the dynamic web content continues during the development of the solution, it will be easier to introduce working features as they are completed rather than having to wait until all features have been finished.

In regards to addressing possible shortcoming of this approach, the project is of a sufficient scale to justify the amount of planning and design that must be undertaken to facilitate a incremental delivery.

## Schedule

Figure X shows the timeline of the project. Each task has been allocated sufficient time for completion and any overlapping of tasks should not occur with exception of the report itself as it will be an ongoing process until the project deadline.

The schedule is robust enough to accommodate minor changes to the overall plan. However every effort will be made to ensure the schedule is followed as strictly as possible.

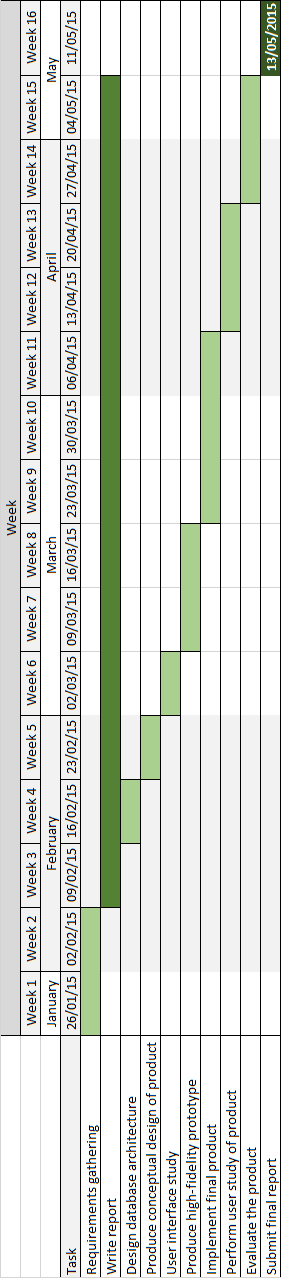


Figure X. Gantt chart of project plan

# Design

## Database design

### Database constraints

The new online database that the software solution requires was to be supplied by the ABSP. The tables and columns had been decided and the solution must be designed to accommodate these constraints. Any recommendations for adjustments to the design of the database would be considered. However, given the limited span of the project it was decided that time was better spent on other areas.

### Current database

The solution that the ABSP employs to store records and calculate player ratings is an offline MySQL database made up of numerous tables. At no time during this project was access given to this database. It was understood that all data stored in this database would be migrated into the new database that is to be used as part of the software solution.

Any data received as part of the development of the project was presented in the form of the new database architecture.

### Database selection

The solution will use an online MySQL database that will be managed and hosted by the ABSP.

It can be argued that MySQL was chosen as the relational database management system (RDBMS) due to its suitability in the context of satisfying the ABSP’s needs as a not-for-profit organization.

MySQL can be used for free by an organization such as the ABSP as its source code is available under the GNU General Public license, meaning that the ABSP will not need to purchase any proprietary software to implement their database.

MySQL is considered to be one of the easiest database management systems to setup and administrate (DuBois, 2005). This is an important factor to take into account as the ABSP does not employ a specialist to manage their website or current database. So any specialist setup or maintenance may incur additional cost.

The choice of a MySQL database is commonly found on projects of this type in which dynamic web pages are developed using databases.

A MySQL database is the common choice for a software solution of this type. It can be used in combination with a web server to create the dynamic web content that is required by the project (DuBois, 2002). The software solution will need to read and write to the database via webpages and MySQL offers that functionality.

Proprietary alternatives to MySQL exist which would be applicable to this type of project such as IBM DB2, Informix or Microsoft SQL Server. However these systems cost money to acquire licenses or hardware to implement. This would not be appropriate for this project as besides the costs associated; a large system is not needed at this stage.

Open-source alternatives to MySQL and the closest match in terms of functionality is PostgreSQL. PostgreSQL actually offers more functions than MySQL. That being said, it is yet to match MySQL in terms of speed or stability. In addition to this, MySQL demands less in terms of hardware dedication (Kofler, 2015).

MySQL would appear to be the correct choice for this project due to its lack of cost, relatively high performance, good core stability, ease of installation and low maintenance needs.

### Provided tables

Figure X shows the database tables that have been selected and supplied by the ABSP that must be used as part of the software solution.

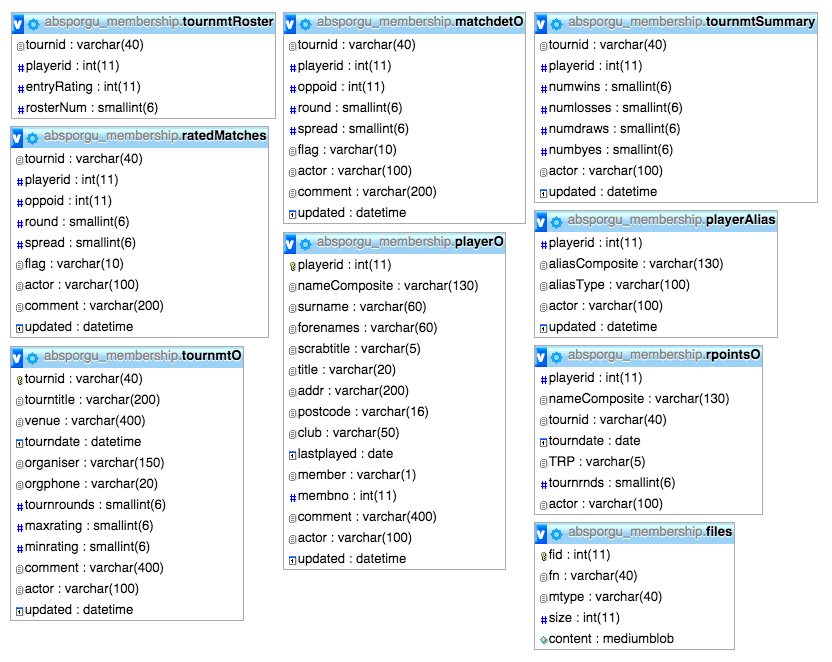


Figure X. The absporgu\_membership database tables supplied by the ABSP

Below is an explanation of the tables and their significance to the software solution:

**tournmtRoster** – Stores records of each player roster of every tournament division. Each record contains the following:

* tournid – Identifies a tournament and its particular division
* playerid – Identifies a single player record
* enrtyRating – The player rating of the individual at the time of the record
* rosterNum – A sequential number assigned to every record with a common tournid

The entryRating of each player will be used in calculations to determine the amount of rating points that are awarded in calculating player ratings.

**ratedMatches** – Stores the record of each rated match that has taken place at every sanctioned ABSP tournament. Each record contains the following:

* tournid – Identifies a tournament and its particular division
* playerid – Identifies a single player record
* oppoid – Identifies a single player record
* round – Indicates which round the match occurred in the tournament division
* spread – The points scored in the match by playerid minus the points scored by oppoid

It is noted that flag, actor, comment and updated are used by ABSP for administrative purposes and are deemed not part of this project.

The spread of match records could be considered a useful piece of information that a player may want to examine when looking at their match records.

When examining the ratedMatches table it is apparent that for each match record there exists two entries where both players involved are assigned the role of playerid and oppoid. For example, for a match at Tournament A between Player A and Player B two records exist. One where playerid is that of Player A and the oppoid is that of Player B and another where playerid is that of Player B and the oppoid is that of Player A. This poses a problem of redundancy as changes made to the first record would also need to be made to the other.

**tournmtO** – Stores each record of every sanctioned tournament. Each record contains the following:

* tournid – Identifies a tournament and its particular division
* tourntitle – Is the name of the overall tournament
* venue – Identifies the location geographically of the tournament
* tourndate – Identifies the date the tournament took place
* organiser – Is a name of the individual who organized the tournament venue
* orgphone – Is a contact number stored for the organizer
* tournrounds – Identifies the number of rounds that the tournament division contained
* maxrating – identifies the maximum allowed player rating that the tournament division would allow to compete
* minrating - identifies the minimum player rating required to compete in that tournament division

It is noted that actor, comment and updated are used by ABSP for administrative purposes and are deemed not part of this project.

The tourndate and tournrounds will be used in calculating player ratings as only the most recent records are taken into account and weighted sums involve knowing the chronological order of rated matches.

**playerO** – Stores a record each registered member of the ABSP. This table also includes past members. Each record contains the following:

* playerid – Identifies a single player record
* surname – Is the surname of the member
* forenames – Is the first and middle names of the member
* scrabtitle – Identifies any titles that a member has been designated (e.g. Expert or Grandmaster)
* title – Accommodates the inclusion of a formal title (e.g. Mr, Mrs or Dr etc.)
* addr – Is the address on record for the member
* postcode – Is the post code on record for the member
* club – Is a the regional club that a member is associated with. In lieu of a club a location like a town or city is used
* nameComposite – Is a composition of forenames, surname and scrabtitle
* member – Indicates if an individual is an active member
* membno – Indicates the members assigned membership number

It is noted that actor, comment and updated are used by ABSP for administrative purposes and are deemed not part of this project.

Much of the playerO table is needed in development of the software product, as these player records will provide meaning to information to pages.

As a security precaution, the addr column had been redacted from any data records received by the ABSP so at no point were members contact addresses at risk of being released.

**tournmtSummary** – Stores a summary of each members match records for every tournament division they have competed in. This table also includes past members. Each record contains the following:

* tournid – Identifies a tournament and its particular division
* playerid – Identifies a single player record
* numwins – Identifies the number of wins the player had in the tournament division
* numlosses – Identifies the number of losses the player had in the tournament division
* numdraws – Identifies the number of draws the player had in the tournament division
* numbyes – Identifies the number of matches in which the player advanced due to an opponent not being present

It is noted that actor and updated are used by ABSP for administrative purposes and are deemed not part of this project.

Much of this table is needed to develop an effective solution as these records can be used to present meaningful information to players. For example, a sum of all wins, losses, draws and byes for every record of single player will provide the amount of rated matches that a player has had in their history.

### Unused tables

The following tables are not used as part of the project. However, are included in software product files as they form part of the absporgu\_membership database that the ABSP has provided.

**matchdetO** – This table is not needed as part of the project and was deemed out of scope.

**playerAlias** – This table stores any previous aliases used by ABSP members for historical record purposes.

**files** - This table is not needed as part of the project and was deemed out of scope.

### Additional tables

To provide a secure means by which a player can submit tournament records the database will require a table to store login credentials that will be used by the website to determine if an individual can access secure pages. The absporgu\_membership database supplied by the ABSP does not include any such table.

The project will include an absp\_users table, which will store credentials login for every member of the ABSP. Every record of username and password record will each be associated with the distinct playerid of every ABSP member.

A userRole will also be included to determine what type of permissions a registered user will have. Players will be assigned the role of Player, which will provide them with the ability to add or edit tournament records that correspond to their playerid. The ABSP representatives charged with curating the new ratings system will be assigned the role of Administrator. This will allow these users with the functionality to add or edit any record in the system.

Finally, the ability to lock accounts will be a feature of the design. This will ensure that access to secure areas of the site can be closely controlled. For example, a user’s account could become locked after a pre-determined number of incorrect login attempts are made using that account’s username.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **playerid** | **username** | **password** | **userRole** | **accountLocked** |
| 2191 | john\_doe1 | johnDoePass | Player | FALSE |
| 101 | luke\_freeborn1 | Frizbee1986 | Administrator | FALSE |
| 202 | john\_smith22 | hardpassword#1! | Player | TRUE |

Figure X. Design of absp\_users table

## Interface design

### Background of interface design

### Interface study of similar systems

# Implementation

## Justifications

# Evaluation

## User study

## WCAG evaluation

# Conclusion

## Reflection on project processes and outcomes

## Future development

# List of References

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# Appendix A - External Materials

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# Appendix B - Ethical Issues Addressed

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