

Tutorials #5

We want to build a desktop computer for common tasks. First, we bought a motherboard clocked at 1833 MHz with the following features:

- 4 slots for RAM, each with 2GB aligned to 2B clocked at 1633 MHz
- 2 PCI-32 slots
- 1 PCI-E X8 slot
- 1 SATA II slot
- 1 ATA66 slot
- 2 USB 2.0 ports
- L3 cache memory with a size of 12MB

Then, we added the following electronic components to the motherboard:

- Intel i5 quad-core processor clocked at 1400 MHz. The processor is equipped with two cache memories, L1 and L2. The size of L1 is 512KB, and the size of L2 is 6MB. The processor can execute two types of instructions (simple and complex). The simple instruction requires 8 cycles to execute, while the complex instruction requires 12 cycles to execute
- 160GB hard drive disk (HDD)
- CD-ROM reader
- Keyboard and mouse
- Nvidia graphics card
- Network card and modem

Questions:

1. What is missing from this computer for it to work?
2. What are the slowest and fastest slots on this motherboard? Provide their bandwidth.
3. Provide the slot type for each electronic component in this computer.
4. Define the electronic component responsible for managing all slots on this motherboard.
5. What is the maximum RAM capacity that can be installed on this computer?
6. What is the width of the system bus?
7. Calculate the computer bandwidth.
8. Calculate the delay imposed on the processor.
9. Calculate the number of blocks in L1, L2, and L3, given that the size of an L1 block is 128B.
10. Calculate the maximum number of executions in parallel.
11. Calculate the MIPS.
12. We want to execute a program with 10^9 instructions composed of 35% simple instructions and 65% complex instructions.

Calculate the time required for the execution of this program knowing that the hit rate in L1 is 70%, in L2 is 80% and in L3 is 90%. The processor requires 2 cycles to load an instruction into L1, 2 cycles to load an instruction into L2 and 3 cycles to load an instruction in L3.