Synchronization

What will happen if the synchronization is not handled in your simple OS? Illustrate by example the problem of your simple OS if you have any.

Answer:
If synchronization is not handled in a simple OS, the following common concurrency issues may occur due to the use of multiple CPUs:

- **Data race:** Happens when processes or threads perform read and write operations on the same data block concurrently, leading to inconsistent or unexpected results.
- **Race condition:** Happens when the order of execution of processes or threads affects the output, possibly producing undesirable results.
- **Deadlock:** Occurs when multiple threads are waiting for each other to access shared resources, causing them to be stuck indefinitely.

Below is an example that illustrates this problem with 2 CPUs and 1 ready queue:

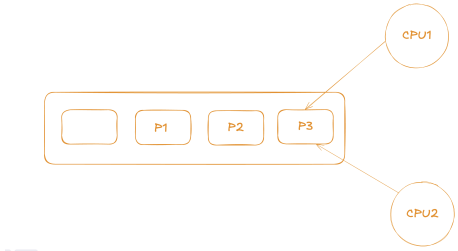

Figure 1: Due to the lack of synchronization, both CPUs pick the first process from the *ready_queue* simultaneously, specifically P3.

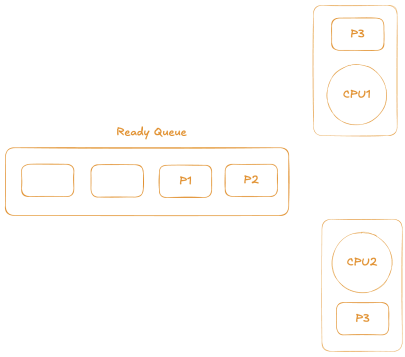

Figure 2: Both CPUs execute P3 (assuming no data race occurs during execution for simplicity of visualization).

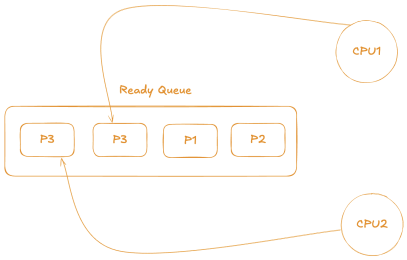

Figure 3: Both CPUs inserted process P3 into the *ready_queue*, but since CPU 2 was slightly slower, there are now two instances of P3 in the *ready_queue*.