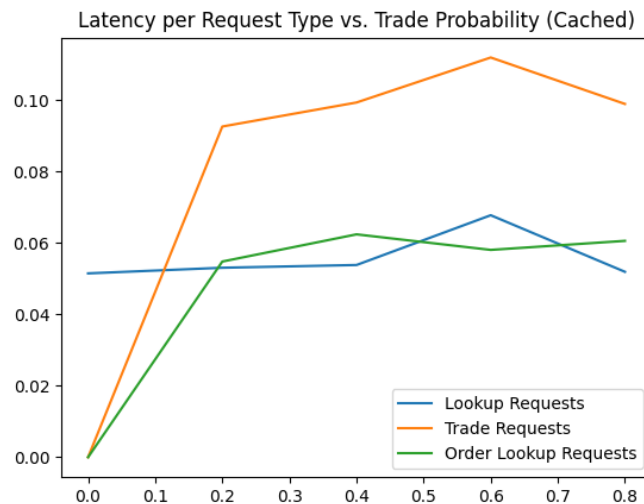
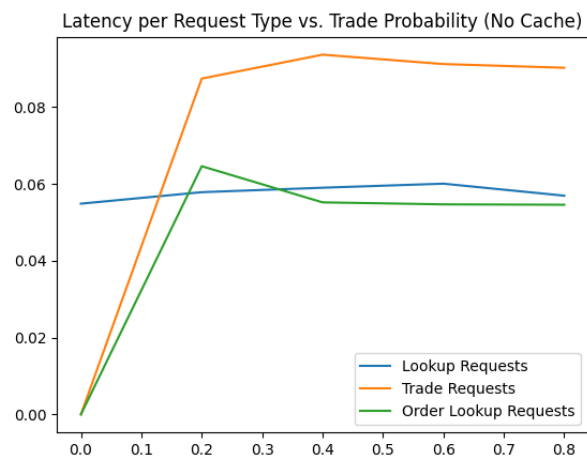


## Section 1: Effect of Caching on Performance



*Figure 1: Graph comparing request latency by type to the probability of trading a stock when the front end saved the information of stocks looked up in a cache. The y-axis is in seconds, and the x-axis is the probability of making a trade.*



*Figure 2: Graph comparing request latency by type to the probability of trading a stock when the front end did not save the information of stocks looked up in a cache. The y-axis is in seconds, and the x-axis is the probability of making a trade.*

### **Analysis**

Based on the plots shown in figures 1 and 2, one will observe that performance appeared to be consistent across the trade and order lookup requests regardless of whether caching was used at the front end when stock lookups were performed. However, one will observe that in the scenario where a cache was used, the average lookup latency time appeared to be closer to 0.05 seconds, and in the case where no

cache was used the average lookup latency time was closer to 0.06 seconds. Thus, the plots and the data suggest that caching improved lookup latency time by roughly 15% to 20% when compared to the scenario where no cache was used by the front end. Furthermore, one may also conclude that caching does indeed provide a slight improvement in performance.

## **Section 2: Fault Tolerance Tests**

To test fault tolerance, the first experiment that was conducted was to cause a random order service replica that was not the leader to crash. When an order server that was not the leader crashed, this failure was completely transparent to each the clients issuing requests over their session; that is, after a non-leader order server crashed, client trade requests and order lookups were still able to be processed by the order service and returned to each client. Furthermore, bringing the crashed order server back online also allowed it to resynchronize its database with the other order services, and by the end of the session all of the databases for each order service were consistent with each other.

In addition, the case where the lead order service crashed was also tested. In this scenario, the behavior between the client and the application was similar to the previous scenario: the clients did not appear to notice that the lead order service had crashed, and their trade and order lookup requests were still able to be processed. However, it should be noted that each client appeared to experience a slight delay in receiving responses to their requests immediately after the lead order service crashed, but performance was able to recover to its previous rate eventually. Furthermore, when the original lead order service was brought back online, it was able to resynchronize its database with the other replicas by the end of the session.