

Homework 1 Solution

Q: Suppose that a program runs 2 seconds on machine A. It executes 1G cycles in total. What is the clock frequency of A? We are now experimenting a new version of machine A. The targeting clock frequency is 1.5 times higher than A. But the program would run for 1.5G cycles now. Is the new version faster or slower? And by how much?

$$\text{Answer: Clock frequency of A} = \frac{1}{\text{clock_cycle_time}}$$

$$\text{Clock_cycle_time} = \frac{\text{program_execution_time}}{\text{total_number_of_cycles}} = \frac{2 \text{ seconds}}{1 \times 10^9} = 2 \text{ ns}$$

$$\therefore \text{Clock frequency of A is } \frac{1}{2 \text{ ns}} = 500 \text{ MHz}$$

program execution time for new version = total cycles \times new cycle time

$$= 1.5 \times 10^9 \times \frac{1}{\text{new_clock_frequency}} = 1.5 \times 10^9 \times \frac{1}{1.5 \times 500 \times 10^6} = 2 \text{ sec}$$

Therefore, for this program, there is no difference in execution time between A and its new version, i.e., it is neither faster nor slower.