

User Documentation – Chess Game

Team “Dy herë mat”



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1. Introduction and overview

a. Project introduction

Welcome to our final project for the Introduction to Software Engineering course!

Our project is a recreation of traditional chess, one of the oldest games in human history that is still widely popular and played today all around the world. This game is meant to be played by two players on the same device (local multiplayer).

This user documentation will walk you through everything from chess rules to a few tips and pointers to get you started.

b. Basic rules & objectives

Chess is a board game for two players (White and Black), each controlling an army of chess pieces in their color, with the objective to checkmate the opponent's king. The rules of chess as we know them today emerged in Europe at the end of the 15th century, with standardization and universal acceptance by the end of the 19th century.

Chess is an abstract strategy game that involves no hidden information and no elements of chance. It is played on a chessboard with 64 squares arranged in an eight-by-eight grid. At the start, each player controls sixteen pieces: one king, one queen, two rooks, two bishops, two knights, and eight pawns. White moves first, followed by Black. The game is won by checkmating the opponent's king, i.e. threatening it with inescapable capture. There are also several ways a game can end in a draw.

2. Game rules

This chess game follows the rules of chess as published by FIDE (Fédération Internationale des Échecs; "International Chess Federation"), in the most recent revision of 2023.

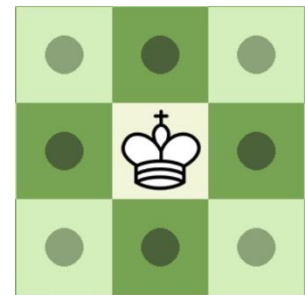
a. Chess board

The chess board is an 8x8 grid with squares alternating between dark and light green.

b. Pieces & movement

Chess pieces are what the players interact with in order to play chess. Pieces are divided into two colors: white and black. There are six different kinds of pieces, and each one moves differently:

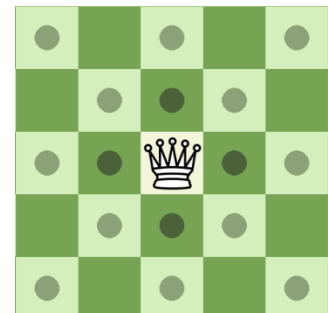
1. **King** – The most important piece in the game. Can move one square in any direction.
 - a. The king does not have a point value, as it can not be captured. Remember, the game ends when the king would be captured!
 - b. The king may not move to a square which would place it *in check* (threatened with capture).



- c. Once a game, if the king and a rook have not yet moved and the king is not in check, the king may make a special *castling* move, as demonstrated below. (The images portray a before and after the castling move being made. On the left, shown the black king *castling queenside (long castling)*. On the right, the white king *castling kingside (short castling)*.)

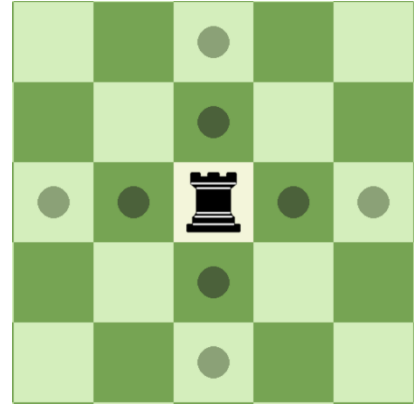


2. **Queen** – The most powerful piece in the game. Can move any number of squares vertically, horizontally, or diagonally, as long as it is not blocked by its own pieces or an occupied square.
 - a. The queen is a *major piece*, worth 9 points.



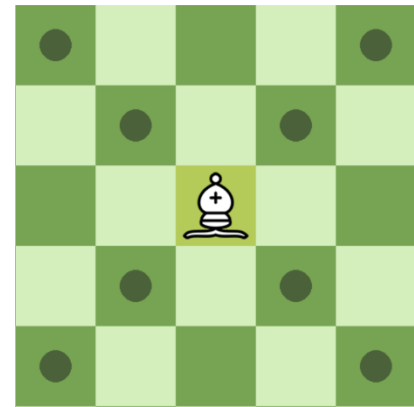
3. **Rook** – Can move any number of squares horizontally or vertically, as long as it is not blocked by its own pieces or an occupied square.

a. The rook is a *major piece*, worth 5 points.



4. **Bishop** – Can move any number of squares diagonally, as long as it is not blocked by its own pieces or an occupied square.

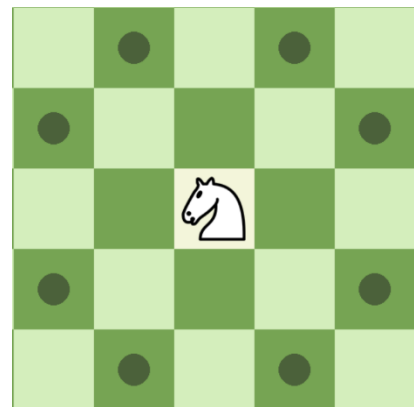
a. The bishop is a *minor piece*, worth 3 points.



5. **Knight** – Can move in an ‘L-shape’: two squares in a straight direction, then one square perpendicular to that.

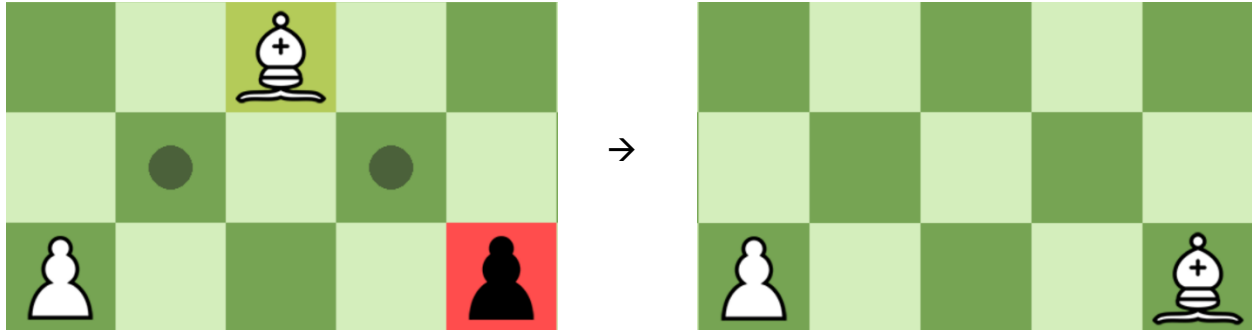
a. The knight is unique in its movement in that it can “jump over” other pieces, which means it does not need empty squares along its path in order to move to a specific square.

b. The knight is a *minor piece*, worth 3 points.

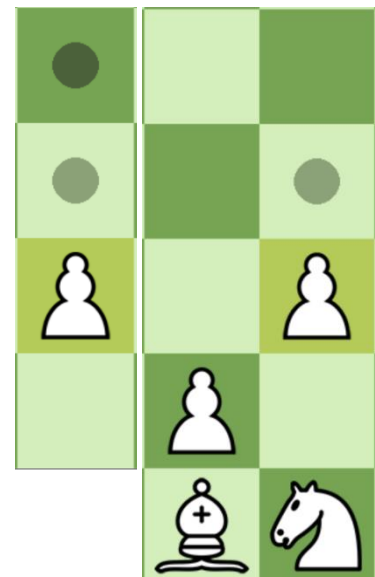


All the pieces covered so far can also capture opponent pieces. This happens when the square they land on was occupied by an opponent piece. When a piece is *captured*, it is taken out of the game!

Demonstrated below, a black pawn being captured by a white bishop:



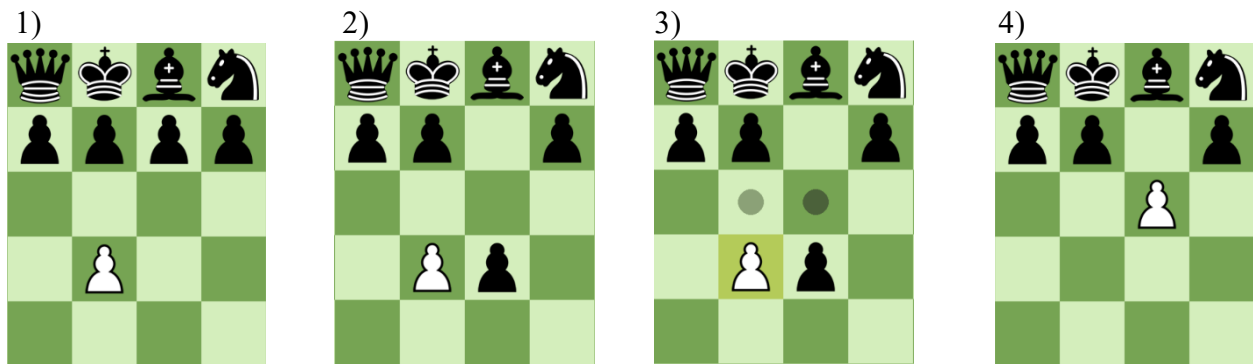
6. **Pawn** – The weakest piece in the game. Despite this, the pawn has the most complex moveset in the game.
- Can move one square forward.
 - If a pawn has not moved yet, it can choose to move two squares forward.
(To the left, a pawn which has not moved yet; it can either move one or two squares forward. To the right, a moved pawn. It can only move one square forward.)



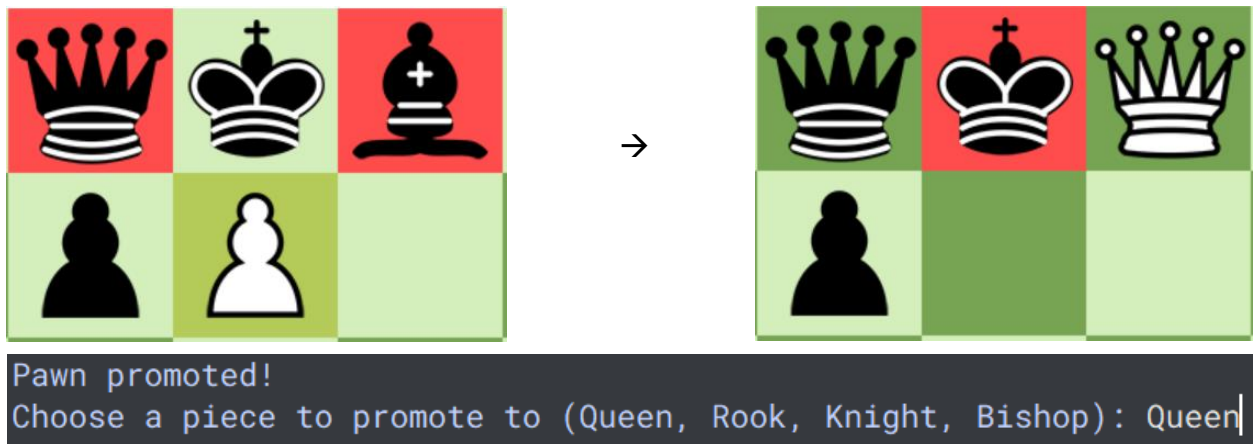
- Unlike other pieces, the pawn does not capture in the spaces that it moves. A pawn captures one square forward diagonally, to its left or right (shown on the right, a white pawn threatening to capture a black rook).



- d. The pawn is capable of not one, but two special moves as well: *en passant* and *promotion*.
- e. En passant happens when a pawn captures an enemy pawn on an adjacent file after it has just made an initial two-square move. The capturing happens as if the opposing pawn has only moved one square (sequence shown below).
Capturing en passant may only be done in the turn immediately after the opponent pawn moved 2 squares forward.



- f. Promotion allows a pawn which has advanced to its last *rank* to be “promoted” to a queen, rook, bishop or knight of the same color. The pawn is replaced by the new piece on the same move.
When this happens, you will be prompted on the command prompt to enter what piece you would like to replace the pawn with (sequence shown below).

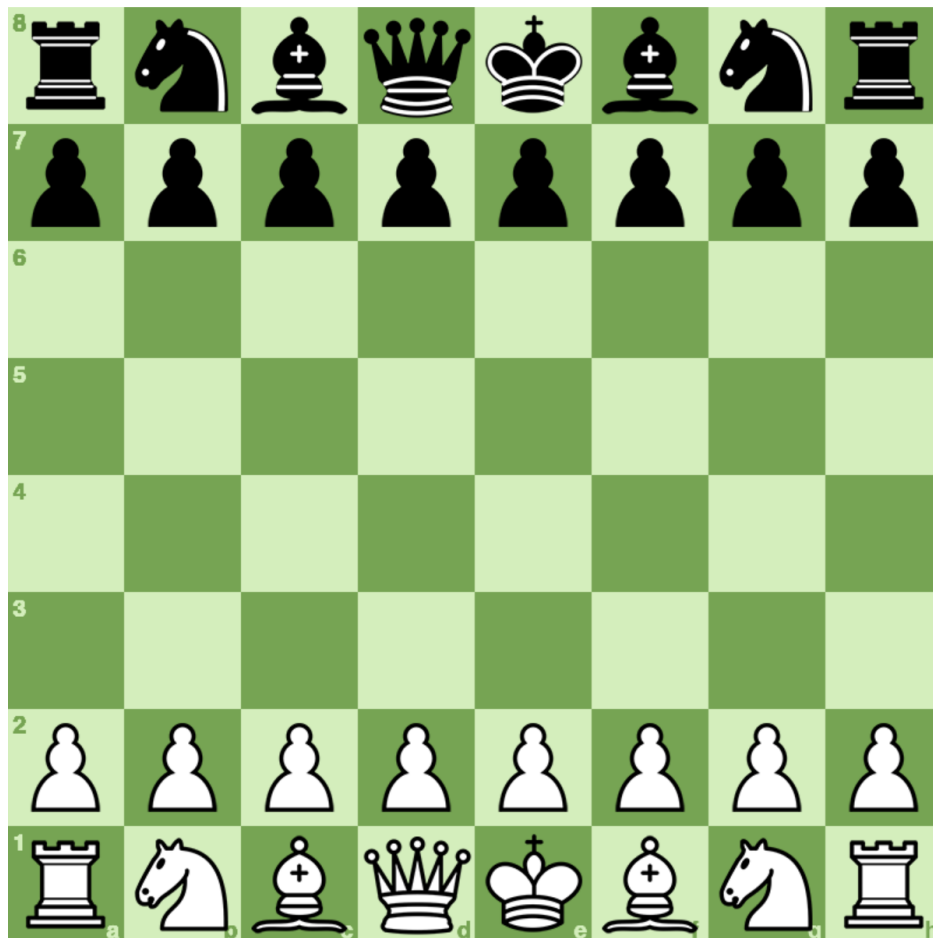


- g. The pawn is worth only 1 point.

c. Setup & turns

Chess pieces are divided into two differently colored sets: white and black. Each set consists of sixteen pieces, and the players of the sets are referred to as “White” and “Black” respectively.

At the start of the game, each player starts with these sixteen pieces: one king, one queen, two rooks, two bishops, two knights, and eight pawns. The pieces are arranged as shown below.



In chess, White is always the first to move. After White moves, Black may continue its turn, then White again and so on.

d. Check & checkmate

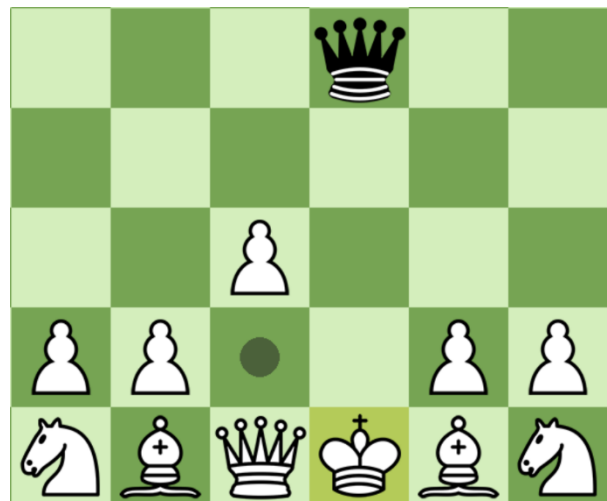
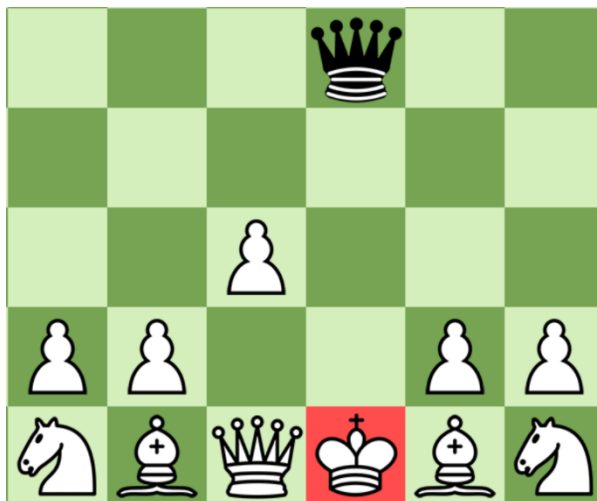
When a king is under immediate attack, it is said to be *in check*. A move in response to a check is legal only if it results in a position where the king is no longer in check. There are three ways to counter a check:

1. Capture the checking piece.
2. Interpose a piece between the checking piece and the king (which is possible only if the attacking piece is a queen, rook, or bishop and there is a square between it and the king).
3. Move the king to a square where it is not under attack.

Castling is not a permissible response to a check.

The object of the game is to *checkmate* the opponent; this occurs when the opponent's king is in check, and there is no legal way to get it out of check. It is never legal for a player to make a move that puts or leaves the player's own king in check.

Shown below, a king in check, and its available moves. It may not move forward, as that leaves the king in check, thus being an illegal move.



e. End of game

This chess game may end in a win or a draw:

- Win: Game ends in a *checkmate*.
- Draw: Game ends in a *stalemate*.

When the game ends, the game will be declared over, the winner will be announced on the command prompt and you will be prompted if you wish to continue playing or not. If you do, the game will reset to its original setup and you may continue playing.

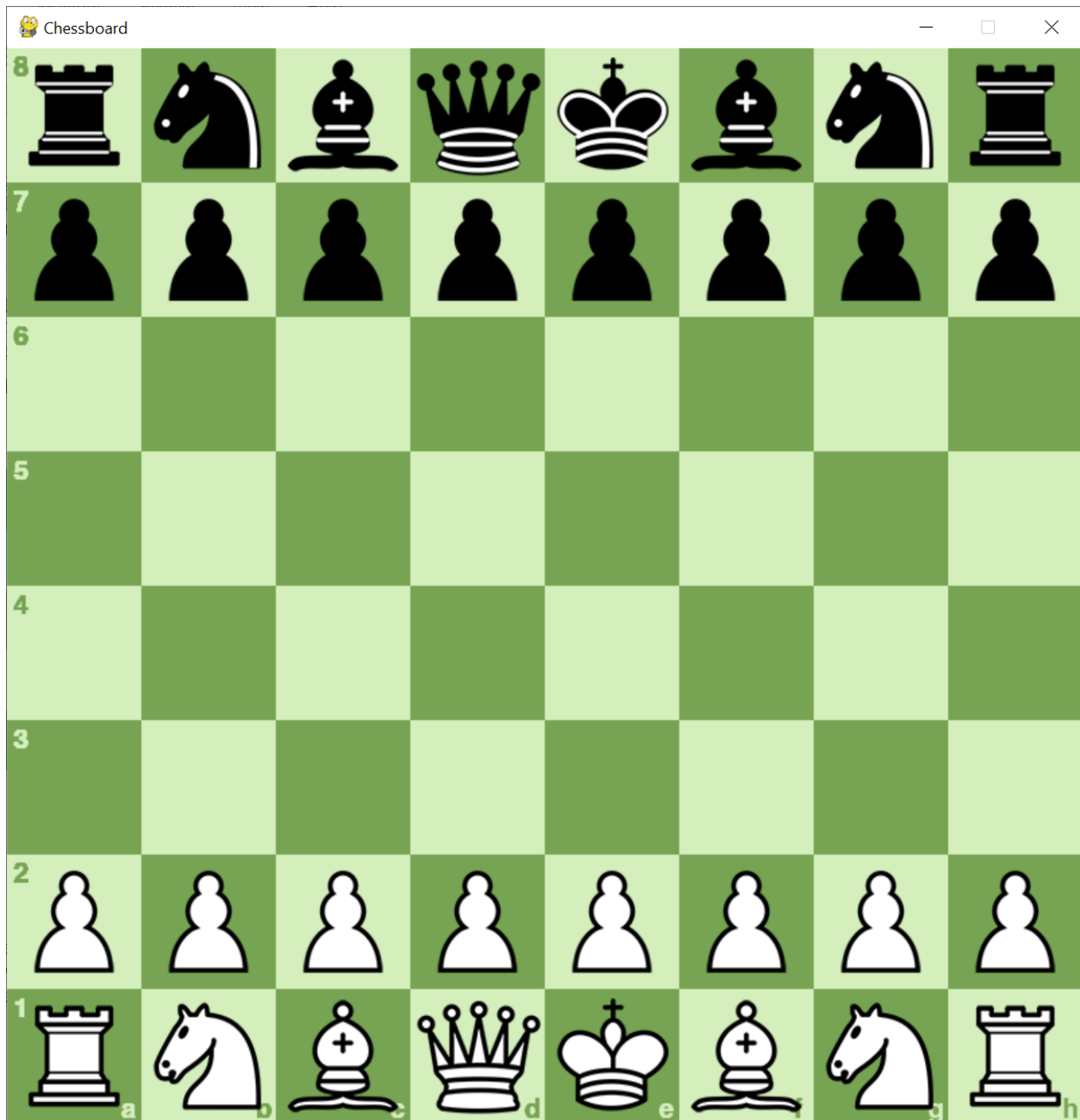
```
Checkmate!  
Black wins.  
Game over.  
Play again? (Y/N): |
```



3. User interface

a. Window

When the game is launched, the user will be met with the following interface:



b. Moving a piece

Each piece can be interacted with (clicked) in order to move it.

- Click a piece once to view the moves available to it.
- Click one of the squares with a circle on top in order to finalize the move.
- Otherwise, click the piece itself or an empty square to cancel the move.

c. Legend

Different colors and symbols convey different information in the game. Below is a list of all of them and what they mean.



Dark circle: indicates an available move on this square.



Highlighted square: selected piece.



Red square: piece may be captured. When the king's square is red, this indicates the king is in check.



Gray square: the piece selected does not correspond to the turn to move.

d. Command prompt

Everything is handled in the main window except for the following two cases, where you will be asked to enter an input through the command prompt:

1. Pawn promotion: you will have to enter the type of piece you wish to replace your pawn with.
2. Game end: you will have to enter whether you wish to continue playing or not.

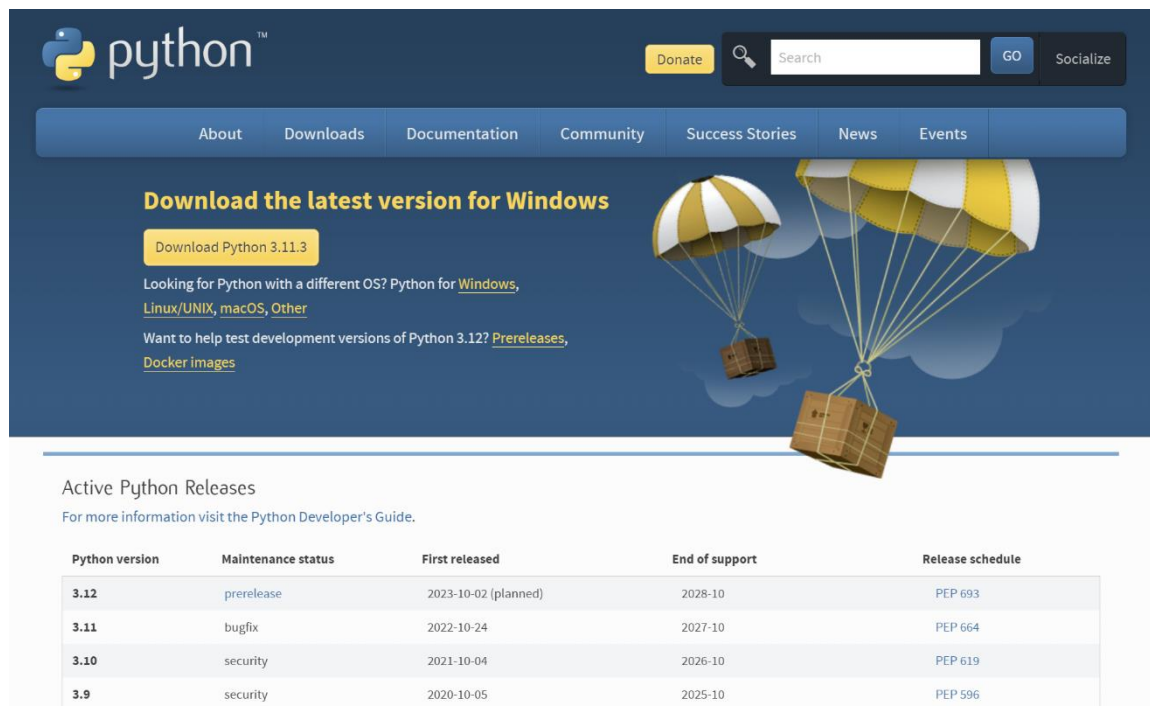
3. Gameplay instructions

a. Getting started

The chess game is run on Python using the pygame module. As such, it is required to have downloaded and properly installed them in order to play.

Installing Python:

1. Open your browser of choice.
2. Enter the link <https://www.python.org/downloads/> on the search bar and press Enter. You should see this page (as of 01/06/2023).



The screenshot shows the Python.org website. At the top, there is a navigation bar with links: About, Downloads, Documentation, Community, Success Stories, News, Events. Below this, a large banner for Windows download features a yellow and white striped parachute carrying a box. The text on the banner says "Download the latest version for Windows" and "Download Python 3.11.3". Below the banner, there is a section titled "Active Python Releases" with a table of release information.

Python version	Maintenance status	First released	End of support	Release schedule
3.12	prerelease	2023-10-02 (planned)	2028-10	PEP 693
3.11	bugfix	2022-10-24	2027-10	PEP 664
3.10	security	2021-10-04	2026-10	PEP 619
3.9	security	2020-10-05	2025-10	PEP 596

3. Scroll down until you see the “Looking for a specific release?” section:

Looking for a specific release?

Python releases by version number:

Release version	Release date	Click for more
Python 3.10.11	April 5, 2023	Download Release Notes
Python 3.11.3	April 5, 2023	Download Release Notes
Python 3.10.10	Feb. 8, 2023	Download Release Notes
Python 3.11.2	Feb. 8, 2023	Download Release Notes
Python 3.11.1	Dec. 6, 2022	Download Release Notes
Python 3.10.9	Dec. 6, 2022	Download Release Notes
Python 3.9.16	Dec. 6, 2022	Download Release Notes

[View older releases](#)

- Download any of the Python 3 releases. To be sure, we recommend downloading Python 3.11.3, as that is the version that the Chess game runs on.



- You will be redirected to another page. Scroll down again until you see the “Files” section.

Files

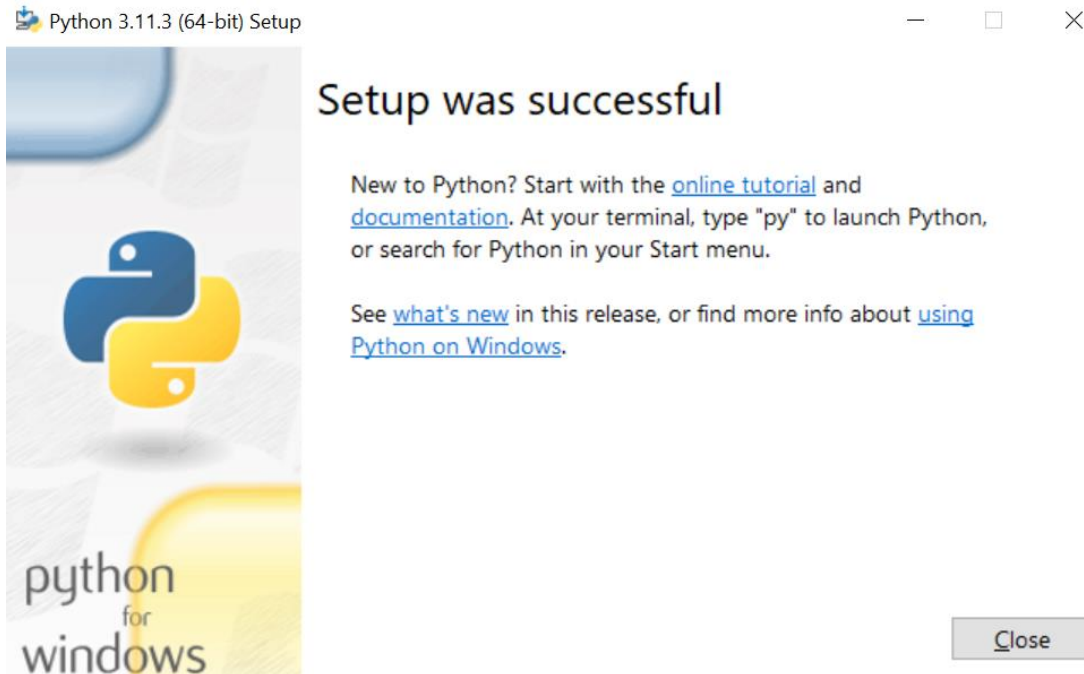
Version	Operating System	Description	MD5 Sum	File Size	GPG	Sigstore
Gzipped source tarball	Source release		016ba65bc80411f9ec20c614ab385e81	26455738	SIG	.sigstore
XZ compressed source tarball	Source release		c8d52fc4fb8ad9932a11d86d142ee73a	19906156	SIG	.sigstore
macOS 64-bit universal2 installer	macOS	for macOS 10.9 and later	11eda9f16a4a85fcc61dfc4b3f95e69	42859789	SIG	.sigstore
Windows embeddable package (32-bit)	Windows		58fc103df167d587ec4d1918dfcd4a62	9572139	SIG	.sigstore
Windows embeddable package (64-bit)	Windows		a58510bc0e8689cd3f80238f9435632d	10569806	SIG	.sigstore
Windows embeddable package (ARM64)	Windows		0e19be55774218c8ee46ed4176db68f3	9939202	SIG	.sigstore
Windows installer (32-bit)	Windows		691232496e346ce0860aef052dd6844f	24161448	SIG	.sigstore
Windows installer (64-bit)	Windows	Recommended	62414ff53148ae41b4cec89122532a82	25347040	SIG	.sigstore
Windows installer (ARM64)	Windows	Experimental	d6441f490e2c2163d7d67c78c7628bf9	24631624	SIG	.sigstore

- Download the appropriate installer for your device by clicking on one of the hyperlinked texts in the Version column.
- When the installer is downloaded, open it. You will see the following setup wizard appear on the screen:



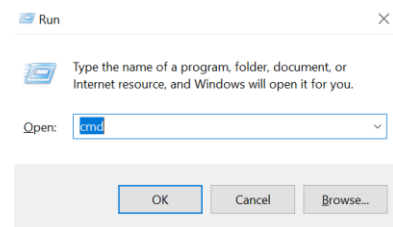
- Before you click Install Now, make sure to check both “Use admin privileges when installing py.exe” and “Add python.exe to PATH”.

9. After you've done that, you can click on Install Now.
10. When prompted "Do you want this app to make changes to your device?", click Yes.
11. Wait for the Setup to be finished by the wizard.
12. That's it! Now Python is installed in your device.



Next step is to install pygame:

1. Open the command prompt by pressing the Windows key + R simultaneously, and typing in cmd in the search bar.
 2. In the command prompt, enter the following line: "pip install pygame".
 3. Pygame will be installed to your device automatically.
- When it's done, you should see something like this:



```
Command Prompt
Microsoft Windows [Version 10.0.18363.1440]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\DELL>python --version
Python 3.9.0

C:\Users\DELL>pip --version
pip 20.2.3 from c:\python39\lib\site-packages\pip (python 3.9)

C:\Users\DELL>pip install pygame
Collecting pygame
  Downloading pygame-2.0.1-cp39-cp39-win_amd64.whl (5.2 MB)
    |#####| 5.2 MB 148 kB/s
Installing collected packages: pygame
Successfully installed pygame-2.0.1
WARNING: You are using pip version 20.2.3; however, version 21.0.1 is available.
You should consider upgrading via the 'c:\python39\python.exe -m pip install --upgrade pip' command.

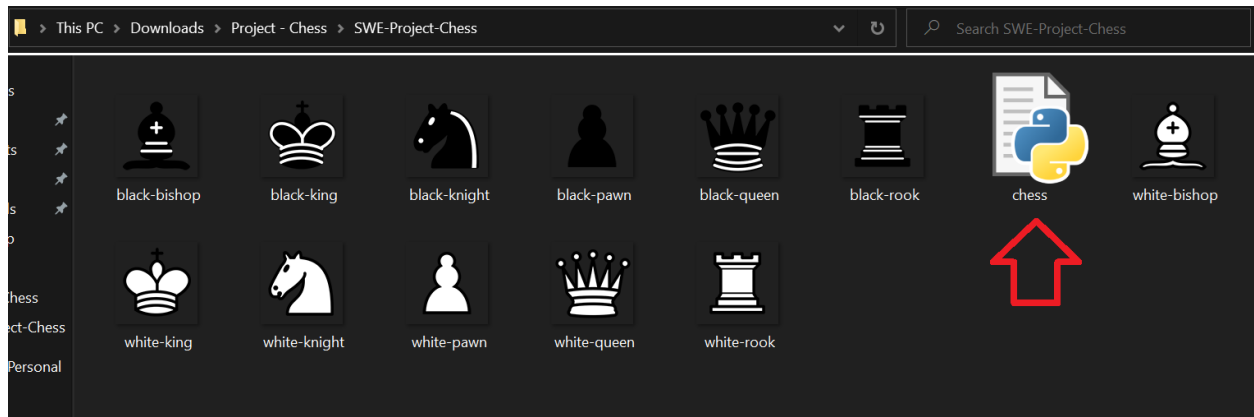
C:\Users\DELL>
```

Now you have properly installed Python and pygame on your device and are ready to start playing!

b. How to play

The chess game is very easy to start playing.

1. Navigate in your computer to where you have downloaded the Chess zip file containing the .py file and the piece .png sprites.
2. Double click on the chess.py file to open it.



And that's it! Once you have opened the chess.py file, the Chessboard window and the command prompt should pop up and you can immediately start playing.

Note that this game is meant to be played between two players locally. Players take turns to move their pieces until the game is over. The game can not be played singleplayer vs. the computer (AI).

When you are done playing, you may simply press the X button to exit. Alternatively, you can also exit the game by entering 'N' into the command prompt once the game is over.

c. Algebraic notation

Each square of the chessboard is identified by a unique coordinate pair – a letter and a number – from White's point of view.

- The vertical columns of squares, called *files*, are labeled a through h from White's left (the queenside) to right (the kingside).
- The horizontal rows of squares, called *ranks*, are numbered 1 to 8 starting from White's side of the board.

Thus each square has a unique identification of file letter followed by rank number. For example, the initial square of White's king is designated as "e1".

5. Tips and strategies

This section aims to briefly introduce you to chess strategies in order to get you familiarized with them. When you feel ready to learn more, feel free to check out the resources listed below for more in-depth information!

a. Opening/Book moves

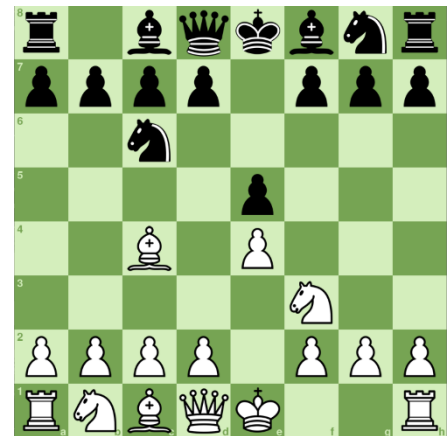
The first few moves of a chess game can be some of the most important moves you make. In those moves, you will establish your early plans and fight for your place on the board.

Most beginners don't need to memorize exact opening moves and should instead focus on good opening principles like controlling the center and developing your pieces. However, it is useful to know some openings as they can be common, and they do help reinforce good plans.

With that said, here are a few recommendations for opening moves for beginners:

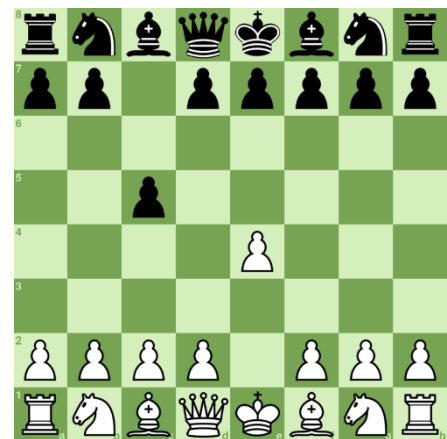
1. The Italian Game

- a. The Italian game begins with 1.e4 e5 2.Nf3 Nc6 3.Bc4. The point is to control the center quickly with your pawn and knight and then put your bishop on its most dangerous square. You are also preparing to castle to safety.



2. The Sicilian Defense

- a. The Sicilian Defense is the most popular choice of aggressive players with the black pieces. Often White will play 2.Nf3 and 3.d4 which will gain central space, but it allows Black to benefit by exchanging a central pawn for a bishop's pawn.



3. The French Defense

- a. The French Defense is one of the first strategic openings every chess player should learn. After e5 (now or later), both sides will have pawn chains. One risk of the French Defense is that the c8-bishop can be very hard to develop.

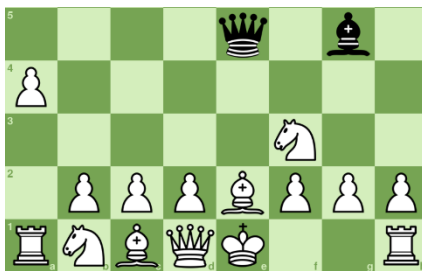


Keep in mind, as a rule of thumb; control the center!

Source: (<https://www.chess.com/article/view/the-best-chess-openings-for-beginners>)

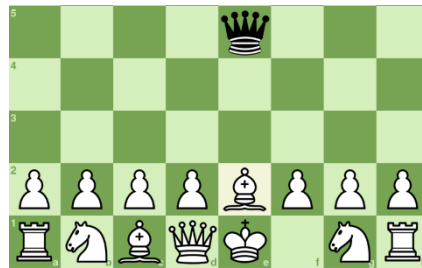
b. Chess tactics

- *Fork*: Simultaneously attacking two or more pieces with one move, forcing the opponent to choose which piece to save.



On the left, an example of a fork. Moving the knight to f3 causes an attack on both the black queen and bishop. Black has to choose whether they want to save the queen or the bishop, by moving either one away from the knight's attack.

- *Pin*: Restricting the movement of an opponent's piece by placing pressure on it, often with the threat of capturing a more valuable piece behind it.



On the left is shown a form of a pin called the *absolute pin*. This happens when the piece whose movement is restricted is guarding the king.

Note how the bishop in e2 is selected, but has no legal moves. If it were to move, the king would be in check, and as such it is stuck in place.

- *Skewer*: Attacking a less valuable piece, forcing it to move and revealing a more valuable piece behind it, which can be captured on the subsequent move.
- *Discovered Attack*: Moving one piece to reveal an attack by another piece, often targeting a valuable piece or creating a threat that must be addressed.
- *Double Attack*: Simultaneously attacking two different pieces or squares, forcing the opponent to choose which threat to counter.

- *Sacrifice*: Intentionally sacrificing a piece to gain a strategic advantage, such as opening up lines or squares, creating an attack, or exposing the opponent's king.
- *Zugzwang*: Manipulating the position to force the opponent into a disadvantageous move or series of moves.
- *Deflection*: Redirecting the opponent's piece away from a crucial square or defending piece to create vulnerabilities or exploit weaknesses.

c. Key concepts

1. Material

In chess, ‘material’ means the pieces. To see which player has more material, we “count” the pieces. Not all pieces are equal. Each one is given a value that tells how good it is at moving around the board. The better it moves, the higher the number (refer to section 2b for the numerical values of the pieces!).

The queen is the most powerful piece, so she counts the most. The pawns are the slowest. They count the least. The values are based on hundreds of years of experience by chess masters. They agree these numbers are a good measure of the strength of the pieces.

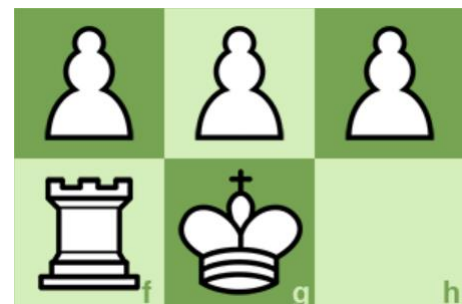
These values are useful for determining whether a trade is good or not. However, keep in mind these are guidelines, and not rules. Sometimes, sacrificing a valuable piece may lead to checkmate!

2. King safety

Material is not the only thing that matters. The position of the pieces is important too. Especially the position of the kings. Nobody cares about the piece count when there’s a checkmate. The safety of the king is one of the basic ideas of chess strategy. We can tell how safe a king is in two ways:

1. By how open he is
2. The number of attackers and defenders

To the right, an example of a safe king. The pawns in front of the king have not moved (so they are protecting it) and the king has castled.



3. Freedom

Besides material and safety, the other important thing in chess is how well the pieces are placed. The key to understanding the position of the pieces is the idea of freedom. Everyone likes freedom and so do the chess pieces. For them, it means being able to move. The more they can move, the happier and stronger they are.

d. Endgame strategies

Your ability to win a chess game is based on whether or not you can checkmate the enemy King. But more importantly, you can't truly make accurate decisions in the more complex situations of a game unless you are confident in your ability to deliver a full point when it matters most. The basic checkmates that must be mastered are:

1. *King and Queen vs King*: Because every King and Pawn Ending ends with the promotion of a pawn. If you can't checkmate with a Queen, then you can't truly master King and Pawn Endings.
2. *Two Rooks (or the Rook Roller) vs King*: also known as laddering.
3. *King and Rook vs King*: Because many Rook and Pawn endings (arguably the most commonly reached practical ending) end with one side having to give up their Rook for a Pawn. If you can't do this mate, then you can't win Rook and Pawn endings.
4. *King and Two Bishops vs King*.

For more in-depth strategies, refer to section 5e.

e. Resources

If you would like to improve your chess knowledge and gameplay, here are some beginner resources to check out!

1. **Lichess**: <https://lichess.org/> (learn, train and play for free)
2. **Chessfactor**: <https://www.chessfactor.com/> (for structured training)
3. **Chessable**: <http://chessable.com/> (interactive chess books)
 - a. **Recommended courses** – Basic Endgames, Chess Basics, Basic Checkmate Patterns
4. **Aimchess**: <https://www.aimchess.com/> (learn your strengths and weaknesses)
5. **Listudy**: <https://listudy.org/> (memorise openings)
6. **Chess guide (Youtube) by Levy Rozman**:
https://www.youtube.com/playlist?list=PLBRObSmbZluRBQOO_6FzyxQUaFyzusSl0
7. **Chess Fundamentals (Youtube) by John Bartholomew**:
<https://www.youtube.com/playlist?list=PLI9uuRYQ-6MBwqkmwT4211f17Z0bYuwwO>
8. **Chesspecker**: <https://www.chesspecker.com/> (tactics)
9. **Chess Endgame Training**: <https://chess-endgame-trainer.web.app/home> (as the name suggests)

6. Glossary

A glossary of some of the most common terms & terms mentioned in this user guide, useful for playing and talking about chess.

- absolute pin
 - A pin against the king is called absolute since the pinned piece cannot legally move out of the line of attack (as moving it would expose the king to check).
- advantage
 - A better position with the chance of winning the game. Evaluation factors can include space, time, material, and threats.
- algebraic notation
 - The standard way to record the moves of a chess game, using alphanumeric coordinates for the squares. Also called standard notation.
- attack
 - An aggressive action on a part of the chessboard, or to threaten the capture of a piece or pawn.
- blunder
 - A mistake that results in an immediate and major disadvantage. Also, “to blunder a piece” is to give away a piece.
- book move
 - A standard or conventional move.
- capture
 - A move that removes an opponent’s piece from the board.
- castle
 - A special type of move and is the only time a player can move two pieces at once. The king moves over two squares in either direction, and then the rook jumps to the other side of the king. There are a few rules. A player cannot castle while in check. The king cannot castle if it crosses a square controlled by an enemy, nor can it move onto a square controlled by an enemy. The king cannot castle if there are pieces between it and the rook. It must be the king’s first move and the rook’s first move.
- check
 - A direct attack on the king.
- checkmate
 - When the king is put into check and cannot escape.
- discovered attack
 - An attack by a piece after another one moves out of its way.
- discovered check
 - A discovered attack on the king. This occurs after another piece moves out of the way to clear the path for the attacker.
- development

- The state of having moved pieces off their starting squares. If a player has a lead “in development,” he or she has activated more pieces.
- en passant
 - French for “in passing,” it is a special type of capture that pawns can perform. If a pawn moves two squares on its opening move and lands adjacent to an opposing pawn, the opponent can move to capture the first player’s pawn by moving diagonally behind it.
- endgame
 - The last phase of a chess game, when players typically have only their king and a small number of pieces.
- evaluation
 - A comparison of progress between Black and White. When a chess engine is used to evaluate a game, a positive number means White has an advantage, and a negative number means Black does.
- exchange
 - When two players capture each other’s pieces, typically in sequence. A player can be “up or down” an exchange depending on the value of the pieces traded.
- FIDE
 - The Fédération Internationale des Échecs, or International Chess Federation, the governing body of chess.
- file
 - A column on the chessboard.
- fork
 - A piece that is attacking more than one other piece.
- gambit
 - An opening in which a player offers to give up a piece, usually a pawn, in favor of a positional advantage.
- hanging
 - undefended, as when a piece can be captured by an opponent without consequence.
- material
 - Another way to refer to pieces. Players can be “up” or “down” material if they have more pieces than their opponent.
- open file
 - A file with no pawns on it.
- opening
 - The initial part of a chess game, typically consisting of an established set of moves known as “theory.”
- passed pawn
 - A pawn with no opposing pawns on the same or adjacent files between it and the eighth rank. Colloquially called a “passer.”

- piece
 - A rook, bishop, knight, pawn, king or queen. Players can be “up a piece” if they have one or more rooks, bishops or knights than their opponent, and vice versa if they are “down a piece.”
- pin
 - When a piece is attacked but cannot legally move, because doing so would expose the player's own king to the attack; or when a piece is attacked and can legally move out of the line of attack, but such a move would expose a more valuable piece (or an unprotected piece) to capture. See absolute pin and relative pin, respectively.
- promotion
 - An upgrade for a pawn. When a pawn reaches the opposite end of the board, it becomes a knight, bishop, rook or queen. A pawn can become any of these pieces regardless of whether the player has previously captured one.
- rank
 - A row on the chessboard.
- result
 - The end state of a chess game; a win, loss or draw.
- relative pin
 - A pin where it is legal to move the pinned piece out of the line of attack. In other words, the piece is not pinned to the king, but to some other piece. Contrast with absolute pin where the pinned piece is not permitted to move, because the piece it is pinned to is the king.
- stalemate
 - Stalemate occurs when it becomes one player's turn and he or she has no legal moves, but the king is not in checkmate.
- tactic
 - A move, or combination of moves, that gives a player an advantage or win. There are dozens of types of moves and strategies that fall under the umbrella of tactics, a few of which are in this glossary.
- title
 - A designation for a player who has achieved a certain level of skill or performance. The most difficult title to obtain is grandmaster.
- underpromote
 - To promote a pawn to any piece that is not a queen. Typically used only in niche checkmate sequences to avoid stalemate.
- zugzwang
 - German for “compulsion to move.” A situation in which a player must move but all of the moves weaken the position. Typically occurs during endgame.