1. Timings:

BaseMarkov:

time source #chars

0.091 487614 1000

0.184 487614 2000

0.284 487614 4000

0.724 487614 8000

1.402 487614 16000

2.695 487614 32000

0.358 487614 4096

0.706 975228 4096

1.053 1462842 4096

1.390 1950456 4096

1.764 2438070 4096

2.161 2925684 4096

2.546 3413298 4096

2.911 3900912 4096

3.521 4388526 4096

3.858 4876140 4096

Given the output from running Benchmark.java using BaseMarkov, it is evident that this program runs O(NT). In the first group of timings where N remains fixed and T doubles in value, we can see how times approximately doubles with each consecutive run as T doubles. An example of this can be best seen in the time difference between when T is 1000 and when T is 2000. The time of the second is approximately double that of the first because time is growing linearly in regard to T. Moreover, the second group, where T is fixed and N varies, demonstrates something similar. We can see that last run of the second group of timings has 10 times the value of N and time than the first run. Therefore, we can see that this group follows suit with the first one where the time grows approximately by the same value of N; therefore, time grows linearly in respect to N. Because we know that time grows in a linear fashion to both N and T, we can state that BaseMarkov runs O(NT) because it’s output is linearly dependent on both N and T.

1. Timings:

time source #chars

0.105 487614 1000

0.132 487614 2000

0.105 487614 4000

0.089 487614 8000

0.096 487614 16000

0.068 487614 32000

0.059 487614 4096

0.131 975228 4096

0.213 1462842 4096

0.275 1950456 4096

0.331 2438070 4096

0.467 2925684 4096

0.652 3413298 4096

0.906 3900912 4096

1.103 4388526 4096

1.132 4876140 4096

Given by the output of Benchmark.java, EfficientMarkov runs O(N + T). The first group of timings, where N is fixed and T varies, show times that are more or less consistent with one another. There is a subtle change between each time as T doubles. This is due to the fact that because N is too large and T is too small to take make drastic changes in runtimes. In the second group of timings where N varies and T is fixed, there drastic change among the runtimes. This is because N is drastically increasing in value in comparison to the small fixed value of T. This demonstrates that big changes in the changing value in comparison to the fixed value will bring upon big changes in the runtime, while small and minute changes in the changing variable in comparison to a large fixed value will bring upon little to no change in runtimes. This proves that the EfficientMarkov runs O(N + T) because for there to be drastic change in runtime, either N or T or both have to be a much larger value that it was before.

1. Using poe.txt:

the bells jingled. ``I have an arm above the ninth and finding

his cap jingled as he said, ``over the bells jingled. ``I have

before spoken. Throwing the mould. ``Drink,'' I shall not the

bones had told them that made bold to return. No? Then I was.

You are encrusted with the foot of the noble Fortunato. The Cask

of the love of De Grave. He was a cough.'' ``True-true,'' I should

use within itself, but the rheum of a few paces. ``But let it

at last and let it up. Against the damp ground of some fools

will go back; you are encrusted with human foot d'or, in wine.

He was turned. I stepped back from his dull torch, endeavoured

to be avenged; this interior crypt were no engagement;-come.''

``My friend, as my friend found it is not the very definitiveness

with the