OS Assignment 1 Solution

1. MS-DOS provided no means of concurrent processing. Discuss three major complications that concurrent processing adds to an operating system. (20%)

Answer:
A. A method of time sharing must be implemented to allow each of several processes to have access to the system. This method involves the preemption of processes that do not voluntarily give up the CPU (by using a system call, for instance) and the kernel being reentrant (so more than one process may be executing kernel code concurrently).

B. Processes and system resources must have protections and must be protected from each other. Any given process must be limited in the amount of memory it can use and the operations it can perform on devices like disks.

C. Care must be taken in the kernel to prevent deadlocks between processes, so processes aren’t waiting for each other’s allocated resources.

2. Describe the differences among short-term, medium-term, and long-term scheduling. (20%)

Answer:
A. Short-term (CPU scheduler)—selects from jobs in memory those jobs that are ready to execute and allocates the CPU to them.

B. Medium-term—used especially with time-sharing systems as an intermediate scheduling level. A swapping scheme is implemented to remove partially run programs from memory and reinstate them later to continue where they left off.

C. Long-term (job scheduler)—determines which jobs are brought into memory for processing.

The primary difference is in the frequency of their execution. The short-term must select a new process quite often. Long-term is used much less often since it handles placing jobs in the system and may wait a while for a job to finish before it admits another one.

3. Describe the actions a kernel takes to context switch between processes. (20%)

Answer:
In general, the operating system must save the state of the currently running process and restore the state of the process scheduled to be run next. Saving the state of a process typically includes the values of all the CPU registers in addition to memory allocation. Context switches must also perform many architecture-specific operations, including flushing data and instruction caches.