Iowa State University, Department of Computer Engineering

Computer Science 612
Assignment 4

Ibne Farabi Shihab

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1 Third Problem

At first, copy [x] contains initial value of shared object X.

Algorithm 1: (proc p_i)

```
1  operation Enq(v):
2      in ← NEXT.fetchadd (1);
3     Q[in] ← v;
4      return ()
5  operation Deq():
6      last ← NEXT - 1;
7      for i from 0 until last do
8          aux ← Q[i].swap (nil);
9          if (aux 6= ) then return (aux)
10     return (nil)
```

In this algorithm unbounded array Q and a variable next pointed to the next variable slot is used.

The implementation is wait-free: every process completes each of its operations in a finite number of its own steps: the number of steps performed by Enq() is two, and the number of steps performed by Deq() is proportional to the queue size as evaluated in the first line of its code. So the algorithm is correct. As we are using array, dequeue is constant while enque operation is linear.

2 Fourth Problem

$READ_1 WRITE_1(1) RET_1(v_1) READ_2 ACK_1 WRITE_2(2) RET_2(v_2) READ_3 ACK_2 RET_3(v_3)$

possible way 1:

$READ_1 RET_1(v_1) WRITE_1(1) ACK_1 READ_2 RET_2(v_2) WRITE_2(2) ACK_2 READ_3 RET_3(v_3)$ RWRWR Read 1: value=0, Read 2: value=1, Read 3: value=2

possible way 2:

$WRITE_1(1) ACK_1 READ_1 RET_1(v_1) WRITE_2(2) ACK_2 READ_2 RET_2(v_2) READ_3 RET_3(v_3)$ WRWRR Read 1: value=1, Read 2: value=2, Read 3: value=2

possible way 3:

$WRITE_1(1) ACK_1 READ_1 RET_1(v_1) READ_2 RET_2(v_2) WRITE_2(2) ACK_2 READ_3 RET_3(v_3)$ WRRWR Read 1: value=1, Read 2: value=1, Read 3: value=2