

## Course Mini-Project #3: Memory and Storage Performance Profiling

Due date: March 12

**1. Introduction**

The objective of this mini-project is to develop first-hands knowledge and deeper understanding on the performance of modern memory and storage devices. You do not need to write any code for this project. Instead, you will use publicly available software packages to carry out comprehensive experiments to measure the read/write latency of your memory and storage devices under various data access throughput. You should observe a clear trade-off between access latency and throughput (as revealed by queueing theory discussed in class): As you increase the memory/storage access queue depth (hence increase data access workload stress), memory/storage devices will achieve higher resource utilization and hence higher throughput, but meanwhile the latency of each data access request will be longer.

**2. Requirement**

For this project, your Github site only needs to host a detailed report that describes your experiment environment/settings/results and presents your analysis and conclusions. Your experiments should cover a wide range of settings in terms of read vs. write intensity ratio (e.g., read-only, write-only, 70%:30% read vs. write), data access size (e.g., 64B/256B for memory and 4KB/32KB for SSD), throughput vs. latency. For experiments on storage device, you should carry out experiments over the storage device with and without file system installed. Below are two software packages you may use:

- Cache and memory: Intel Memory Latency Checker, and you can find details and download at <https://software.intel.com/content/www/us/en/develop/articles/intelr-memory-latency-checker.html>
- Storage: Flexible IO tester (FIO), which is available at <https://github.com/axboe/fio> It may be already included in your Linux distribution, and the man page is <https://linux.die.net/man/1/fio>

The latest Intel Data Center NVMe SSD D7-P5600 (1.6TB) has a read-only 4KB IOPS of 400K and write-only 4KB IOPS of 118K. Compare your results with this Intel enterprise-grade SSD, and try to explain any unexpected observation (e.g., your client-grade SSD shows very close or even better IOPS than such expensive enterprise-grade SSD).