

CSCI 341: Computer Organization  
WS 10: CPU Performance

1	Write the equation relating performance and execution time.															
2	Define clock period and clock frequency. Compare and contrast the two.															
3	What are a couple areas in which performance can be improved?															
4	Write the equation for clock cycles.															
5	Write the equation for CPU time.															
6	Calculate the average CPI from the table below. <table><tr><td>Operation</td><td>Frequency</td><td>CPI</td></tr><tr><td>ALU</td><td>40%</td><td>1</td></tr><tr><td>Load</td><td>30%</td><td>5</td></tr><tr><td>Store</td><td>25%</td><td>3</td></tr><tr><td>Branch</td><td>5%</td><td>2</td></tr></table>	Operation	Frequency	CPI	ALU	40%	1	Load	30%	5	Store	25%	3	Branch	5%	2
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7	Explain Ambhal's law. What does it say about performance enhancement?
8	Explain the difference between response time and throughput, and give an example outlining how these two concepts are different.
9	A metric $n$ denotes that computer A is $n$ times faster than computer B. Give $n$ in terms of the execution time of computer A and B.
10	What is the execution time of program X if the <i>clock period</i> is 5 ns (nanoseconds) and the program requires 21.9 million cycles to finish execution.

**11** Computer A has a clock cycle time of 700 ps (picoseconds) and an average CPI of 4.2 for program X. Computer B has a clock rate of 0.7 GHz (gigahertz) and an average CPI of 3.1 for program X. Which computer executes program X faster and by how much faster is it than the other computer?

**12** For a particular program X, there are three types of instructions: FP, memory access, and arithmetic/logic. This program X is run on a computer with a clock cycle time of 500 ps, and there are 10 million instructions total in the program. Use the table below demonstrating each instruction's CPI and percent composition of the program to find the execution time of the program.

Instruction Type	FP	Memory Access	Arithmetic/
CPI	2.4	5	1.2
Composition of Total Program	50%	30%	20%

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Computer A runs a program with half of the total execution time of computer B. Computer A has a clock rate of 4 GHz, and an average CPI of 2.8, while computer B has a clock period of 500 ps, and a composition of instructions described in the table below. Find the missing CPI X in the table below.

Instruction Type	FP	Memory Access	Arithmetic/
CPI	3	X	0.8
Composition of Total Program	19%	39%	42%