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Scorpio <sup>[3]</sup>

### Scorpio,

a sophisticated [open source chess engine](#) by [Daniel Shawul](#), written in [C++](#) and compliant to the [Chess Engine Communication Protocol](#) with builds running under [Windows](#) and [Linux](#). Scorpio participated at the [CCT9](#), [CCT11](#) and [CCT12 online tournaments](#), and played the [ICT 2007](#) over the board. It is base of Daniel's [general game playing](#) engine [Nebiyu](#), able to play [Chess variants](#), [Checkers](#), [Reversi](#), [Go](#) and [Amazons](#) <sup>[1]</sup>. Scorpio **2.7.9**, released in December 2017, optionally features a [Monte-Carlo Tree Search](#) <sup>[2]</sup>.

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## Description

### Board Representation

Scorpio combines [Bitboards](#) with a [0x88](#) board representation, and the coordinate transformation in [scanning bits](#) along with the lookup of the [De Bruijn multiplication](#). The "unique" 64-bit routine was generated with the help of the [De Bruijn Sequence Generator](#) passing Daniel's birth date <sup>[4]</sup>. [Magic bitboard](#) implementation by [Pradu Kannan](#) <sup>[5]</sup>. Thanks for the acknowledgment of both!

### Distributed Search

Scorpio performs a [distributed search](#) <sup>[6]</sup> <sup>[7]</sup> around an [iterative depth-first search](#) framework <sup>[8]</sup>: Scorpio uses a decentralized approach ([p2p](#)) where neither [memory](#) nor jobs are centralized. Each host could have multiple processors in which case [shared memory search](#) (centralized search with [threads](#)) will be used. One processor per node will be started by [mpirun](#), then each [process](#) at each node will create enough threads to engage all its processors.

### Evaluation

Scorpio's [evaluation](#) includes following features and techniques <sup>[9]</sup>:

- [Candidate Passed Pawn](#)
- [Evaluation Hash Table](#)
- [King Safety](#)
- [Lazy Evaluation](#)
- [Material](#)
- [Mobility](#) of [bishops](#) and [knights](#)

- [Outposts](#)
- [Passed Pawn](#)
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- [Tapered Eval](#)
- [Trapped Pieces](#)

## Bitbases

*see main article* [Scorpio Bitbases](#)

Scorpio has its own [endgame bitbase](#) format, which might be probed by other programs via a [shared library](#).

## See also

- [Arthropod](#)
- [Astronomy](#)
- [DanChess](#)
- [Mythology](#)

## Dedicated Namesake

- [Novag Scorpio 68000](#) from [Schachcomputer.info Wiki](#) » [Novag](#), [David Kittinger](#)

## Forum Posts

### 2005 ...

- [Scorpio chess engine by Daniel Shawul](#) by [Dann Corbit](#), [CCC](#), April 18, 2005
- [Scorpio chess engine by Daniel Shawul](#) by [Dann Corbit](#), [Winboard Forum](#), April 19, 2005
- [Gauntlet Scorpio v1.0 - games - new entry!](#) by [Karl-Heinz Söntges](#), [CCC](#), April 21, 2005
- [Gauntlet Scorpio v1.1 - games - replaced DanChess](#) by [Karl-Heinz Söntges](#), [CCC](#), June 02, 2005
- [Scorpio 1.3 looks promising](#) by [Dann Corbit](#), [CCC](#), June 29, 2005
- [Scorpio 1.5 is very strong!](#) by Ómar Skúlason, [CCC](#), August 22, 2005
- [Has anyone tried the Scorpio engine?](#) by [Lance Perkins](#), [CCC](#), October 05, 2005
- [Standardgauntlet - Scorpio is fighting for a place in the sun !](#) by [Karl-Heinz Söntges](#), [CCC](#), February 26, 2006
- [Special Scorpio 1.91 build for Core2Duo/Quad/Xeon](#) by [Jim Ablett](#), [CCC](#), July 21, 2007

- [Scorpio 2.0 Windows x64 build available](#) by [Jim Ablett](#), [CCC](#), December 22, 2007
- [Scorpio 64 bit questions](#) by [Denis P. Mendoza](#), [CCC](#), December 23, 2007
- [Scorpio 202 Under Linux Resolved](#) by [Joshua Shriver](#), [CCC](#), October 03, 2008

## 2010 ...

- [asynchronous search](#) by [Daniel Shawul](#), [CCC](#), April 6, 2010
- [Scorpio 2.6 JA available](#) by [Jim Ablett](#), [CCC](#), June 25, 2010
- [Scorpio 2.7 Linux](#) by [Jon Dart](#), [CCC](#), December 02, 2011
- [Scorpio Chess 2.7 by Jim Ablett is out](#) by [Norbert Raimund Leisner](#), [CCC](#), January 24, 2012

## 2015 ...

- [scorpio can run on 8192 cores](#) by [Daniel Shawul](#), [CCC](#), August 22, 2015
- [Scorpio 2.7.7](#) by Krzysztof Grzelak, [CCC](#), March 21, 2016
- [Happy halloween - scorpio 2.7.8](#) by [Daniel Shawul](#), [CCC](#), October 31, 2017
- [Scorpio 2.7.9](#) by [Daniel Shawul](#), [CCC](#), December 16, 2017
- [Alpha-Beta as a rollouts algorithm](#) by [Daniel Shawul](#), [CCC](#), January 25, 2018 » [Alpha-Beta](#), [MCαβ](#), [Monte-Carlo Tree Search](#)
- [Scorpio 2.8](#) by [Daniel Shawul](#), [CCC](#), February 10, 2018
- [comparing minimax and averaging MCTS with alphabeta rollouts](#) by [Daniel Shawul](#), [CCC](#), March 20, 2018 » [Monte-Carlo Tree Search](#)

## External Links

### Chess Engine

- [Scorpio Chess and Nebiyu Alien](#)
- [dshawul/Scorpio · GitHub](#)
- [Engine: Scorpio](#) from [WBEC Ridderkerk](#)
- [Update: scorpio 2.5 debian package \(unofficial\)](#), [Linux and Chess](#), March 13, 2010
- [The chess games of Scorpio](#) from [chessgames.com](#)

### Misc

- [Scorpio \(astrology\)](#) from [Wikipedia](#)
- [Scorpius](#) from [Wikipedia](#)
- [Scorpion](#) from [Wikipedia](#)
- [Scorpion \(disambiguation\)](#) from [Wikipedia](#)

## References

1. [^](#) [Scorpio Chess and Nebiyu Alien](#)
2. [^](#) [Scorpio 2.7.9](#) by [Daniel Shawul](#), [CCC](#), December 16, 2017

3. <sup>^</sup> [Scorpio symbol](#), [Book of Hours](#), the Falstof Master, [Bodleian Library](#), [Oxford](#), [Scorpio](#) (astrology) from [Wikipedia](#)
4. <sup>^</sup> [Scorpio/scorpio.h at master · dshawul/Scorpio · GitHub](#)
5. <sup>^</sup> [Scorpio/magics.cpp at master · dshawul/Scorpio · GitHub](#)
6. <sup>^</sup> [Scorpio/parallel.cpp at master · dshawul/Scorpio · GitHub](#)
7. <sup>^</sup> [asynchronous search](#) by [Daniel Shawul](#), [CCC](#), April 6, 2010
8. <sup>^</sup> [Scorpio/search.cpp at master · dshawul/Scorpio · GitHub](#)
9. <sup>^</sup> [Scorpio/eval.cpp at master · dshawul/Scorpio · GitHub](#)

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