

Tutorials #4

Exercise 01:

We have a laptop equipped with a quad-core processor with a frequency of 1.4 GHz and three cache memories, L1 with a size of 256KB, L2 with a size of 1MB and L3 with a size of 12MB. The hit rate in L1 is 80%, while the hit rate in L2 is 90%. The miss rate in L3 is 10%. The processor requires 3 cycles to load an instruction into L2, 2 cycles to load an instruction into L1 and 5 cycles to load an instruction in L3.

1. Calculate the number of blocks in L1, L2 and L3, knowing that the size of an L1 block is 128B.
2. Calculate the time required for the execution of a program with 10^6 instructions, considering that an instruction takes 10 cycles to execute.

Exercise 02:

A desktop computer is equipped with a sixth-generation i7 processor with a 2-core configuration. The processor operates with an internal clock of 2.4 GHz and has four super scalars. The first super scalar contains 8 units and processes complex instructions with an average time of 2 cycles per unit. The second one contains 6 units designed for multimedia instructions with an average time of 2 cycles per unit. The third super scalar contains 5 units specialized in arithmetic and logic instructions with an average processing time of 1 cycle per unit and the last one contains 5 units specialized in float instructions with an average processing time of 2 cycle per unit.

1. Calculate the MIPS.
2. Calculate the average execution time of a program with 10^9 instructions composed of 25% arithmetic and logic instructions, 25% of float instructions, 35% multimedia instructions, and 15% complex instructions.

Exercise 03:

The computers in the machine room have an identical configuration, featuring a dual-core processor with a clock speed of 2.1 GHz and a 32-bit MATSONIC motherboard with a 1600MHz front-side bus (FSB). The processor is equipped with pipeline technology with 6 stages and 3 cycles for each stage.

1. Calculate the computer's bandwidth.
2. Calculate the time required for the execution of a program with 10^6 instructions.

Exercise 04:

We want to execute a program with 10^9 instructions on a computer containing an Intel i5 processor with a 4-core configuration and a frequency of 3 GHz. The processor is installed on a motherboard with a 2433MHz FSB and a maximum RAM capacity of 16GB. The processor is equipped with pipeline and super-scalar technology. It also has two cache memories, L1 with 128 blocks and L2 with 16 blocks. The first super scalar contains 7 units, and it requires 1 cycle per unit. The second super scalar contains 6 units and consumes 2 cycles per unit.

1. Calculate the MIPS.
2. Calculate the maximum number of executions in parallel.
3. Calculate the size of L1, knowing that the size of L2 is 16MB.
4. Calculate the average execution time of the program, given that the cache miss rate is 40% in L1 and 20% in L2, and the processor needs 5 cycles to load an instruction into L2 and 3 cycles to load an instruction into L1.