CHAPTER 6 DISCUSSION AND CONCLUSION
The final chapter for this documentation is discussion and conclusion. There are a few main topics that will be discussed in this chapter. Some of the topics are:-

- Problem Encountered and Solutions
- System Evaluation
- System Applications
- Conclusion

6.1 Problem Encountered and Solutions
There are a lot of problem encountered when developing this Dragon Sudoku system. Although there are a lot of problems and obstacles, all of the problems can be solved successfully with the best solutions. A lot of precious experience has been gained by solving the problems. The problems will be explained in details in the following section.

6.1.1 Use of New Development Tools
The Dragon Sudoku is developed using development tools called XAMPP server. A lot of studies and researches have been done to determine the most suitable programming tools to develop the system. The server XAMPP using is Apache Server. Apache Server is an open-source server and has the ability to support a large number of system platforms. The database XAMPP using is MySQL. The programming language chosen is PHP. There are some problems encountered when installing XAMPP server. It is due to the conflict on the IIS that currently running on the computer. This problem is solved by disabling the IIS and preventing it from being started up when the computer boots.

Another problem that occurs from using the new development tools is send email function in XAMPP. There has problems send emailing notify user on latest update on Dragon Sudoku. The solution for this problem is use another email server called phpmailer to solve the problem.

Another new development tool that we are using is Adobe Photoshop CS. We need a lot of time to master the Adobe Photoshop CS.

6.1.2 Lack of Programming Skills
Since we only have the basic knowledge in PHP, a lot has to be learned by ourselves in order to develop a complex system. We do not have any experience in developing online Sudoku Game. So this is the first time we develop an online Sudoku Game in PHP. The solution is we learn the language from basic and use internet as a reference to search for any bugs occurs in using PHP to develop the system. It takes us a lot of our time to master the PHP.
6.1.3 Poor Programming Techniques
Poor programming technique is another problem that resolves from lack of programming skills. Since we have basic knowledge in PHP, the programming technique that we are using is very basic. There is no advance programming technique that we use. As long and long we develop the program using PHP, we have some programming techniques that can do the same functions but using less line of code compared to the earlier coding we have done.

6.2 System Evaluation
System evaluation is performed to evaluate the system suitability against system usability specification. [Ian, S., 2004].

For Dragon Sudoku system evaluation, a total of 20 questionnaires have been distributed to random users. The main purpose of this questionnaire is to determine the overall functionality and user satisfaction on Dragon Sudoku Online Game. Feedbacks collected will be used as future implementation to improve the current Dragon Sudoku Online Game. After the questionnaire has been distributed and collected, the answers given by the respondents is analyzed. Total respondents for this questionnaire are 20.

6.2.1 System Strengths

6.2.1.1 Security
Dragon Sudoku requires users to login before they can use the system. Basically, Dragon Sudoku has two main users role. One of the users’ roles is player. Another user role is administrator. Administrator can modify all player details while player can only modify his/her own details. So, the access control role has been implemented in Dragon Sudoku as administrator and player will access and perform different functions.

6.2.1.2 Dynamic generated Sudoku puzzle
The generated Sudoku puzzle is unique and original because each puzzle is generated from the system on demand. The system does not copy existing puzzles from internet or choose from a fixed amount of existing puzzles. As a result, user is able to play an endless amount of new puzzles with no repeating puzzle from the previous puzzles. Users will not getting bored easily if solving different Sudoku rather than solving the same Sudoku puzzle.
6.2.1.3 Print Sudoku puzzle

Last but not least, another feature that makes this system significant is the Sudoku puzzle that has been generated by the system can be printed out with the answer provided along for publication purposes. User can choose to print either answer or solution of the puzzle.

6.2.2 System Weakness and Limitations

6.2.2.1 Player cannot customize the layout of web site and interface design of game

The interface design and layout of the game is fixed. So, user cannot customize the layout of web site and interface design of game. In addition, the sound effect and music of the game are also fixed. User only can listen to a set of predefined music. User cannot choose music user desire and upload music to the system to listen while playing the game.

6.2.2.2 The web site and the game application only support the language of English

Currently, Dragon Sudoku only supports English language. So it is a English-based system.

6.2.2.3 User can only play a Sudoku Game at one time.

Dragon Sudoku only allowed user to play a Sudoku game at one time. User can choose to play again or play other types of Sudoku once user has finish playing the current game and the game has ended. In other word, Dragon Sudoku does not support concurrent Sudoku Game running at a same time whether it is in Single Player Mode or Multi Player Mode.

6.2.2.4 Multi Player Mode does not support print features

Currently, user only can print the puzzle and solution in Single Player Mode.
6.2.3 Future Enhancements and Expansions
Although Dragon Sudoku system has been completed and the system has fulfilled all its objectives and project scope, there are many future enhancements and expansions that can be done to this system to make this system better than the existing version. In addition, future enhancements and expansions can be done on all existing system limitations and constraints.

6.2.3.1 Player can customize the layout of web site and interface design of game
The interface design and layout of the game is dynamic. This means user can customize the layout of web site and interface design of game as user wishes. In addition, the sound effect and music of the game are also can be choose and changed at user will. User can choose music user desire and upload music to the system to listen while playing the game.

6.2.3.2 The web site and the game application able to support the language of Malay, English and Chinese.
Currently, Dragon Sudoku only supports English language. Future enhancements will be done so that Dragon Sudoku is able to support multiple languages such as Malay, English and Chinese.

6.2.3.3 User can only play more than a type of Sudoku Game at one time.
Dragon Sudoku will allow user to play more than a type Sudoku game at one time in the future. In other word, Dragon Sudoku able to support concurrent Sudoku Game running at a same time whether it is in Single Player Mode or Multi Player Mode.

6.2.3.4 Multi Player Mode support prints features.
Currently, user only can print the puzzle and solution in Single Player Mode. Future enhancements will be made so that user can print the puzzle and solution in Single Player Mode and in Multi Player Mode.

6.3 System Applications

6.3.1 Usefulness of the System
Dragon Sudoku is a web-based system that enables users to play Sudoku game online instead of using the traditional ways such as using pencil and pen to play it in a piece of paper.

This Sudoku Online Game is built in order to make user has an easier way to solve the puzzle compare to traditional method. This system has 1 major significant compared to normal Sudoku game. The major significant is this online game is able to support multiplayer game among two users. Two users can choose the game variant and play with each other instead of playing alone.
Other than that, this system will automatically check whether the value input by user correct or not on the spot. It will deduct the mark if user enters the wrong value. This makes the game more interactive and interesting.

In addition, this system has the ability to generate an endless supply of random, unique, original Sudoku puzzles. As a consequence, none of the Sudoku puzzles will be repeated for the same time. Users will not getting bored easily if solving different Sudoku rather than solving the same Sudoku puzzle.

Last but not least, another feature that makes this system significant is the Sudoku puzzle that has been generated by the system can be printed out with the answer provided along for publication purposes.

6.3.2 Benefits Gained
As a result of this system, users can manage their Sudoku Game statistic more efficiently and be able to keep track of the game progress easily as well as playing the game.

6.4 Conclusion
As a conclusion, this system is a web-based system that is useful to any range of age and gender who are interested in playing the Sudoku game and users who wish to generate the puzzle for publication purpose.

6.4.1 Knowledge and Experience Gained
Throughout the development process Dragon Sudoku, a lot of precious knowledge and experience has been gained. Programming skills and programming techniques have been greatly improved when developing this system. My understanding in PHP, JavaScript and HTML has been improved tremendously.

6.4.2 Communication and Presentation Skills
Throughout this project, we have 2 presentations which will evaluate our presentation skills and also the communication skills. From the first presentation during thesis 1, we have already known what our weaknesses in our presentation skills are. With this, we have to improve our presentation skill during thesis 2 presentation, and make sure that the content of the presentation is successfully delivered to the audience in the second presentation and also other presentations in future.
6.4.3 Project Outcome
The main project outcome is the Dragon Sudoku System that can enable users to learn the logic of number concept using the Sudoku Game.