Tianyi Mu
CS201
Boggle

The results of Lexicon benchmark:

size of SimpleLexicon: 80612
iter time: 0.007000 size: 80612
word time: 0.006000 words: 80612
pref time: 0.017000 size: 16466

size of TrieLexicon: 80612
iter time: 0.025000 size: 80612
word time: 0.001000 words: 80612
pref time: 0.009000 size: 16466

size of CompressedTrieLexicon: 80612
iter time: 0.011000 size: 80612
word time: 0.001000 words: 80612
pref time: 0.011000 size: 16466

size of BinarySearchLexicon: 80612
iter time: 0.001000 size: 80612
word time: 0.000000 words: 80612
pref time: 0.020000 size: 16466

Based on the results, BinarySearchLexicon has the fastest iter time and word time and TrieLexicon has the fastest pref time for the given dictionary. As the size of the dictionary grows, SimpleLexicon will be the slowest one and the other three will be the fastest. However, for finding prefix, CompressedTrieLexicon will be the fastest with its benefit of trading space for time.

BoggleStats results:
For running 1000 times:
4x4

LexiconFirstAutoPlayer SimpleLexicon count: 1000 max: 889 time: 41.080000
BoardFirstAutoPlayer SimpleLexicon count: 1000 max: 889 time: 2.672000
LexiconFirstAutoPlayer TrieLexicon count: 1000 max: 889 time: 50.070000
BoardFirstAutoPlayer TrieLexicon count: 1000 max: 889 time: 1.056000
LexiconFirstAutoPlayer BinarySearchLexicon count: 1000 max: 889 time: 40.605000
BoardFirstAutoPlayer BinarySearchLexicon count: 1000 max: 889 time: 3.838000
LexiconFirstAutoPlayer CompressedTrieLexicon count: 1000 max: 889 time: 51.642000
BoardFirstAutoPlayer CompressedTrieLexicon count: 1000 max: 889 time: 1.073000

5x5

LexiconFirstAutoPlayer SimpleLexicon count: 1000 max: 1301 time: 67.705000
BoardFirstAutoPlayer SimpleLexicon count: 1000 max: 1301 time: 8.373000
LexiconFirstAutoPlayer TrieLexicon count: 1000 max: 1301 time: 75.871000
BoardFirstAutoPlayer TrieLexicon count: 1000 max: 1301 time: 3.473000
LexiconFirstAutoPlayer BinarySearchLexicon count: 1000 max: 1301 time: 67.456000
BoardFirstAutoPlayer BinarySearchLexicon count: 1000 max: 1301 time: 12.798000
LexiconFirstAutoPlayer CompressedTrieLexicon count: 1000 max: 1301 time: 76.978000
BoardFirstAutoPlayer CompressedTrieLexicon count: 1000 max: 1301 time: 3.268000

For running 10,000 times:

4x4

LexiconFirstAutoPlayer SimpleLexicon count: 10000 max: 889 time: 416.116000
BoardFirstAutoPlayer SimpleLexicon count: 10000 max: 889 time: 25.576000
LexiconFirstAutoPlayer TrieLexicon count: 10000 max: 889 time: 515.286000
BoardFirstAutoPlayer TrieLexicon count: 10000 max: 889 time: 9.864000
LexiconFirstAutoPlayer BinarySearchLexicon count: 10000 max: 889 time: 379.939000
BoardFirstAutoPlayer BinarySearchLexicon count: 10000 max: 889 time: 34.142000
LexiconFirstAutoPlayer CompressedTrieLexicon count: 10000 max: 889 time: 508.003000
BoardFirstAutoPlayer CompressedTrieLexicon count: 10000 max: 889 time: 10.069000

5x5

LexiconFirstAutoPlayer SimpleLexicon count: 10000 max: 2120 time: 671.020000
BoardFirstAutoPlayer SimpleLexicon count: 10000 max: 2120 time: 84.004000
LexiconFirstAutoPlayer TrieLexicon count: 10000 max: 2120 time: 761.481000
BoardFirstAutoPlayer TrieLexicon count: 10000 max: 2120 time: 33.084000
LexiconFirstAutoPlayer BinarySearchLexicon count: 10000 max: 2120 time: 615.397000
BoardFirstAutoPlayer BinarySearchLexicon count: 10000 max: 2120 time: 114.445000
LexiconFirstAutoPlayer CompressedTrieLexicon count: 10000 max: 2120 time: 742.960000
BoardFirstAutoPlayer CompressedTrieLexicon count: 10000 max: 2120 time: 32.090000

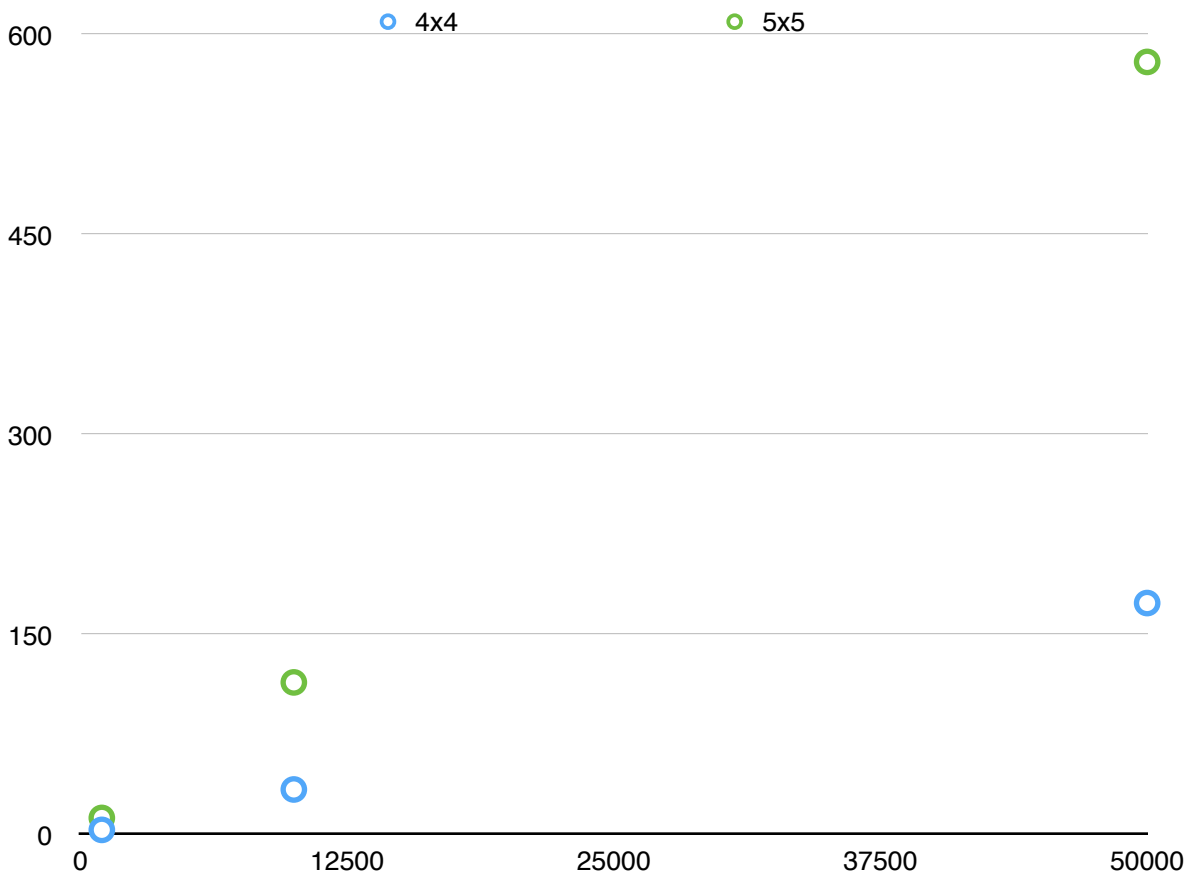
For running 50,000 times:

4x4

LexiconFirstAutoPlayer SimpleLexicon count: 50000 max: 1011 time: 2016.618000
BoardFirstAutoPlayer SimpleLexicon count: 50000 max: 1011 time: 121.501000
LexiconFirstAutoPlayer TrieLexicon count: 50000 max: 1011 time: 2472.946000
BoardFirstAutoPlayer TrieLexicon count: 50000 max: 1011 time: 53.335000
LexiconFirstAutoPlayer BinarySearchLexicon count: 50000 max: 1011 time: 1884.091000
BoardFirstAutoPlayer BinarySearchLexicon count: 50000 max: 1011 time: 173.956000
LexiconFirstAutoPlayer CompressedTrieLexicon count: 50000 max: 1011 time: 2425.087000
BoardFirstAutoPlayer CompressedTrieLexicon count: 50000 max: 1011 time: 51.819000

5x5

LexiconFirstAutoPlayer SimpleLexicon count: 50000 max: 2120 time: 3137.555000
BoardFirstAutoPlayer SimpleLexicon count: 50000 max: 2120 time: 380.248000
LexiconFirstAutoPlayer TrieLexicon count: 50000 max: 2120 time: 3699.906000
BoardFirstAutoPlayer TrieLexicon count: 50000 max: 2120 time: 180.176000
LexiconFirstAutoPlayer BinarySearchLexicon count: 50000 max: 2120 time: 3050.574000
BoardFirstAutoPlayer BinarySearchLexicon count: 50000 max: 2120 time: 579.806000
LexiconFirstAutoPlayer CompressedTrieLexicon count: 50000 max: 2120 time: 3608.952000
BoardFirstAutoPlayer CompressedTrieLexicon count: 50000 max: 2120 time: 169.111000



As we can see from the chart, which is based on the time for BoardFirstAutoPlayer with BinarySearchLexicon, the time is almost linear.
Thus the time for running 100,000 times will be roughly twice the time for 50,000 and the time for running 1,000,000 times will be roughly twenty times the time for 50,000.

By adding testing conditions to BoggleStats, the boards for max score on 4x4 and 5x5 are found.
The max score for 4x4 is the 25115 board:

```
c l i t
s m e r
b d a s
c l e h
```

BoardFirstAutoPlayer TrieLexicon count: 50000 max: 1011 time: 24.403000

The max score for 5x5 is the 7046 board:

```
p a c o d
o x s e r
a t n t r
n i e a s
d r n c e
```

BoardFirstAutoPlayer TrieLexicon count: 50000 max: 2120 time: 22.522000