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CSM151B
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DIS 1G

HW1

1.2 a) Performance via Pipelining
b) Performance via Parallelism
c) Performance via Prediction
d) Make the Common Case Fast
e) Hierarchy of Memories
f) Dependability via Redundancy
g) Use abstraction to simplify design

1.7 P1 2.5 GHz A B C D — 1 2 3 3 P2 3GHz A B C D — 2 2 2 2

1,000,000 instructions

A: 10% B: 20% C: 50% D: 20%

	A	B	C	D
#	100,000	200,000	500,000	200,000
P1	1	2	3	3
P2	2	2	2	2

P1: $(100{,}000 \times 1) + (200{,}000 \times 2) + (500{,}000 \times 3) + (200{,}000 \times 3)$

2.6 million clock cycles, $\boxed{2.6\ CPI}$

P2: $(100{,}000 \times 2) + (200{,}000 \times 2) + (500{,}000 \times 2) + (200{,}000 \times 2)$

2.0 million clock cycles, $\boxed{2.0\ CPI}$

P1 Time : $\frac{2.6 \times 10^5}{2.5 \times 10^9} = 0.00104s$

P2 Time : $\frac{2.0 \times 10^5}{3.0 \times 10^9} = 0.00066$

P2 is faster

	Total Clock Cycles	CPI	Faster
P1	2.6 million	2.6	
P2	2.0 million	2.0	✓

1.8 A: 1,000,000,000 instructions 1.1s

B: 1,200,000,000 instructions 1.5s

a) Clock Cycle Time: 1ns

A: 1.1×10^9 cycles to finish execution 1.0×10^9 instructions

$(1.1 \times 10^9) / (1.0 \times 10^9) = 1.1$ CPI

B: 1.5×10^9 cycles to finish execution 1.2×10^9 instructions

$(1.5 \times 10^9) / (1.2 \times 10^9) = 1.25$ CPI

b) Say that A and B finish in 1 second

$\text{CPU Time} = \frac{\text{CPU clock cycles}}{\text{Clock Rate}}$

$\text{Clock Rate} = \frac{\text{CPU Clock Cycles}}{\text{CPU Time}}$

CPU Clock Cycles = Instruction Count × CPI

$\text{Clock Rate} = \frac{IC \times CPI}{\text{CPU Time}}$ (CPU Time = Execution Time)

A: $\frac{(1 \times 10^9) \times 1.1}{\text{CPU time}}$ B: $\frac{(1.2 \times 10^9) \times 1.25}{\text{CPU Time}}$

$\frac{B}{A} = \frac{(1.2 \times 10^9) \times 1.25}{\text{CPU Time}} \times \frac{\text{CPU Time}}{(1 \times 10^9) \times 1.1} = 1.37$

$\boxed{\text{The Clock Rate of A is 1.37x faster than clock rate of B}}$

c) 600000000 instructions 1.1 CPI 1ns cycle time

$(x) / 6 \times 10^8 = 1.1$

$x = 6.6 \times 10^8$ ns (0.66 s)

A: 1.1s / 0.665 = 1.67

B: 1.5s / 0.66 s = 2.27

$\boxed{\begin{array}{l}\text{The new compiler is 1.67x faster than compiler A.} \\ \text{The new compiler is 2.27x faster than compiler B.}\end{array}}$