Minesweeper

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1. Introduction [1]-

Minesweeper is a simple one−player computer game commonly found on machines with popular operating systems such as Linux or Microsoft Windows. The game consists of a 2-dimensional rectangular playing field (or board) where some known numbers of mines have been hidden. Initially, all the squares on the board are "covered up" and no information is given to indicate the location of the mines. The player's job is to either deduce or guess which board squares are clear of mines and step there to reveal a number. If successful, this number will indicate the number of mines to be found in the squares adjacent to the square with the number. Obviously, the first move of the game must be a guess because no information has been provided. Since the board is a rectangular grid, each interior square has exactly 8 neighbouring squares, edge squares have 5 neighbours, and corner squares have 3 neighbours. Therefore, the number found under any given square will be in the range of 0 to 8 (inclusive). Game play continues until the player has uncovered (or "stepped" on) each square that does not hide a mine, while avoiding all the mines. If the player can do this, they are considered to have won the game. However, if at any point the player attempts to uncover a square that contains a mine, the game immediately ends, and the player is said to have lost.

2. Literature Survey [2]-

- **Using Games to Teach Cognitive Skills** The use of games to attempt to teach cognitive skills goes back to ancient times. It is thought that the game now known as "Go," is possibly one of the first games that were used to teach mental ability. Chess also has a history of being used to teach thinking, one legend suggests that the philosopher Phallometer created the game in the late middle ages to teach the king to live a virtuous life (Adams, 2006). While Chess likely existed previous to the time of this legend, the legends about Chess and Go both show that people have believed that these games had the ability to help a person learn things beyond the game itself. Several studies with chess suggest that learning chess can help with math ability, although a study by Thompson (2003), which controlled for IQ showed no scholastic improvement. Further, research by Horgan and Morgan (1988), suggests that spatial abilities are more correlated to chess playing abilities than logical abilities. The game Minesweeper, and its variants, in contrast to many of the other games studied for cognitive effects, is recognized to utilize direct logical thinking.

- **The Value of Logical Hypothetical Thinking** -Wilson and Conyers suggest that Hypothetical Thinking is a "Cognitive Asset," which they define as skills that are related to thinking which are of extraordinary value. Wilson and Conyers have defined 26 such assets that they believe are important for students to gain executive intelligence. Wilson and Conyers define the cognitive asset of Making Inferences/Hypothetical Thinking as "The ability to solve 9 problems and create new information by making inferences based on the information given. Hypothetical reasoning is a central topic in cognitive science and is a major component of what is known in Dual Processing Theory as Type 2 Processing done by our brains. Type 2 processing is what allows us to generally analyse possibilities and make rational decisions, compared to what is usually our default thinking, which is called Type 1 processing. Type 1 processing is fast and automatic, but often leads to wrong conclusions. Research is showing that instrumental rationality, defined as behaving in the world so you get what you want given your resources, is reliant upon Type 2 processing, and having good logic skills combined with specific types of thinking dispositions.

3. Problem Domain-

In the lockdown many people were facing the issue of boredom to help them to utilise their time and increase their logical thinking.

4. System Domain

Table below shows the tools, technology, environment, platform and hardware/ software specifications needed for implementing the 'Minesweeper Game': -

Tool/Technologies	Description/Justification
Operating System	**Any modern OS can be chosen for development of Minesweeper Game.**
MySQL	**MySQL is to be used as a database to save the login credentials of a user and their respective data.**
JDBC	**JDBC makes it possible to establish a connection with a data source and extract data from a database.**
Hibernate	**Primary feature of hibernate is mapping from Java classes to database tables, and mapping from Java data types to SQL data types.**
HTML, CSS, JavaScript	**Front-End of application is to be developed using HTML, CSS and JavaScript.**
Java	**To implement the project, Java was chosen as a platform for its more interactive community and lots of libraries.**
IntelliJ Idea	**IntelliJ IDE is to be used as the main development tool to develop this project.**
Web Browser	**Minesweeper Game can be developed and tested with any of the modern web browsers.**

5. Application Domain-

In recent years, the use of mobile applications and computer-based games as pedagogical tools has become more and more popular. Additionally, many people are facing the problem of boredom to help them utilise their time or to eliminate the feeling of boredom.

6. Expected Outcome-

Several studies have found a positive correlation between a student's mathematical background and their success in an introductory college level computer science course. Specifically, Konvalina, Wileman, and L. J Stephens (1983) found that mathematical reasoning, including logical ability, was a key factor in predicting the success of Computer Science students. It should be noted that a Computer Science course is generally at a higher mathematical and logical level than an introductory computer literacy course. Most literature about computer literacy has focused on attitudes and not pre-requisite skills or aptitudes, and not on skills. The previous successful use of Minesweeper to assist in teaching logical proofs, and the importance of logic in hypothetical thinking and computer usage, suggests that learning Minesweeper may inherently help people to improve their hypothetical thinking and computer usage.

7. References-

1. Minesweeper as a Constraint Satisfaction Problem
2. Minesweeper and Hypothetical Thinking Action Research & Pilot Study (ed.gov)
3. Wikipedia
4. Playing Minesweeper
5. Learn Playing Minesweeper