

Siddhant Khanna

CompSci 201

BruteAutocomplete with fourletterwords.txt

Found 456976 words

Time to initialize - 0.071178545

Time for topMatch("") - 0.002095451997

Time for topMatch("nenk") - 0.005733239241695304

Time for topMatch("n") - 0.003537685269

Time for topMatch("ne") - 0.003779358244

Time for topMatch("notarealword") - 0.008168939794453507

Time for topKMatches("", 1) - 0.00854883234

Time for topKMatches("", 2) - 0.00782713118

Time for topKMatches("", 4) - 0.00768462048

Time for topKMatches("", 8) - 0.00742315533

Time for topKMatches("", 16) - 0.00764707389

Time for topKMatches("", 32) - 0.0078349093

Time for topKMatches("", 64) - 0.01074238167

Time for topKMatches("", 128) - 0.00996893019

Time for topKMatches("", 256) - 0.0086359106

Time for topKMatches("nenk", 1) - 0.00766772878

Time for topKMatches("nenk", 2) - 0.00762952511

Time for topKMatches("nenk", 4) - 0.00745935367

Time for topKMatches("nenk", 8) - 0.00758916679

Time for topKMatches("nenk", 16) - 0.00792346381

Time for topKMatches("nenk", 32) - 0.00785925485

Time for topKMatches("nenk", 64) - 0.00750676053

Time for topKMatches("nenk", 128) - 0.00754515619

Time for topKMatches("nenk", 256) - 0.00752284583

Time for topKMatches("n", 1) - 0.007462127

Time for topKMatches("n", 2) - 0.00751944956

Time for topKMatches("n", 4) - 0.00742729398

Time for topKMatches("n", 8) - 0.00732257737

Time for topKMatches("n", 16) - 0.00729246329

Time for topKMatches("n", 32) - 0.00717697762

Time for topKMatches("n", 64) - 0.00719834505

Time for topKMatches("n", 128) - 0.00725125589

Time for topKMatches("n", 256) - 0.00733419975

Time for topKMatches("ne", 1) - 0.00707229086

Time for topKMatches("ne", 2) - 0.00719781171

Time for topKMatches("ne", 4) - 0.00962299797

Time for topKMatches("ne", 8) - 0.00716929336

Time for topKMatches("ne", 16) - 0.00709616282

Time for topKMatches("ne", 32) - 0.00717219469

Time for topKMatches("ne", 64) - 0.00710478148

Time for topKMatches("ne", 128) - 0.00708631964

Time for topKMatches("ne", 256) - 0.0071681627

Time for topKMatches("notarealword", 1) - 0.00622698031
Time for topKMatches("notarealword", 2) - 0.00669924403
Time for topKMatches("notarealword", 4) - 0.00672696878
Time for topKMatches("notarealword", 8) - 0.00645684232
Time for topKMatches("notarealword", 16) - 0.00654906616
Time for topKMatches("notarealword", 32) - 0.00631258655
Time for topKMatches("notarealword", 64) - 0.00657684638
Time for topKMatches("notarealword", 128) - 0.00632133748
Time for topKMatches("notarealword", 256) - 0.00649613398

BruteAutocomplete with fourletterwordshalf.txt

Found 228488 words

Time to initialize - 0.038598761
Time for topMatch("") - 0.001022807001
Time for topMatch("aenk") - 0.005095535308553971
Time for topMatch("a") - 0.001004769273
Time for topMatch("ae") - 0.001058982726
Time for topMatch("notarealword") - 0.005427163896963124
Time for topKMatches("", 1) - 0.00723444525
Time for topKMatches("", 2) - 0.00386843499
Time for topKMatches("", 4) - 0.00676976338
Time for topKMatches("", 8) - 0.00669880457
Time for topKMatches("", 16) - 0.00809758192
Time for topKMatches("", 32) - 0.00381703456
Time for topKMatches("", 64) - 0.00395399431
Time for topKMatches("", 128) - 0.00394977032
Time for topKMatches("", 256) - 0.00409694448
Time for topKMatches("aenk", 1) - 0.00379354232
Time for topKMatches("aenk", 2) - 0.00368567264
Time for topKMatches("aenk", 4) - 0.00401629608
Time for topKMatches("aenk", 8) - 0.00416117476
Time for topKMatches("aenk", 16) - 0.00437302293
Time for topKMatches("aenk", 32) - 0.00628513914
Time for topKMatches("aenk", 64) - 0.00417525901
Time for topKMatches("aenk", 128) - 0.00431315745
Time for topKMatches("aenk", 256) - 0.00438475199
Time for topKMatches("a", 1) - 0.00481072672
Time for topKMatches("a", 2) - 0.00428303056
Time for topKMatches("a", 4) - 0.00426187219
Time for topKMatches("a", 8) - 0.00395062366
Time for topKMatches("a", 16) - 0.00395167326
Time for topKMatches("a", 32) - 0.00409629595
Time for topKMatches("a", 64) - 0.00400423423
Time for topKMatches("a", 128) - 0.00404864589
Time for topKMatches("a", 256) - 0.00410113007
Time for topKMatches("ae", 1) - 0.00397760601
Time for topKMatches("ae", 2) - 0.00391587598

Time for topKMatches("ae", 4) - 0.00398713773
Time for topKMatches("ae", 8) - 0.00394225247
Time for topKMatches("ae", 16) - 0.0039841468
Time for topKMatches("ae", 32) - 0.00400274517
Time for topKMatches("ae", 64) - 0.0039439378
Time for topKMatches("ae", 128) - 0.00403740324
Time for topKMatches("ae", 256) - 0.00403491578
Time for topKMatches("notarealword", 1) - 0.00345288371
Time for topKMatches("notarealword", 2) - 0.00340965392
Time for topKMatches("notarealword", 4) - 0.0034536901
Time for topKMatches("notarealword", 8) - 0.00351212201
Time for topKMatches("notarealword", 16) - 0.00329936077
Time for topKMatches("notarealword", 32) - 0.00328206799
Time for topKMatches("notarealword", 64) - 0.00319675615
Time for topKMatches("notarealword", 128) - 0.00318958815
Time for topKMatches("notarealword", 256) - 0.0031634122

BinarySearchAutocomplete with fourletterwords.txt

Found 456976 words

Time to initialize - 0.02942459
Time for topMatch("") - 9.51040511E-4
Time for topMatch("nenk") - 4.776525E-6
Time for topMatch("n") - 2.0459485E-5
Time for topMatch("ne") - 2.766076E-6
Time for topMatch("notarealword") - 3.61002E-6
Time for topKMatches("", 1) - 0.00601438973
Time for topKMatches("", 2) - 0.00784066502
Time for topKMatches("", 4) - 0.0104838733
Time for topKMatches("", 8) - 0.01321114332
Time for topKMatches("", 16) - 0.01623864108
Time for topKMatches("", 32) - 0.01957309513
Time for topKMatches("", 64) - 0.02414752572
Time for topKMatches("", 128) - 0.02839647847
Time for topKMatches("", 256) - 0.02957873139
Time for topKMatches("nenk", 1) - 2.5216E-6
Time for topKMatches("nenk", 2) - 1.29279E-6
Time for topKMatches("nenk", 4) - 1.408E-6
Time for topKMatches("nenk", 8) - 1.36107E-6
Time for topKMatches("nenk", 16) - 9.728E-7
Time for topKMatches("nenk", 32) - 7.2106E-7
Time for topKMatches("nenk", 64) - 7.5947E-7
Time for topKMatches("nenk", 128) - 7.6373E-7
Time for topKMatches("nenk", 256) - 9.088E-7
Time for topKMatches("n", 1) - 2.531153E-4
Time for topKMatches("n", 2) - 3.0138402E-4
Time for topKMatches("n", 4) - 4.5052936E-4
Time for topKMatches("n", 8) - 5.6464544E-4

Time for topKMatches("n", 16) - 6.5413435E-4
Time for topKMatches("n", 32) - 8.0200823E-4
Time for topKMatches("n", 64) - 8.9557608E-4
Time for topKMatches("n", 128) - 0.00114951911
Time for topKMatches("n", 256) - 0.00130002978
Time for topKMatches("ne", 1) - 1.179732E-5
Time for topKMatches("ne", 2) - 1.321811E-5
Time for topKMatches("ne", 4) - 1.78261E-5
Time for topKMatches("ne", 8) - 2.169597E-5
Time for topKMatches("ne", 16) - 2.711036E-5
Time for topKMatches("ne", 32) - 3.797753E-5
Time for topKMatches("ne", 64) - 3.60106E-5
Time for topKMatches("ne", 128) - 4.195834E-5
Time for topKMatches("ne", 256) - 5.495457E-5
Time for topKMatches("notarealword", 1) - 1.18187E-6
Time for topKMatches("notarealword", 2) - 8.1066E-7
Time for topKMatches("notarealword", 4) - 8.064E-7
Time for topKMatches("notarealword", 8) - 7.8079E-7
Time for topKMatches("notarealword", 16) - 6.9547E-7
Time for topKMatches("notarealword", 32) - 5.9307E-7
Time for topKMatches("notarealword", 64) - 4.9493E-7
Time for topKMatches("notarealword", 128) - 5.248E-7
Time for topKMatches("notarealword", 256) - 9.1733E-7

BinarySearchAutocomplete with fourletterwordshalf.txt

Found 228488 words

Time to initialize - 0.034882927
Time for topMatch("") - 4.40249702E-4
Time for topMatch("aenk") - 2.529276E-6
Time for topMatch("a") - 1.9243487E-5
Time for topMatch("ae") - 1.672531E-6
Time for topMatch("notarealword") - 2.606502E-6
Time for topKMatches("", 1) - 0.00317172792
Time for topKMatches("", 2) - 0.00410009753
Time for topKMatches("", 4) - 0.00609973572
Time for topKMatches("", 8) - 0.00713623102
Time for topKMatches("", 16) - 0.00841885283
Time for topKMatches("", 32) - 0.00994835209
Time for topKMatches("", 64) - 0.011718316
Time for topKMatches("", 128) - 0.01338826088
Time for topKMatches("", 256) - 0.01526409342
Time for topKMatches("aenk", 1) - 3.29813E-6
Time for topKMatches("aenk", 2) - 1.44213E-6
Time for topKMatches("aenk", 4) - 1.28426E-6
Time for topKMatches("aenk", 8) - 1.2544E-6
Time for topKMatches("aenk", 16) - 1.27146E-6
Time for topKMatches("aenk", 32) - 1.24161E-6

Time for topKMatches("aenk", 64) - 1.29706E-6
Time for topKMatches("aenk", 128) - 1.34827E-6
Time for topKMatches("aenk", 256) - 1.39946E-6
Time for topKMatches("a", 1) - 2.7498193E-4
Time for topKMatches("a", 2) - 2.7879632E-4
Time for topKMatches("a", 4) - 3.949348E-4
Time for topKMatches("a", 8) - 4.9862315E-4
Time for topKMatches("a", 16) - 6.8819509E-4
Time for topKMatches("a", 32) - 7.7400188E-4
Time for topKMatches("a", 64) - 9.2239202E-4
Time for topKMatches("a", 128) - 0.00114283752
Time for topKMatches("a", 256) - 0.00126204371
Time for topKMatches("ae", 1) - 1.014184E-5
Time for topKMatches("ae", 2) - 1.127252E-5
Time for topKMatches("ae", 4) - 1.632851E-5
Time for topKMatches("ae", 8) - 2.030503E-5
Time for topKMatches("ae", 16) - 2.632102E-5
Time for topKMatches("ae", 32) - 3.009702E-5
Time for topKMatches("ae", 64) - 3.529381E-5
Time for topKMatches("ae", 128) - 4.006393E-5
Time for topKMatches("ae", 256) - 4.945911E-5
Time for topKMatches("notarealword", 1) - 8.832E-7
Time for topKMatches("notarealword", 2) - 5.5466E-7
Time for topKMatches("notarealword", 4) - 5.0773E-7
Time for topKMatches("notarealword", 8) - 5.2053E-7
Time for topKMatches("notarealword", 16) - 7.0826E-7
Time for topKMatches("notarealword", 32) - 4.736E-7
Time for topKMatches("notarealword", 64) - 7.4239E-7
Time for topKMatches("notarealword", 128) - 5.504E-7
Time for topKMatches("notarealword", 256) - 6.1866E-7

TrieAutocomplete with fourletterwords.txt

Found 456976 words

Time to initialize - 0.139853414

Created 475255 nodes

Time for topMatch("") - 2.617595E-6

Time for topMatch("nenk") - 4.00212E-7

Time for topMatch("n") - 1.550931E-6

Time for topMatch("ne") - 1.158824E-6

Time for topMatch("notarealword") - 2.86293E-7

Time for topKMatches("", 1) - 1.3692137E-4

Time for topKMatches("", 2) - 6.732362E-5

Time for topKMatches("", 4) - 1.2603711E-4

Time for topKMatches("", 8) - 7.229854E-5

Time for topKMatches("", 16) - 1.9791753E-4

Time for topKMatches("", 32) - 2.0819591E-4

Time for topKMatches("", 64) - 4.0955663E-4

Time for topKMatches("", 128) - 8.6744599E-4
Time for topKMatches("", 256) - 0.0011386562
Time for topKMatches("nenk", 1) - 3.74185E-6
Time for topKMatches("nenk", 2) - 2.3936E-6
Time for topKMatches("nenk", 4) - 2.77333E-6
Time for topKMatches("nenk", 8) - 1.8048E-6
Time for topKMatches("nenk", 16) - 1.77066E-6
Time for topKMatches("nenk", 32) - 1.7792E-6
Time for topKMatches("nenk", 64) - 1.8816E-6
Time for topKMatches("nenk", 128) - 1.83467E-6
Time for topKMatches("nenk", 256) - 1.95839E-6
Time for topKMatches("n", 1) - 1.090131E-5
Time for topKMatches("n", 2) - 7.08265E-6
Time for topKMatches("n", 4) - 1.007358E-5
Time for topKMatches("n", 8) - 2.469969E-5
Time for topKMatches("n", 16) - 4.502606E-5
Time for topKMatches("n", 32) - 8.830705E-5
Time for topKMatches("n", 64) - 1.9530633E-4
Time for topKMatches("n", 128) - 3.4425968E-4
Time for topKMatches("n", 256) - 4.1846542E-4
Time for topKMatches("ne", 1) - 1.42934E-6
Time for topKMatches("ne", 2) - 1.65546E-6
Time for topKMatches("ne", 4) - 2.81173E-6
Time for topKMatches("ne", 8) - 5.46986E-6
Time for topKMatches("ne", 16) - 9.91145E-6
Time for topKMatches("ne", 32) - 1.599144E-5
Time for topKMatches("ne", 64) - 3.266128E-5
Time for topKMatches("ne", 128) - 4.057593E-5
Time for topKMatches("ne", 256) - 8.833691E-5
Time for topKMatches("notarealword", 1) - 3.17439E-6
Time for topKMatches("notarealword", 2) - 1.39947E-6
Time for topKMatches("notarealword", 4) - 1.42507E-6
Time for topKMatches("notarealword", 8) - 1.28426E-6
Time for topKMatches("notarealword", 16) - 1.2544E-6
Time for topKMatches("notarealword", 32) - 1.24586E-6
Time for topKMatches("notarealword", 64) - 7.33439E-6
Time for topKMatches("notarealword", 128) - 1.73653E-6
Time for topKMatches("notarealword", 256) - 1.86879E-6

TrieAutocomplete with fourletterwordshalf.txt

Found 228488 words

Time to initialize - 0.15061905

Created 237628 nodes

Time for topMatch("") - 3.081808E-6

Time for topMatch("aenk") - 5.6448E-7

Time for topMatch("a") - 1.783891E-6

Time for topMatch("ae") - 1.897384E-6

Time for topMatch("notarealword") - 1.96267E-7
Time for topKMatches("", 1) - 7.051082E-5
Time for topKMatches("", 2) - 4.980898E-5
Time for topKMatches("", 4) - 8.531612E-5
Time for topKMatches("", 8) - 7.730334E-5
Time for topKMatches("", 16) - 9.224517E-5
Time for topKMatches("", 32) - 1.8927328E-4
Time for topKMatches("", 64) - 3.321765E-4
Time for topKMatches("", 128) - 7.638899E-4
Time for topKMatches("", 256) - 0.00115626043
Time for topKMatches("aenk", 1) - 2.73067E-6
Time for topKMatches("aenk", 2) - 1.5488E-6
Time for topKMatches("aenk", 4) - 1.86879E-6
Time for topKMatches("aenk", 8) - 1.2416E-6
Time for topKMatches("aenk", 16) - 1.1648E-6
Time for topKMatches("aenk", 32) - 1.22026E-6
Time for topKMatches("aenk", 64) - 1.21173E-6
Time for topKMatches("aenk", 128) - 1.28427E-6
Time for topKMatches("aenk", 256) - 1.93279E-6
Time for topKMatches("a", 1) - 1.405011E-5
Time for topKMatches("a", 2) - 8.81066E-6
Time for topKMatches("a", 4) - 9.79199E-6
Time for topKMatches("a", 8) - 1.811197E-5
Time for topKMatches("a", 16) - 4.0721E-5
Time for topKMatches("a", 32) - 7.118921E-5
Time for topKMatches("a", 64) - 2.0142045E-4
Time for topKMatches("a", 128) - 2.4129239E-4
Time for topKMatches("a", 256) - 4.1525689E-4
Time for topKMatches("ae", 1) - 2.16747E-6
Time for topKMatches("ae", 2) - 3.136E-6
Time for topKMatches("ae", 4) - 5.5936E-6
Time for topKMatches("ae", 8) - 9.96265E-6
Time for topKMatches("ae", 16) - 1.787304E-5
Time for topKMatches("ae", 32) - 3.206394E-5
Time for topKMatches("ae", 64) - 2.724262E-5
Time for topKMatches("ae", 128) - 3.760207E-5
Time for topKMatches("ae", 256) - 9.724144E-5
Time for topKMatches("notarealword", 1) - 1.79627E-6
Time for topKMatches("notarealword", 2) - 9.9839E-7
Time for topKMatches("notarealword", 4) - 8.5333E-7
Time for topKMatches("notarealword", 8) - 6.4426E-7
Time for topKMatches("notarealword", 16) - 7.2534E-7
Time for topKMatches("notarealword", 32) - 6.9547E-7
Time for topKMatches("notarealword", 64) - 6.9973E-7
Time for topKMatches("notarealword", 128) - 8.576E-7
Time for topKMatches("notarealword", 256) - 7.552E-7

Conclusions:

Section 1, prefix size

BruteAutocomplete: here, $k=1$ for all prefix length. Here, as prefix length increased, runtime remains constant i.e. is independent of the size of the prefix or k , but is dependent on number of entries, N , since `topMatches` loops through the entire N terms. As N is fixed, runtime is constant.

Runtime: $O(N) + O(M \log M)$

BinarySearchAutocomplete: here, runtime is independent of the size of the prefix, but is positive in relation with number of matches, k , since `topMatches` loops through M terms taking $O(\log k)$ time to add a term to the priority queue each time. It also takes $O(\log N)$ to reach the first/last index.

Thus runtime: $O(\log N) + O(M \log k)$

TrieAutocomplete: The runtime of TrieAutocomplete is negative related to the size of the prefix and positive to the number of matches k . This is because M will be smaller as prefix increases in size. If p is the size of the prefix, first for loop takes $O(p)$ to run. The while loop takes $O(M \log k)$ to run.

Thus runtime: $O(p) + O(M \log k)$