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1. Consider a processor with a clock rate of 500 MHz. What is the clock cycle time? (6 pts.)

Clock Cycle Time = 1/Clock Rate = 1/(500\*10^6 cycles/sec) = 2\*10^-9 sec/cycle = 2 nsec/cycle

2. A processor has a 2 GHz clock frequency and an average CPI of 4 on a given program. If the processor executes that program in 8 seconds, find: (6 pts. each)

(a) the number of instructions, and

4 Billion instructions

(b) the number of cycles.

16 Billion cycles

(IC \* 4CPI)/2GHz = 8 sec

IC = (8sec\*2\*10^9 cycles/sec)/(4 cycles/instruction)

= 4\*10^9 instructions = 4 Billion instructions

CPI = Cycles/instruction 🡪 4=Cycles/4 Billion instructions 🡪 Cycles = 16 Billion

3. If a processor redesign could reduce the average CPI of a workload from 3 to 2 and also reduce the clock cycle time from 2 nsec to 1.5 nsec, what is the total speedup? (12 pts.)

Overall speedup = Exec time\_old/ Exec time\_new = IC\_old\*CPI\_old\*CCT\_old/IC\_new\*CPI\_new\*CCT\_new

= 3\*2/2\*1.5=6/3= Overall speedup of 2