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“A condition variable contains a value and an associated queue. When a thread waits on a condition variable inside a monitor, it exits the monitor and is placed in the condition variable’s queue, Threads wait in the queue until signaled by another thread” (Deitel et al, 2004) This wiki is for helping your peers understand how a condition variable works.

You will Improve this wiki doing one of the following continuations.

* another definition of condition variable that complement and improve the given definition.
* an explanation with an example (different from the examples given in the course) that includes a pseudocode implementation in a high-level programming language.
* an explanation of why conditional variables are important in concurrent programming.

In addition to storing a value and a queue, a condition variable functions as a signaling mechanism, allowing threads to coordinate their execution within a concurrent application. When a thread waits on a condition variable within a monitor, it voluntarily gives up control of the monitor and joins the condition variable's queue, thereby halting its execution. Other threads can continue to run within the monitor, or access shared resources while the waiting thread is in the queue. When another thread signals the condition variable, it alerts the waiting thread that a specific condition or event has happened, causing it to re-enter the monitor and restart execution. This signaling technique allows threads to synchronize and coordinate their activity in response to specified conditions or events, increasing concurrent systems' overall efficiency and effectiveness.

Condition variables are essential in concurrent programming because they allow threads to communicate and synchronize their tasks without waiting or wasting system resources. Condition variables make building complicated synchronization patterns and coordination mechanisms in concurrent applications easier by allowing threads to wait for specific criteria to be met before progressing. For example, in a producer-consumer situation, several producer threads may wait for a condition variable showing that the buffer is full, while multiple consumer threads await another condition variable indicating that the buffer is empty. When a producer adds an item to the buffer, it triggers the condition variable associated with buffer fullness, allowing a waiting consumer to consume it. Similarly, when a consumer takes an item from the buffer, it triggers the condition variable associated with buffer emptiness, letting a waiting producer proceed and manufacture more items. This coordinated messaging between threads promotes effective resource use while avoiding excessive delays or conflict, making condition variables a vital building block in concurrent programming paradigms.