

## ??? WINS HEX 11x11 AND HEX 13x13 TOURNAMENTS

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TODO: new pix

**Figure 1:** Participants and observers at the Hex competitions.

### 1. THE TOURNAMENTS

At the 2016 Olympiad there were two Hex tournaments:  $11 \times 11$  and  $13 \times 13$ . Three programs competed in the  $11 \times 11$  tournament: EZO by Kei Takada, supervised by Masahito Yamamoto, from Japan; HEXAMAZE by Tianli Zhang, operated by Yunxiao Sun, from China; and MOHEX 2.0 (**Undefined reference**), by Broderick Arneson, Ryan Hayward, Philip Henderson, Aja Huang, and Jakub Pawlewicz, from Canada.

Three programs competed in the  $13 \times 13$  tournament: EZO, HEXAMAZE, and MOHEXNET from Canada, with the same authors as MOHEX, plus Noah Weninger and Kenny Young.

EZO is a TODO version of the program that competed in the 2013 Olympiad. EZO uses alpha-beta search with an evaluation function based on a weighted combination of two different network connectivity measures. EZO ran on an i7 laptop.

HEXAMAZE is a new program? by ?

MOHEX, the winner of the previous five Olympiad Hex competitions (**Undefined reference**), is an MCTS program that uses the Benzene Hex framework built on the code base of FUEGO (**Undefined reference**), the Go program developed by Martin Müller, Markus Enzenberger and others at the University of Alberta. Benzene allows virtual connection and inferior cell computations. MOHEX performs these computations in UCT tree nodes visited at least 256 times. MOHEX ran on a 24 core shared-memory machine, with 4 cores reserved for the Depth-First Proof Number Search solver, which produces perfect play if it solves the position within the time allotted for a move. MOHEX uses a book — built by Broderick Arneson using Thomas Lincke’s method (**Undefined reference**) — with two  $11 \times 11$  openings.

MOHEXNET is a new hybrid program that combines the MOHEX MCTS search tree with a depth-1 tree created by calling NEUROHEX, a Deep Convolution Neural Net, once from the root.

TODO cite Nx paper.

Each tournament was a three-player double round robin, so 12 games in total with 8 games per player. Post-game win-detection is by our solver.

### $11 \times 11$ Tournament

11x11 results	MOHEX	EZO	HEXAMAZE	total	result
MOHEX		?-?	?-?	?-?	?
EZO	?-?	?-?		?-?	?
HEXAMAZE	?-?		?-?	?-?	?

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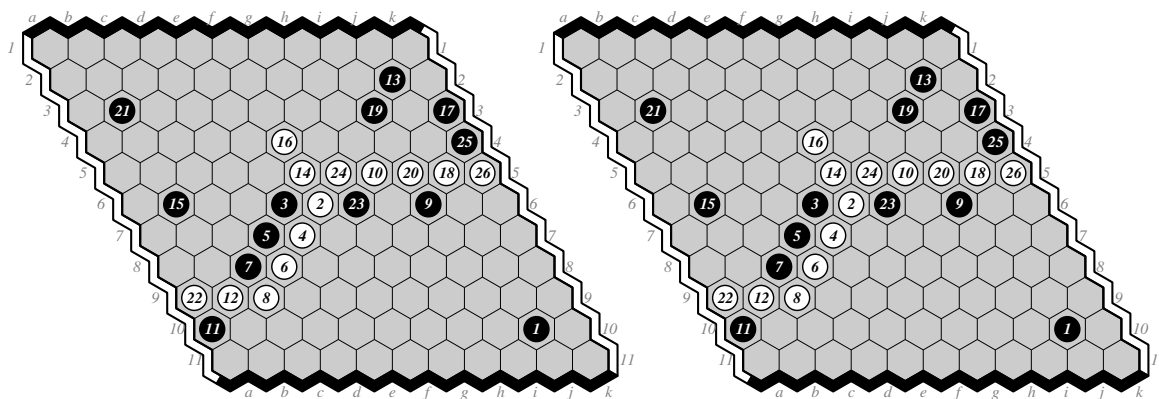
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Here are some selected games.

**Game 1.** E-M 0-1. 1.B[a7] 2.W[swap] 3.W[c9] ... MOHEX sees the win by move 30.B[e4].



**Figure 2:** Some game: EZO-MOHEX 0-1. Some game:

## 13×13 Tournament

13x13 results	MOHEX	EZO	HEXAMAZE	total	result
MOHEX		?-?	?-?	bronze	
EZO	?-?	?-?	?-?	bronze	
HEXAMAZE	?-?	?-?	?-?	bronze	

Above, playoff results are inside parentheses. Here are some selected games.

## 2. CONCLUSIONS

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