Performance

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1 How these things effect `CPI`, `IC` and `Clock Rate`

1.1 Written program

- `CPI`: Purely the written program does not affect the `CPI` **directly** (because `CPI` is determined by the hardware used in CPU,) but because the written program *directly* defines which instructions will be executed (not exact direct 'cause the compiler actually chooses the instructions), and **the overview of these instructions will define the average `CPI`**, we can say: *because the written program defines the instructions and overall instructions will define the average CPI*, written program will affect `CPI`. So better program, results in better compiled version, and the better the chosen instructions, the lower the `CPI`.

- `IC`: Written program directly affects `IC`; compiler reads and compiles *what the program actually is*, so the better code, the better compiled version and the better compiled code will result in the lower `IC` for the program.

- `Clock Rate`: Does NOT affected by the program, 'cause it is determined directly by the technology of the CPU

1.2 Compiler

- `CPI`: As discussed the `CPI` section of written program section, 'cause the compiler chooses the instructions to be executed and the overall instructions will affect the `CPI` so the compiler affects `CPI` in this manner.

- `IC`: Compiler directly determines and affects `IC`, the better and the more clever the compiler, the lower and the better the chosen instructions.

- `Clock Rate`: Does NOT affected by the compiler, 'cause it is determined directly by the technology of the CPU

1.3 ISA

- `CPI`: Different instructions may have differenct operations which should be done by CPU (hardware), and different operations may have different steps to be done, so `ISA` (the instructions) will determine the *average* `CPI`, 'cause the instruction are executed by the CPU. Feels natural :)

- `IC`: Imagine CPU `a` implements a hardware which can *multiply* two numbers, and CPU `b` cannot, and just have a module which can do *addition*.

```
[1]: # Assume this program

first = 10
last = 20
result = first * last
```

CPU `a` can do this in one instruction and one clock cycle, but CPU `b` should do many additions to get the result.

- **Clock Rate**: Does NOT affected by the `ISA`, 'cause it is determined directly by the technology of the CPU

1.4 Hardware

- **CPI**: Hardware the part which affects `CPI` directly, the better the technology and design of the hardware, the lower the `CPI`.

- **IC**: Does NOT affect the `IC`

- **Clock Rate**: Direcly affects `Clock Rate`, 'cause clock rate must synchronize the CPU, it should be calculated in a way that all modules inside the cpu could work together.