# Queues

## HW-QUEUE

ori@Ori-Laptop:~/workspace/genmc$ for t in ../linearizability-testing/tests/generated/hw-queue\_8\_0/\*.c; do echo $t; ./src/genmc $t; done  
../linearizability-testing/tests/generated/hw-queue\_8\_0/t1.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 4357734  
Total wall-clock time: 19687.04s  
../linearizability-testing/tests/generated/hw-queue\_8\_0/t2.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 290476  
Total wall-clock time: 69.02s  
../linearizability-testing/tests/generated/hw-queue\_8\_0/t3.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 341  
Total wall-clock time: 0.06s  
../linearizability-testing/tests/generated/hw-queue\_8\_0/t4.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 8874  
Total wall-clock time: 0.60s  
../linearizability-testing/tests/generated/hw-queue\_8\_0/t5.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 37458  
Total wall-clock time: 3.49s  
../linearizability-testing/tests/generated/hw-queue\_8\_0/t6.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1420  
Total wall-clock time: 0.12s  
../linearizability-testing/tests/generated/hw-queue\_8\_0/t7.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 2962  
Total wall-clock time: 0.22s  
../linearizability-testing/tests/generated/hw-queue\_8\_0/t8.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 261  
Total wall-clock time: 0.04s  
../linearizability-testing/tests/generated/hw-queue\_8\_0/t9.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1  
Total wall-clock time: 0.03s

Negative test we expected to fail was: [‘Enq(A)\_Enq(B)’, ‘Deq(B)\_Enq(C)’, ‘Deq(C)\_Deq(D)’, ‘Enq(D)\_Deq(A)’]  
Which is equivalent to t7: ['enq(A)\_enq(D)', 'deq(B)\_deq(C)', 'enq(C)\_deq(A)', 'deq(D)\_enq(B)']  
It did not fail, so we can look into what’s the difference in this implementation from the paper.

## MPMC

ori@Ori-Laptop:~/workspace/genmc$ for t in ../linearizability-testing/tests/generated/mpmc\_6\_0/\*.c; do echo $t; ./src/genmc $t; done  
../linearizability-testing/tests/generated/mpmc\_6\_0/t1.c  
Error detected: Non-Atomic race!  
Event (6, 7) conflicts with event (1, 5) in graph:  
<-1, 0> main:  
 (0, 0): B  
 (0, 1): M  
 (0, 2): M  
 (0, 3): M  
 (0, 4): M  
 (0, 5): M  
 (0, 6): M  
 (0, 7): TC [forks 1] L.130  
 (0, 8): Wna (t\_0, 1) L.130  
 (0, 9): TC [forks 2] L.134  
 (0, 10): Wna (t\_1, 2) L.134  
 (0, 11): TC [forks 3] L.138  
 (0, 12): Wna (t\_2, 3) L.138  
 (0, 13): TC [forks 4] L.142  
 (0, 14): Wna (t\_3, 4) L.142  
 (0, 15): TC [forks 5] L.146  
 (0, 16): Wna (t\_4, 5) L.146  
 (0, 17): TC [forks 6] L.150  
 (0, 18): Wna (t\_5, 6) L.150  
 (0, 19): E  
<0, 1> thread\_0:  
 (1, 0): B  
 (1, 1): Racq (q.m\_rdwr, 0) [INIT] L.56: mpmc-queue.h  
 (1, 2): Car (q.m\_rdwr, 0) [INIT] L.66: mpmc-queue.h  
 (1, 3): Car (q.m\_rdwr, 1) L.66: mpmc-queue.h  
 (1, 4): Racq (q.m\_read, 0) [INIT] L.71: mpmc-queue.h  
 (1, 5): Wna (q.m\_array[0], 1) L.8: mpmc-queue-wrapper.h  
 (1, 6): Urel (q.m\_written, 1) [(3, 8)] L.80: mpmc-queue.h  
 (1, 7): Urel (q.m\_written, 2) L.80: mpmc-queue.h  
 (1, 8): Wrel (f\_0, 1) L.40  
 (1, 9): E  
<0, 2> thread\_1:  
 (2, 0): B  
 (2, 1): M  
 (2, 2): Wna (res, 0) L.50  
 (2, 3): Racq (q.m\_rdwr, 1) [(1, 3)] L.27: mpmc-queue.h  
 (2, 4): Car (q.m\_rdwr, 65538) [(3, 4)] L.37: mpmc-queue.h  
 (2, 5): Car (q.m\_rdwr, 131074) [(4, 5)] L.37: mpmc-queue.h  
 (2, 6): Urel (q.m\_read, 0) [INIT] L.51: mpmc-queue.h  
 (2, 7): Urel (q.m\_read, 1) L.51: mpmc-queue.h  
 (2, 8): Rna (res, 0) [(2, 2)] L.54  
<0, 3> thread\_2:  
 (3, 0): B  
 (3, 1): Racq (q.m\_rdwr, 0) [INIT] L.56: mpmc-queue.h  
 (3, 2): Car (q.m\_rdwr, 65537) [(6, 5)] L.66: mpmc-queue.h  
 (3, 3): Car (q.m\_rdwr, 65537) [(6, 5)] L.66: mpmc-queue.h  
 (3, 4): Car (q.m\_rdwr, 65538) L.66: mpmc-queue.h  
 (3, 5): Racq (q.m\_read, 1) [(2, 7)] L.71: mpmc-queue.h  
 (3, 6): Wna (q.m\_array[1], 2) L.8: mpmc-queue-wrapper.h  
 (3, 7): Urel (q.m\_written, 0) [INIT] L.80: mpmc-queue.h  
 (3, 8): Urel (q.m\_written, 1) L.80: mpmc-queue.h  
 (3, 9): Wrel (f\_2, 1) L.69  
 (3, 10): E  
<0, 4> thread\_3:  
 (4, 0): B  
 (4, 1): M  
 (4, 2): Wna (res, 0) L.79  
 (4, 3): Racq (q.m\_rdwr, 65538) [(3, 4)] L.27: mpmc-queue.h  
 (4, 4): Car (q.m\_rdwr, 65538) [(3, 4)] L.37: mpmc-queue.h  
 (4, 5): Car (q.m\_rdwr, 131074) L.37: mpmc-queue.h  
 (4, 6): Racq (q.m\_written, 0) [INIT] L.42: mpmc-queue.h  
<0, 5> thread\_4:  
 (5, 0): B  
 (5, 1): Racq (f\_5, 0) [INIT] L.97  
<0, 6> thread\_5:  
 (6, 0): B  
 (6, 1): M  
 (6, 2): Wna (res, 0) L.112  
 (6, 3): Racq (q.m\_rdwr, 1) [(1, 3)] L.27: mpmc-queue.h  
 (6, 4): Car (q.m\_rdwr, 1) [(1, 3)] L.37: mpmc-queue.h  
 (6, 5): Car (q.m\_rdwr, 65537) L.37: mpmc-queue.h  
 (6, 6): Racq (q.m\_written, 1) [(3, 8)] L.42: mpmc-queue.h  
 (6, 7): Rna (q.m\_array[0], 0) [INIT] L.16: mpmc-queue-wrapper.h  
  
Number of complete executions explored: 0  
Number of blocked executions seen: 30794  
Total wall-clock time: 2.31s  
../linearizability-testing/tests/generated/mpmc\_6\_0/t2.c  
Error detected: Non-Atomic race!  
Event (6, 7) conflicts with event (1, 5) in graph:  
<-1, 0> main:  
 (0, 0): B  
 (0, 1): M  
 (0, 2): M  
 (0, 3): M  
 (0, 4): M  
 (0, 5): M  
 (0, 6): M  
 (0, 7): TC [forks 1] L.134  
 (0, 8): Wna (t\_0, 1) L.134  
 (0, 9): TC [forks 2] L.138  
 (0, 10): Wna (t\_1, 2) L.138  
 (0, 11): TC [forks 3] L.142  
 (0, 12): Wna (t\_2, 3) L.142  
 (0, 13): TC [forks 4] L.146  
 (0, 14): Wna (t\_3, 4) L.146  
 (0, 15): TC [forks 5] L.150  
 (0, 16): Wna (t\_4, 5) L.150  
 (0, 17): TC [forks 6] L.154  
 (0, 18): Wna (t\_5, 6) L.154  
 (0, 19): E  
<0, 1> thread\_0:  
 (1, 0): B  
 (1, 1): Racq (q.m\_rdwr, 0) [INIT] L.56: mpmc-queue.h  
 (1, 2): Car (q.m\_rdwr, 0) [INIT] L.66: mpmc-queue.h  
 (1, 3): Car (q.m\_rdwr, 1) L.66: mpmc-queue.h  
 (1, 4): Racq (q.m\_read, 0) [INIT] L.71: mpmc-queue.h  
 (1, 5): Wna (q.m\_array[0], 1) L.8: mpmc-queue-wrapper.h  
 (1, 6): Urel (q.m\_written, 1) [(3, 8)] L.80: mpmc-queue.h  
 (1, 7): Urel (q.m\_written, 2) L.80: mpmc-queue.h  
 (1, 8): Wrel (f\_0, 1) L.40  
 (1, 9): E  
<0, 2> thread\_1:  
 (2, 0): B  
 (2, 1): M  
 (2, 2): Racq (f\_5, 0) [INIT] L.51  
<0, 3> thread\_2:  
 (3, 0): B  
 (3, 1): Racq (q.m\_rdwr, 1) [(1, 3)] L.56: mpmc-queue.h  
 (3, 2): Car (q.m\_rdwr, 65537) [(6, 5)] L.66: mpmc-queue.h  
 (3, 3): Car (q.m\_rdwr, 65537) [(6, 5)] L.66: mpmc-queue.h  
 (3, 4): Car (q.m\_rdwr, 65538) L.66: mpmc-queue.h  
 (3, 5): Racq (q.m\_read, 1) [(4, 5)] L.71: mpmc-queue.h  
 (3, 6): Wna (q.m\_array[1], 2) L.8: mpmc-queue-wrapper.h  
 (3, 7): Urel (q.m\_written, 0) [INIT] L.80: mpmc-queue.h  
 (3, 8): Urel (q.m\_written, 1) L.80: mpmc-queue.h  
 (3, 9): Wrel (f\_2, 1) L.73  
 (3, 10): E  
<0, 4> thread\_3:  
 (4, 0): B  
 (4, 1): M  
 (4, 2): Wna (res, 0) L.83  
 (4, 3): Racq (q.m\_rdwr, 0) [INIT] L.27: mpmc-queue.h  
 (4, 4): Urel (q.m\_read, 0) [INIT] L.51: mpmc-queue.h  
 (4, 5): Urel (q.m\_read, 1) L.51: mpmc-queue.h  
 (4, 6): Rna (res, 0) [(4, 2)] L.87  
<0, 5> thread\_4:  
 (5, 0): B  
 (5, 1): Racq (f\_0, 0) [INIT] L.101  
<0, 6> thread\_5:  
 (6, 0): B  
 (6, 1): M  
 (6, 2): Wna (res, 0) L.116  
 (6, 3): Racq (q.m\_rdwr, 1) [(1, 3)] L.27: mpmc-queue.h  
 (6, 4): Car (q.m\_rdwr, 1) [(1, 3)] L.37: mpmc-queue.h  
 (6, 5): Car (q.m\_rdwr, 65537) L.37: mpmc-queue.h  
 (6, 6): Racq (q.m\_written, 1) [(3, 8)] L.42: mpmc-queue.h  
 (6, 7): Rna (q.m\_array[0], 0) [INIT] L.16: mpmc-queue-wrapper.h  
  
Number of complete executions explored: 0  
Number of blocked executions seen: 41734  
Total wall-clock time: 3.00s  
../linearizability-testing/tests/generated/mpmc\_6\_0/t3.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 308  
Total wall-clock time: 0.05s  
../linearizability-testing/tests/generated/mpmc\_6\_0/t4.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 348  
Total wall-clock time: 0.05s  
../linearizability-testing/tests/generated/mpmc\_6\_0/t5.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 6  
Total wall-clock time: 0.03s

the race is between   
(1, 5): Wna (q.m\_array[0], 1) L.8: mpmc-queue-wrapper.h

void enqueue(queue\_t \*q, unsigned int val)

{

    int32\_t \*bin = write\_prepare(q);

    \*bin = val;

    write\_publish(q);

}

Enq(1) in thread 0  
and  
(6, 7): Rna (q.m\_array[0], 0) [INIT] L.16: mpmc-queue-wrapper.h

bool dequeue(queue\_t \*q, unsigned int \*retVal)

{

    int32\_t \*bin = read\_fetch(q);

    if (bin != NULL) {

        \*retVal = \*bin;

    }

    read\_consume(q);

    return true;

}

Deq(3) in thread 5

In t1 (['deq(C)\_enq(C)']) and t2 (['enq(A)\_enq(C)', 'deq(C)\_deq(A)']), these are the only 2 tests where enq(1) doesn’t wait for another operation.

Trying to add load\_32() throws another error

In file included from ../linearizability-testing/tests/generated/mpmc\_6\_0/t1.c:8:  
../linearizability-testing/tests/generated/mpmc\_6\_0/../../../wrappers/mpmc-queue-wrapper.h:16:19: warning: implicit declaration of function 'load\_32' is invalid in C99 [-Wimplicit-function-declaration]  
 \*retVal = load\_32(bin);  
 ^  
1 warning generated.  
Segmentation fault

## MS-QUEUE

ori@Ori-Laptop:~/workspace/genmc$ for t in ../linearizability-testing/tests/generated/ms-queue\_6\_0/\*.c; do echo $t; ./src/genmc $t; done  
../linearizability-testing/tests/generated/ms-queue\_6\_0/t1.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1395162  
Total wall-clock time: 690.44s  
../linearizability-testing/tests/generated/ms-queue\_6\_0/t2.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 210521  
Total wall-clock time: 71.95s  
../linearizability-testing/tests/generated/ms-queue\_6\_0/t3.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 625  
Total wall-clock time: 0.18s  
../linearizability-testing/tests/generated/ms-queue\_6\_0/t4.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1054  
Total wall-clock time: 0.18s  
../linearizability-testing/tests/generated/ms-queue\_6\_0/t5.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1  
Total wall-clock time: 0.05s

## QU

ori@Ori-Laptop:~/workspace/genmc$ for t in ../linearizability-testing/tests/generated/qu\_6\_0/\*.c; do echo $t; ./src/genmc $t; done  
../linearizability-testing/tests/generated/qu\_6\_0/t1.c  
Error detected: Safety violation!  
Event (3, 26) in graph:  
<-1, 0> main:  
 (0, 0): B  
 (0, 1): M  
 (0, 2): M  
 (0, 3): M  
 (0, 4): M  
 (0, 5): M  
 (0, 6): M  
 (0, 7): M  
 (0, 8): M  
 (0, 9): M  
 (0, 10): Wna (, 0x0) L.31: qu.c  
 (0, 11): Rna (, 0) [(0, 10)] L.31: qu.c  
 (0, 12): Wrel (q.init.next, 0) L.31: qu.c  
 (0, 13): Wna (, 0x560f765c3360) L.32: qu.c  
 (0, 14): Rna (, 94624410252128) [(0, 13)] L.32: qu.c  
 (0, 15): Wrel (q.head, 94624410252128) L.32: qu.c  
 (0, 16): Wna (, 0x560f765c3360) L.33: qu.c  
 (0, 17): Rna (, 94624410252128) [(0, 16)] L.33: qu.c  
 (0, 18): Wrel (q.tail, 94624410252128) L.33: qu.c  
 (0, 19): Wrel (q.is\_initialized, 1) L.34: qu.c  
 (0, 20): TC [forks 1] L.130  
 (0, 21): Wna (t\_0, 1) L.130  
 (0, 22): TC [forks 2] L.134  
 (0, 23): Wna (t\_1, 2) L.134  
 (0, 24): TC [forks 3] L.138  
 (0, 25): Wna (t\_2, 3) L.138  
 (0, 26): TC [forks 4] L.142  
 (0, 27): Wna (t\_3, 4) L.142  
 (0, 28): TC [forks 5] L.146  
 (0, 29): Wna (t\_4, 5) L.146  
 (0, 30): TC [forks 6] L.150  
 (0, 31): Wna (t\_5, 6) L.150  
 (0, 32): E  
<0, 1> thread\_0:  
 (1, 0): B  
 (1, 1): M  
 (1, 2): M  
 (1, 3): M  
 (1, 4): M  
 (1, 5): Rna (free\_index[0], 0) [INIT] L.38: qu-wrapper.h  
 (1, 6): Rna (free\_index[0], 0) [INIT] L.39: qu-wrapper.h  
 (1, 7): Wna (free\_index[0], 1) L.39: qu-wrapper.h  
 (1, 8): Wna (free\_lists[0][0].data, 1) L.62: qu.c  
 (1, 9): Wna (, 0x0) L.63: qu.c  
 (1, 10): Rna (, 0) [(1, 9)] L.63: qu.c  
 (1, 11): Wrlx (free\_lists[0][0].next, 0) L.63: qu.c  
 (1, 12): M  
 (1, 13): M  
 (1, 14): M  
 (1, 15): Racq (q.tail, 94624410252128) [(0, 18)] L.44: qu.c  
 (1, 16): Wna (, 94624410252128) L.44: qu.c  
 (1, 17): Rna (, 0x560f765c3360) [(1, 16)] L.44: qu.c  
 (1, 18): Rrlx (q.init.next, 0) [(0, 12)] L.45: qu.c  
 (1, 19): Wna (, 0) L.45: qu.c  
 (1, 20): Rna (, 0x0) [(1, 19)] L.45: qu.c  
 (1, 21): Wna (v, 0x0) L.70: qu.c  
 (1, 22): Wna (, 0x560f76612740) L.71: qu.c  
 (1, 23): Rna (v, 0) [(1, 21)] L.71: qu.c  
 (1, 24): Rna (, 94624410576704) [(1, 22)] L.71: qu.c  
 (1, 25): Crel (q.init.next, 0) [(0, 12)] L.71: qu.c  
 (1, 26): Crel (q.init.next, 94624410576704) L.71: qu.c  
 (1, 27): Wna (, 0x560f76612740) L.74: qu.c  
 (1, 28): Rna (, 94624410576704) [(1, 27)] L.74: qu.c  
 (1, 29): Wrel (q.tail, 94624410576704) L.74: qu.c  
 (1, 30): Wrel (f\_0, 1) L.40  
 (1, 31): E  
<0, 2> thread\_1:  
 (2, 0): B  
 (2, 1): M  
 (2, 2): Wna (res, 0) L.50  
 (2, 3): M  
 (2, 4): M  
 (2, 5): M  
 (2, 6): M  
 (2, 7): Racq (q.head, 94624410252128) [(0, 15)] L.83: qu.c  
 (2, 8): Wna (, 94624410252128) L.83: qu.c  
 (2, 9): Rna (, 0x560f765c3360) [(2, 8)] L.83: qu.c  
 (2, 10): Wna (head, 0x560f765c3360) L.83: qu.c  
 (2, 11): Rna (head, 0x560f765c3360) [(2, 10)] L.84: qu.c  
 (2, 12): Racq (q.init.next, 0) [(0, 12)] L.84: qu.c  
 (2, 13): Wna (, 0) L.84: qu.c  
 (2, 14): Rna (, 0x0) [(2, 13)] L.84: qu.c  
<0, 3> thread\_2:  
 (3, 0): B  
 (3, 1): M  
 (3, 2): M  
 (3, 3): M  
 (3, 4): M  
 (3, 5): Rna (free\_index[2], 0) [INIT] L.38: qu-wrapper.h  
 (3, 6): Rna (free\_index[2], 0) [INIT] L.39: qu-wrapper.h  
 (3, 7): Wna (free\_index[2], 1) L.39: qu-wrapper.h  
 (3, 8): Wna (free\_lists[2][0].data, 2) L.62: qu.c  
 (3, 9): Wna (, 0x0) L.63: qu.c  
 (3, 10): Rna (, 0) [(3, 9)] L.63: qu.c  
 (3, 11): Wrlx (free\_lists[2][0].next, 0) L.63: qu.c  
 (3, 12): M  
 (3, 13): M  
 (3, 14): M  
 (3, 15): Racq (q.tail, 94624410252128) [(0, 18)] L.44: qu.c  
 (3, 16): Wna (, 94624410252128) L.44: qu.c  
 (3, 17): Rna (, 0x560f765c3360) [(3, 16)] L.44: qu.c  
 (3, 18): Rrlx (q.init.next, 0) [(0, 12)] L.45: qu.c  
 (3, 19): Wna (, 0) L.45: qu.c  
 (3, 20): Rna (, 0x0) [(3, 19)] L.45: qu.c  
 (3, 21): Wna (v, 0x0) L.70: qu.c  
 (3, 22): Wna (, 0x560f76612b40) L.71: qu.c  
 (3, 23): Rna (v, 0) [(3, 21)] L.71: qu.c  
 (3, 24): Rna (, 94624410577728) [(3, 22)] L.71: qu.c  
 (3, 25): Crel (q.init.next, 94624410576704) [(1, 26)] L.71: qu.c  
 (3, 26): Wna (v, 94624410576704) L.71: qu.c  
<0, 4> thread\_3:  
 (4, 0): B  
<0, 5> thread\_4:  
 (5, 0): B  
<0, 6> thread\_5:  
 (6, 0): B  
  
Assertion violation: ret == 0  
Number of complete executions explored: 0  
Total wall-clock time: 0.04s  
../linearizability-testing/tests/generated/qu\_6\_0/t2.c  
Error detected: Safety violation!  
Event (3, 26) in graph:  
<-1, 0> main:  
 (0, 0): B  
 (0, 1): M  
 (0, 2): M  
 (0, 3): M  
 (0, 4): M  
 (0, 5): M  
 (0, 6): M  
 (0, 7): M  
 (0, 8): M  
 (0, 9): M  
 (0, 10): Wna (, 0x0) L.31: qu.c  
 (0, 11): Rna (, 0) [(0, 10)] L.31: qu.c  
 (0, 12): Wrel (q.init.next, 0) L.31: qu.c  
 (0, 13): Wna (, 0x559bb8120740) L.32: qu.c  
 (0, 14): Rna (, 94127296481088) [(0, 13)] L.32: qu.c  
 (0, 15): Wrel (q.head, 94127296481088) L.32: qu.c  
 (0, 16): Wna (, 0x559bb8120740) L.33: qu.c  
 (0, 17): Rna (, 94127296481088) [(0, 16)] L.33: qu.c  
 (0, 18): Wrel (q.tail, 94127296481088) L.33: qu.c  
 (0, 19): Wrel (q.is\_initialized, 1) L.34: qu.c  
 (0, 20): TC [forks 1] L.134  
 (0, 21): Wna (t\_0, 1) L.134  
 (0, 22): TC [forks 2] L.138  
 (0, 23): Wna (t\_1, 2) L.138  
 (0, 24): TC [forks 3] L.142  
 (0, 25): Wna (t\_2, 3) L.142  
 (0, 26): TC [forks 4] L.146  
 (0, 27): Wna (t\_3, 4) L.146  
 (0, 28): TC [forks 5] L.150  
 (0, 29): Wna (t\_4, 5) L.150  
 (0, 30): TC [forks 6] L.154  
 (0, 31): Wna (t\_5, 6) L.154  
 (0, 32): E  
<0, 1> thread\_0:  
 (1, 0): B  
 (1, 1): M  
 (1, 2): M  
 (1, 3): M  
 (1, 4): M  
 (1, 5): Rna (free\_index[0], 0) [INIT] L.38: qu-wrapper.h  
 (1, 6): Rna (free\_index[0], 0) [INIT] L.39: qu-wrapper.h  
 (1, 7): Wna (free\_index[0], 1) L.39: qu-wrapper.h  
 (1, 8): Wna (free\_lists[0][0].data, 1) L.62: qu.c  
 (1, 9): Wna (, 0x0) L.63: qu.c  
 (1, 10): Rna (, 0) [(1, 9)] L.63: qu.c  
 (1, 11): Wrlx (free\_lists[0][0].next, 0) L.63: qu.c  
 (1, 12): M  
 (1, 13): M  
 (1, 14): M  
 (1, 15): Racq (q.tail, 94127296481088) [(0, 18)] L.44: qu.c  
 (1, 16): Wna (, 94127296481088) L.44: qu.c  
 (1, 17): Rna (, 0x559bb8120740) [(1, 16)] L.44: qu.c  
 (1, 18): Rrlx (q.init.next, 0) [(0, 12)] L.45: qu.c  
 (1, 19): Wna (, 0) L.45: qu.c  
 (1, 20): Rna (, 0x0) [(1, 19)] L.45: qu.c  
 (1, 21): Wna (v, 0x0) L.70: qu.c  
 (1, 22): Wna (, 0x559bb817b200) L.71: qu.c  
 (1, 23): Rna (v, 0) [(1, 21)] L.71: qu.c  
 (1, 24): Rna (, 94127296852480) [(1, 22)] L.71: qu.c  
 (1, 25): Crel (q.init.next, 0) [(0, 12)] L.71: qu.c  
 (1, 26): Crel (q.init.next, 94127296852480) L.71: qu.c  
 (1, 27): Wna (, 0x559bb817b200) L.74: qu.c  
 (1, 28): Rna (, 94127296852480) [(1, 27)] L.74: qu.c  
 (1, 29): Wrel (q.tail, 94127296852480) L.74: qu.c  
 (1, 30): Wrel (f\_0, 1) L.40  
 (1, 31): E  
<0, 2> thread\_1:  
 (2, 0): B  
 (2, 1): M  
 (2, 2): Racq (f\_5, 0) [INIT] L.51  
<0, 3> thread\_2:  
 (3, 0): B  
 (3, 1): M  
 (3, 2): M  
 (3, 3): M  
 (3, 4): M  
 (3, 5): Rna (free\_index[2], 0) [INIT] L.38: qu-wrapper.h  
 (3, 6): Rna (free\_index[2], 0) [INIT] L.39: qu-wrapper.h  
 (3, 7): Wna (free\_index[2], 1) L.39: qu-wrapper.h  
 (3, 8): Wna (free\_lists[2][0].data, 2) L.62: qu.c  
 (3, 9): Wna (, 0x0) L.63: qu.c  
 (3, 10): Rna (, 0) [(3, 9)] L.63: qu.c  
 (3, 11): Wrlx (free\_lists[2][0].next, 0) L.63: qu.c  
 (3, 12): M  
 (3, 13): M  
 (3, 14): M  
 (3, 15): Racq (q.tail, 94127296481088) [(0, 18)] L.44: qu.c  
 (3, 16): Wna (, 94127296481088) L.44: qu.c  
 (3, 17): Rna (, 0x559bb8120740) [(3, 16)] L.44: qu.c  
 (3, 18): Rrlx (q.init.next, 0) [(0, 12)] L.45: qu.c  
 (3, 19): Wna (, 0) L.45: qu.c  
 (3, 20): Rna (, 0x0) [(3, 19)] L.45: qu.c  
 (3, 21): Wna (v, 0x0) L.70: qu.c  
 (3, 22): Wna (, 0x559bb817b600) L.71: qu.c  
 (3, 23): Rna (v, 0) [(3, 21)] L.71: qu.c  
 (3, 24): Rna (, 94127296853504) [(3, 22)] L.71: qu.c  
 (3, 25): Crel (q.init.next, 94127296852480) [(1, 26)] L.71: qu.c  
 (3, 26): Wna (v, 94127296852480) L.71: qu.c  
<0, 4> thread\_3:  
 (4, 0): B  
<0, 5> thread\_4:  
 (5, 0): B  
<0, 6> thread\_5:  
 (6, 0): B  
  
Assertion violation: ret == 0  
Number of complete executions explored: 0  
Total wall-clock time: 0.03s  
../linearizability-testing/tests/generated/qu\_6\_0/t3.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 23  
Total wall-clock time: 0.03s  
../linearizability-testing/tests/generated/qu\_6\_0/t4.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 49  
Total wall-clock time: 0.03s  
../linearizability-testing/tests/generated/qu\_6\_0/t5.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1  
Total wall-clock time: 0.03s

In both cases the error is here

atomic\_compare\_exchange\_strong\_explicit(&tail->next, &v, node,

                            memory\_order\_release,

                            memory\_order\_release)

I tried playing around with both memory orders to make it stronger, it did not change anything.

## CHASE-LEV

ori@Ori-Laptop:~/workspace/genmc$ for t in ../linearizability-testing/tests/generated/chase-lev\_6\_0/\*.c; do echo $t; ./src/genmc $t; done  
../linearizability-testing/tests/generated/chase-lev\_6\_0/t1.c  
Error detected: Non-Atomic race!  
Event (3, 4) conflicts with event (1, 4) in graph:  
<-1, 0> main:  
 (0, 0): B  
 (0, 1): M  
 (0, 2): M  
 (0, 3): M  
 (0, 4): M  
 (0, 5): M  
 (0, 6): M  
 (0, 7): TC [forks 1] L.130  
 (0, 8): Wna (t\_0, 1) L.130  
 (0, 9): TC [forks 2] L.134  
 (0, 10): Wna (t\_1, 2) L.134  
 (0, 11): TC [forks 3] L.138  
 (0, 12): Wna (t\_2, 3) L.138  
 (0, 13): TC [forks 4] L.142  
 (0, 14): Wna (t\_3, 4) L.142  
 (0, 15): TC [forks 5] L.146  
 (0, 16): Wna (t\_4, 5) L.146  
 (0, 17): TC [forks 6] L.150  
 (0, 18): Wna (t\_5, 6) L.150  
 (0, 19): E  
<0, 1> thread\_0:  
 (1, 0): B  
 (1, 1): Rna (N, 10) [INIT] L.9: chase-lev-wrapper.h  
 (1, 2): Rrlx (q.bottom, 0) [INIT] L.17: deque.h  
 (1, 3): Racq (q.top, 0) [INIT] L.18: deque.h  
 (1, 4): Wna (q.buffer[0], 1) L.25: deque.h  
 (1, 5): Wrel (q.bottom, 1) L.26: deque.h  
 (1, 6): Wrel (f\_0, 1) L.40  
 (1, 7): E  
<0, 2> thread\_1:  
 (2, 0): B  
 (2, 1): M  
 (2, 2): Wna (res, 0) L.50  
 (2, 3): M  
 (2, 4): Wna (val, 0) L.15: chase-lev-wrapper.h  
 (2, 5): Rna (N, 10) [INIT] L.16: chase-lev-wrapper.h  
 (2, 6): Rrlx (q.top, 0) [INIT] L.61: deque.h  
 (2, 7): Fsc L.63: deque.h  
 (2, 8): Racq (q.bottom, 0) [INIT] L.65: deque.h  
 (2, 9): Rna (val, 0) [(2, 4)] L.17: chase-lev-wrapper.h  
 (2, 10): Wna (res, 0) L.17: chase-lev-wrapper.h  
<0, 3> thread\_2:  
 (3, 0): B  
 (3, 1): Rna (N, 10) [INIT] L.9: chase-lev-wrapper.h  
 (3, 2): Rrlx (q.bottom, 0) [INIT] L.17: deque.h  
 (3, 3): Racq (q.top, 0) [INIT] L.18: deque.h  
 (3, 4): Wna (q.buffer[0], 2) L.25: deque.h  
<0, 4> thread\_3:  
 (4, 0): B  
<0, 5> thread\_4:  
 (5, 0): B  
<0, 6> thread\_5:  
 (6, 0): B  
  
Number of complete executions explored: 0  
Total wall-clock time: 0.03s  
../linearizability-testing/tests/generated/chase-lev\_6\_0/t2.c  
Error detected: Non-Atomic race!  
Event (3, 4) conflicts with event (1, 4) in graph:  
<-1, 0> main:  
 (0, 0): B  
 (0, 1): M  
 (0, 2): M  
 (0, 3): M  
 (0, 4): M  
 (0, 5): M  
 (0, 6): M  
 (0, 7): TC [forks 1] L.134  
 (0, 8): Wna (t\_0, 1) L.134  
 (0, 9): TC [forks 2] L.138  
 (0, 10): Wna (t\_1, 2) L.138  
 (0, 11): TC [forks 3] L.142  
 (0, 12): Wna (t\_2, 3) L.142  
 (0, 13): TC [forks 4] L.146  
 (0, 14): Wna (t\_3, 4) L.146  
 (0, 15): TC [forks 5] L.150  
 (0, 16): Wna (t\_4, 5) L.150  
 (0, 17): TC [forks 6] L.154  
 (0, 18): Wna (t\_5, 6) L.154  
 (0, 19): E  
<0, 1> thread\_0:  
 (1, 0): B  
 (1, 1): Rna (N, 10) [INIT] L.9: chase-lev-wrapper.h  
 (1, 2): Rrlx (q.bottom, 0) [INIT] L.17: deque.h  
 (1, 3): Racq (q.top, 0) [INIT] L.18: deque.h  
 (1, 4): Wna (q.buffer[0], 1) L.25: deque.h  
 (1, 5): Wrel (q.bottom, 1) L.26: deque.h  
 (1, 6): Wrel (f\_0, 1) L.40  
 (1, 7): E  
<0, 2> thread\_1:  
 (2, 0): B  
 (2, 1): M  
 (2, 2): Racq (f\_5, 0) [INIT] L.51  
<0, 3> thread\_2:  
 (3, 0): B  
 (3, 1): Rna (N, 10) [INIT] L.9: chase-lev-wrapper.h  
 (3, 2): Rrlx (q.bottom, 0) [INIT] L.17: deque.h  
 (3, 3): Racq (q.top, 0) [INIT] L.18: deque.h  
 (3, 4): Wna (q.buffer[0], 2) L.25: deque.h  
<0, 4> thread\_3:  
 (4, 0): B  
<0, 5> thread\_4:  
 (5, 0): B  
<0, 6> thread\_5:  
 (6, 0): B  
  
Number of complete executions explored: 0  
Total wall-clock time: 0.03s  
../linearizability-testing/tests/generated/chase-lev\_6\_0/t3.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 39  
Total wall-clock time: 0.03s  
../linearizability-testing/tests/generated/chase-lev\_6\_0/t4.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 28  
Total wall-clock time: 0.03s  
../linearizability-testing/tests/generated/chase-lev\_6\_0/t5.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1  
Total wall-clock time: 0.03s

race between 2 enq operations here:

int64\_t try\_push(struct Deque \*deq, int64\_t N, int64\_t data)

{

    uint64\_t b = atomic\_load\_explicit(&deq->bottom, mo\_rlx);

    uint64\_t t = atomic\_load\_explicit(&deq->top, mo\_acq);

    int64\_t len = (int64\_t) (b - t);

    if (len >= N) {

        return -1; // full

    }

    deq->buffer[b % N] = data;

    atomic\_store\_explicit(&deq->bottom, b + 1, mo\_rel);

    return 0;

}

In tests t1 and t2 which both don’t define order between Enq(1) and Enq(2).  
It makes sense because both are trying to write to the same non-atomic location in buffer. In the queue definition it is mentioned

struct Deque {

    atomic\_uint\_fast64\_t bottom;

    atomic\_uint\_fast64\_t top;

    int64\_t buffer[LEN]; // in fact, it should be marked as atomic

    //due to the race between push and

    // steal.

};

Although we witnessed a conflict between two push operations. When making the following change:

struct Deque {

    atomic\_uint\_fast64\_t bottom;

    atomic\_uint\_fast64\_t top;

    atomic\_int\_fast64\_t buffer[LEN];

};

The tests run well

ori@Ori-Laptop:~/workspace/genmc$ for t in ../linearizability-testing/tests/generated/chase-lev\_7\_1/\*.c; do echo $t; ./src/genmc $t; done  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t1.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 16275  
Total wall-clock time: 2.84s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t10.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1753  
Total wall-clock time: 0.24s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t11.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 109  
Total wall-clock time: 0.07s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t2.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 873  
Total wall-clock time: 0.21s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t3.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1  
Total wall-clock time: 0.05s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t4.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 24079  
Total wall-clock time: 3.46s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t5.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 126112  
Total wall-clock time: 79.72s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t6.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 75089  
Total wall-clock time: 20.13s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t7.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 1939  
Total wall-clock time: 0.19s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t8.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 38528  
Total wall-clock time: 6.11s  
../linearizability-testing/tests/generated/chase-lev\_7\_1/t9.c  
Number of complete executions explored: 0  
Number of blocked executions seen: 357  
Total wall-clock time: 0.06s