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[Mark Wilkinson](#), Chess <sup>[3]</sup>

**Chess,**

a [two-player zero-sum abstract strategy board game](#) with [perfect information](#) as classified by [John von Neumann](#). Chess has an estimated [state-space complexity](#) of  $10^{46}$  <sup>[1]</sup>, the estimated [game tree complexity](#) of  $10^{123}$  is based on an [average branching factor](#) of 35 and an average game length of 80 [ply](#) <sup>[2]</sup>.

This page is about the basic chess items, [chessboard](#), [pieces](#) and [moves](#), and how they are considered or encoded inside a chess program, to either represent a [chess position](#) inside its [search](#) and to play the [game of chess](#). It sub-pages intersect with [evaluation](#), [board representation](#) and even [search](#) topics.

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## Chess and Mathematics

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## Chess Maxima

- In 1966, Eero Bonsdorff, [Karl Fabel](#), and Olvai Riihimaa gave 5899 as the maximum number of [moves](#) in a chess game <sup>[5] [6] [7]</sup>
- [Shirish Chinchalkar](#) has determined a [state-space complexity](#) of  $10^{46.25}$  as upper bound for the number of reachable [chess positions](#) <sup>[8]</sup>, [John Tromp](#) gives about  $10^{45.888}$  <sup>[9] [10]</sup>
- The [maximum number of moves](#) per [chess position](#) seems 218 <sup>[11] [12]</sup>

R6R/3Q4/1Q4Q1/4Q3/2Q4Q/Q4Q2/pp1Q4/kBNN1KB1 w - - 0 1

## Chess and Psychology

1. [Adriaan de Groot](#)
2. [Alex de Voogt](#)
3. [Alexandre Linhares](#)
4. [Chess Psychology Booklist](#)
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## Chess and Philosophy

Quote from *Philosophy Looks at Chess* <sup>[13]</sup> :

The game of chess has endured since at least the sixth century. Its earliest variant, the Indian game of [Chaturanga](#), was from the beginning a game for thinkers. Since its inception, scholars, statesmen, strategists, and warriors have been fascinated by the game and its variants. German [philosopher Emanuel Lasker](#) and famed French artist [Marcel Duchamp](#) were both Grandmasters at chess. [Karl Marx](#) played chess avidly, as did [Sir Bertrand Russell](#), [Jean-Paul Sartre](#), and the logical positivist [Max Black](#). [Jean-Jacques Rousseau](#) <sup>[14]</sup> mentions in his *Confessions* that, at the time, he "had another expedient, not less solid, in the game of chess, to which I regularly dedicated, at Maugis's, the evenings on which I did not go to the theater. I became acquainted with [M. de Légal](#), M. Husson, [Philidor](#), and all the great chess players of the day, without making the least improvement in the game." More recently, philosopher [Stuart Rachels](#) reports that his father, the late philosopher and prominent [ethicist James Rachels](#), received a bribe from a Russian Grandmaster while he was the chair of the [U.S. Chess Federation's](#) Ethics committee.

## Chess Programs called Chess

- [Chess](#) the [Northwestern University](#) Chess Program by [Larry Atkin](#) and [David Slate](#)

- [Chess 0.5](#) by [Larry Atkin](#) and [Peter W. Frey](#)
- [Chess 0.5X](#) by [Wim Elsenaar](#)
- [Chess 2001](#), [Dedicated Chess Computers](#)
- [Chess 201x](#) by [Filip Höfer](#)
- [Chess-64](#) by [Fabien Letouzey](#)
- [Chess 7.0](#) by [Larry Atkin](#)

## See also

- [Anti-Computerchess](#)
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## Publications

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- [Claude Shannon](#) (1949). [Programming a Computer for Playing Chess](#). pdf from [The Computer History Museum](#)

### 1950 ...

- [Claude Shannon](#) (1950). *A Chess-Playing Machine*. [Scientific American](#), Vol. 182 (No. 2, February 1950), pp. 48-51. Reprinted in [The World of Mathematics](#), edited by [James R. Newman](#), [Simon & Schuster, NY](#), Vol. 4, 1956, pp. 2124-2133. Included in Part B
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## 2015 ...

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- [Lyudmil Tsvetkov \(2017\)](#). [The Secret of Chess](#). <sup>[22]</sup>
- [David Silver](#), [Thomas Hubert](#), [Julian Schrittwieser](#), [Ioannis Antonoglou](#), [Matthew Lai](#), [Arthur Guez](#), [Marc Lanctot](#), [Laurent Sifre](#), [Dharshan Kumaran](#), [Thore Graepel](#), [Timothy Lillicrap](#), [Karen Simonyan](#), [Demis Hassabis \(2017\)](#). *Mastering Chess and Shogi by Self-Play with a General Reinforcement Learning Algorithm*. [arXiv:1712.01815](#) » [AlphaZero](#)

## Forum Posts

## 1989

- [Can Chess Help Adapt to Life?](#) by [Mike Valvo](#), [rgc](#), September 06, 1989

## 1990 ...

- [Is chess in NP?](#) by Antti Juhani Ylikoski, [rec.games.programmer](#), May 26, 1997

## 2000 ...

- [Does this position blow up your program?](#) by [Mike Byrne](#), [CCC](#), December 23, 2002
- [Subject: Maximum Number of Legal Moves](#) by [Andrew Shapira](#), [CCC](#), May 08, 2005
- [Variants and Board Size](#) by [Harm Geert Muller](#), [CCC](#), October 25, 2007

## 2010 ...

- [max amount of moves from a position?](#) by [Srdja Matovic](#), [CCC](#), June 10, 2011
- [Contest: Find Position with the most moves](#) by [Charles Roberson](#), [CCC](#), December 09, 2011
- [New chess variants](#) by [Ferdinand Mosca](#), [CCC](#), March 03, 2012 » [Chess Variants](#)
- [Chess and the "Golden Ratio"...](#) by [Steve Maughan](#), [CCC](#), December 19, 2012
- [Chess with incomplete information](#) by [Harm Geert Muller](#), [CCC](#), December 13, 2013

## 2014

- [Total possible chess positions?](#) by [Matthew R. Brades](#), [CCC](#), March 26, 2014
- [for Chess-variant authors](#) by [Harm Geert Muller](#), [CCC](#), September 17, 2014 » [Chess Engine Communication Protocol](#), [WinBoard](#), [XBoard](#)
- [XBoard and chess variants](#) by [Evert Glebbeek](#), [CCC](#), October 28, 2014
- [UCCI2WB](#) by [Harm Geert Muller](#), [CCC](#), October 27, 2014 » [Chinese Chess](#) (Universal Chinese Chess Interface, UCCI)
- [UCI protocol for chess variants](#) by [Evert Glebbeek](#), [CCC](#), October 28, 2014 » [UCI](#)

## 2015 ...

- [Most common chess variant?](#) by [Stefano Gemma](#), [CCC](#), April 15, 2015 » [Chess Variants](#)
- [The future of chess and elo ratings](#) by [Larry Kaufman](#), [CCC](#), September 20, 2015 » [Match Statistics](#), [Opening Book](#)
- [Winboard 4.8.0b and Amazon chess variant](#) by [Ferdinand Mosca](#), [CCC](#), December 05, 2015 » [WinBoard](#)
- [Matibay an amazon chess variant engine](#) by [Ferdinand Mosca](#), [CCC](#), December 08, 2015
- [Masipag, a nightrider chess variant engine](#) by [Ferdinand Mosca](#), [CCC](#), December 09, 2015

## 2016

- [Grande Acedrex](#) by [Harm Geert Muller](#), [CCC](#), January 04, 2016
- [Tamerlane Chess](#) by [Harm Geert Muller](#), [CCC](#), January 28, 2016
- [New chess variant](#) by [Evert Glebbeek](#), [CCC](#), June 06, 2016 » [Chess Variants](#)
- [Max moves in a position](#) by [Laurie Tunnicliffe](#), [CCC](#), October 22, 2016 » [Chess Maxima](#)

## 2017

- [Winboard variants online](#) by [Erin Dame](#), [CCC](#), March 22, 2017 » [Chess Variants](#), [WinBoard](#)
- [The Peace-Chess Challenge](#) by [Harm Geert Muller](#), [CCC](#), September 24, 2017 » [Chess Variants](#)
- [Weakly vs strongly solving chess](#) by Greg Simpson, [CCC](#), September 26, 2017
- [best board representation for variants \(javascript\) ?](#) by [Mahmoud Uthman](#), [CCC](#), December 10, 2017 » [Board Representation](#), [JavaScript](#)

## 2018

- [Is modern chess software lossless or lossy?](#) by Meni Rosenfeld, [CCC](#), January 10, 2018 » [Playing Strength](#), [Selectivity](#)
- [Is chess still 99% tactics?](#) by [Alvaro Cardoso](#), [CCC](#), January 11, 2018 » [Tactics](#)
- [A Chess variant with low draw rate](#) by [Kai Laskos](#), [CCC](#), January 19, 2018 » [Chess Variants](#)

## External Links

### Wikipedia

- [Chess from Wikipedia](#)
- [Chess theory from Wikipedia](#)
- [Computer chess from Wikipedia](#)
- [First-move advantage in chess from Wikipedia](#)
- [Outline of chess from Wikipedia](#)
- [Rules of Chess from Wikipedia](#)
- [School of chess from Wikipedia](#)
- [Solving chess from Wikipedia](#)
- [Glossary of chess from Wikipedia](#)

### Chess

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- [Welcome to the Chess Museum - Links](#)
- [Earliest Occurrences of Chess Terms](#) by [Edward Winter](#)
- [Chess History Center - Chess Notes](#) by [Edward Winter](#)
- [Chess](#) from [MathWorld - A Wolfram Web Resource](#) by [Eric W. Weisstein](#)

## Chess Variants

- [Chess variant from Wikipedia](#)
- [The Chess Variant Pages](#) by [Hans L. Bodlaender](#)
- [Fairy chess from Wikipedia](#)
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- [Betza notation and XBoard](#) » [Moves](#), [XBoard](#)

## Misc

- [CHESS - Microsoft Research](#) a tool for finding and reproducing [Heisenbugs](#) in concurrent programs.
- [Chess \(musical\) from Wikipedia](#)
- [BBC World Service Programmes - The Friday Documentary: Seeking The Endgame](#), by Simon Terrington, with statements by [David Levy](#) et al. <sup>[23]</sup>
- [BBC - Future - The cyborg chess players that can't be beaten](#) by [Chris Baraniuk](#), December 04, 2015 » [David Levy](#), [Boris Alterman](#), [Shay Bushinsky](#), [Mark Lefler](#)
- [Mathematics and Chess Page](#)
- [SFE - The Science Fiction Encyclopedia - Chess](#)
- [Anthony Braxton](#) Interview - Chess, Math & Music, [YouTube](#) Video
- [Marcel Duchamp](#) on Chess, [YouTube](#) Video

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2. <sup>^</sup> [Victor Allis](#) (1994). *Searching for Solutions in Games and Artificial Intelligence*. Ph.D. Thesis, [University of Limburg](#), pdf, 6.3.9 Chess pp. 171
3. <sup>^</sup> [Tableaux ayant pour sujet les échecs](#)
4. <sup>^</sup> [Seirawan chess from Wikipedia](#)
5. <sup>^</sup> Eero Bonsdorff, [Karl Fabel](#), Olvai Riihimaa (1966) *Schach und Zahl - Unterhaltsame Schachmathematik*. Seite 11-13, Walter Rau Verlag, Düsseldorf (German)
6. <sup>^</sup> [50-Züge-Regel - Schachmathematik from Wikipedia.de](#) (German)
7. <sup>^</sup> [Defending Humanity's Honor](#) by [Tim Krabbé](#), see game [NewRival](#) - [Faile](#) with 493 moves, and playing 402 moves with bare kings!
8. <sup>^</sup> [Shirish Chinchalkar](#) (1996). *An Upper Bound for the Number of Reachable Positions*. [ICCA Journal](#), Vol. 19, No. 3
9. <sup>^</sup> [John's Chess Playground - Number of chess diagrams and positions](#)
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14. <sup>^</sup> [Jean-Jacques Rousseau and Chess](#) by [Edward Winter](#)

15. ^ [Chess Metaphors – Artificial Intelligence and the Human Mind](#) by [Diego Rasskin-Gutman](#), [ChessBase News](#), January 28, 2010
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17. ^ [Machine creativity: what it is and what it isn't](#) by [Albert Silver](#), [ChessBase News](#), August 28, 2016
18. ^ [The joys of chess – and the value of the pieces](#), [ChessBase News](#), December 21, 2011
19. ^ [Re: Tony's positional test suite](#) by [Louis Zulli](#), [CCC](#), August 01, 2017
20. ^ [Progressive chess from Wikipedia](#)
21. ^ [Using GAN to play chess](#) by Evgeniy Zheltonozhskiy, [CCC](#), February 23, 2017
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23. ^ [BBC Computer Chess Radio Programme](#) by [Harvey Williamson](#), [Hiarcs Forum](#), September 11, 2010

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