Harold Molina-Bulla DTSC-UC3M

MULTIPROCESSWITH LOCKS AND SEMAPHORES

SESSION 7

2022

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ABOUT MIMD

- MIMD: MULTIPLE INSTRUCTION, MULTIPLE DATA
  - We was working with SIMD (Single Instruction, Single Data)
- The general purpose processors, like our computer's processor, are able to execute multiple programs in parallel: that is Multiple Instruction
- If our general parallel program works with parallel treads needs to be synchronized
- In order to wait until the end of the processes, it is necessary block the execution "joining" to the child processes.

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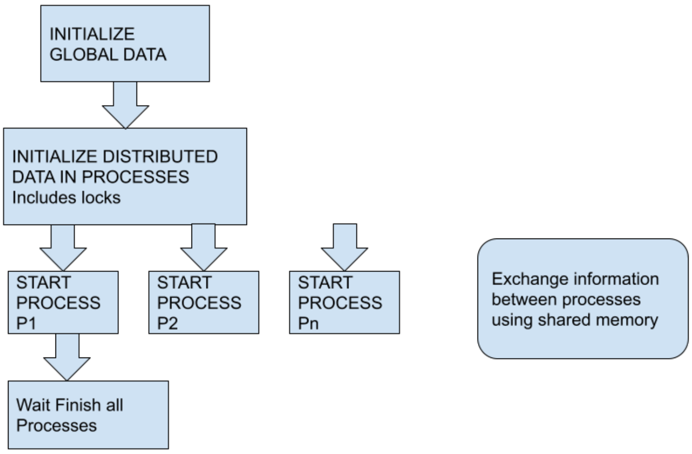

INITIALIZE GLOBAL DATA
INITIALIZE DISTRIBUTED DATA IN PROCESSES Includes locks
START PROCESS P1
START PROCESS P2
START PROCESS Pn
Exchange information between processes using shared memory
Wait Finish all Processes

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LOCK

- Locks are used to restrict access to shared memory variables to other processes.
- There are 2 types of locks, depending the influenced variables.
    - Only one variable affected: Invoking the method get_lock()
        - The lock blocks meanwhile execute the inner block
    - All the shared variables in a block: Using an multiprocess object Lock()
        - You get the lock invoking method Lock.aquire() and release the access to the variables invoking the method release()

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SEMAPHORES

- The semaphore allows execute part of the code if the semaphore is available.
- It is used to restrict the access to limited resources.
- It is a counter, which decrease (by 1) if the semaphore is acquired by a process and increase if the semaphore is released.
- If the semaphore counter is 0, the sub-process can not acquire the semaphore and will wait.

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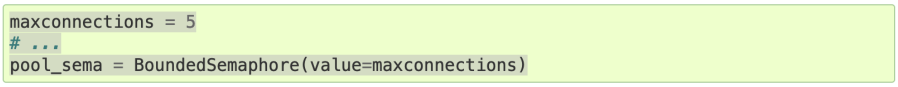
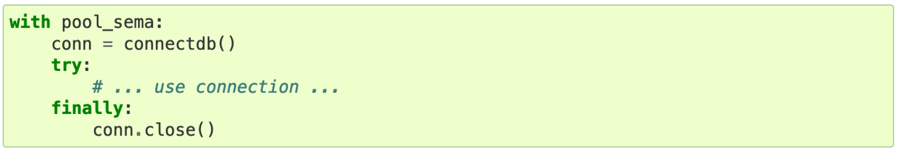
BOUNDEDSEMAPHORE

- BoundedSemaphore is a special heir of Semaphore Object



```
maxconnections = 5
# ...
pool_sema = BoundedSemaphore(value=maxconnections)
```



```
with pool_sema:
    conn = connectdb()
    try:
        # ... use connection ...
    finally:
        conn.close()
```

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THINKS ABOUT TAKE CARE

- How to distribute resources:
  - Memory, Computational Cores
- How to exchange information
  - Shared Memory Structures (global locks)
- When finish the processes
  - Well limited execution time/cycles
  - Exchanging information between processes
  - Kill processes

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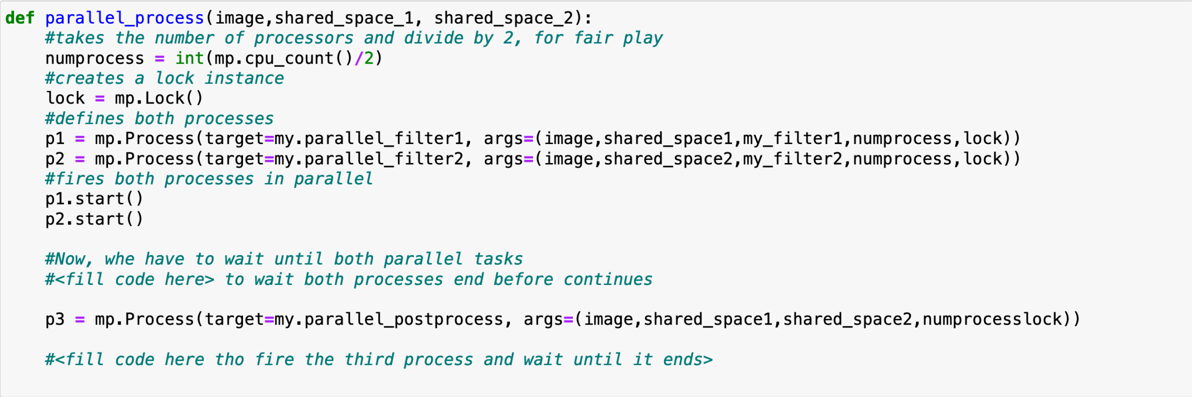

```
def parallel_process(image,shared_space_1, shared_space_2):
    #takes the number of processors and divide by 2, for fair play
    numprocess = int(mp.cpu_count()/2)
    #creates a lock instance
    lock = mp.Lock()
    #defines both processes
    p1 = mp.Process(target=my.parallel_filter1, args=(image,shared_space1,my_filter1,numprocess,lock))
    p2 = mp.Process(target=my.parallel_filter2, args=(image,shared_space2,my_filter2,numprocess,lock))
    #fires both processes in parallel
    p1.start()
    p2.start()

    #Now, whe have to wait until both parallel tasks
    #<fill code here> to wait both processes end before continues

    p3 = mp.Process(target=my.parallel_postprocess, args=(image,shared_space1,shared_space2,numprocesslock))

    #<fill code here tho fire the third process and wait until it ends>
```

WINDOWS ISSUES

- Due how MS Windows implements multithreading, and separate memory areas should take care about:
    - If uses nested parallelism, needs to define different modules for different levels.
    - Needs multiple initialization levels.