Computer arch #6

① (a) $MIPS = \frac{CR}{CPI \cdot 10^6}$

MIPS with coprocessor $= \frac{16.7\,MHz}{10 \cdot 10^6} = 1.67$

MIPS the software $= \frac{16.7\,MHz}{7 \cdot 10^6} = 2.39$

(b) using $IC = MIPS \cdot 10^6 \cdot CPU\,time$

IC with coprocessor $= 1.67 \cdot 10^6 \cdot 1.08 = 1.8036 \cdot 10^6$

IC the software $= 2.3857 \cdot 10^6 \cdot 13.6 = 32.4457 \cdot 10^6$

(c) FP with coprocessor $82014 + 8226 + 73220 + 21399 + 6006 + 4710 = 195575$

INT with coprocessor $X = 1.8036 \cdot 10^6 - 195575 = 1608025$

FP without coprocessor $32.4457 \cdot 10^6 - 1608025 = 30841975$

INT need to use FP operation = number of instructions

$\frac{A}{B} = 187.7$

② (a) A:

$IC = 120 \cdot 10^6$

$CPI = 3.3$

$CR = 450 \cdot 10^6 Hz$

$CPU\,time = \frac{(120 \cdot 3.3 \cdot 10^6)}{(450 \cdot 10^6)} = 0.88$

B:

$IC = 105 \cdot 10^6$

$CPI = 3.9$

$CR = 500 \cdot 10^6 Hz$

$CPU\,time = \frac{(105 \cdot 3.9 \cdot 10^6)}{(500 \cdot 10^6)} = 0.819$

computer B runs faster by 1.074

(b) A: New time:

$0.88 \cdot (0.4 + \frac{27}{55}) = 0.384$

B: New time:

$0.819 \cdot (0.5 + \frac{27}{55}) = 0.714$

computer B runs faster by 1.098

③ A

$CPI = 0.2 \cdot 2 + 0.2 \cdot 2 + 0.6 \cdot 1 = 1.2$

$CPU\,time = 1.2 \cdot IC_A \cdot CC_A$

In A CPU each branch command has a compare command, and B CPU saves 20% of command, therefore B has less commands - only 80% of the commands that there in A CPU $IC_B = 0.8 \cdot IC_A$

B CPU $\frac{20\%}{80\%} = 25\%$

B

$CPI = 0.25 \cdot 2 + 0.75 \cdot 1 = 1.25$

$CPU\,time = (0.8 \cdot IC_A) \cdot 1.25 \cdot (1.25 \cdot CCT_A) = 1.25 \cdot IC_A \cdot CC_A$

A CPU is faster