

Author: Samuel Chan

1. Run the **AutocompletorBenchmark** file for each of three implementations of the **Autocompletor** interface: **BruteAutocomplete**, **BinarySearchAutocomplete**, and **TrieAutocomplete**.

Done

2. Run the benchmark on two files from the data folder: fourletterwords.txt and fourletterwordshalf.txt. These files consist of every four letter word 'aaaa' to 'zzzz' and half of these words, those from 'aaaa' to 'mzzz', respectively.

Done

3. Using the results from the benchmark program make conclusions about the size of the prefix and how it affects runtimes for each of the **Autocompletor** implementations. Using these results explain how the number of matches **k** that's a parameter to **topMatches** affects runtimes. Since the number of word/weight pairs in fourletterwords.txt and fourletterwordshalf.txt differ by a factor of two you should be able to relate these conclusions to **N**, the total number of entries stored in each implementation. For **TrieAutocomplete** be sure to note the total # of nodes used.

See Below:

Total # of nodes used for TrieAutocomplete:

- 805917 nodes in Words-333333, 475255 nodes in Fourletterwordshalf, 237628 in Fourletterwords

For N, the number of words in the file:

BruteAutocomplete: Takes $O(N)$ time to search, $O(M \log M)$ to sort, because it sorts every time a term word to find the heaviest term each search—PQ changes $O(N + M \log M)$ to $O(N \log M)$ —Find M, then sort versus PQ insertion. Doesn't take constant factors into account.

BinarySearchAutocomplete: Runs in $O(\log N)$ because it uses binary search, splitting the data in half each time. By comparing the target to the middle element, it divides in half successively until it reaches the middle value (or the first/last index value) If the search ends with half being empty, the target is not in the set. $O(\log N + M \log M)$, Requires initial sort of $O(N \log N)$, only once

TrieAutocomplete: Runs in $O(M)$ time (which is actually closer to $O(1)$ time with small inputs), $O(N) + O(M)^*$ – upper bound... Finding prefix "root" is very fast: $O(w)$

For prefix size:

From the data, it is hard to tell a clear correlation because the prefix sizes are so small. Generally, the prefix size doesn't affect the runtime because the prefix sizes are generally much smaller compared to the length of the text file, and both N and k affect the runtime significantly more.

For k , the number of top searches for autocomplete

There is a clear increase in runtime for the algorithm with trie as the k value increases. Using the binary search, there is an increase, although it is less obvious. There seems to be no correlation between the k value and the runtimes for the brute force algorithm.

Words 333333

Benchmarking BruteAutocomplete...

Found 333333 words

Time to initialize - 0.141702272

Time for topMatch("") - 0.001924966731

Time for topMatch("khombu") - 0.004595573207

Time for topMatch("k") - 0.002069036406

Time for topMatch("kh") - 0.002394711582

Time for topMatch("notarealword") - 0.004388010706

Time for topKMatches("", 1) - 0.00576436277

Time for topKMatches("", 2) - 0.0054210545

Time for topKMatches("", 4) - 0.00595524645

Time for topKMatches("", 8) - 0.00526126211

Time for topKMatches("", 16) - 0.00531623181

Time for topKMatches("", 32) - 0.00503102687

Time for topKMatches("", 64) - 0.00558603396

Time for topKMatches("", 128) - 0.00630332352

Time for topKMatches("", 256) - 0.00504268602

Time for topKMatches("khombu", 1) - 0.00677807118

Time for topKMatches("khombu", 2) - 0.00679731613

Time for topKMatches("khombu", 4) - 0.0060534642

Time for topKMatches("khombu", 8) - 0.00605467113

Time for topKMatches("khombu", 16) - 0.0061437354

Time for topKMatches("khombu", 32) - 0.00624155727

Time for topKMatches("khombu", 64) - 0.00613972331

Time for topKMatches("khombu", 128) - 0.00633644317
Time for topKMatches("khombu", 256) - 0.00616914516
Time for topKMatches("k", 1) - 0.00505038298
Time for topKMatches("k", 2) - 0.00503115209
Time for topKMatches("k", 4) - 0.00526002149
Time for topKMatches("k", 8) - 0.00515915985
Time for topKMatches("k", 16) - 0.00505706872
Time for topKMatches("k", 32) - 0.00507602798
Time for topKMatches("k", 64) - 0.00491153814
Time for topKMatches("k", 128) - 0.00514553837
Time for topKMatches("k", 256) - 0.0050973906
Time for topKMatches("kh", 1) - 0.00487163465
Time for topKMatches("kh", 2) - 0.00505723366
Time for topKMatches("kh", 4) - 0.00558382401
Time for topKMatches("kh", 8) - 0.00519391596
Time for topKMatches("kh", 16) - 0.00517026834
Time for topKMatches("kh", 32) - 0.00503316016
Time for topKMatches("kh", 64) - 0.00493516276
Time for topKMatches("kh", 128) - 0.00494689989
Time for topKMatches("kh", 256) - 0.00525050656
Time for topKMatches("notarealword", 1) - 0.00438500145
Time for topKMatches("notarealword", 2) - 0.00500051636
Time for topKMatches("notarealword", 4) - 0.00512185925
Time for topKMatches("notarealword", 8) - 0.00503259631
Time for topKMatches("notarealword", 16) - 0.00467364547
Time for topKMatches("notarealword", 32) - 0.00541414865
Time for topKMatches("notarealword", 64) - 0.00466062694
Time for topKMatches("notarealword", 128) - 0.00799968377
Time for topKMatches("notarealword", 256) - 0.00611109682

Benchmarking BinarySearchAutocomplete...

Found 333333 words

Time to initialize - 1.381378248

Time for topMatch("") - 0.002417289064

Time for topMatch("khombu") - 9.50695085E-4

Time for topMatch("k") - 4.97806842E-4

Time for topMatch("kh") - 4.63020208E-4

Time for topMatch("notarealword") - 9.01323452E-4

Time for topKMatches("", 1) - 0.01825087184

Time for topKMatches("", 2) - 0.01747586662

Time for topKMatches("", 4) - 0.01977746216

Time for topKMatches("", 8) - 0.03231737079
Time for topKMatches("", 16) - 0.04494464354
Time for topKMatches("", 32) - 0.03447309296
Time for topKMatches("", 64) - 0.04685086873
Time for topKMatches("", 128) - 0.05050026586
Time for topKMatches("", 256) - 0.05045437929
Time for topKMatches("khombu", 1) - 9.7033798E-4
Time for topKMatches("khombu", 2) - 9.9405805E-4
Time for topKMatches("khombu", 4) - 6.5928767E-4
Time for topKMatches("khombu", 8) - 0.00149174104
Time for topKMatches("khombu", 16) - 7.2265196E-4
Time for topKMatches("khombu", 32) - 5.1554514E-4
Time for topKMatches("khombu", 64) - 7.1726667E-4
Time for topKMatches("khombu", 128) - 6.0392966E-4
Time for topKMatches("khombu", 256) - 6.6959493E-4
Time for topKMatches("k", 1) - 0.00144125101
Time for topKMatches("k", 2) - 0.00117666537
Time for topKMatches("k", 4) - 0.00151006537
Time for topKMatches("k", 8) - 0.00348856281
Time for topKMatches("k", 16) - 0.00267426852
Time for topKMatches("k", 32) - 0.00401060235
Time for topKMatches("k", 64) - 0.00252207403
Time for topKMatches("k", 128) - 0.00442276768
Time for topKMatches("k", 256) - 0.00877647418
Time for topKMatches("kh", 1) - 0.00256011111
Time for topKMatches("kh", 2) - 7.8941701E-4
Time for topKMatches("kh", 4) - 0.00126228815
Time for topKMatches("kh", 8) - 6.0865232E-4
Time for topKMatches("kh", 16) - 0.00132935883
Time for topKMatches("kh", 32) - 0.00129269411
Time for topKMatches("kh", 64) - 0.00171428641
Time for topKMatches("kh", 128) - 9.7747417E-4
Time for topKMatches("kh", 256) - 0.00150793275
Time for topKMatches("notarealword", 1) - 9.4782208E-4
Time for topKMatches("notarealword", 2) - 7.1203497E-4
Time for topKMatches("notarealword", 4) - 8.461184E-4
Time for topKMatches("notarealword", 8) - 0.00112789693
Time for topKMatches("notarealword", 16) - 0.00132340577
Time for topKMatches("notarealword", 32) - 0.00115195362
Time for topKMatches("notarealword", 64) - 0.0011693574
Time for topKMatches("notarealword", 128) - 0.00172818845
Time for topKMatches("notarealword", 256) - 5.6876074E-4

Benchmarking TrieAutocomplete...

Found 456976 words

Time to initialize - 0.202566137

Created 475255 nodes

Time for topMatch("") - 1.981823E-6

Time for topMatch("nenk") - 5.24372E-7

Time for topMatch("n") - 1.93431E-6

Time for topMatch("ne") - 1.577761E-6

Time for topMatch("notarealword") - 5.39421E-7

Time for topKMatches("", 1) - 7.646265E-5

Time for topKMatches("", 2) - 4.247724E-5

Time for topKMatches("", 4) - 1.2582035E-4

Time for topKMatches("", 8) - 5.95164E-5

Time for topKMatches("", 16) - 1.2564131E-4

Time for topKMatches("", 32) - 2.3517038E-4

Time for topKMatches("", 64) - 3.2208232E-4

Time for topKMatches("", 128) - 0.00126647906

Time for topKMatches("", 256) - 0.00139065851

Time for topKMatches("nenk", 1) - 4.82063E-6

Time for topKMatches("nenk", 2) - 2.92227E-6

Time for topKMatches("nenk", 4) - 3.92287E-6

Time for topKMatches("nenk", 8) - 3.31222E-6

Time for topKMatches("nenk", 16) - 2.73121E-6

Time for topKMatches("nenk", 32) - 2.70142E-6

Time for topKMatches("nenk", 64) - 2.68879E-6

Time for topKMatches("nenk", 128) - 3.69935E-6

Time for topKMatches("nenk", 256) - 8.7453E-7

Time for topKMatches("n", 1) - 3.79726E-6

Time for topKMatches("n", 2) - 7.08999E-6

Time for topKMatches("n", 4) - 9.28952E-6

Time for topKMatches("n", 8) - 2.32083E-5

Time for topKMatches("n", 16) - 4.217772E-5

Time for topKMatches("n", 32) - 9.008621E-5

Time for topKMatches("n", 64) - 1.5363332E-4

Time for topKMatches("n", 128) - 3.4988472E-4

Time for topKMatches("n", 256) - 3.4589246E-4

Time for topKMatches("ne", 1) - 1.44169E-6

Time for topKMatches("ne", 2) - 1.12727E-6

Time for topKMatches("ne", 4) - 2.14659E-6

Time for topKMatches("ne", 8) - 4.63697E-6

Time for topKMatches("ne", 16) - 1.124484E-5

Time for topKMatches("ne", 32) - 1.308317E-5
Time for topKMatches("ne", 64) - 2.028429E-5
Time for topKMatches("ne", 128) - 4.353036E-5
Time for topKMatches("ne", 256) - 6.541356E-5
Time for topKMatches("notarealword", 1) - 3.47689E-6
Time for topKMatches("notarealword", 2) - 1.11593E-6
Time for topKMatches("notarealword", 4) - 1.14337E-6
Time for topKMatches("notarealword", 8) - 1.21322E-6
Time for topKMatches("notarealword", 16) - 1.29436E-6
Time for topKMatches("notarealword", 32) - 1.17997E-6
Time for topKMatches("notarealword", 64) - 8.2687E-7
Time for topKMatches("notarealword", 128) - 7.4325E-7
Time for topKMatches("notarealword", 256) - 1.05327E-6

Benchmarking TrieAutocomplete...

Found 228488 words

Time to initialize - 0.074178879

Created 237628 nodes

Time for topMatch("") - 2.391487E-6
Time for topMatch("aenk") - 3.12994E-7
Time for topMatch("a") - 1.301543E-6
Time for topMatch("ae") - 8.93662E-7
Time for topMatch("notarealword") - 1.41705E-7
Time for topKMatches("", 1) - 7.063381E-5
Time for topKMatches("", 2) - 7.426656E-5
Time for topKMatches("", 4) - 8.454892E-5
Time for topKMatches("", 8) - 5.926434E-5
Time for topKMatches("", 16) - 8.546672E-5
Time for topKMatches("", 32) - 2.6942915E-4
Time for topKMatches("", 64) - 7.0236184E-4
Time for topKMatches("", 128) - 9.2370842E-4
Time for topKMatches("", 256) - 0.00104509866
Time for topKMatches("aenk", 1) - 4.51381E-6
Time for topKMatches("aenk", 2) - 5.96103E-6
Time for topKMatches("aenk", 4) - 3.16275E-6
Time for topKMatches("aenk", 8) - 2.94017E-6
Time for topKMatches("aenk", 16) - 2.83067E-6
Time for topKMatches("aenk", 32) - 3.96096E-6
Time for topKMatches("aenk", 64) - 8.5896E-7
Time for topKMatches("aenk", 128) - 9.0011E-7
Time for topKMatches("aenk", 256) - 1.03071E-6
Time for topKMatches("a", 1) - 1.301302E-5

Time for topKMatches("a", 2) - 9.37817E-6
Time for topKMatches("a", 4) - 1.761909E-5
Time for topKMatches("a", 8) - 6.092228E-5
Time for topKMatches("a", 16) - 4.833528E-5
Time for topKMatches("a", 32) - 1.0324087E-4
Time for topKMatches("a", 64) - 1.7125977E-4
Time for topKMatches("a", 128) - 3.5529265E-4
Time for topKMatches("a", 256) - 3.4685465E-4
Time for topKMatches("ae", 1) - 1.70767E-6
Time for topKMatches("ae", 2) - 1.70788E-6
Time for topKMatches("ae", 4) - 2.84229E-6
Time for topKMatches("ae", 8) - 5.22308E-6
Time for topKMatches("ae", 16) - 9.6149E-6
Time for topKMatches("ae", 32) - 1.698469E-5
Time for topKMatches("ae", 64) - 2.457125E-5
Time for topKMatches("ae", 128) - 4.254452E-5
Time for topKMatches("ae", 256) - 6.663549E-5
Time for topKMatches("notarealword", 1) - 2.79565E-6
Time for topKMatches("notarealword", 2) - 4.3451E-7
Time for topKMatches("notarealword", 4) - 4.0217E-7
Time for topKMatches("notarealword", 8) - 4.1496E-7
Time for topKMatches("notarealword", 16) - 4.0362E-7
Time for topKMatches("notarealword", 32) - 4.088E-7
Time for topKMatches("notarealword", 64) - 6.8557E-7
Time for topKMatches("notarealword", 128) - 4.4205E-7
Time for topKMatches("notarealword", 256) - 3.982E-7

fourletterwords

Benchmarking BruteAutocomplete...

Found 456976 words

Time to initialize - 0.167156551

Time for topMatch("") - 0.002223425979

Time for topMatch("nenk") - 0.006390219595663265

Time for topMatch("n") - 0.004410864159

Time for topMatch("ne") - 0.004505881998

Time for topMatch("notarealword") - 0.005160619368421052

Time for topKMatches("", 1) - 0.0072868396

Time for topKMatches("", 2) - 0.00969792904

Time for topKMatches("", 4) - 0.00683696379

Time for topKMatches("", 8) - 0.00658325731

Time for topKMatches("", 16) - 0.00628187121
Time for topKMatches("", 32) - 0.0065069991
Time for topKMatches("", 64) - 0.00662681756
Time for topKMatches("", 128) - 0.00662525169
Time for topKMatches("", 256) - 0.00680716238
Time for topKMatches("nenk", 1) - 0.00977412756
Time for topKMatches("nenk", 2) - 0.00727391878
Time for topKMatches("nenk", 4) - 0.00669303606
Time for topKMatches("nenk", 8) - 0.0065654267
Time for topKMatches("nenk", 16) - 0.00713439378
Time for topKMatches("nenk", 32) - 0.00656822605
Time for topKMatches("nenk", 64) - 0.00664909763
Time for topKMatches("nenk", 128) - 0.00655616057
Time for topKMatches("nenk", 256) - 0.0065401996
Time for topKMatches("n", 1) - 0.00688830544
Time for topKMatches("n", 2) - 0.00683897092
Time for topKMatches("n", 4) - 0.00682337588
Time for topKMatches("n", 8) - 0.00678831225
Time for topKMatches("n", 16) - 0.00689419527
Time for topKMatches("n", 32) - 0.00742501682
Time for topKMatches("n", 64) - 0.0066161251
Time for topKMatches("n", 128) - 0.00672728171
Time for topKMatches("n", 256) - 0.00679725201
Time for topKMatches("ne", 1) - 0.00656879432
Time for topKMatches("ne", 2) - 0.00678860428
Time for topKMatches("ne", 4) - 0.00658705662
Time for topKMatches("ne", 8) - 0.0068110371
Time for topKMatches("ne", 16) - 0.00668553146
Time for topKMatches("ne", 32) - 0.00668789407
Time for topKMatches("ne", 64) - 0.00646749475
Time for topKMatches("ne", 128) - 0.00663867104
Time for topKMatches("ne", 256) - 0.00658570853
Time for topKMatches("notarealword", 1) - 0.00512709837
Time for topKMatches("notarealword", 2) - 0.00512021247
Time for topKMatches("notarealword", 4) - 0.00699967252
Time for topKMatches("notarealword", 8) - 0.01020161529
Time for topKMatches("notarealword", 16) - 0.00963079414
Time for topKMatches("notarealword", 32) - 0.00828742289
Time for topKMatches("notarealword", 64) - 0.00494263867
Time for topKMatches("notarealword", 128) - 0.00513491467
Time for topKMatches("notarealword", 256) - 0.0052610894

Benchmarking BinarySearchAutocomplete...
Found 456976 words
Time to initialize - 0.219441701
Time for topMatch("") - 0.005714334486857143
Time for topMatch("nenk") - 0.001239375119
Time for topMatch("n") - 0.001365441834
Time for topMatch("ne") - 0.001167504624
Time for topMatch("notarealword") - 0.001236935064
Time for topKMatches("", 1) - 0.0310763033
Time for topKMatches("", 2) - 0.04427725266
Time for topKMatches("", 4) - 0.05014007015
Time for topKMatches("", 8) - 0.05040036162
Time for topKMatches("", 16) - 0.05056864554
Time for topKMatches("", 32) - 0.05002196685
Time for topKMatches("", 64) - 0.05073455532
Time for topKMatches("", 128) - 0.051132909
Time for topKMatches("", 256) - 0.05077726626
Time for topKMatches("nenk", 1) - 0.00172806517
Time for topKMatches("nenk", 2) - 0.00141723917
Time for topKMatches("nenk", 4) - 0.00172726607
Time for topKMatches("nenk", 8) - 0.00156297489
Time for topKMatches("nenk", 16) - 0.00146713461
Time for topKMatches("nenk", 32) - 0.0015796048
Time for topKMatches("nenk", 64) - 0.00128110649
Time for topKMatches("nenk", 128) - 0.00163267893
Time for topKMatches("nenk", 256) - 0.00147332074
Time for topKMatches("n", 1) - 0.00284977812
Time for topKMatches("n", 2) - 0.00348479299
Time for topKMatches("n", 4) - 0.00338740299
Time for topKMatches("n", 8) - 0.00400076289
Time for topKMatches("n", 16) - 0.00477156517
Time for topKMatches("n", 32) - 0.00554894428
Time for topKMatches("n", 64) - 0.00613483485
Time for topKMatches("n", 128) - 0.00673066735
Time for topKMatches("n", 256) - 0.00762630463
Time for topKMatches("ne", 1) - 0.00142665772
Time for topKMatches("ne", 2) - 0.001611377
Time for topKMatches("ne", 4) - 0.00141964243
Time for topKMatches("ne", 8) - 0.00157081725
Time for topKMatches("ne", 16) - 0.00144476206
Time for topKMatches("ne", 32) - 0.00179069415
Time for topKMatches("ne", 64) - 0.00171967059
Time for topKMatches("ne", 128) - 0.00146826412

Time for topKMatches("ne", 256) - 0.00186365418
Time for topKMatches("notarealword", 1) - 0.00124432701
Time for topKMatches("notarealword", 2) - 0.00161403997
Time for topKMatches("notarealword", 4) - 0.00146117301
Time for topKMatches("notarealword", 8) - 0.00125124194
Time for topKMatches("notarealword", 16) - 0.00166071225
Time for topKMatches("notarealword", 32) - 0.00170506049
Time for topKMatches("notarealword", 64) - 0.00143243246
Time for topKMatches("notarealword", 128) - 0.00143480757
Time for topKMatches("notarealword", 256) - 0.00153516933

Benchmarking TrieAutocomplete...

Found 228488 words

Time to initialize - 0.083999638

Created 237628 nodes

Time for topMatch("") - 3.490232E-6

Time for topMatch("aenk") - 1.74008E-7

Time for topMatch("a") - 1.54562E-6

Time for topMatch("ae") - 2.005835E-6

Time for topMatch("notarealword") - 1.6666E-7

Time for topKMatches("", 1) - 0.05062769883

Time for topKMatches("", 2) - 0.05140621642

Time for topKMatches("", 4) - 0.0512221014

Time for topKMatches("", 8) - 0.05068781149

Time for topKMatches("", 16) - 0.05144926106

Time for topKMatches("", 32) - 0.05030670374

Time for topKMatches("", 64) - 0.05063504761

Time for topKMatches("", 128) - 0.05051763343

Time for topKMatches("", 256) - 0.0502203537

Time for topKMatches("aenk", 1) - 0.05065458354

Time for topKMatches("aenk", 2) - 0.05065872146

Time for topKMatches("aenk", 4) - 0.05115156324

Time for topKMatches("aenk", 8) - 0.05013832262

Time for topKMatches("aenk", 16) - 0.05060118945

Time for topKMatches("aenk", 32) - 0.05058119395

Time for topKMatches("aenk", 64) - 0.05148845094

Time for topKMatches("aenk", 128) - 0.05030097036

Time for topKMatches("aenk", 256) - 0.05106473561

Time for topKMatches("a", 1) - 0.0505733815

Time for topKMatches("a", 2) - 0.05045454547

Time for topKMatches("a", 4) - 0.05089204231

Time for topKMatches("a", 8) - 0.05094245141

Time for topKMatches("a", 16) - 0.05026431737
Time for topKMatches("a", 32) - 0.05092308438
Time for topKMatches("a", 64) - 0.05132690019
Time for topKMatches("a", 128) - 0.05070240774
Time for topKMatches("a", 256) - 0.05099395907
Time for topKMatches("ae", 1) - 0.05104700987
Time for topKMatches("ae", 2) - 0.05164979373
Time for topKMatches("ae", 4) - 0.0500361579
Time for topKMatches("ae", 8) - 0.05136195955
Time for topKMatches("ae", 16) - 0.05000293311
Time for topKMatches("ae", 32) - 0.0509794007
Time for topKMatches("ae", 64) - 0.05098579845
Time for topKMatches("ae", 128) - 0.05124052102
Time for topKMatches("ae", 256) - 0.05067821964
Time for topKMatches("notarealword", 1) - 0.05153762921
Time for topKMatches("notarealword", 2) - 0.05049046966
Time for topKMatches("notarealword", 4) - 0.05049099555
Time for topKMatches("notarealword", 8) - 0.05057404156
Time for topKMatches("notarealword", 16) - 0.05039861452
Time for topKMatches("notarealword", 32) - 0.05087892158
Time for topKMatches("notarealword", 64) - 0.05057438977
Time for topKMatches("notarealword", 128) - 0.05137567362
Time for topKMatches("notarealword", 256) - 0.05054022441

Fourletterwordshalf

Found 228488 words

Time to initialize - 0.12695102
Time for topMatch("") - 0.001947034917
Time for topMatch("aenk") - 0.014900164824404762
Time for topMatch("a") - 0.001777640943
Time for topMatch("ae") - 0.002209848707
Time for topMatch("notarealword") - 0.011881695268408552
Time for topKMatches("", 1) - 0.01728112428
Time for topKMatches("", 2) - 0.01542219216
Time for topKMatches("", 4) - 0.02398197368
Time for topKMatches("", 8) - 0.0146743061
Time for topKMatches("", 16) - 0.0071730428
Time for topKMatches("", 32) - 0.00951306964
Time for topKMatches("", 64) - 0.01056434785

Time for topKMatches("", 128) - 0.00957827901
Time for topKMatches("", 256) - 0.01113423819
Time for topKMatches("aenk", 1) - 0.038139767
Time for topKMatches("aenk", 2) - 0.01460217483
Time for topKMatches("aenk", 4) - 0.01989045437
Time for topKMatches("aenk", 8) - 0.02016410871
Time for topKMatches("aenk", 16) - 0.01512062901
Time for topKMatches("aenk", 32) - 0.0085229046
Time for topKMatches("aenk", 64) - 0.00814124754
Time for topKMatches("aenk", 128) - 0.00764815989
Time for topKMatches("aenk", 256) - 0.0068048832
Time for topKMatches("a", 1) - 0.00679265754
Time for topKMatches("a", 2) - 0.00370988338
Time for topKMatches("a", 4) - 0.00332558777
Time for topKMatches("a", 8) - 0.00318290242
Time for topKMatches("a", 16) - 0.00340437757
Time for topKMatches("a", 32) - 0.00332283964
Time for topKMatches("a", 64) - 0.00325895523
Time for topKMatches("a", 128) - 0.00637176505
Time for topKMatches("a", 256) - 0.00733549311
Time for topKMatches("ae", 1) - 0.00681080744
Time for topKMatches("ae", 2) - 0.00670901274
Time for topKMatches("ae", 4) - 0.0067160641
Time for topKMatches("ae", 8) - 0.00675996224
Time for topKMatches("ae", 16) - 0.00667278012
Time for topKMatches("ae", 32) - 0.01227953802
Time for topKMatches("ae", 64) - 0.01148048454
Time for topKMatches("ae", 128) - 0.00976293374
Time for topKMatches("ae", 256) - 0.01016613206
Time for topKMatches("notarealword", 1) - 0.00677670701
Time for topKMatches("notarealword", 2) - 0.00757023329
Time for topKMatches("notarealword", 4) - 0.00680477342
Time for topKMatches("notarealword", 8) - 0.00690239031
Time for topKMatches("notarealword", 16) - 0.00704514385
Time for topKMatches("notarealword", 32) - 0.00521132886
Time for topKMatches("notarealword", 64) - 0.00539969219
Time for topKMatches("notarealword", 128) - 0.00535480624
Time for topKMatches("notarealword", 256) - 0.00733040953

Benchmarking BinarySearchAutocomplete...

Found 228488 words

Time to initialize - 0.134561302

Time for topMatch("") - 0.003418989055
Time for topMatch("aenk") - 0.001105616978
Time for topMatch("a") - 8.4949812E-4
Time for topMatch("ae") - 5.56288506E-4
Time for topMatch("notarealword") - 6.25410992E-4
Time for topKMatches("", 1) - 0.01572196283
Time for topKMatches("", 2) - 0.02424353745
Time for topKMatches("", 4) - 0.02911364871
Time for topKMatches("", 8) - 0.0367234222
Time for topKMatches("", 16) - 0.05027149357
Time for topKMatches("", 32) - 0.05070974031
Time for topKMatches("", 64) - 0.05061420283
Time for topKMatches("", 128) - 0.05030237803
Time for topKMatches("", 256) - 0.05057873107
Time for topKMatches("aenk", 1) - 2.433536E-4
Time for topKMatches("aenk", 2) - 0.00113379373
Time for topKMatches("aenk", 4) - 9.0372794E-4
Time for topKMatches("aenk", 8) - 0.00101776006
Time for topKMatches("aenk", 16) - 0.00123020902
Time for topKMatches("aenk", 32) - 9.0931729E-4
Time for topKMatches("aenk", 64) - 0.00100809049
Time for topKMatches("aenk", 128) - 0.00111354274
Time for topKMatches("aenk", 256) - 9.8048311E-4
Time for topKMatches("a", 1) - 0.00347301818
Time for topKMatches("a", 2) - 0.00389216191
Time for topKMatches("a", 4) - 0.00409448455
Time for topKMatches("a", 8) - 0.0048631945
Time for topKMatches("a", 16) - 0.00596554563
Time for topKMatches("a", 32) - 0.00709156997
Time for topKMatches("a", 64) - 0.00839243046
Time for topKMatches("a", 128) - 0.00803405972
Time for topKMatches("a", 256) - 0.00923088677
Time for topKMatches("ae", 1) - 8.9085708E-4
Time for topKMatches("ae", 2) - 0.0011650876
Time for topKMatches("ae", 4) - 9.5582686E-4
Time for topKMatches("ae", 8) - 0.00107429249
Time for topKMatches("ae", 16) - 9.964474E-4
Time for topKMatches("ae", 32) - 0.00107475177
Time for topKMatches("ae", 64) - 0.00133209
Time for topKMatches("ae", 128) - 0.00129365337
Time for topKMatches("ae", 256) - 8.8956709E-4
Time for topKMatches("notarealword", 1) - 7.6002426E-4
Time for topKMatches("notarealword", 2) - 0.00111692634

Time for topKMatches("notarealword", 4) - 9.1769646E-4
Time for topKMatches("notarealword", 8) - 9.5128165E-4
Time for topKMatches("notarealword", 16) - 0.0015307226
Time for topKMatches("notarealword", 32) - 0.0011431766
Time for topKMatches("notarealword", 64) - 0.00128813766
Time for topKMatches("notarealword", 128) - 0.0013410312
Time for topKMatches("notarealword", 256) - 9.3438889E-4

Benchmarking TrieAutocomplete...

Found 456976 words

Time to initialize - 0.102706581

Created 475255 nodes

Time for topMatch("") - 4.083362E-6

Time for topMatch("nenk") - 2.41108E-7

Time for topMatch("n") - 2.806608E-6

Time for topMatch("ne") - 2.635611E-6

Time for topMatch("notarealword") - 2.10376E-7

Time for topKMatches("", 1) - 0.05188251872

Time for topKMatches("", 2) - 0.05114762157

Time for topKMatches("", 4) - 0.05080034558

Time for topKMatches("", 8) - 0.05085782225

Time for topKMatches("", 16) - 0.05110282376

Time for topKMatches("", 32) - 0.05256018723

Time for topKMatches("", 64) - 0.05090988194

Time for topKMatches("", 128) - 0.05170554164

Time for topKMatches("", 256) - 0.05110515438

Time for topKMatches("nenk", 1) - 0.05369715288

Time for topKMatches("nenk", 2) - 0.05368152528

Time for topKMatches("nenk", 4) - 0.05340233048

Time for topKMatches("nenk", 8) - 0.05089862837

Time for topKMatches("nenk", 16) - 0.05139038184

Time for topKMatches("nenk", 32) - 0.05233411594

Time for topKMatches("nenk", 64) - 0.05179128803

Time for topKMatches("nenk", 128) - 0.05117554119

Time for topKMatches("nenk", 256) - 0.05365992048

Time for topKMatches("n", 1) - 0.05015427015

Time for topKMatches("n", 2) - 0.0501125651

Time for topKMatches("n", 4) - 0.0536443131

Time for topKMatches("n", 8) - 0.05002752226

Time for topKMatches("n", 16) - 0.05371064426

Time for topKMatches("n", 32) - 0.05346835677

Time for topKMatches("n", 64) - 0.05379128924

Time for topKMatches("n", 128) - 0.05341863561

Time for topKMatches("n", 256) - 0.05239781104
Time for topKMatches("ne", 1) - 0.05272036246
Time for topKMatches("ne", 2) - 0.05076478217
Time for topKMatches("ne", 4) - 0.05318873399
Time for topKMatches("ne", 8) - 0.05337331985
Time for topKMatches("ne", 16) - 0.05348683163
Time for topKMatches("ne", 32) - 0.05324167818
Time for topKMatches("ne", 64) - 0.05368106793
Time for topKMatches("ne", 128) - 0.05332601119
Time for topKMatches("ne", 256) - 0.0533660104
Time for topKMatches("notarealword", 1) - 0.05265458183
Time for topKMatches("notarealword", 2) - 0.05309368541
Time for topKMatches("notarealword", 4) - 0.05276297302
Time for topKMatches("notarealword", 8) - 0.05229327738
Time for topKMatches("notarealword", 16) - 0.05125461308
Time for topKMatches("notarealword", 32) - 0.05237747662
Time for topKMatches("notarealword", 64) - 0.05099234629
Time for topKMatches("notarealword", 128) - 0.05185725185
Time for topKMatches("notarealword", 256) - 0.05048612174