(1) What are “static code optimizations”?

Static code optimizations are any activities* to of improving performance (e.g., execution time and program size) that are performed before a processor starts executing codes (i.e., programs).

*note: most typical code optimizations are changing the order of instructions, replacing instructions by other instructions (but not limited to them).

(2) What are the major disadvantages in “dynamic code optimizations”?

Dynamic code optimizations are known to have the following disadvantages (but not limited to them):

- Since code optimizations must be executed in run-time, complex optimization algorithms are not easy to perform (they may slow down program executions, instead of speeding them up).

- Since dynamic code optimizations are performed by processors by themselves, processors need hardware circuits for code optimizations, which usually increase the complexity in the hardware. It usually increases the price of processors.

- Since dynamic code optimizations are performed by processors by themselves, processors need hardware circuits for code optimizations, which usually increase the complexity in the hardware. It usually increases the risk of hardware bugs in processors.
(3) What is “instruction set” (also mention the three factors in “instruction set”)?

The term, “instruction set”, means all the instructions that are available to a processor (or to a processor family). Instruction sets consist of (a) the type of operations, (b) memory access modes, and (c) the types of implementations (hard-wired and micro-coded instructions).

(4) Which of “variable-size instructions” or “fixed-size instructions” have lower CPI? Why?

Variable-size instructions have a lower CPI. It is because a processor has to calculate the memory address of the next instruction, which appears at a different memory address for each instruction, while it is easier for a processor to find the memory address of the next instruction for fixed-size instructions.

(5) What are “micro-coded instructions”?

Micro-coded instructions are those instructions ALU does not execute. Instead, a processor executes each micro-coded instruction by executing special codes, called “micro codes” which are stored in ROM in a processor. ALU does so as commanded by the control unit (CU).