

# CS 101

## *Project Manual*

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## **ACKNOWLEDGEMENTS**

We would like to thank the following for our project; for helping us:

- God, without whose grace anything is impossible
- Professor D B Phatak, for teaching us the course so well. Hats off to you sir!
- Our T.A. Apekshit Sharma (aka Appy), for helping us out whenever we needed him. We believe there wasn't a single occasion where he wasn't there to help us.

## INTRODUCTION

In this project we have attempted to make a gaming interface, which include three games, which are as follows (in alphabetical order):

1. Chess
2. Minesweeper
3. Snakes

The work among us has been divided by making three subgroups, one in order to make each game. These are described as follows:

*Chess:*

- **Ayush Kanodia**
- **Bhaskar Sharma**
- **Parth Chaudhuri**

*Minesweeper:*

- **Bhavesk Khandelwal**
- **Bhavya Senwar**

*Snakes:*

- **Avanesh Kumar**
- **Parth Dalal**

The interface will be completed once the three games are completed.

The individual introductions of these follow.

**Chess:**

Chess is a two-player board game played on a chessboard, a square-checkered board with 64 squares arranged in an eight-by-eight grid. It is one of the world's most popular games, played by millions of people worldwide at home, in clubs, online, by correspondence, and in tournaments.

Each player begins the game with sixteen pieces: one king, one queen, two rooks, two knights, two bishops, and eight pawns, each of these types of pieces moving differently. Pieces are used to attack and capture the opponent's pieces. The object of the game is to checkmate the opponent's king by placing it under threat of capture ("check") which cannot be avoided. In addition to checkmate, the game can be won by the voluntary resignation of one's opponent, which may occur when too much material is lost, or if checkmate appears unavoidable. A game may result in a draw in several ways, and neither player

wins. The course of the game is divided in three phases. The beginning of the game is called the opening (with the development of pieces). The opening yields to the phase called the middlegame. The last phase is the endgame, generally characterised by the disappearance of queens.

In this program, we attempt to simulate the game of chess, between two players, using the c++ programming language, and to make it as interactive as we can.

The creation of chess requires two distinct jobs; the algorithmic and the graphical aspect, which has been mutually divided among the team members.

#### *Limitations:*

We as a team have attempted to simulate all features of chess as far as possible. Apart from the basic feature of chess already being covered, i.e. the definitions of moves of the various pieces and the legitimacy of any move, chess has many special features which are non-trivial and time consuming to simulate. Some of the important ones among these are namely,

1. End of game condition,
2. Prevention of a move which places the king into check,
3. Stalemate,
4. Castling,
5. El passant,
6. Pawn promotion,
7. Three fold repetition and
8. Various conditions for a draw.

Out of these, condition '1' has been implemented partially, condition '6' fully, and we are trying to cover as many of the rest of the cases as possible, with as much rigor as our limited time can afford us. Any other special features' inclusion in our program has not been considered as of now, although this possibility hasn't altogether been ruled out. Nevertheless, since the basic features of the game are on track, the game can, in general be played without hassle. We hope that we are able to cover most cases to a reasonable extent, so that the users can utilize and enjoy our work.

For a more detailed introduction to chess as well as the formal rules of the game, please refer to Appendix '1'.

#### *Minesweeper:*

Minesweeper is a single-player video game. The object of the game is to clear an abstract minefield without detonating a mine. The game has been written for many system platforms in use today.

Minesweeper cannot always be solved with 100% certainty, and may require the occasional use of probability to flag the square most likely to have a mine. In other words, one must sometimes guess to solve a minesweeper puzzle.

The game is developed using basic c++ programming and a logic to implement the functioning.

#### *Limitations:*

1. The game is sufficient in basic gaming but lacks for the users trying harder ones, that is the game does not includes different difficulty levels for the player playing the game.
2. The game does not include high graphics.
3. There is no animation for bomb explosion.

The complete rules of the game of minesweeper have been appended in Appendix '2'.

#### *Snakes:*

*Snake* is a video game that originated during the late 1970s in arcades and has maintained popularity since then, becoming something of a classic. After it became the standard pre-loaded game on Nokia phones in 1998, Snake found a massive audience.

The player controls a long, thin creature, resembling a snake, which roams around on a bordered plane, picking up food (or some other item), trying to avoid hitting its own tail or the "walls" that surround the playing area. Each time the snake eats a piece of food, its tail grows longer, making the game increasingly difficult. The user controls the direction of the snake's head (up, down, left, or right), and the snake's body follows. The player cannot stop the snake from moving while the game is in progress, and cannot make the snake go in reverse.

All this basic features have been included in the game made by us.

For more details on rules of the game, please refer to Appendix '3'.

## FUNCTIONAL SPECIFICATIONS

The basic functional specifications require that inputs shall be taken from the mouse and keyboard, as and how the user responds to situations in the game which is being played. The user shall then see output (or the results of his actions) on screen and in a reasonably standard format. More details on each of the three games follow:

### *Chess:*

The program objective, of course is to simulate the game of chess on screen. It gives the users an interactive interface to play and enjoy the game of chess.

The user shall provide information to the computer about his choices during gameplay using the mouse by clicking in suitable regions of the gaming screen after reading the instructions which shall continually be appearing on the screen, and certain conventions which have been used in order to decide in order to convey specific meanings which have been detailed in the description of input and output. The game ends when a suitable error message is displayed.

### *Minesweeper:*

The game functions in a very user friendly manner, it takes input from mouse by clicking on the desired box to flag it or to open it. The player should click on the desired box by left clicking to open it or right clicking to flag it. The flag can also be removed by again right clicking on the box.

### *Snakes:*

The program objective, of course is to simulate the game of snakes on screen. It gives the users an interactive interface to play and enjoy the game of snakes.

The user shall control the snake by using the arrow keys on the key board. The game ends when the snake hits itself or the wall. The user can also end the game at any time by pressing the escape key.

## DESCRIPTION OF DATA (INPUT/ OUTPUT)

In general, Input and output are standard and as expected, with slight modifications from what might be seen by the user. These have been specified as follows:

### *Chess:*

Input: the inputs comprise of the user telling the computer the pieces which he/she wishes to move. The method to do this has been elaborated in the User Interface Requirements.

Output: the output of course is the state of the game at any point in time as well as specific messages conveyed by the system to the player(s). These also have been elaborated on in the section User Interface Requirements.

### *Minesweeper:*

Input: the input is taken by the mouse telling him to open the box the box by clicking on it.

Output: the output is given on the screen by opening the box or flagging it. The game winning and over notice is also printed on the screen.

### *Snakes:*

Input: the inputs comprise of the user telling the computer the direction in which he/she wishes to move the snake.

Output: the output is the snake moving in the direction given by the user and the response of the system to the food which the snake has to eat.



## USER INTERFACE REQUIREMENTS:

In general, the project has been designed to take inputs from on screen gestures using the mouse, as well as responses from the keyboard. The specific game requirements have been detailed as follows:

### *Chess*

The basis of output is a standard chessboard on screen, appearing in a separate window for itself. The essential background (chessboard) is a simple 8\*8 grid of black and white colors (there may be slight variations in color, but they shall still be comparable). On this chessboard, as in standard configuration during the beginning of the game, we shall have black to be on one side of the chessboard, and white on the other. We happen to select the upper portion of the chessboard for black and the lower portion for white pieces. The pieces are depicted by suitable two dimensional images; whose meaning is self-evident, if the user has basic familiarity with chess. As soon as “The game begins”, the user (i.e. the player whose chance it is) can see the pieces which he is allowed to move as “Highlighted”; this is indicated by representing the square occupied by the piece with a different color (blue). Now, the user is expected to select the piece which he wishes to move by clicking on the desired square (note that this square must be one of the “Highlighted” squares), for otherwise, the user shall not be allowed to move that piece. Once the user has selected one of the highlighted squares, he must now move that piece to one of the new allowed squares. This can be done by clicking on one of the new allowed squares. As soon as the user selects one of the allowed pieces, the squares to which he can now move this piece become highlighted. This is different from the previous set of highlighted squares. Note that the square on which the piece resides itself will be highlighted. This has been in order that if the user makes the mistake of selecting the piece he wishes to move wrongly, he can again click on the same square, so that the piece will essentially be put down, and the user may again make his move. Also, the piece which the user can capture by means of a legitimate move will also be highlighted. Hence, by this procedure, once the user has selected the position to which he wishes to send his piece, the state of the chessboard will be changed by transferring the desired piece from its old to its new position, and any piece, if captured, shall be removed from the chessboard. Note, however, that once a move is made, then, as in conventional chess, the user cannot undo this move. This thus is the sequence to make a move. Once a particular player, black or white completes a legitimate move, the next player is supposed to make his move, with the format of action exactly as described above. The program shall display appropriate messages and provide self-explanatory instructions to the user via a suitable message box, so that the user can “play” accordingly. The game ends when either side wins or it is a draw, at which point an appropriate error message will be displayed. It may be noted that the graphics library EZWindows has been used in order to implement the graphical user interface of the entire program.

### *Minesweeper*

The basic output is in a separate window, meant for it. The workspace is a 9 \* 9 grid, where the standard simulations of minesweeper apply. There are ten mines for every case. The user can “open” a square (view its contents) by applying a left click within that box, or he can flag it by right clicking on it. He may flag atmost 10 mines. The game essentially continues, until either the user “opens” a square which

contains a mine, or until all mines have been exhausted by either a left click or a right click. The first case is when the user is said to have lost the game, and the second, of course, when the user is said to have won the game.

### *Snakes*

The game starts with the user pressing any arrow key to initialize the direction of snake. A snake of black color will be allowed to move in an 8x8 arena of white background surrounded by walls on all four sides. The main motive of the user should be to eat as much food as possible, after every food eaten the user gets 15 points and also the length of the snake increases by a specific size. Each food piece appears for a specific time and then disappears, and then another food piece appears in a new position. The game ends when the snake hits itself or the wall or the user presses escape key. It may be noted that the graphics library EZWindows has been used in order to implement the graphical user interface of the entire program.

## **INTERFACES TO OTHER SYSTEMS**

The project that we have made uses the interface of the EZWindows library extensively. This is done essentially in order to make the Graphical User Interface of the Project. Apart from this, this project neither uses resources nor interfaces from other predefined systems, nor has any well-defined applications to existing systems. These, however may be established in the future by making suitable modifications to the program.

## **BRIEF DESCRIPTION OF VARIOUS MODULES**

A brief description of the various modules is as follows: Our project is a gaming interface which involves the following three games.

These are as follows:

Chess: These are exactly identical to the first stage submission

Minesweeper: These are exactly identical to the first stage submission

Snakes: These are exactly identical to the first stage submission

## STATUS OF COMPLETION:

### *Chess:*

As specified earlier, we planned to attempt the following, with these limitations.

#### *Limitations:*

We as a team have attempted to simulate all features of chess as far as possible. Apart from the basic feature of chess already being covered, i.e. the definitions of moves of the various pieces and the legitimacy of any move, chess has many special features which are non-trivial and time consuming to simulate. Some of the important ones among these are namely,

1. End of game condition,
2. Prevention of a move which places the king into check,
3. Stalemate,
4. Castling,
5. El passant,
6. Pawn promotion,
7. Three fold repetition and
8. Various conditions for a draw.

Out of these, condition '1' has been implemented partially, condition '6' fully, and we are trying to cover as many of the rest of the cases as possible, with as much rigor as our limited time can afford us. Any other special features' inclusion in our program has not been considered as of now, although this possibility hasn't altogether been ruled out. Nevertheless, since the basic features of the game are on track, the game can, in general be played without hassle. We hope that we are able to cover most cases to a reasonable extent, so that the users can utilize and enjoy our work.

We now have fully integrated condition 2, condition 3, and condition 1, *comprehensively*.

As regards the graphics portion, it is complete as such. However, we believe we could have improved graphics to a reasonable extent had we used a more versatile graphics package, and also the speed at which graphics load is seeming unsatisfactory. However we are unable to explain the reason for the same.

We, however, would like to inform the instructor that we made some intensive, time consuming mistakes while making snakes, because we were ignorant of the working of the mouse handling events. We, however, did rectify them well within time as shows up in our project. However, we have taken a considerable amount of time more than what's required, which shows up in our consolidated diaries.

### *Minesweeper:*

The game is complete too. Here again, not much apart from the graphics portions can be improved for the same reasons as stated above.

We, however, would like to inform the instructor that we made some intensive, time consuming mistakes while making minesweeper, because we were ignorant of the working of the mouse handling events. We, however, did rectify them well within time as shows up in our project. However, we have taken a considerable amount of time more than what's required, which shows up in our consolidated diaries.

### *Snake:*

The game is complete as such, apart from graphics optimization. Here too, we would like to inform the instructor that we spent a lot of time studying multi-threading to try and take input from the keyboard. That however, did not work out and we leave that as a future idea.

## IDEAS FOR FUTURE WORK

The following are the ideas of future work for the interface:

- We can include certain things such as high scores.
- We can include user input options such as the mouse and the keyboard, or vice versa.
- We can include miscellaneous options such reading the rules of a game, or even displaying the instructions for playing a game.

### *Chess:*

The following are the ideas of future work for chess:

- The biggest and best idea for future work through this entire project is the making of a single player chess game, in which the bot is simulated by the computer itself. It is probably this hurdle of not having a reliable chess game which prevented us from taking up a full project comprising of a single player chess game.
- In the graphics window, one can show the pieces which have been captured and, and also a log of each of the pieces played.
- The auxiliary moves of chess such as en passant, three- fold repetition et al. described above can be detailed, as explained above.
- The graphics can be made to look more elegant.
- We can add the timer for each move. Or, more generally, we can make a timer mode in which each player has to make a move in a certain amount of time.
- All the various draw conditions can be included.
- Proactive measures to not allow a move which places one's king into check can be included.
- The pieces which are under threat of capture can be shown.
- The representation can be in 3 dimensional fashions.
- We can use the algorithm to make checkers.
- We can use the algorithm to make another popular variant of chess, name Antichess. For more details, please refer to Wikipedia ([en.wikipedia.org/wiki/Antichess](https://en.wikipedia.org/wiki/Antichess) )
- Any other variants of chess can also be tried out.

### *Minesweeper*

The following are the ideas of future work for minesweeper.

- The main idea is to include the timer function in the window to show the user how much time he has taken to complete the minesweeper.
- The main graphic can be made more helping and more attractive to become friendly with user.
- The mouse right and left click can be included to ensure ease for player.
- The different difficulty levels can be introduced to enhance the player skills and interest in playing.
- The graphic code can be made reliable to take less time for loading.

- The high score and help & instructions can be added to help player understand minesweeper well.
- To show the blast of mines when the player opens a tile which has a mine.

### *Snake*

The following are the ideas for future work for snake:

- We can ask the user to choose whether to take inputs from the mouse or the keyboard.
- We can use bitmap images to represent the snake and the background.
- We can add bonus food items to appear randomly to make the game livelier.
- We can introduce hurdles in the path of the snake.
- We can make a 3 dimensional snake game.
- We can include an option to pause the game.



## ACTUAL WORK DONE BY EACH OF THE INDIVIDUALS:

The following is the actual work done by each of the individuals

### *Avanesh Kumar:* Snake-

- Consistency in all group discussions
- Helped in Printing the snake
- Helped in making the mouse click function
- Gave the idea of including various levels in the program
- Studied multi-threading with Parth Dalal

### *Ayush Kanodia:* Chess and Integration

- Wrote the entire algorithm of chess
- Consistency in all group discussions
- Assisted in integrating the algorithm with the graphics
- Studied the mouse click function along with sub-team members and Bhavesh extensively
- Helped Bhavesh to integrate his minesweeper with the mouse click
- Helped integrate the three games into a single interface

### *Bhaskar Sharma:* Chess

- Consistency in all group discussions
- Did all the graphics operations in chess
- Studied the mouse click functions extensively with his sub team
- Helped integrate graphics with the algorithm

### *Bhavesh Khandelwal:* Minesweeper

- Consistency in all group discussions
- Made the algorithm of minesweeper along with bhavya
- Spent a lot of time in studying graphics and wrote a lot of lines of code which ended up going unused.
- Ultimately finished graphics and integrating it with the algorithm with Ayush.

### *Bhavya Senwar:* Minesweeper

- Consistency in all team meetings
- Made the algorithm of minesweeper along with Bhavesh

### *Parth Chaudhary:* Chess

- Consistency in all group discussions
- Did all the graphics operations in chess

- Studied the mouse click functions extensively with his sub team

*Parth Dalal:* Snake

- Consistency in all group discussions
- Helped make the algorithm along with Avanes
- Studied multi-threading extensively but to no avail
- Ultimately used mouse clicks to run the game
- Integrated the algorithm with the graphics

## APPENDICES

### *Appendix 1: Rules of Chess*

#### **Preface**

The Laws of Chess cannot cover all possible situations that may arise during a game, nor can they regulate all administrative questions. Where cases are not precisely regulated by an Article of the Laws, it should be possible to reach a correct decision by studying analogous situations which are discussed in the Laws. The Laws assume that arbiters have the necessary competence, sound judgement and absolute objectivity. Too detailed a rule might deprive the arbiter of his freedom of judgement and thus prevent him from finding the solution to a problem dictated by fairness, logic and special factors. FIDE appeals to all chess players and federations to accept this view.

A member federation is free to introduce more detailed rules provided they:

- a. do not conflict in any way with the official FIDE Laws of Chess, and
- b. are limited to the territory of the federation concerned, and
- c. are not valid for any FIDE match, championship or qualifying event, or for a FIDE title or rating tournament.

#### **BASIC RULES OF PLAY**

##### **Article 1: The nature and objectives of the game of chess**

- 1.1 The game of chess is played between two opponents who move their pieces alternately on a square board called a 'chessboard'. The player with the white pieces commences the game. A player is said to 'have the move', when his opponent's move has been 'made'. (See Article 6.7)
- 1.2 The objective of each player is to place the opponent's king 'under attack' in such a way that the opponent has no legal move. The player who achieves this goal is said to have 'checkmated' the opponent's king and to have won the game. Leaving one's own king under attack, exposing one's own king to attack and also 'capturing' the opponent's king are not allowed. The opponent whose king has been checkmated has lost the game.
- 1.3 If the position is such that neither player can possibly checkmate, the game is drawn.

##### **Article 2: The initial position of the pieces on the chessboard**

2.1 The chessboard is composed of an 8 x 8 grid of 64 equal squares alternately light (the 'white' squares) and dark (the 'black' squares).  
The chessboard is placed between the players in such a way that the near corner square to the right of the player is white.

2.2 At the beginning of the game one player has 16 light-coloured pieces (the 'white' pieces); the other has 16 dark-coloured pieces (the 'black' pieces).

These pieces are as follows:

A white king, usually indicated by the symbol



A white queen, usually indicated by the symbol



Two white rooks, usually indicated by the symbol



Two white bishops, usually indicated by the symbol



Two white knights, usually indicated by the symbol



Eight white pawns, usually indicated by the symbol



A black king, usually indicated by the symbol



A black queen, usually indicated by the symbol



Two black rooks, usually indicated by the symbol



Two black bishops, usually indicated by the symbol



Two black knights, usually indicated by the symbol



Eight black pawns, usually indicated by the symbol



2.3 The initial position of the pieces on the chessboard is as follows:

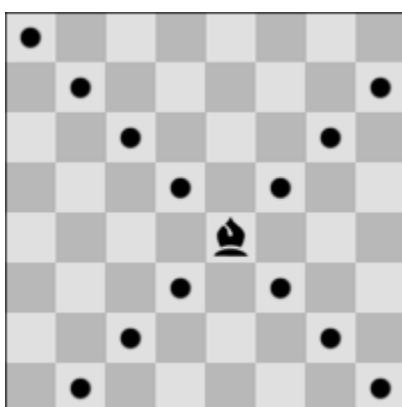


- 2.4 The eight vertical columns of squares are called 'files'. The eight horizontal rows of squares are called 'ranks'. A straight line of squares of the same colour, running from one edge of the board to an adjacent edge, is called a 'diagonal'.

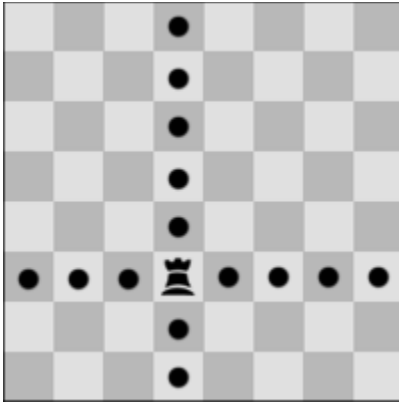
### Article 3: The moves of the pieces

- 3.1 It is not permitted to move a piece to a square occupied by a piece of the same colour. If a piece moves to a square occupied by an opponent's piece the latter is captured and removed from the chessboard as part of the same move. A piece is said to attack an opponent's piece if the piece could make a capture on that square according to the Articles 3.2 to 3.8. A piece is considered to attack a square, even if such a piece is constrained from moving to that square because it would then leave or place the king of its own colour under attack.

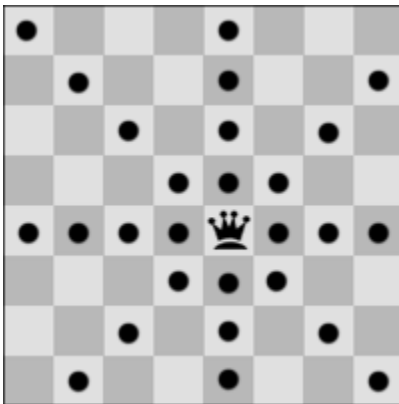
- 3.2 The bishop may move to any square along a diagonal on which it stands.



- 3.3 The rook may move to any square along the file or the rank on which it stands.

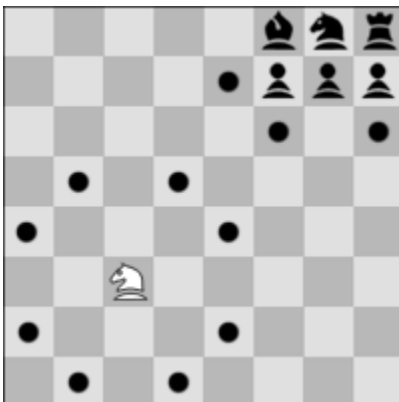


- 3.4 The queen may move to any square along the file, the rank or a diagonal on which it stands.

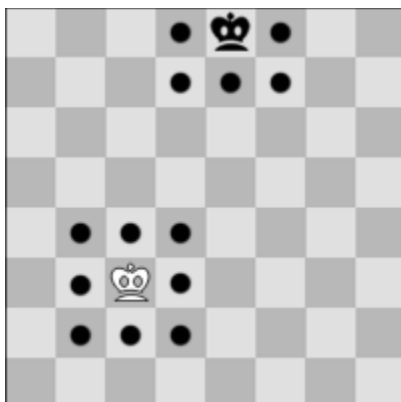


- 3.5 When making these moves the bishop, rook or queen may not move over any intervening pieces.

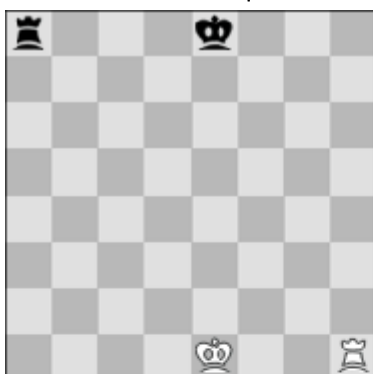
- 3.6 The knight may move to one of the squares nearest to that on which it stands but not on the same rank, file or diagonal.



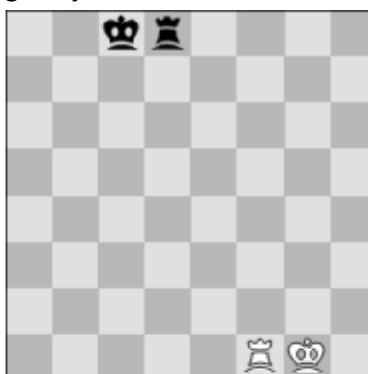




or by 'castling'. This is a move of the king and either rook of the same colour along the player's first rank, counting as a single move of the king and executed as follows: the king is transferred from its original square two squares towards the rook on its original square, then that rook is transferred to the square the king has just crossed.



*Before white kingside castling*



*After white kingside castling*

*Before black queenside castling*

*After black queenside castling*



*Before white queenside castling*



*After white queenside castling*

*Before black kingside castling*

*After black kingside castling*

- b. (1) The right to castle has been lost:
  - a. if the king has already moved, or



b. with a rook that has already moved.

(2) Castling is prevented temporarily:

c. if the square on which the king stands, or the square which it must cross, or the square which it is to occupy, is attacked by one or more of the opponent's pieces, or

d. If there is any piece between the king and the rook with which castling is to be effected.

3.9 The king is said to be 'in check' if it is attacked by one or more of the opponent's pieces, even if such pieces are constrained from moving to that square because they would then leave or place their own king in check. No piece can be moved that will either expose the king of the same colour to check or leave that king in check.

#### **Article 4: The act of moving the pieces**

4.1 Each move must be made with one hand only.

4.2 Provided that he first expresses his intention (for example by saying „j'adoube“ or “I adjust”), the player having the move may adjust one or more pieces on their squares.

4.3 Except as provided in Article 4.2, if the player having the move deliberately touches on the chessboard:

- a. one or more of his own pieces, he must move the first piece touched which can be moved
- b. one or more of his opponent's pieces, he must capture the first piece touched which can be captured
- c. one piece of each colour, he must capture the opponent's piece with his piece or, if this is illegal, move or capture the first piece touched which can be moved or captured. If it is unclear, whether the player's own piece or his opponent's was touched first, the player's own piece shall be considered to have been touched before his opponent's.

4.4 If a player having the move:

- a. deliberately touches his king and rook he must castle on that side if it is legal to do so
- b. deliberately touches a rook and then his king he is not allowed to castle on that side on that move and the situation shall be governed by Article 4.3.a

- c. intending to castle, touches the king or king and rook at the same time, but castling on that side is illegal, the player must make another legal move with his king (which may include castling on the other side). If the king has no legal move, the player is free to make any legal move
  - d. promotes a pawn, the choice of the piece is finalised, when the piece has touched the square of promotion.
- 4.5 If none of the pieces touched can be moved or captured, the player may make any legal move.
- 4.6 When, as a legal move or part of a legal move, a piece has been released on a square, it cannot be moved to another square on this move. The move is then considered to have been made:
- a. in the case of a capture, when the captured piece has been removed from the chessboard and the player, having placed his own piece on its new square, has released this capturing piece from his hand
  - b. in the case of castling, when the player's hand has released the rook on the square previously crossed by the king. When the player has released the king from his hand, the move is not yet made, but the player no longer has the right to make any move other than castling on that side, if this is legal
  - c. in the case of the promotion of a pawn, when the pawn has been removed from the chessboard and the player's hand has released the new piece after placing it on the promotion square. If the player has released from his hand the pawn that has reached the promotion square, the move is not yet made, but the player no longer has the right to play the pawn to another square.
- The move is called legal when all the relevant requirements of Article 3 have been fulfilled. If the move is not legal, another move shall be made instead as per Article 4.5.
- 4.7 A player forfeits his right to a claim against his opponent's violation of Article 4 once he deliberately touches a piece.

## **Article 5: The completion of the game**

- 5.1
- a. The game is won by the player who has checkmated his opponent's king. This immediately ends the game, provided that the move producing the checkmate position was a legal move.
  - b. The game is won by the player whose opponent declares he resigns. This immediately

ends the game.

- 5.2
- a. The game is drawn when the player to move has no legal move and his king is not in check. The game is said to end in 'stalemate'. This immediately ends the game, provided that the move producing the stalemate position was legal.
  - b. The game is drawn when a position has arisen in which neither player can checkmate the opponent's king with any series of legal moves. The game is said to end in a 'dead position'. This immediately ends the game, provided that the move producing the position was legal. (See Article 9.6)
  - c. The game is drawn upon agreement between the two players during the game. This immediately ends the game. (See Article 9.1)
  - d. The game may be drawn if any identical position is about to appear or has appeared on the chessboard at least three times. (See Article 9.2)
  - e. The game may be drawn if each player has made at least the last 50 consecutive moves without the movement of any pawn and without any capture. (See Article 9.3)

## COMPETITION RULES

### Article 6: The chess clock

- 6.1 'Chess clock' means a clock with two time displays, connected to each other in such a way that only one of them can run at one time.  
'Clock' in the Laws of Chess, means one of the two time displays.  
Each time display has a 'flag'.  
'Flag fall' means the expiration of the allotted time for a player.
- 6.2
- a. When using a chess clock, each player must make a minimum number of moves or all moves in an allotted period of time and/or may be allocated an additional amount of time with each move. All these must be specified in advance.
  - b. The time saved by a player during one period is added to his time available for the next period, except in the 'time delay' mode.  
In the time delay mode both players receive an allotted 'main thinking time'. Each player also receives a 'fixed extra time' with every move. The countdown of the main time only commences after the fixed time has expired. Provided the player stops his clock before the expiration of the fixed time, the main thinking time does not change, irrespective of

the proportion of the fixed time used.

- 6.3 Immediately after a flag falls, the requirements of article 6.2 a. must be checked.
- 6.4 Before the start of the game the arbiter decides where the chess clock is placed.
- 6.5 At the time determined for the start of the game the clock of the player who has the white pieces is started.
- 6.6
  - a. Any player who arrives at the chessboard after the start of the session shall lose the game. Thus the default time is 0 minutes. The rules of a competition may specify otherwise.
  - b. If the rules of a competition specify a different default time, the following shall apply. If neither player is present initially, the player who has the white pieces shall lose all the time that elapses until he arrives, unless the rules of the competition specify or the arbiter decides otherwise.
- 6.7
  - a. During the game each player, having made his move on the chessboard, shall stop his own clock and start his opponent's clock. A player must always be allowed to stop his clock. His move is not considered to have been completed until he has done so, unless the move that was made ends the game. (See the Articles 5.1.a, 5.2.a, 5.2.b, 5.2.c and 9.6) The time between making the move on the chessboard and stopping his own clock and starting his opponent's clock is regarded as part of the time allotted to the player.
  - b. A player must stop his clock with the same hand as that with which he made his move. It is forbidden for a player to keep his finger on the button or to 'hover' over it.
  - c. The players must handle the chess clock properly. It is forbidden to punch it forcibly, to pick it up or to knock it over. Improper clock handling shall be penalised in accordance with Article 13.4.
  - d. If a player is unable to use the clock, an assistant, who must be acceptable to the arbiter, may be provided by the player to perform this operation. His clock shall be adjusted by the arbiter in an equitable way.
- 6.8 A flag is considered to have fallen when the arbiter observes the fact or when either player has made a valid claim to that effect.
- 6.9 Except where one of the Articles: 5.1.a, 5.1.b, 5.2.a, 5.2.b, 5.2.c applies, if a player does not complete the prescribed number of moves in the allotted time, the game is lost by the player. However, the game is drawn, if the position is such that the opponent cannot checkmate the player's king by any possible series of legal moves.

- 6.10 a. Every indication given by the clocks is considered to be conclusive in the absence of any evident defect. A chess clock with an evident defect shall be replaced. The arbiter shall replace the clock and use his best judgment when determining the times to be shown on the replacement chess clocks.
- b. If during a game it is found that the setting of either or both clocks was incorrect, either player or the arbiter shall stop the clocks immediately. The arbiter shall install the correct setting and adjust the times and move counter. He shall use his best judgement when determining the correct settings.
- 6.11 If both flags have fallen and it is impossible to establish which flag fell first then:
- a. the game shall continue if it happens in any period of the game except the last period
- b. the game is drawn if it happens in the period of a game, in which all remaining moves must be completed.
- 6.12 a. If the game needs to be interrupted, the arbiter shall stop the clocks.
- b. A player may stop the clocks only in order to seek the arbiter's assistance, for example when promotion has taken place and the piece required is not available.
- c. The arbiter shall decide when the game is to be restarted in either case.
- d. If a player stops the clocks in order to seek the arbiter's assistance, the arbiter shall determine if the player had any valid reason for doing so. If it is obvious that the player had no valid reason for stopping the clocks, the player shall be penalised according to Article 13.4.
- 6.13 If an irregularity occurs and/or the pieces have to be restored to a previous position, the arbiter shall use his best judgement to determine the times to be shown on the clocks. He shall also, if necessary, adjust the clock's move counter.
- 6.14 Screens, monitors, or demonstration boards showing the current position on the chessboard, the moves and the number of moves made, and clocks which also show the number of moves, are allowed in the playing hall. However, the player may not make a claim relying solely on information shown in this manner.

## **Article 7: Irregularities**

- 7.1 a. If during a game it is found that the initial position of the pieces was incorrect, the game shall be cancelled and a new game played.

- b. If during a game it is found that the chessboard has been placed contrary to Article 2.1, the game continues but the position reached must be transferred to a correctly placed chessboard.
- 7.2 If a game has begun with colours reversed then it shall continue, unless the arbiter rules otherwise.
- 7.3 If a player displaces one or more pieces, he shall re-establish the correct position on his own time. If necessary, either the player or his opponent shall stop the clocks and ask for the arbiter's assistance. The arbiter may penalise the player who displaced the pieces.
- 7.4
  - a. If during a game it is found that an illegal move, including failing to meet the requirements of the promotion of a pawn or capturing the opponent's king, has been completed, the position immediately before the irregularity shall be reinstated. If the position immediately before the irregularity cannot be determined the game shall continue from the last identifiable position prior to the irregularity. The clocks shall be adjusted according to Article 6.13. The Articles 4.3 and 4.6 apply to the move replacing the illegal move. The game shall then continue from this re-instated position.
  - b. After the action taken under Article 7.4.a, for the first two illegal moves by a player the arbiter shall give two minutes extra time to his opponent in each instance; for a third illegal move by the same player, the arbiter shall declare the game lost by this player. However, the game is drawn if the position is such that the opponent cannot checkmate the player's king by any possible series of legal moves.
- 7.5 If during a game it is found that pieces have been displaced from their squares, the position before the irregularity shall be re-instated. If the position immediately before the irregularity cannot be determined, the game shall continue from the last identifiable position prior to the irregularity. The clocks shall be adjusted according to Article 6.13. The game shall then continue from this re-instated position.

## **Article 8: The recording of the moves**

- 8.1 In the course of play each player is required to record his own moves and those of his opponent in the correct manner, move after move, as clearly and legibly as possible, in the algebraic notation (See Appendix C), on the scoresheet prescribed for the competition.

It is forbidden to write the moves in advance, unless the player is claiming a draw according to Article 9.2, or 9.3 or adjourning a game according to the Guidelines of Adjourning Games point 1.a.

A player may reply to his opponent's move before recording it, if he so wishes. He must record his previous move before making another.

Both players must record the offer of a draw on the scoresheet. (See Appendix C.13)

If a player is unable to keep score, an assistant, who must be acceptable to the arbiter, may be provided by the player to write the moves. His clock shall be adjusted by the arbiter in an equitable way.

- 8.2 The scoresheet shall be visible to the arbiter throughout the game.
- 8.3 The scoresheets are the property of the organisers of the event.
- 8.4 If a player has less than five minutes left on his clock at some stage in a period and does not have additional time of 30 seconds or more added with each move, then for the remainder of the period he is not obliged to meet the requirements of Article 8.1. Immediately after one flag has fallen the player must update his scoresheet completely before moving a piece on the chessboard.
- 8.5
  - a. If neither player is required to keep score under Article 8.4, the arbiter or an assistant should try to be present and keep score. In this case, immediately after one flag has fallen, the arbiter shall stop the clocks. Then both players shall update their scoresheets, using the arbiter's or the opponent's scoresheet.
  - b. If only one player is not required to keep score under Article 8.4, he must, as soon as either flag has fallen, update his scoresheet completely before moving a piece on the chessboard. Provided it is the player's move, he may use his opponent's scoresheet, but must return it before making a move.
  - c. If no complete scoresheet is available, the players must reconstruct the game on a second chessboard under the control of the arbiter or an assistant. He shall first record the actual game position, clock times and the number of moves made, if this information is available, before reconstruction takes place.
- 8.6 If the scoresheets cannot be brought up to date showing that a player has overstepped the allotted time, the next move made shall be considered as the first of the following time period, unless there is evidence that more moves have been made.
- 8.7 At the conclusion of the game both players shall sign both scoresheets, indicating the result of the game. Even if incorrect, this result shall stand, unless the arbiter decides otherwise.

## **Article 9: The drawn game**

- 9.1 a. The rules of a competition may specify that players cannot agree to a draw, whether in less than a specified number of moves or at all, without the consent of the arbiter.
- b. If the rules of a competition allow a draw agreement the following apply:
1. A player wishing to offer a draw shall do so after having made a move on the chessboard and before stopping his clock and starting the opponent's clock. An offer at any other time during play is still valid but Article 12.6 must be considered. No conditions can be attached to the offer. In both cases the offer cannot be withdrawn and remains valid until the opponent accepts it, rejects it orally, rejects it by touching a piece with the intention of moving or capturing it, or the game is concluded in some other way.
  2. The offer of a draw shall be noted by each player on his scoresheet with a symbol. (See Appendix C.13)
  3. A claim of a draw under Article 9.2, 9.3 or 10.2 shall be considered to be an offer of a draw.
- 9.2 The game is drawn upon a correct claim by the player having the move, when the same position, for at least the third time (not necessarily by a repetition of moves):
- a. is about to appear, if he first writes his move on his scoresheet and declares to the arbiter his intention to make this move, or
  - b. has just appeared, and the player claiming the draw has the move.
- Positions as in (a) and (b) are considered the same, if the same player has the move, pieces of the same kind and colour occupy the same squares, and the possible moves of all the pieces of both players are the same.
- Positions are not the same if a pawn that could have been captured en passant can no longer be captured in this manner. When a king or a rook is forced to move, it will lose its castling rights, if any, only after it is moved.
- 9.3 The game is drawn, upon a correct claim by the player having the move, if:
- a. he writes his move on his scoresheet and declares to the arbiter his intention to make this move, which shall result in the last 50 moves having been made by each player without the movement of any pawn and without any capture, or
  - b. the last 50 consecutive moves have been made by each player without the movement of any pawn and without any capture.
- 9.4 If the player touches a piece as in Article 4.3 without having claimed the draw he loses the right



to claim, as in Article 9.2 or 9.3, on that move.

- 9.5 If a player claims a draw as in Article 9.2 or 9.3 he may stop both clocks. (See Article 6.12.b) He is not allowed to withdraw his claim.
- a. If the claim is found to be correct, the game is immediately drawn.
  - b. If the claim is found to be incorrect, the arbiter shall add three minutes to the opponent's remaining thinking time. Then the game shall continue. If the claim was based on an intended move, this move must be made as according to Article 4.
- 9.6 The game is drawn when a position is reached from which a checkmate cannot occur by any possible series of legal moves. This immediately ends the game, provided that the move producing this position was legal.

#### **Article 10: Quickplay Finish**

- 10.1 A 'quickplay finish' is the phase of a game when all the (remaining) moves must be made in a limited time.
- 10.2 If the player, having the move, has less than two minutes left on his clock, he may claim a draw before his flag falls. He shall summon the arbiter and may stop the clocks. (See Article 6.12.b)
- a. If the arbiter agrees the opponent is making no effort to win the game by normal means, or that it is not possible to win by normal means, then he shall declare the game drawn. Otherwise he shall postpone his decision or reject the claim.
  - b. If the arbiter postpones his decision, the opponent may be awarded two extra minutes and the game shall continue, if possible in the presence of an arbiter. The arbiter shall declare the final result later in the game or as soon as possible after a flag has fallen. He shall declare the game drawn if he agrees that the final position cannot be won by normal means, or that the opponent was not making sufficient attempts to win by normal means.
  - c. If the arbiter has rejected the claim, the opponent shall be awarded two extra minutes time.
  - d. The decision of the arbiter shall be final relating to (a), (b) and (c).

#### **Article 11: Points**

- 11.1 Unless announced otherwise in advance, a player who wins his game, or wins by forfeit, scores one point (1), a player who loses his game, or forfeits scores no points (0) and a player who draws his game scores a half point ( $\frac{1}{2}$ ).

## **Article 12: The conduct of the players**

- 12.1 The players shall take no action that will bring the game of chess into disrepute.
- 12.2 Players are not allowed to leave the 'playing venue' without permission from the arbiter. The playing venue is defined as the playing area, rest rooms, refreshment area, area set aside for smoking and other places as designated by the arbiter.
- The player having the move is not allowed to leave the playing area without permission of the arbiter.
- 12.3 a. During play the players are forbidden to make use of any notes, sources of information or advice, or analyse on another chessboard
- b. Without the permission of the arbiter a player is forbidden to have a mobile phone or other electronic means of communication in the playing venue, unless they are completely switched off. If any such device produces a sound, the player shall lose the game. The opponent shall win. However, if the opponent cannot win the game by any series of legal moves, his score shall be a draw.
- c. Smoking is permitted only in the section of the venue designated by the arbiter
- 12.4 The scoresheet shall be used only for recording the moves, the times of the clocks, the offers of a draw, and matters relating to a claim and other relevant data.
- 12.5 Players who have finished their games shall be considered to be spectators.
- 12.6 It is forbidden to distract or annoy the opponent in any manner whatsoever. This includes unreasonable claims, unreasonable offers of a draw or the introduction of a source of noise into the playing area.
- 12.7 Infraction of any part of Articles 12.1 to 12.6 shall lead to penalties in accordance with Article 13.4.
- 12.8 Persistent refusal by a player to comply with the Laws of Chess shall be penalised by loss of the game. The arbiter shall decide the score of the opponent.
- 12.9 If both players are found guilty according to Article 12.8, the game shall be declared lost by both

players.

12.10 In the case of Article 10.2.d or Appendix D a player may not appeal against the decision of the arbiter.

Otherwise a player may appeal against any decision of the arbiter, unless the rules of the competition specify otherwise.

### **Article 13: The role of the Arbiter (See Preface)**

13.1 The arbiter shall see that the Laws of Chess are strictly observed.

13.2 The arbiter shall act in the best interest of the competition. He should ensure that a good playing environment is maintained and that the players are not disturbed. He shall supervise the progress of the competition.

13.3 The arbiter shall observe the games, especially when the players are short of time, enforce decisions he has made and impose penalties on players where appropriate.

13.4 The arbiter can apply one or more of the following penalties:

- a. warning
- b. increasing the remaining time of the opponent
- c. reducing the remaining time of the offending player
- d. declaring the game to be lost
- e. reducing the points scored in the game by the offending party
- f. increasing the points scored in the game by the opponent to the maximum available for that game
- g. expulsion from the event.

13.5 The arbiter may award either or both players additional time in the event of external disturbance of the game.

13.6 The arbiter must not intervene in a game except in cases described by the Laws of Chess. He shall not indicate the number of moves made, except in applying Article 8.5, when at least one flag has fallen. The arbiter shall refrain from informing a player that his opponent has completed a move or that the player has not pressed his clock.

- 13.7 a. Spectators and players in other games are not to speak about or otherwise interfere in a game. If necessary, the arbiter may expel offenders from the playing venue. If someone observes an irregularity, he may inform only the arbiter.
- b. Unless authorised by the arbiter, it is forbidden for anybody to use a mobile phone or any kind of communication device in the playing venue and any contiguous area designated by the arbiter.

#### **Article 14: FIDE**

- 14.1 Member federations may ask FIDE to give an official decision about problems relating to the Laws of Chess.

Source: [www.fide.com](http://www.fide.com)

CREDITS TO: Federation Internationale des Echecs (FIDE)

PS: The above are the exact rules of chess and we attempt to cover a limited number of them in our project.

## *Appendix 2: Rules of Minesweeper*

### *The object*

Find the empty squares while avoiding the mines. The faster you clear the board, the better your score.

### *The board*

Minesweeper has three standard boards to choose from, each progressively more difficult.

- 81 tiles, 10 mines

### *How to play*

The rules in Minesweeper are simple:

- Uncover a mine, and the game ends.
- Uncover an empty square, and you keep playing.
- Uncover a number, and it tells you how many mines lay hidden in the eight surrounding squares—information you use to deduce which nearby squares are safe to click.

### *Hints and tips*

- Mark the mines. If you suspect a square conceals a mine, right-click it. This puts a flag on the square. (If you're not sure, right-click again to make it a question mark.)
- Study the patterns. If three squares in a row display 2-3-2, then you know three mines are probably lined up beside that row. If a square says 8, every surrounding square is mined.
- Explore the unexplored. Not sure where to click next? Try clearing some unexplored territory. You're better off clicking in the middle of unmarked squares than in an area you suspect is mined.

### *Appendix 3: Rules of Snakes*

The goal is to score points by having the snake eat food pieces while avoiding losing the snake's life.

Use your arrow keys: up, left, right, and down to move the snake in the required direction.

Each time your snake eats a food piece, you earn at 15 points. For each piece eaten, your snake grows one unit longer. Every time a food piece is eaten or the time limit is over, a new food piece, which can be of any of the five basic colors, drops into the arena.

Your snake dies if its head collides with its body or the walls.