

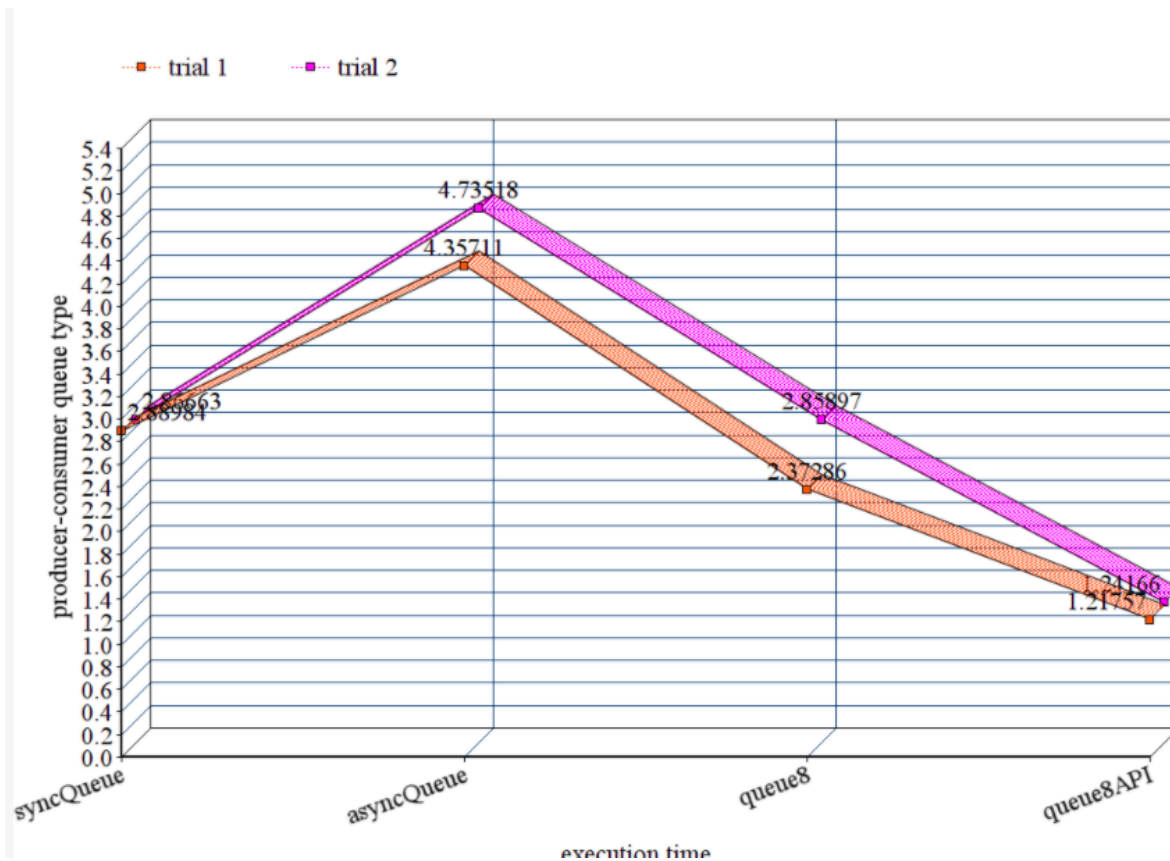
./syncQueue
synchronous producer-consume Q time: 2.88984
./syncQueue
synchronous producer-consume Q time: 2.86663

./asyncQueue
asynchronous producer-consume Q time: 4.35711

./asyncQueue
asynchronous producer-consume Q time: 4.73518

./queue8
optimizing using asynchronous producer-consume Q time: 2.37286
./queue8
optimizing using asynchronous producer-consume Q time: 2.85897

base) gim-ijin-ui-MacBookAir:part1 peach\$./queue8API
new API calls Q time: 1.21757
(base) gim-ijin-ui-MacBookAir:part1 peach\$./queue8API
new API calls Q time: 1.24166



Synchronous queue enqueue and dequeue 1 item at a time. Before leaving the deq of synchronous, the flag should be resetted to false so that the next deq will wait for the next value to be enqueued. Similarly, after enqueue, it will wait for dequeue to reset the flag to false. If the queue enqueue and dequeue in the right order, there won't be any additional delay between those two. Asynchronous queues can enqueue and dequeue multiple items at a time. If there's nothing in the queue to deque, it will spin and wait until there's an element to dequeue. Similarly, for enqueue, if there's no more space to enqueue, it will spin and wait until there's a space to enqueue. For optimizing asynchronous, it will reduce execution time with the threads communicating 8 items at a time (enqueueing and dequeuing 8 times in a row). For enq_8 and deq_8 functions, I modified wait and spin for enqueue to happen while there's no minimum of 9 spaces left to enqueue. For dequeue, it will wait and spin while there's less than 8 items enqueued in the buffer.

As you can see from the graph above, optimized asynchronous queues are often faster than asyncQueue and syncQueue, and normal synchronous queues are always faster than asynchronous queues. Overall, optimized asynchronous queues with optimized programs (queue8API) is the fastest. Synchronous queues are always faster than asynchronous because there's less spinning and waiting for the next value. This happens because enqueue and dequeue are mostly taken in the right order for synchronous queues while asynchronous queues don't. Execution time for optimized asynchronous queues with optimized programs is the fastest because it spins and waits less frequently and enqueue and dequeue 8 elements at once, which make them to be 2x faster than any other type of producer-consumer type.