1. How do the scheduler and dispatcher work together within the operating system's kernel to manage processes?

The scheduler maintains a record of processes, adds new processes to the pool, and removes completed processes. It also maintains a process table in memory. The dispatcher oversees the execution of scheduled processes, using time slices and interrupts to switch between them.

2. What is the role of the process table, and what information does it contain?

The process table is a block of information in the main memory maintained by the scheduler. It contains information about each process, including the memory area assigned to it, its priority, and whether it is ready or waiting for an external event.

3. How is the concept of mutual exclusion related to the use of semaphores in operating systems?

Mutual exclusion refers to the requirement that only one process can execute a critical region at a time. Semaphores are used to achieve mutual exclusion by guarding critical regions. A process must check and set a semaphore before entering a critical region, ensuring only one process enters it at a time.

What are the three conditions that must be satisfied for a deadlock to occur in resource allocation, and how can these conditions be addressed?

4. The three conditions for a deadlock are competition for non-sharable resources, partial resource requests, and the inability to forcibly retrieve allocated resources. Deadlocks can be addressed through deadlock detection and correction schemes (e.g., killing processes) or deadlock avoidance schemes (e.g., requiring all resources to be requested at once or converting non-sharable resources into sharable ones).