

Name: Shreyas Bhat Kera

ID: 2018A7P31119P

Q1.

Semaphores:

empty, full, mutex, half-filled

Initial: empty = 10, half-filled = 0, mutex = 1
 full = 0 { 3 pointers for adding & removing }

P_1 do {

create half filled item in next P

wait(empty)

wait(mutex)

Add half finished item to buffer

signal(mutex)

signal(halffilled) } while (1)

P_2 do {

wait(halffilled)

wait(mutex)

finish half finished item; - buffer

signal(mutex)

signal(full) } while (1)

C do {

wait(full)

wait(mutex)

remove item from buffer

signal(mutex)

signal(empty) } while (1)

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Q2. $P = 2$, $Q = 0$, $R = 0$, $P_1 = 2$

Process P

do {

wait(P)

wait(P_1)wait(P_1)

<critical

section>

signal(P_1)signal(P_1)

signal(Q)

} while(1)

Process Q

do {

wait(Q)

wait(Q)

wait(P_1)wait(P_1)

<critical

section>

signal(A)

signal(R)

} while(1)

Process R

do {

wait(R)

<critical

section>

signal(P)

signal(P_1)

} while(1)