NAME: SUBHAM KUMAR DASH ID:2017A7PS0004P

KSHITIJ GUPTA ID: 2017B3A70601P

**Solution 1:**
**To run:**
Type the following
make thread=<no of thread>
Eg **make thread=3**
Above line will run the program with three threads.

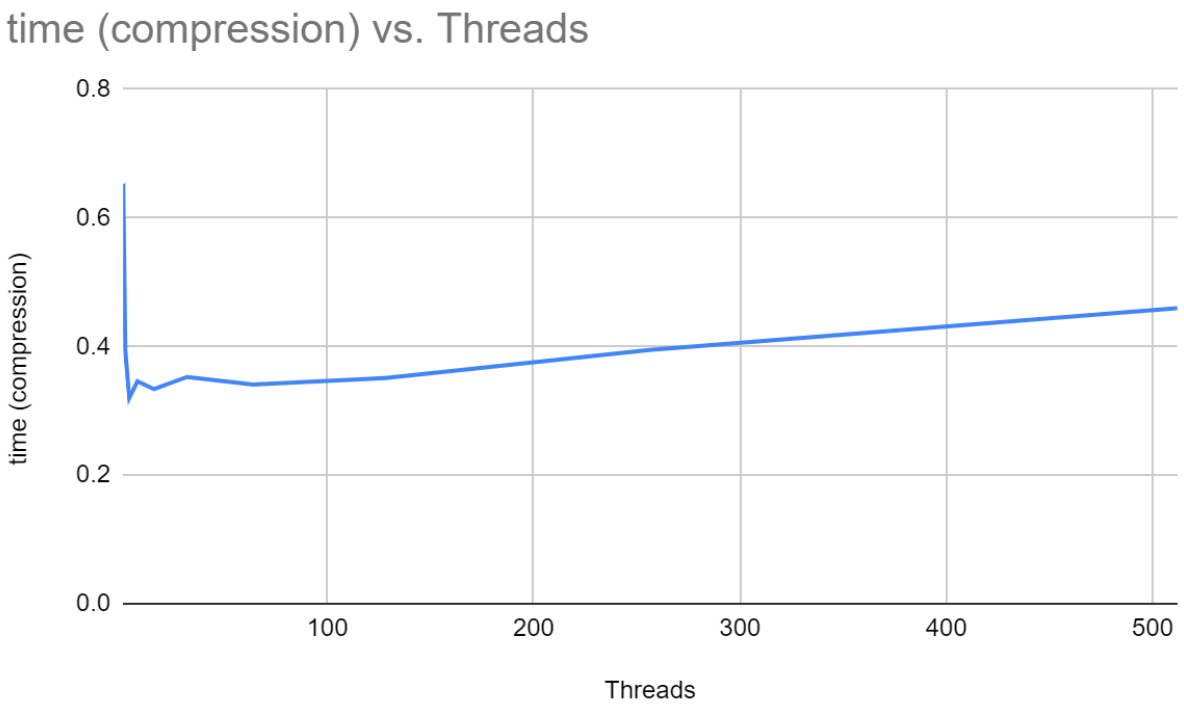
**Design:**

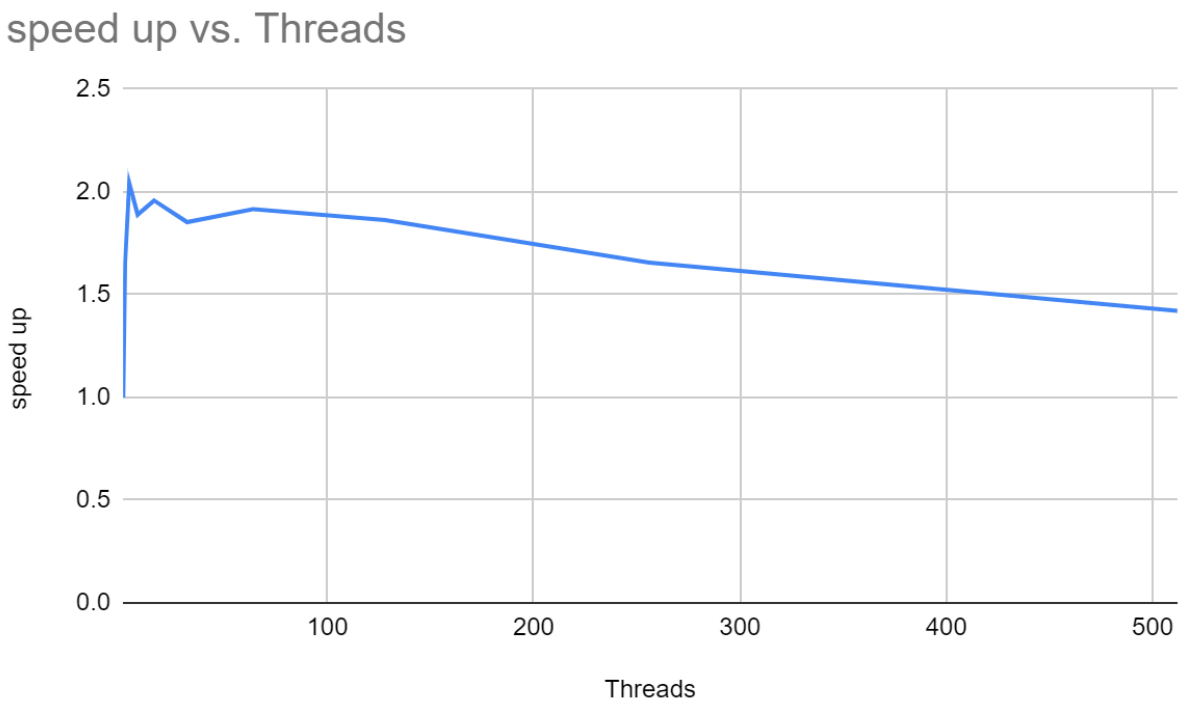
A huffman mapping is created by taking the common character frequency from internet.
The whole file is divided into n chunks where n is the number of pthreads.
Each thread will encode its chunk and save the encoding in a separate file.
A script is run to concat all the files generated by the threads and store the result in output.txt file
For decoding, the parent thread sequentially goes through the output.txt file and decode it and store the result in decompressed.txt.

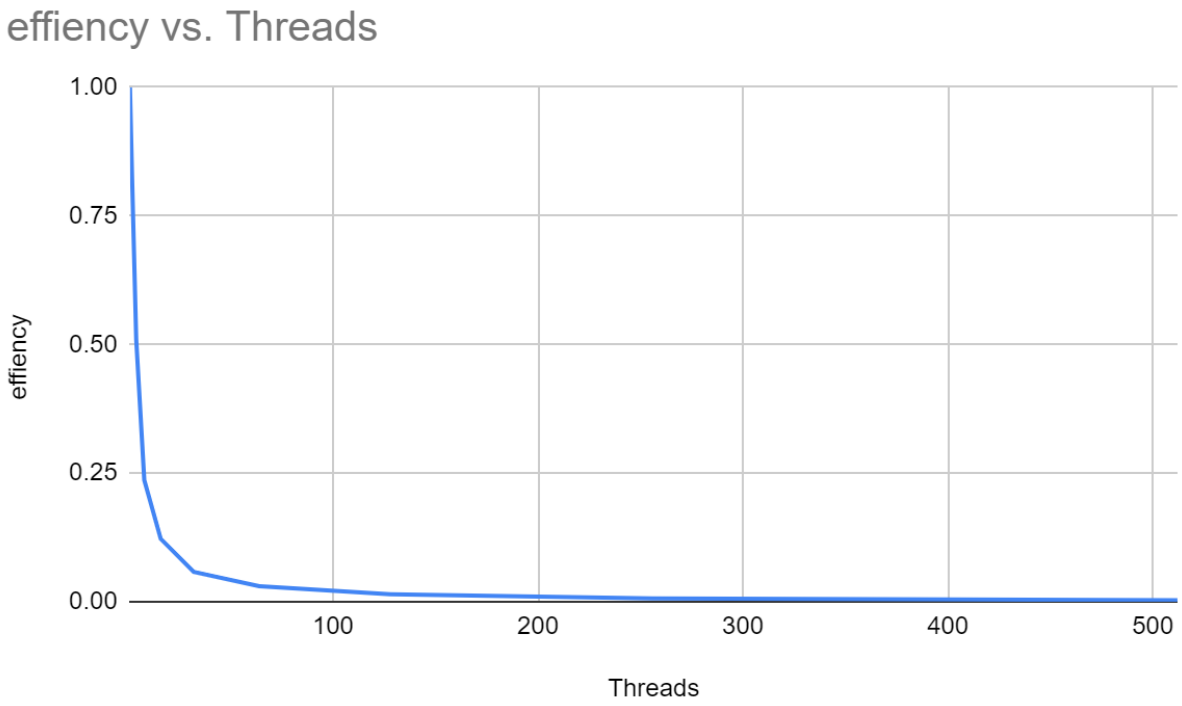
| Threads | time (compressic | time (decoding) | speed up | effiency | cost |
|---|---|---|---|---|---|
| 1 | 0.65329 | 0.28811 | 1 | 1 | 0.65329 |
| 2 | 0.394443 | 0.294449 | 1.656234234 | 0.828117117 | 0.788886 |
| 4 | 0.320218 | 0.288921 | 2.040141404 | 0.5100353509 | 1.280872 |
| 8 | 0.345873 | 0.287 | 1.888814681 | 0.2361018351 | 2.766984 |
| 16 | 0.333624 | 0.2887 | 1.958162482 | 0.1223851551 | 5.337984 |
| 32 | 0.35263 | 0.2934 | 1.852621728 | 0.057894429 | 11.28416 |
| 64 | 0.340918 | 0.2931 | 1.916267255 | 0.02994167586 | 21.818752 |
| 128 | 0.350785 | 0.2891 | 1.862365837 | 0.0145497331 | 44.90048 |
| 256 | 0.394539 | 0.2889 | 1.655831236 | 0.006468090765 | 101.001984 |
| 512 | 0.459716 | 0.2912 | 1.42107301 | 0.002775533223 | 235.374592 |

The generation of huffman tree , code table and decompression algo work sequentially..

4 Threads are needed to solve this problem optimally. As it has lowest cost and takes minimum time and has highest speedup.


time (compression) vs. Threads
0.8
0.6
0.4
0.2
0.0
time (compression)
100
200
300
400
500
Threads


speed up vs. Threads
2.5
2.0
1.5
1.0
0.5
0.0
speed up
100
200
300
400
500
Threads


effiency vs. Threads
1.00
0.75
0.50
0.25
0.00
effiency
100
200
300
400
500
Threads