Theory Assignment 1 Ali Hanni

COMP 346 40157164

**Question 1.**

1. A program that acts as an intermediary between a user of a computer and the computer hardware. The operating system executes user programs and make solving user problems easier.
2. List
   * Batch: OS group similar jobs into batches and send to hardware (CPU). The OS does not interact with the computer directly. Less idle time, easy to manage less work repeatedly. Hard to debug
   * Time sharing: Each task is given a time to execute, making all tasks work smoothly. This type of OS reduces response time without increasing CPU usage. However, with this approach, synchronization must be given greater importance since OS is constantly switching between tasks.
   * Dedicated: A simple and compact OS that is specialized in one particular thing and is fast and efficient in it.
   * Parallel: Breaks large tasks into smaller ones that are executed simultaneously in different places by different mechanism (i.e., Multicore CPUs). Many CPU doing small similar jobs connected at a shared infrastructure.
   * Multiprogramming: A multiprogramming OS interleave the execution of several jobs by the same processing core. When one job is waiting, another one takes it place and starts executing. This resolve CPU underutilization problem. Jobs are kept in main memory and a portion of one is executed, then a portion of another etc. Tasks are never executed at the same actual time.
3. When there are multiples tasks to be done concurrently, either by the same user or by multiple users trying to execute tasks. Time sharing environment, with fast hardware and efficient mechanism, can serve all request concurrently. From the user viewpoint, he has exclusive access and CPU is constantly working on his task.

**Question 2.**

1. Since we are dealing with a single programmed OS, all steps would be executed one after another

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| P1(CPU) | P1(IO) | P1(CPU) | P2(CPU) | P2(IO) | P2(CPU) |
| 15 | 10 | 10 | 10 | 5 | 15 |

For a total of 65 units.

1. With a multiprogrammed OS, one process would run when the other is waiting for IO.

|  |  |  |  |
| --- | --- | --- | --- |
| P1(PCU) | P2(CPU) | P1(CPU) | P2(CPU) |
| 15 | 10 | 10 | 15 |

For a total of 50 units.

1. For single programmed OS: 65/2 = 32.5

For multiprogrammed OS: 50/2 = 25

Multiprogrammed OS reduces the throughputs by completing tasks more efficiently and reducing CPU idle time.

**Question 3.**

1. Interrupts notices that the CPU requires its attention and interrupts the ongoing process whereas the polling method constantly check register status to know if a device is ready or not. Usually, interrupt is way more efficient that polling. Given that interrupts require a context switch, if there are to many requests for interrupts, the system would be better of with a polling system. In the case where I/O jobs are short and frequent.
2. DMA is a direct memory access controller