

Based on BoardFirstAutoPlayer running times, the TrieLexicon implementation was the fastest, followed by CompressedTrieLexicon, BinarySearchLexicon, and SimpleLexicon. BoardFirstAutoPlayer tested out the implementations of each method by calling their wordStatus methods multiple times. The LexiconFirstAutoPlayer method to find all words merely iterated through all words in the lexicon, which should be the same for all implementations of ILexicon, with the only difference being the time required to construct an iterator, since TrieLexicon and CompressedTrieLexicon needed to be converted from tries into ArrayLists. Thus, the times recorded for LexiconFirst were less helpful in determining effectiveness of the implementations.

The run time was calculated by the time required to go through a loop a certain number of games and find all words on board. For this experiment, all boards were the same, since they were created from the same random seed of 12345.

<i>4x4; 1,000 games</i>	<b>BoardFirst (s)</b>	<b>LexiconFirst (s)</b>
<b>Simple</b>	1.20	50.5
<b>BinarySearch</b>	1.02	49.0
<b>Trie</b>	0.664	58.2
<b>CompressedTrie</b>	0.716	56.4

<i>4x4; 4,000 games</i>	<b>BoardFirst (s)</b>	<b>LexiconFirst (s)</b>
<b>Simple</b>	4.50	199
<b>BinarySearch</b>	3.33	194
<b>Trie</b>	2.71	235
<b>CompressedTrie</b>	2.91	233

<i>4x4; 10,000 games</i>	<b>BoardFirst (s)</b>	<b>LexiconFirst (s)</b>
<b>Simple</b>	10.7	784
<b>BinarySearch</b>	12.8	692
<b>Trie</b>	5.90	814
<b>CompressedTrie</b>	6.49	539

Using BoardFirstAutoPlayer, the board that scored the highest of all 4x4 and 5x5 boards with 50,000 games was:

```

e  o  e  m  s
s  b  a  g  e
c  t  n  l  c
g  i  e  o  t
y  n  s  r  a

```

with a score of 2019.

The seconds it takes to run 1,000 and 10,000 games on a 4x4 board with BoardFirst and TrieLexicon were .664 seconds and 5.90 seconds, respectively. The seconds it would take to simulate 100,000 and 1 million games would be roughly one minute and 10 minutes, respectively. The results from the 1,000 and 10,000 run suggest that the running time complexity of any implementation of IAutoPlayer and ILexicon is  $O(N)$ , where  $N$  is the number of games simulated.