Comparison between MacBook Pro 2018 (macOS Majove) and Lenovo Laptop (Win 10)

1. Configurations
   - MacBook Pro 2018 (macOS Majove):

     Intel Core i5 CPU @ 2.60GHz

     L1 cache size: 32768 Bytes = 32KB

     L2 cache size: 262144 Bytes = 256KB

     L3 cache size: 6291456 Bytes = 6MB.

   - Lenovo Laptop (Win 10):

     Intel(R) Core(TM) i7-7700HQ CPU @ 2.80GHz

     L1 cache size: 32768 Bytes = 256KB

     L2 cache size: 262144 Bytes = 1MB

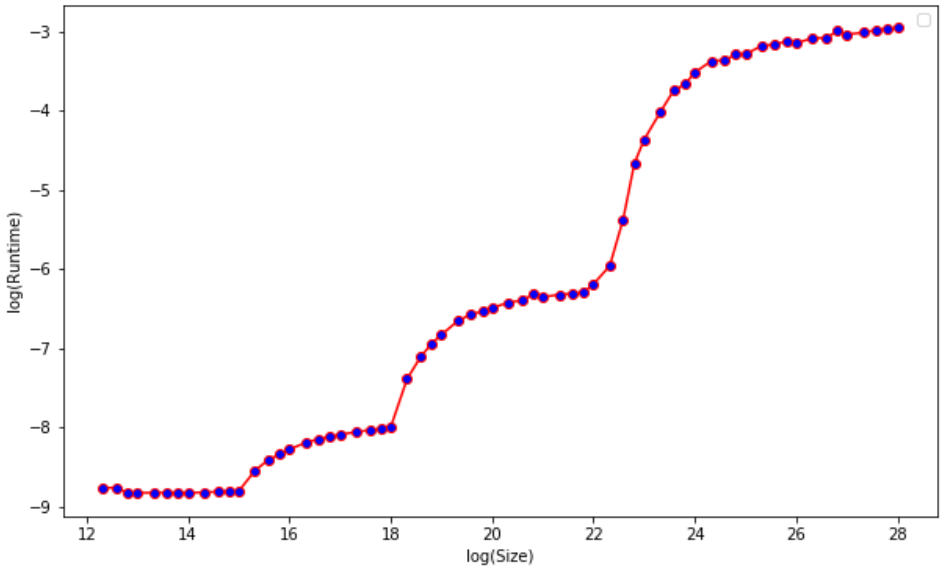
     L3 cache size: 6291456 Bytes = 6MB.

   From the configuration parameters, it is obvious that the settings of Lenovo is better than Mac, so its performance should be better than Mac according to our knowledge. But what is it in fact? We can use the experiment in our lab to verify it.

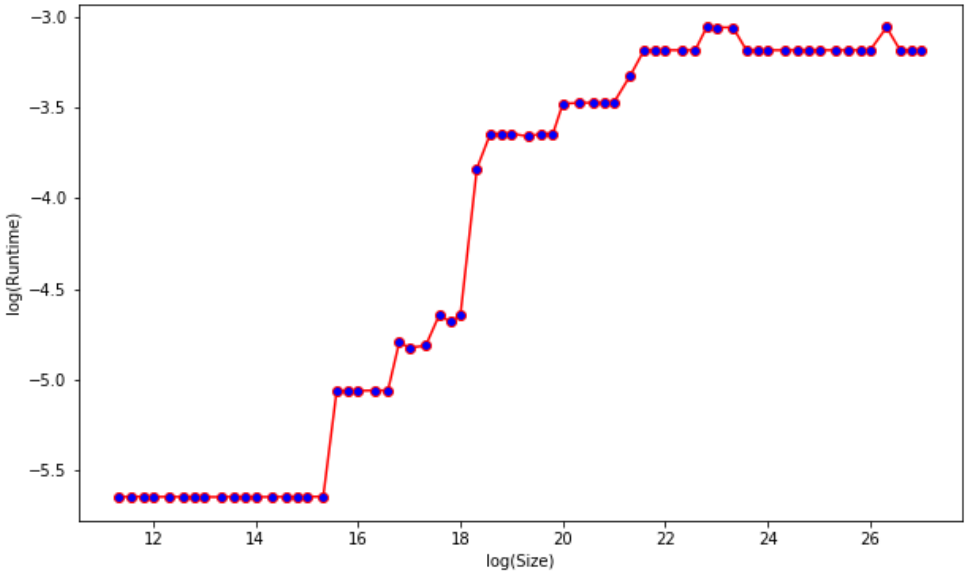
2. Shuffle on plots:.

   The

   - MacBook Pro 2018 (macOS Majove):



   - Lenovo Laptop (Win 10):



3. Where did you run your code? Do you know any memory configuration of this computer?

   My MacBook Pro 2018.

4. Do you think stride prefetching is being done on your architecture? Why or why not?

   When shuffle on, there is no stride prefetching. Because from the shuffle-on plots, we can see the run time is gradually increasing, there is no stride prefetching.

   When shuffle off, there is stride prefetching being done. From the shuffle-off plots, we can see the run time is almost constant (subtle variations) so there is stride prefetching to prefetch data from memory.

5. What factors could be influencing the quality of your measurements?

   - Too many background processes.

     There might be too many background processes in my computer which will occupy part of the cache, therefore influencing the measurement result.

   - Equipment aging.

     The computer may be used for a long time then causing the degradation of performance.

   - Interruption mechanism

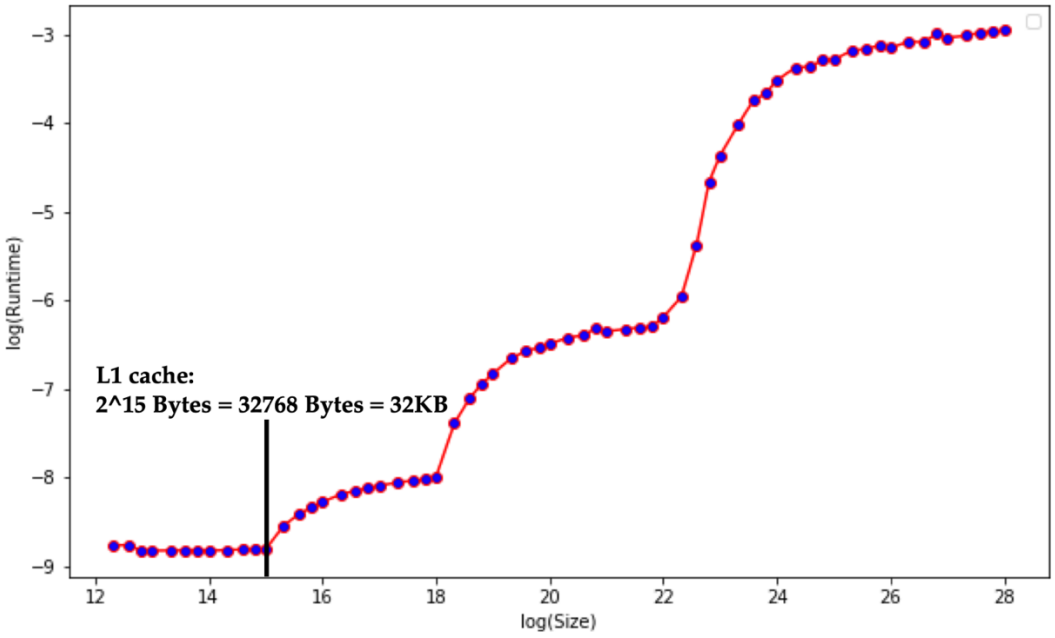
     The process might be interrupted by the interruption mechanism to execute another one, increasing the execution time and the result.

6. What steps could you use to improve the quality of your measurements?

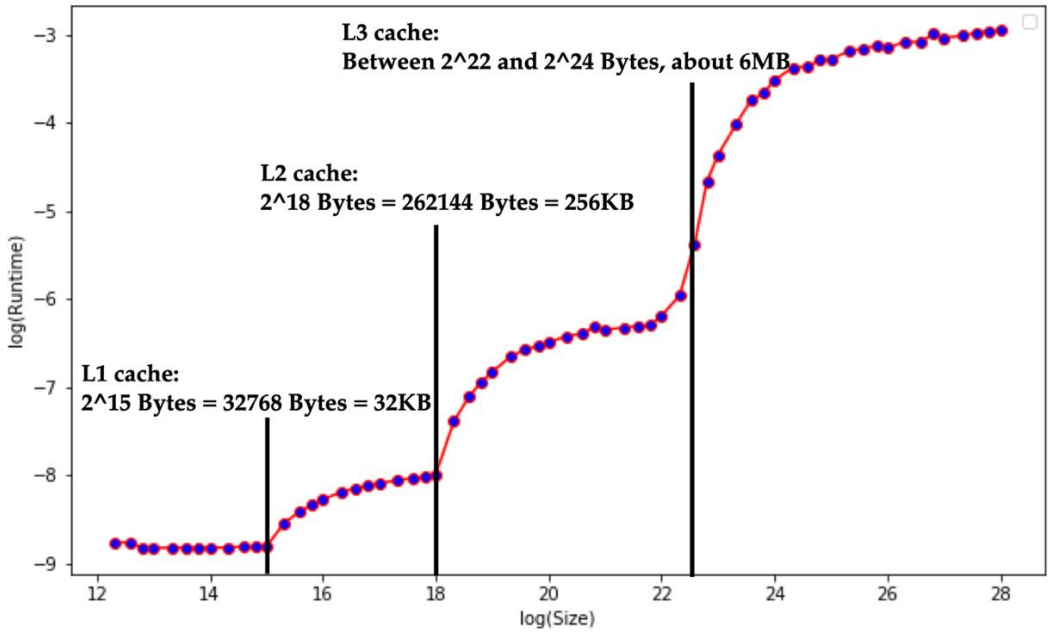
   According to question 4, I suppose I can do the following things to improve the result:

   - Reduce the number of processes executed in the background to free the space of cache.
   - Update the equipment of computer to improve its performance.
   - No interrupting during program running time to eliminate the extra running time, therefore optimizing our result.

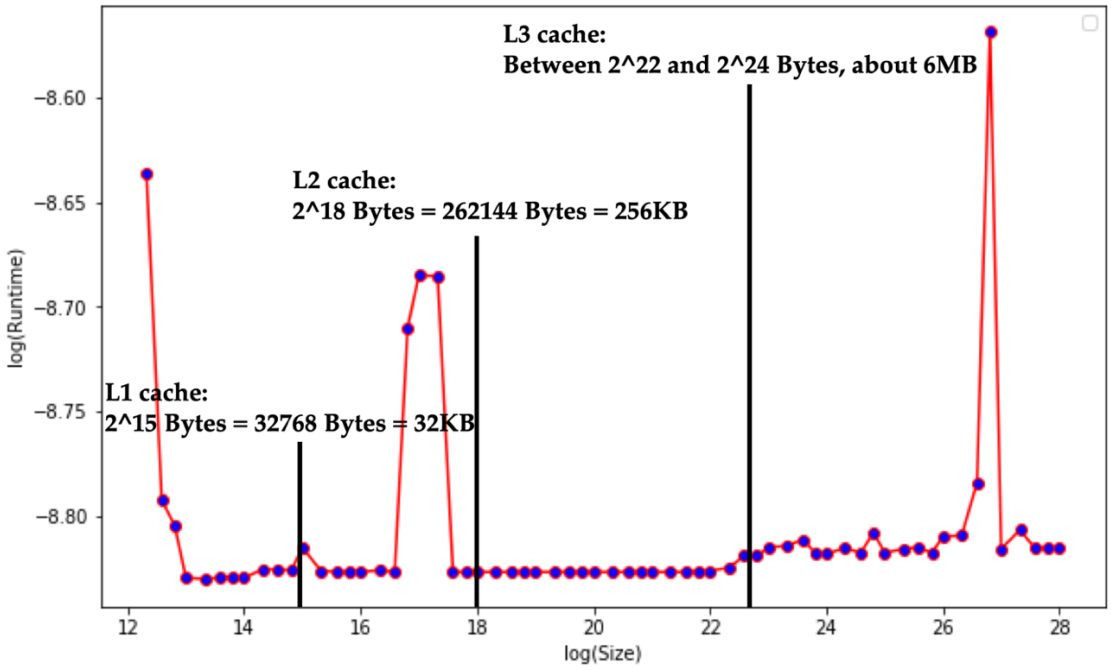
7. Estimate the L1 cache size. Label this point on your two plots.



8. How many levels of memory hierarchy do you detect? Explain and label these on your two plots.
   - Shuffle on



   - Shuffle off



9. Estimate the memory bandwidth you are seeing in the L1 part of the curve.

   32768 /1024 / 1024 / 0.00223184 = 14.001899777761 Mb/s.