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COP4600

HW 2.1

3. On all current computers, at least part of the interrupt handlers are written in assembly language. Why?

At least part of the interrupt handlers is written in assembly language because certain actions in hardware can only be performed in assembly as high-level languages cannot. This include manipulating the stack pointer and registers. In addition, assembly language is faster than high-level languages, allowing for faster processing of interrupts.

6. A computer has 4 GB of RAM of which the operating system occupies 512 MB. The processes are all 256 MB (for simplicity) and have the same characteristics. If the goal is 99% CPU utilization, what is the maximum I/O wait that can be tolerated?

RAM = 4 GB = 4096 MB OS = 512 MB Processes = 256 MB

Available for Process = 4096 MB – 512 MB = 3584 MB

Number of Processes = 3584 MB/256 MB = 14 processes = n

CPU utilization -> CPU=1-IO^n -> 0.99=1-IO^(14) -> IO=0.72 -> 72%

Therefore, the maximum I/O wait that can be tolerated is 72%.

7. Multiple jobs can run in parallel and finish faster than if they had run sequentially. Suppose that two jobs, each needing 20 minutes of CPU time, start simultaneously. How long will the last one take to complete if they run sequentially? How long if they run in parallel? Assume 50% I/O wait.

Job Time = 20min Number of Jobs = 2 I/O Time = 50% -> CPU Time = 50%

Since half the time is spent processing and the other half is spent waiting the total time for a job to be completed is 40min.

2 Job \* 40min = 80min to complete if they run sequentially.

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CPU=1-IO^n = 1-0.5^(2) = 0.75

CPU share = 0.75/2 = 0.375

20 min / 0.375 = 53.33min to complete if they run parallel.

8. Consider a multiprogrammed system with degree of 6 (i.e., six programs in memory at the same time). Assume that each process spends 40% of its time waiting for I/O. What will be the CPU utilization?

I/O Time = 40% Number of Processes = 6

CPU=1-IO^n = 1-(40/100)^(6) = 0.995

Therefore the CPU utilization is 99%.