Usman Institute of Technology

Department of Computer Science Fall 2022

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Course: Operating Systems (CS312)

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Date: 22-Dec-2022

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20b-115-se
SE-B
OS Lab#10
Ma’am Shabina Mushtaq

Lab Tasks:

1. Write a python program that demonstrates the synchronization of Consumer producer Bounded Buffer Problem using semaphores.

```python
import threading,os

try:
    from rich.console import Console
    from rich.table import Table
except ImportError:
    os.system("pip install rich")
    from rich.console import Console
    from rich.table import Table

console = Console()
table = Table(show_header=True, header_style="bold magenta")

buf = []
empty = threading.Semaphore(5)
full = threading.Semaphore(0)
mutex = threading.Lock()

table.add_column("Name", style="dim", width=12)
table.add_column("Full", style="dim", width=12)
table.add_column("Empty", style="dim", width=12)


def producer(name):
    empty.acquire()
    mutex.acquire() # added
    print("Before name: {} Full: {} Empty: {}".format(name,full._value,empty._value))
    print("Producer is producing")
    mutex.release() # added
    full.release()
    print("After name: {} Full: {} Empty: {}".format(name,full._value,empty._value))
    table.add_row(name, str(full._value), str(empty._value))

def consumer(name):
    full.acquire()
    mutex.acquire() # added
```

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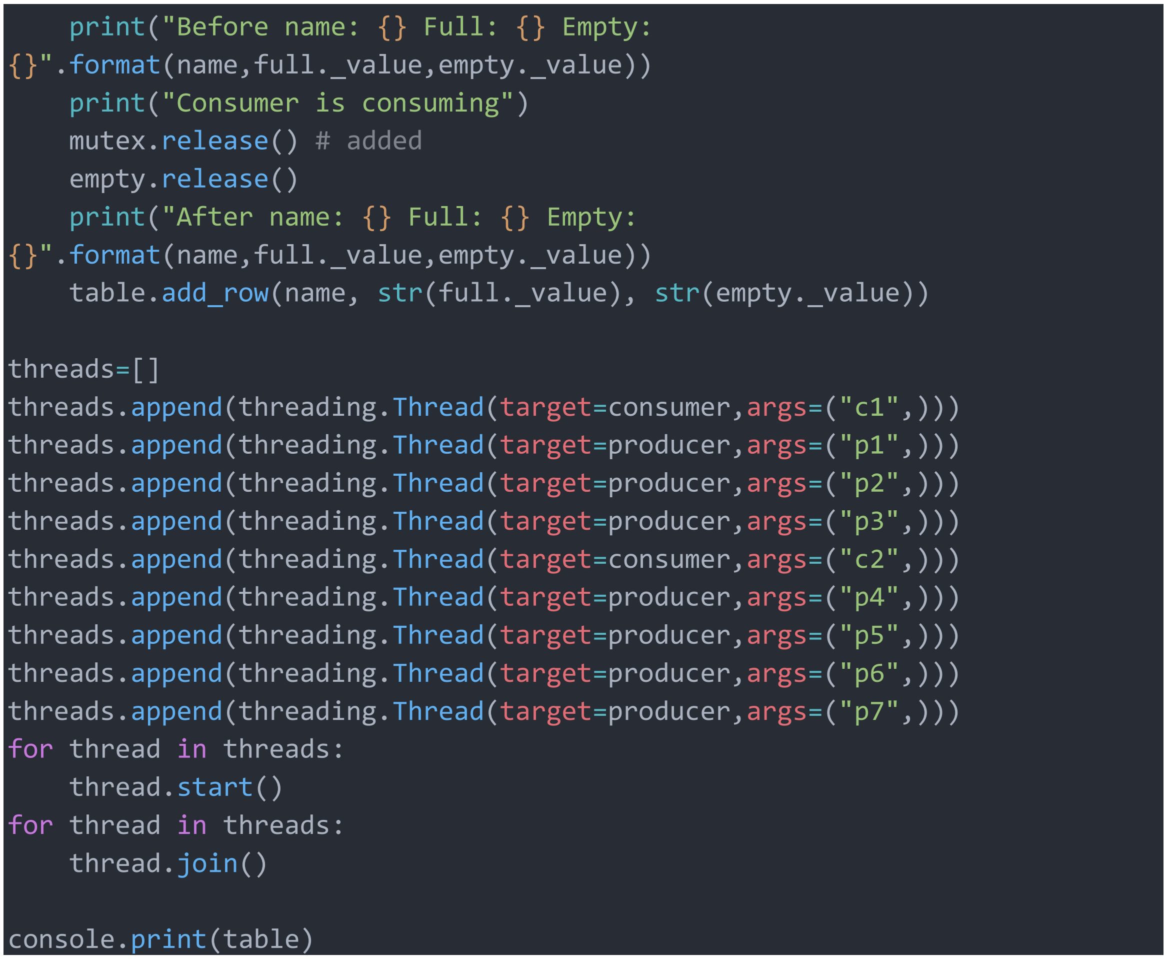

```
    print("Before name: {} Full: {} Empty:
{}".format(name,full._value,empty._value))
    print("Consumer is consuming")
    mutex.release() # added
    empty.release()
    print("After name: {} Full: {} Empty:
{}".format(name,full._value,empty._value))
    table.add_row(name, str(full._value), str(empty._value))

threads=[]
threads.append(threading.Thread(target=consumer,args=("c1",)))
threads.append(threading.Thread(target=producer,args=("p1",)))
threads.append(threading.Thread(target=producer,args=("p2",)))
threads.append(threading.Thread(target=producer,args=("p3",)))
threads.append(threading.Thread(target=consumer,args=("c2",)))
threads.append(threading.Thread(target=producer,args=("p4",)))
threads.append(threading.Thread(target=producer,args=("p5",)))
threads.append(threading.Thread(target=producer,args=("p6",)))
threads.append(threading.Thread(target=producer,args=("p7",)))
for thread in threads:
    thread.start()
for thread in threads:
    thread.join()

console.print(table)
```

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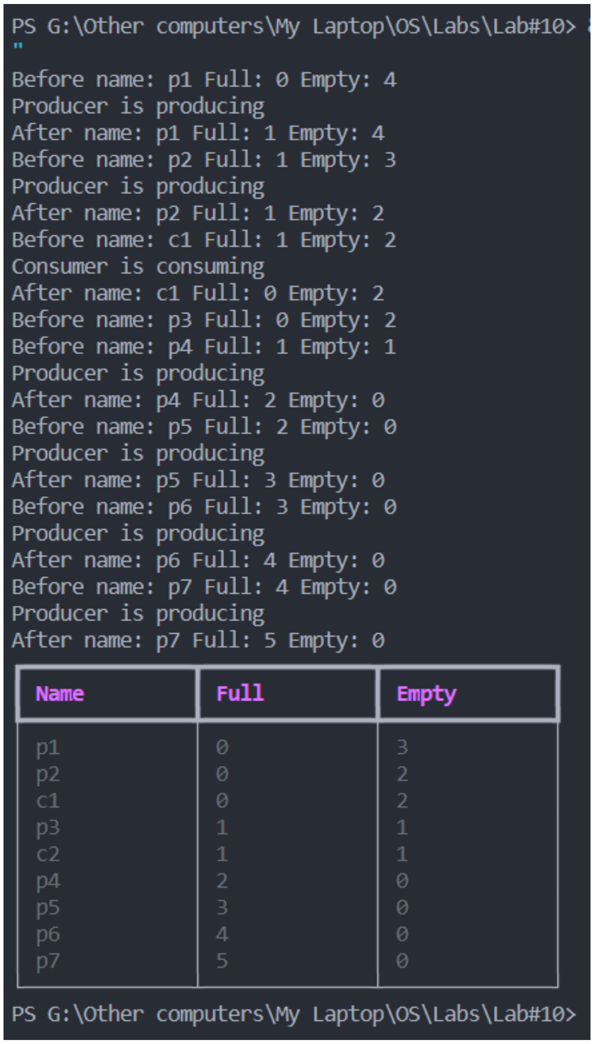
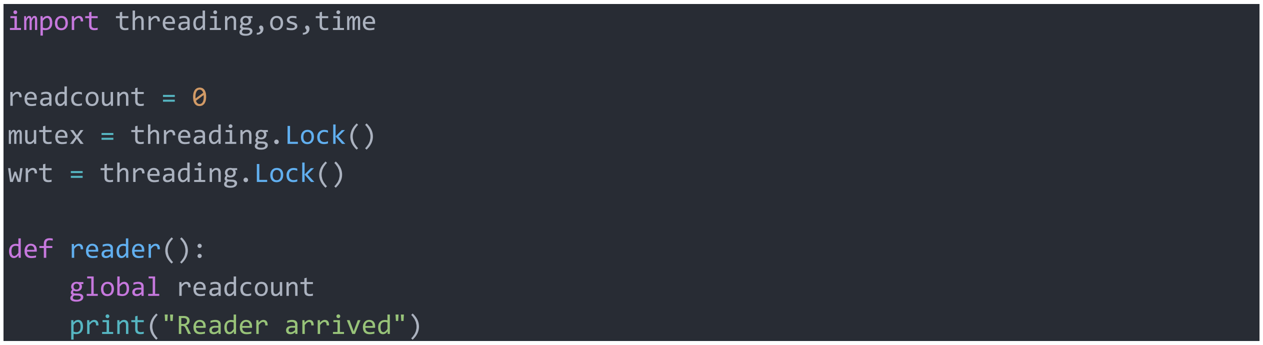
Output:



```
PS G:\Other computers\My Laptop\OS\Labs\Lab#10>
"

Before name: p1 Full: 0 Empty: 4
Producer is producing
After name: p1 Full: 1 Empty: 4
Before name: p2 Full: 1 Empty: 3
Producer is producing
After name: p2 Full: 1 Empty: 2
Before name: c1 Full: 1 Empty: 2
Consumer is consuming
After name: c1 Full: 0 Empty: 2
Before name: p3 Full: 0 Empty: 2
Before name: p4 Full: 1 Empty: 1
Producer is producing
After name: p4 Full: 2 Empty: 0
Before name: p5 Full: 2 Empty: 0
Producer is producing
After name: p5 Full: 3 Empty: 0
Before name: p6 Full: 3 Empty: 0
Producer is producing
After name: p6 Full: 4 Empty: 0
Before name: p7 Full: 4 Empty: 0
Producer is producing
After name: p7 Full: 5 Empty: 0
┏━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━┓
┃ Name          ┃ Full          ┃ Empty         ┃
┡━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━┩
│ p1            │ 0             │ 3             │
│ p2            │ 0             │ 2             │
│ c1            │ 0             │ 2             │
│ p3            │ 1             │ 1             │
│ c2            │ 1             │ 1             │
│ p4            │ 2             │ 0             │
│ p5            │ 3             │ 0             │
│ p6            │ 4             │ 0             │
│ p7            │ 5             │ 0             │
└───────────────┴───────────────┴───────────────┘
PS G:\Other computers\My Laptop\OS\Labs\Lab#10>
```

2. Write a python program that demonstrates the synchronization of Readers and Writer Problem using semaphores.



```
import threading,os,time

readcount = 0
mutex = threading.Lock()
wrt = threading.Lock()

def reader():
    global readcount
    print("Reader arrived")
```

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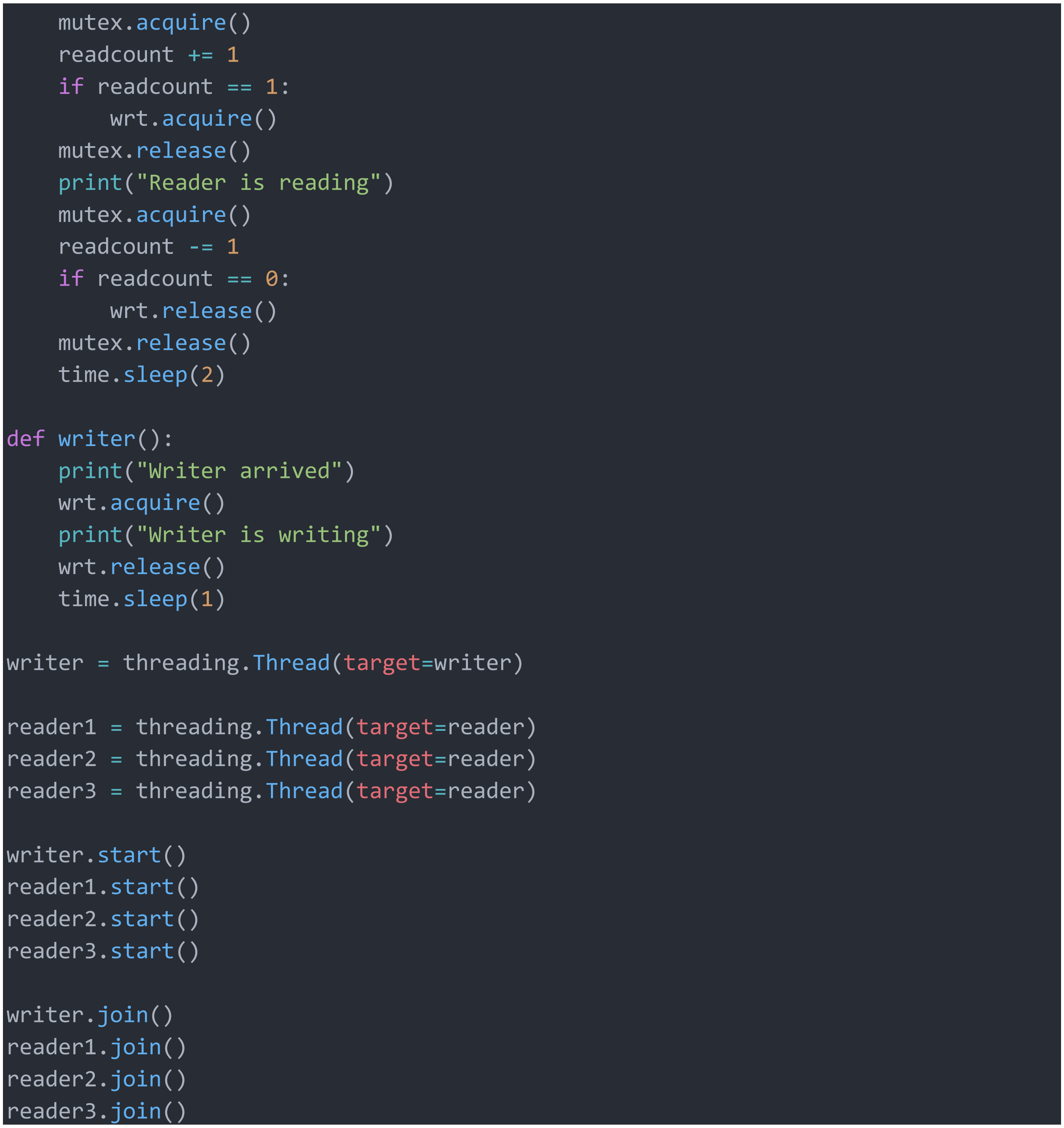
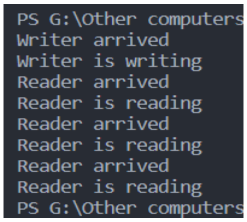


```
    mutex.acquire()
    readcount += 1
    if readcount == 1:
        wrt.acquire()
    mutex.release()
    print("Reader is reading")
    mutex.acquire()
    readcount -= 1
    if readcount == 0:
        wrt.release()
    mutex.release()
    time.sleep(2)

def writer():
    print("Writer arrived")
    wrt.acquire()
    print("Writer is writing")
    wrt.release()
    time.sleep(1)

writer = threading.Thread(target=writer)

reader1 = threading.Thread(target=reader)
reader2 = threading.Thread(target=reader)
reader3 = threading.Thread(target=reader)

writer.start()
reader1.start()
reader2.start()
reader3.start()

writer.join()
reader1.join()
reader2.join()
reader3.join()
```

Output:



```
PS G:\Other computers
Writer arrived
Writer is writing
Reader arrived
Reader is reading
Reader arrived
Reader is reading
Reader arrived
Reader is reading
PS G:\Other computers
```