

I pledge my honor that I have abided by the Stevens Honor System.

1. **Describe the fetch-execute cycle. Explain the importance of a CPU's clock cycle. For example, what would it mean for a CPU to run at 4.77MHZ.**
 - a. Fetch-Execute Cycle: The computer fetches the instruction from its memory and executes it. Repeat from when the computer is turned on to when it is shut down.
 - b. CPU Clock Cycle: The clock controls when each step in the instruction takes place. The pulses are separated sufficiently to assure each step has time to complete, before the next step.
 - c. CPU at 4.77MHZ: The clock would have 4.77 million pulses per second.
2. **Most CPUs today are superscalar. What does that mean?**
 - a. Superscalar: A microprocessor design that allows for more than one instruction to be executed in one clock cycle.
3. **When a system has multiple levels of cache memory, L2 always has more memory than L1. Why is this necessary?**
 - a. L2 exists to speed up the case where there is an L1 cache miss. If L2 wasn't bigger than L1, it would not be able to have more lines than L1 to deal with L1 cache misses.
4. **Suppose that a CPU always executes the two instructions following a branch instruction, regardless of whether the branch is taken or not. Explain how this can eliminate most of the delay resulting from branch dependency in a pipelined CPU. What penalties or restrictions does this impose on the programs that are executed on this machine?**
 - a. This eliminates the delay because the CPU doesn't have to wait for the branch to tell it the result in order to continue. If both branches run, there will be a much smaller delay in a pipeline CPU.
 - b. Restrictions: The CPU can only execute linear code, so the code cannot be complex.
5. **In general, what purpose does an interrupt serve? Stated another way, suppose there were no interrupts provided in a computer. What capabilities would be lost?**
 - a. Interrupts increase the overall efficiency of a computer. Without interrupts, the processor would need to poll every device periodically to check if any of them need attention.

6. Although CPU remain the same over the years, various improvements occurred in their architecture. Descried them in details.

a. Improvements:

- i. More transistors per chip: This allows them to be faster, and smaller.
- ii. Better clock speed: This allows them to execute more instructions in a shorter amount of time.
- iii. Superscalar: This allows them to execute more instructions in a single clock cycle.
- iv. Dual-Core/Quad-Core: This allows them to multitask more efficiently.