

LAMPORTS CLOCK

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from multiprocessing import Process, Pipe
from os import getpid
from datetime import datetime

def local_time(counter):
    return ' (LAMPORT_TIME={},
LOCAL_TIME={})'.format(counter, datetime.now())

def calc_rcv_timestamp(rcv_time_stamp, counter):
    return max(rcv_time_stamp, counter) + 1

def event(pid, counter):
    counter += 1
    print('Something happened in {} !\n\n'.\
format(pid) + local_time(counter))
    return counter

def send_message(pipe, pid, counter):
    counter += 1
    pipe.send(('Empty shell', counter))
    print('Message sent from ' + str(pid) + local_time(counter))
    return counter

def rcv_message(pipe, pid, counter):
    message, timestamp = pipe.recv()
    counter = calc_rcv_timestamp(timestamp, counter)
    print('Message received at ' + str(pid) + local_time(counter))
    return counter

def process_one(pipe12):
    pid = getpid()
    counter = 0
    counter = event(pid, counter)
    counter = send_message(pipe12, pid, counter)
    counter = event(pid, counter)
    counter = rcv_message(pipe12, pid, counter)
    counter = event(pid, counter)

def process_two(pipe21, pipe23):
    pid = getpid()
    counter = 0
```

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counter = recv_message(pipe21, pid, counter)
counter = send_message(pipe21, pid, counter)
counter = send_message(pipe23, pid, counter)
counter = recv_message(pipe23, pid, counter)

def process_three(pipe32):
    pid = getpid()
    counter = 0
    counter = recv_message(pipe32, pid, counter)
    counter = send_message(pipe32, pid, counter)

if __name__ == '__main__':
    oneandtwo, twoandone = Pipe()
    twoandthree, threeandtwo = Pipe()

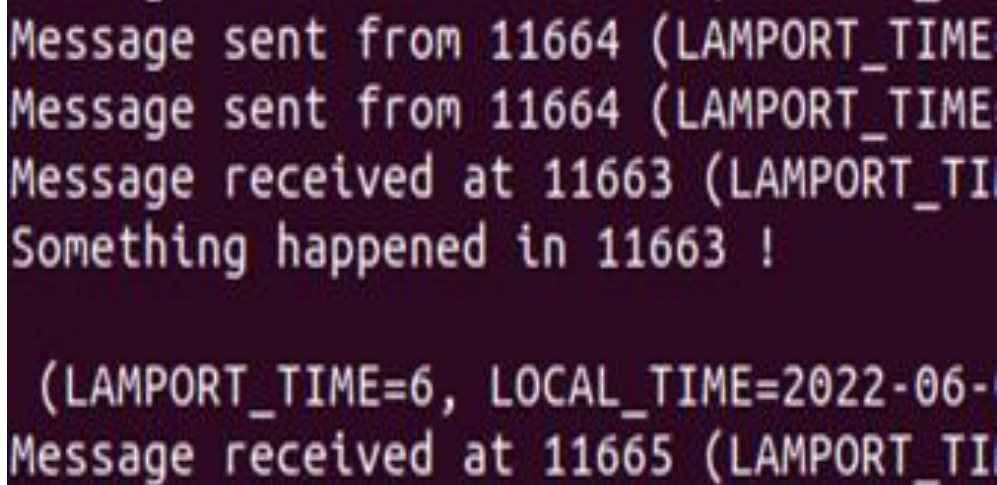
    process1 = Process(target=process_one,
        args=(oneandtwo,))
    process2 = Process(target=process_two,
        args=(twoandone, twoandthree))
    process3 = Process(target=process_three,
        args=(threeandtwo,))

    process1.start()
    process2.start()
    process3.start()

    process1.join()
    process2.join()
    process3.join()

```

INPUT/OUTPUT



```

Message sent from 11664 (LAMPOR_TTIME
Message sent from 11664 (LAMPOR_TTIME
Message received at 11663 (LAMPOR_TI
Something happened in 11663 !

(LAMPOR_TTIME=6, LOCAL_TIME=2022-06-
Message received at 11665 (LAMPOR_TI

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