alebtyle DCD HW1 1.5, 1.8(1,2) 1.10(1,2,3) 1.13(1,2,3) 9/13/16

1.5) P1 rate = 3GHz, CPI = 1.5, T = 1/3G

P2 rate = 2.5GHz, CPI = 1.0, T = 1/2.5G

P3 rate = 4.0GHz, CPI = 2.2, T = 1/4G

a) P1: #inst · 1.5 · 1/3GHz

3GHz/1.5 = inst

$3 \times 10^9 \frac{\text{cycle}}{s} \cdot \frac{1 \text{ inst}}{1.5 \text{ cycle}} = 2 \times 10^9 \frac{\text{inst}}{\text{sec}}$

P2: #inst · 1.0 · 1/2.5GHz

2.5GHz/1 = inst

$2.5 \times 10^9 \frac{\text{inst}}{\text{sec}}$

P3: #inst · 2.2 · 1/4GHz

4GHz/2.2 = inst

$1.8 \times 10^9 \frac{\text{inst}}{\text{sec}}$

P2 is winner

b) P1

10s = #inst · 1.5 · 1/3G

10 · 3x10^9 / 1.5 = #inst

#inst = 2×10^{10}

10s = 1.5 / 3x10^9 Hz = 3×10^{10} cycles

P2

10s = #inst · 1 · 1/2.5G

10 · 2.5G / 1 = 2.5×10^{10}

10s · 2.5x10^9 = 2.5×10^{10}

P3

10s = #inst · 2.2 · 1/4G

10 · 4G / 2.2 = 1.8×10^{10}

10s · 4G = 4×10^{10} cycles

c) P1

0.7 exectime = #inst · 1.2CPI · T

0.7s · inst / 1.2 cycles = 0.56 inst

72% increase

1.8)

a) P1: .1·1 + .2·2 + .5·3 + .2·3 = 2.6 → 2.5GHz

P2: .1·2 + .2·2 + .5·2 + .2·2 = 2 → 3.0GHz

b) P1: $1 \times 10^6 \cdot 2.6 = 2.6 \times 10^6$

P2: $1 \times 10^6 \cdot 2 = 2 \times 10^6$

1.8) Prescott: $90w = C \cdot 1.25^2 \cdot 3.6$ Ivy: $40 = C \cdot 0.9^2 \cdot 3.4$? what about the A?

1.8.1) $\frac{90}{1.25^2 \cdot 3.6} = C$ $16 = C$

$\frac{40}{0.9^2 \cdot 3.4} = C$ $14.5 = C$

Power dissipation?

1.8.2) Prescott: 1:9 Ivy: 3:4

1.10) .1) $yield_1 = \frac{1}{\left(1+\frac{0.020 \cdot 2.10}{2}\right)^2} =$ $\frac{84 - \frac{176.7 \cdot 0.020}{2.10}}{84} = \frac{81.31}{84} = 0.959$ %

wafer area = 176.7; die area = 2.10 cm²

$yield_2 = \frac{1}{\left(1+\frac{(0.031 \cdot 3.14159)}{2}\right)^2} = 0.909$

.2) $Cost\ per\ die_1 = \frac{12}{84 \cdot 0.959} = 0.149$

$Cost\ per\ die_2 = \frac{15}{100 \cdot 0.909} = 0.165$

.3) 1/ 92.4 dies 0.023 $\frac{176.7}{92.4} = 1.912$

$yield_1 = \frac{1}{\left(1+\frac{0.023 \cdot 1.912}{2}\right)^2} = 0.957$

2/ 110 dies 0.03505 $\frac{314.159}{110} = 2.856$

$yield_2 = \frac{1}{\left(1+\frac{0.03505 \cdot 2.856}{2}\right)^2} = 0.906$

.4) die area = 2.00 cm²

$0.95_1 = \frac{1}{\left(1+\frac{defects \cdot 2}{2}\right)^2}$

$0.95_1 = \frac{1}{(1+defects)^2}$

$0.92_2 = 0.0426$

$(1+defects)^2 = \frac{1}{0.95}$

$defects = \left(\frac{1}{0.95} - 1\right) = 0.080$ 0.026

Caleb Kyle — DCD HW 1 - Page 2 — 1.3(1,2,3) 1.5 — 9/13/16

1.3.1) $\frac{250}{230} = 0.944 =$ 5.9%

.2) Cannot tell! And what is INT?

.3) $\frac{250}{210} =$ 19% Nope!

1.5)

total processor(s)	speedup	ratio
2	54 s	46%	93%
4	29 s	71%	86%
8	16.5 s	83.5%	76%
16	10.25 s	89.5%	61%
32	7.125 s	92.875%	44%
64	5.5625 s	94.44%	28%
128	4.78125 s	95.22%	16%