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Based on the collected data, it appears that the length of the prefix has no effect on the runtime of AutoCompletorBenchmark. The runtimes for each of the three classes appeared to remain constant regardless of the length of prefix, yielding a runtime of O(1). A similar pattern was observed when analyzing the relationship between runtime and k for BruteAutoComplete and BinarySearchAutoComplete. The runtimes for both of these classes appeared to be independent of k, yielding O(1) runtimes. The only class which appeared to be related to k was TrieAutoComplete, whose runtimes varied directly with an increasing k. This meant that runtime for TrieAutoComplete was O(k).

Running the classes on documents of lengths that differed by a factor of two showed that runtimes also differed by a factor of two, meaning that the O(1) and O(k) runtimes stay as they are because constants are dropped in Big O analysis. The difference in lengths of the documents also caused the number of nodes created to differ by a factor of two in TrieAutoComplete. The final conclusion is that BruteAutoComplete runs in O(1) time, BinarySearchAutoComplete runs in O(1) time, and TrieAutoComplete runs in O(k) time.

BruteAutoComplete – 4LetterWords

```
Benchmarking BruteAutocomplete...
Found 456976 words
Time to initialize - 0.06895031
Time for topMatch("") - 0.001275110387
Time for topMatch("nenk") - 0.003623783667
Time for topMatch("n") - 0.002102639052
Time for topMatch("ne") - 0.00206668953
Time for topMatch("notarealword") - 0.004339431
Time for topKMatches("", 1) -  0.00250465608
Time for topKMatches("", 2) -  0.0022051189
Time for topKMatches("", 4) -  0.00232718188
Time for topKMatches("", 8) -  0.00235507859
Time for topKMatches("", 16) -  0.00234896808
Time for topKMatches("", 32) -  0.00239634434
Time for topKMatches("", 64) -  0.00241910065
Time for topKMatches("", 128) -  0.00248446585
Time for topKMatches("", 256) -  0.00262562761
Time for topKMatches("nenk", 1) -  0.00259118073
Time for topKMatches("nenk", 2) -  0.0023425736
Time for topKMatches("nenk", 4) -  0.00249356701
Time for topKMatches("nenk", 8) -  0.00238888714
Time for topKMatches("nenk", 16) -  0.00249027168
Time for topKMatches("nenk", 32) -  0.0025598297
Time for topKMatches("nenk", 64) -  0.00244916531
Time for topKMatches("nenk", 128) -  0.00244498228
Time for topKMatches("nenk", 256) -  0.00249377406
Time for topKMatches("n", 1) -  0.00239419033
Time for topKMatches("n", 2) -  0.00219885249
Time for topKMatches("n", 4) -  0.00232158924
Time for topKMatches("n", 8) -  0.00220743159
Time for topKMatches("n", 16) -  0.00225360864
Time for topKMatches("n", 32) -  0.00216207385
Time for topKMatches("n", 64) -  0.00227555277
Time for topKMatches("n", 128) -  0.00241549655
Time for topKMatches("n", 256) -  0.00255246072
Time for topKMatches("ne", 1) -  0.00239822132
Time for topKMatches("ne", 2) -  0.00238534148
Time for topKMatches("ne", 4) -  0.00248696368
Time for topKMatches("ne", 8) -  0.00246549131
Time for topKMatches("ne", 16) -  0.00251000399
Time for topKMatches("ne", 32) -  0.00222466013
Time for topKMatches("ne", 64) -  0.00222855309
Time for topKMatches("ne", 128) -  0.00248559716
Time for topKMatches("ne", 256) -  0.00253253788
Time for topKMatches("notarealword", 1) -  0.0018920032
Time for topKMatches("notarealword", 2) -  0.0020044787
Time for topKMatches("notarealword", 4) -  0.00202797369
Time for topKMatches("notarealword", 8) -  0.00194704661
Time for topKMatches("notarealword", 16) -  0.00194846317
Time for topKMatches("notarealword", 32) -  0.0019320387
Time for topKMatches("notarealword", 64) -  0.00199280726
Time for topKMatches("notarealword", 128) -  0.00188584875
Time for topKMatches("notarealword", 256) -  0.00203769115
```

BruteAutoComplete – 4LetterWordsHalf

```
Benchmarking BruteAutocomplete...
Found 228488 words
Time to initialize - 0.038138132
Time for topMatch("") - 5.51856541E-4
Time for topMatch("aenk") - 0.002550947158
Time for topMatch("a") - 5.20933242E-4
Time for topMatch("ae") - 4.99557758E-4
Time for topMatch("notarealword") - 8.5239707E-4
Time for topKMatches("", 1) -  0.00129661948
Time for topKMatches("", 2) -  0.001136705
Time for topKMatches("", 4) -  0.0011345209
Time for topKMatches("", 8) -  0.00103335504
Time for topKMatches("", 16) -  0.00103415031
Time for topKMatches("", 32) -  0.00102684148
Time for topKMatches("", 64) -  0.00113191559
Time for topKMatches("", 128) -  0.00123167186
Time for topKMatches("", 256) -  0.00139588232
Time for topKMatches("aenk", 1) -  0.00124121522
Time for topKMatches("aenk", 2) -  0.00116006867
Time for topKMatches("aenk", 4) -  0.00123950772
Time for topKMatches("aenk", 8) -  0.00107894406
Time for topKMatches("aenk", 16) -  0.00111452352
Time for topKMatches("aenk", 32) -  0.0010725926
Time for topKMatches("aenk", 64) -  0.00110677127
Time for topKMatches("aenk", 128) -  0.00108763466
Time for topKMatches("aenk", 256) -  0.00109425813
Time for topKMatches("a", 1) -  0.00115356752
Time for topKMatches("a", 2) -  0.00113103137
Time for topKMatches("a", 4) -  0.00115574069
Time for topKMatches("a", 8) -  0.00120756212
Time for topKMatches("a", 16) -  0.00119664566
Time for topKMatches("a", 32) -  0.00120366923
Time for topKMatches("a", 64) -  0.00111798226
Time for topKMatches("a", 128) -  0.00122680239
Time for topKMatches("a", 256) -  0.00137079752
Time for topKMatches("ae", 1) -  0.00120866955
Time for topKMatches("ae", 2) -  0.00117976994
Time for topKMatches("ae", 4) -  0.0011654215
Time for topKMatches("ae", 8) -  0.00118620029
Time for topKMatches("ae", 16) -  0.00125558121
Time for topKMatches("ae", 32) -  0.00120876814
Time for topKMatches("ae", 64) -  0.00116358283
Time for topKMatches("ae", 128) -  0.00103540551
Time for topKMatches("ae", 256) -  0.00122034498
Time for topKMatches("notarealword", 1) -  9.4318495E-4
Time for topKMatches("notarealword", 2) -  9.5915943E-4
Time for topKMatches("notarealword", 4) -  9.5588668E-4
Time for topKMatches("notarealword", 8) -  9.0821322E-4
Time for topKMatches("notarealword", 16) -  9.4433166E-4
Time for topKMatches("notarealword", 32) -  8.6010966E-4
Time for topKMatches("notarealword", 64) -  8.3851215E-4
Time for topKMatches("notarealword", 128) -  8.403747E-4
Time for topKMatches("notarealword", 256) -  8.8181366E-4
```

BinarySearchAutoComplete – 4LetterWords

```
Benchmarking BinarySearchAutocomplete...
Found 456976 words
Time to initialize - 0.034165774
Time for topMatch("") - 5.59883634E-4
Time for topMatch("nenk") - 0.003066950937
Time for topMatch("n") - 0.001442194383
Time for topMatch("ne") - 0.001492250508
Time for topMatch("notarealword") - 0.003877563492
Time for topKMatches("", 1) -  0.00668621091
Time for topKMatches("", 2) -  0.00653989919
Time for topKMatches("", 4) -  0.00654805953
Time for topKMatches("", 8) -  0.00638636079
Time for topKMatches("", 16) -  0.00666749061
Time for topKMatches("", 32) -  0.00646349544
Time for topKMatches("", 64) -  0.00656542692
Time for topKMatches("", 128) -  0.00665488148
Time for topKMatches("", 256) -  0.00691008347
Time for topKMatches("nenk", 1) -  0.00630678054
Time for topKMatches("nenk", 2) -  0.00645939181
Time for topKMatches("nenk", 4) -  0.00643197026
Time for topKMatches("nenk", 8) -  0.00639594294
Time for topKMatches("nenk", 16) -  0.00642961787
Time for topKMatches("nenk", 32) -  0.00584884482
Time for topKMatches("nenk", 64) -  0.00646059783
Time for topKMatches("nenk", 128) -  0.00714264443
Time for topKMatches("nenk", 256) -  0.00701208702
Time for topKMatches("n", 1) -  0.00666565296
Time for topKMatches("n", 2) -  0.00631855247
Time for topKMatches("n", 4) -  0.00693280231
Time for topKMatches("n", 8) -  0.00675706554
Time for topKMatches("n", 16) -  0.00634139529
Time for topKMatches("n", 32) -  0.00608988976
Time for topKMatches("n", 64) -  0.00604529352
Time for topKMatches("n", 128) -  0.00434753988
Time for topKMatches("n", 256) -  0.00269352799
Time for topKMatches("ne", 1) -  0.00269852146
Time for topKMatches("ne", 2) -  0.00288794778
Time for topKMatches("ne", 4) -  0.00271445441
Time for topKMatches("ne", 8) -  0.00264652186
Time for topKMatches("ne", 16) -  0.00282109507
Time for topKMatches("ne", 32) -  0.00291264642
Time for topKMatches("ne", 64) -  0.00272453603
Time for topKMatches("ne", 128) -  0.00273338698
Time for topKMatches("ne", 256) -  0.002899659
Time for topKMatches("notarealword", 1) -  0.00246312753
Time for topKMatches("notarealword", 2) -  0.00251483568
Time for topKMatches("notarealword", 4) -  0.00257677011
Time for topKMatches("notarealword", 8) -  0.00237307695
Time for topKMatches("notarealword", 16) -  0.00250644748
Time for topKMatches("notarealword", 32) -  0.00234732534
Time for topKMatches("notarealword", 64) -  0.0025332519
Time for topKMatches("notarealword", 128) -  0.00243107602
Time for topKMatches("notarealword", 256) -  0.0024482058
```

BinarySearchAutoComplete – 4LetterWordsHalf

```
Benchmarking BinarySearchAutocomplete...
Found 228488 words
Time to initialize - 0.019542797
Time for topMatch("") - 2.6634239E-4
Time for topMatch("aenk") - 0.002311868081
Time for topMatch("a") - 2.41184531E-4
Time for topMatch("ae") - 2.58743586E-4
Time for topMatch("notarealword") - 0.001665042515
Time for topKMatches("", 1) -  0.00303837287
Time for topKMatches("", 2) -  0.00274810718
Time for topKMatches("", 4) -  0.00275202647
Time for topKMatches("", 8) -  0.00266290291
Time for topKMatches("", 16) -  0.00274028107
Time for topKMatches("", 32) -  0.00268121691
Time for topKMatches("", 64) -  0.00275896226
Time for topKMatches("", 128) -  0.0028865502
Time for topKMatches("", 256) -  0.00292507648
Time for topKMatches("aenk", 1) -  0.00265690653
Time for topKMatches("aenk", 2) -  0.00269066407
Time for topKMatches("aenk", 4) -  0.00263340344
Time for topKMatches("aenk", 8) -  0.00265927811
Time for topKMatches("aenk", 16) -  0.00264932642
Time for topKMatches("aenk", 32) -  0.00268085376
Time for topKMatches("aenk", 64) -  0.00266413264
Time for topKMatches("aenk", 128) -  0.00265173886
Time for topKMatches("aenk", 256) -  0.00270902595
Time for topKMatches("a", 1) -  0.00258952452
Time for topKMatches("a", 2) -  0.00257077422
Time for topKMatches("a", 4) -  0.00271285727
Time for topKMatches("a", 8) -  0.00263268351
Time for topKMatches("a", 16) -  0.00270747089
Time for topKMatches("a", 32) -  0.00269291312
Time for topKMatches("a", 64) -  0.00266114152
Time for topKMatches("a", 128) -  0.00274660209
Time for topKMatches("a", 256) -  0.00278176685
Time for topKMatches("ae", 1) -  0.00248981657
Time for topKMatches("ae", 2) -  0.00236917316
Time for topKMatches("ae", 4) -  0.00249911457
Time for topKMatches("ae", 8) -  0.00253274852
Time for topKMatches("ae", 16) -  0.00243686626
Time for topKMatches("ae", 32) -  0.00260051241
Time for topKMatches("ae", 64) -  0.00262301284
Time for topKMatches("ae", 128) -  0.0025100522
Time for topKMatches("ae", 256) -  0.00256765973
Time for topKMatches("notarealword", 1) -  0.00210038477
Time for topKMatches("notarealword", 2) -  0.00217053461
Time for topKMatches("notarealword", 4) -  0.00200345482
Time for topKMatches("notarealword", 8) -  0.00207511493
Time for topKMatches("notarealword", 16) -  0.0021084027
Time for topKMatches("notarealword", 32) -  0.00202505732
Time for topKMatches("notarealword", 64) -  0.00218169844
Time for topKMatches("notarealword", 128) -  0.00224359168
Time for topKMatches("notarealword", 256) -  0.00216591644
```

TrieAutoComplete – 4LetterWords

```
Benchmarking TrieAutocomplete...
Found 456976 words
Time to initialize - 0.102438722
Created 475255 nodes
Time for topMatch("") - 3.840897E-6
Time for topMatch("nenk") - 4.20348E-7
Time for topMatch("n") - 1.679098E-6
Time for topMatch("ne") - 1.253589E-6
Time for topMatch("notarealword") - 2.89884E-7
Time for topKMatches("", 1) -  3.633751E-5
Time for topKMatches("", 2) -  4.755138E-5
Time for topKMatches("", 4) -  4.324687E-5
Time for topKMatches("", 8) -  3.155485E-5
Time for topKMatches("", 16) -  5.566869E-5
Time for topKMatches("", 32) -  1.2943248E-4
Time for topKMatches("", 64) -  2.4880518E-4
Time for topKMatches("", 128) -  4.7087069E-4
Time for topKMatches("", 256) -  7.4245218E-4
Time for topKMatches("nenk", 1) -  3.83031E-6
Time for topKMatches("nenk", 2) -  2.04443E-6
Time for topKMatches("nenk", 4) -  2.2097E-6
Time for topKMatches("nenk", 8) -  1.70582E-6
Time for topKMatches("nenk", 16) -  1.60626E-6
Time for topKMatches("nenk", 32) -  1.47857E-6
Time for topKMatches("nenk", 64) -  1.59074E-6
Time for topKMatches("nenk", 128) -  1.5071E-6
Time for topKMatches("nenk", 256) -  1.58613E-6
Time for topKMatches("n", 1) -  3.72658E-6
Time for topKMatches("n", 2) -  4.36674E-6
Time for topKMatches("n", 4) -  8.32489E-6
Time for topKMatches("n", 8) -  1.716049E-5
Time for topKMatches("n", 16) -  3.876121E-5
Time for topKMatches("n", 32) -  8.509175E-5
Time for topKMatches("n", 64) -  1.3234619E-4
Time for topKMatches("n", 128) -  2.7603711E-4
Time for topKMatches("n", 256) -  3.962582E-4
Time for topKMatches("ne", 1) -  1.14941E-6
Time for topKMatches("ne", 2) -  1.1997E-6
Time for topKMatches("ne", 4) -  2.41139E-6
Time for topKMatches("ne", 8) -  4.3179E-6
Time for topKMatches("ne", 16) -  8.56918E-6
Time for topKMatches("ne", 32) -  1.369951E-5
Time for topKMatches("ne", 64) -  1.974801E-5
Time for topKMatches("ne", 128) -  3.473527E-5
Time for topKMatches("ne", 256) -  6.981964E-5
Time for topKMatches("notarealword", 1) -  3.28037E-6
Time for topKMatches("notarealword", 2) -  2.2424E-6
Time for topKMatches("notarealword", 4) -  2.34474E-6
Time for topKMatches("notarealword", 8) -  2.36557E-6
Time for topKMatches("notarealword", 16) -  2.99264E-6
Time for topKMatches("notarealword", 32) -  1.43495E-6
Time for topKMatches("notarealword", 64) -  1.40595E-6
Time for topKMatches("notarealword", 128) -  1.38246E-6
Time for topKMatches("notarealword", 256) -  1.41853E-6
```

TrieAutoComplete – 4LetterWordsHalf

```
Benchmarking TrieAutocomplete...
Found 228488 words
Time to initialize - 0.079092704
Created 237628 nodes
Time for topMatch("") - 2.564252E-6
Time for topMatch("aenk") - 2.43159E-7
Time for topMatch("a") - 1.328603E-6
Time for topMatch("ae") - 9.82255E-7
Time for topMatch("notarealword") - 9.9214E-8
Time for topKMatches("", 1) -  3.794775E-5
Time for topKMatches("", 2) -  2.383644E-5
Time for topKMatches("", 4) -  4.655831E-5
Time for topKMatches("", 8) -  3.140542E-5
Time for topKMatches("", 16) -  6.098556E-5
Time for topKMatches("", 32) -  1.1031246E-4
Time for topKMatches("", 64) -  2.1945185E-4
Time for topKMatches("", 128) -  3.8244445E-4
Time for topKMatches("", 256) -  6.7930871E-4
Time for topKMatches("aenk", 1) -  3.52867E-6
Time for topKMatches("aenk", 2) -  2.12943E-6
Time for topKMatches("aenk", 4) -  2.50814E-6
Time for topKMatches("aenk", 8) -  2.00279E-6
Time for topKMatches("aenk", 16) -  1.94137E-6
Time for topKMatches("aenk", 32) -  1.8373E-6
Time for topKMatches("aenk", 64) -  1.84875E-6
Time for topKMatches("aenk", 128) -  1.86322E-6
Time for topKMatches("aenk", 256) -  1.05444E-6
Time for topKMatches("a", 1) -  2.85673E-6
Time for topKMatches("a", 2) -  4.7423E-6
Time for topKMatches("a", 4) -  8.04594E-6
Time for topKMatches("a", 8) -  1.656895E-5
Time for topKMatches("a", 16) -  3.621312E-5
Time for topKMatches("a", 32) -  6.284176E-5
Time for topKMatches("a", 64) -  1.2530317E-4
Time for topKMatches("a", 128) -  1.9271961E-4
Time for topKMatches("a", 256) -  3.3443066E-4
Time for topKMatches("ae", 1) -  9.0514E-7
Time for topKMatches("ae", 2) -  1.29397E-6
Time for topKMatches("ae", 4) -  2.55222E-6
Time for topKMatches("ae", 8) -  4.14867E-6
Time for topKMatches("ae", 16) -  7.49964E-6
Time for topKMatches("ae", 32) -  1.35085E-5
Time for topKMatches("ae", 64) -  2.216934E-5
Time for topKMatches("ae", 128) -  3.18063E-5
Time for topKMatches("ae", 256) -  6.134367E-5
Time for topKMatches("notarealword", 1) -  1.76772E-6
Time for topKMatches("notarealword", 2) -  4.5911E-7
Time for topKMatches("notarealword", 4) -  4.1083E-7
Time for topKMatches("notarealword", 8) -  3.8164E-7
Time for topKMatches("notarealword", 16) -  3.8531E-7
Time for topKMatches("notarealword", 32) -  3.1489E-7
Time for topKMatches("notarealword", 64) -  3.2077E-7
Time for topKMatches("notarealword", 128) -  3.9688E-7
Time for topKMatches("notarealword", 256) -  4.4643E-7
```