CSE 331/503 HW1

Emre Sezer
1901042640

1.

A) wafer area $= \pi r^2$

for wafer_x : wafer area $= 3{,}14 \cdot 8^2 = 200{,}96 \text{ cm}^2$
for wafer_y : wafer area $= 3{,}14 \cdot 10^2 = 314 \text{ cm}^2$

$$\text{die area} = \frac{\text{wafer area}}{\text{die per wafer}}$$

for wafer_x : $\text{die area} = \frac{200{,}96}{64} = 3{,}14 \text{ cm}^2$

for wafer_y : $\text{die area} = \frac{314}{100} = 3{,}14 \text{ cm}^2$

B) $$\text{Yield} = \frac{1}{\left(1 + \text{Deflects per area} \cdot \frac{\text{die area}}{2}\right)^2}$$

for wafer_x : $\text{Yield} = \frac{1}{\left(1 + 0{,}02 \cdot \frac{3{,}14}{2}\right)^2} = 0{,}94$

for wafer_y : $\text{Yield} = \frac{1}{\left(1 + 0{,}03 \cdot \frac{3{,}14}{2}\right)^2} = 0{,}912$

$$\text{cost per die} = \frac{\text{cost per wafer}}{\text{dies per wafer} \cdot \text{yield}}$$

for wafer_x : $\text{cost per die} = \frac{15}{64 \cdot 0{,}94} = 0{,}2493$

for wafer_y : $\text{cost per die} = \frac{24}{100 \cdot 0{,}912} = 0{,}2631$

c)

	cost per wafer	dies per wafer	deflects per area
wafer_x	12	70,4	0,0230
wafer_y	19,2	110	0,0345

[table after changes]

for wafer_x:

wafer area $= 3{,}14 . 8^2 = 200{,}96\ cm^2$, die area $= \frac{200{,}96}{70{,}4} = 2{,}854\ cm^2$

$$\text{Yield} = \frac{1}{\left(1 + 0{,}023 . \frac{2{,}854}{2}\right)^2} = 0{,}9374$$

$$\text{cost per die} = \frac{12}{70{,}4 . 0{,}9374} = 0{,}1818$$

for wafer_y:

wafer area $= 3{,}14 . 10^2 = 314\ cm^2$, die area $= \frac{314}{110} = 2{,}854\ cm^2$

$$\text{Yield} = \frac{1}{\left(1 + 0{,}0345 . \frac{2{,}854}{2}\right)^2} = 0{,}9083$$

$$\text{cost per die} = \frac{19{,}2}{110 . 0{,}9083} = 0{,}1921$$

Conclusion:

cost per die of wafer_x before > cost per die of wafer_x after , cost per die of wafer_y before > cost per die of wafer_y after

2.

A) Clock cycles for p1 $= \left(\frac{30}{100} \cdot 2 + \frac{50}{100} \cdot 4 + \frac{20}{100} \cdot 3\right) 10^9 = 3{,}2 \cdot 10^9$ cycles

Clock cycles for p2 $= \left(\frac{30}{100} \cdot 3 + \frac{50}{100} \cdot 3 + \frac{20}{100} \cdot 3\right) 10^9 = 3 \cdot 10^9$ cycles

B) Average CPI for p1 $= \frac{3{,}2 \cdot 10^9}{10^9} = 3{,}2$ cycles

Average CPI for P2 $= \frac{3 \cdot 10^9}{10^9} = 3$ cycles

C) Execution time for p1 $= \frac{3{,}2 \cdot 10^9}{3 \cdot 10^9} = 1{,}006$ s

Execution time for p2 $= \frac{3 \cdot 10^9}{1{,}5 \cdot 10^9} = 2$ s

D) $x = \frac{1{,}006}{2} = 0{,}503$, $\frac{1}{x} = \frac{1}{0{,}503} = 1{,}988$

p1 is 1,988 times faster than p2.

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