CTA01 – Geselecteerde uitwerkingen week 1

1.5

processor	clock rate [GHz]	CPI
P1	3.0	1.5
P2	2.5	1.0
P3	4.0	2.2

$$IPS = \frac{clock\ rate}{CPI}$$

processor	clock rate [GHz]	CPI	IPS
P1	3.0	1.5	2.00×10^9
P2	2.5	1.0	2.50×10^9
P3	4.0	2.2	1.82×10^9

P2 has the highest performance expressed in IPS.

$$cycles(10\,\mathrm{s}) = clock\ rate \times 10$$

$$number\ of\ instructions(10\,\mathrm{s}) = \frac{cycles(10\,\mathrm{s})}{CPI} = IPS \times 10$$

processor	clock rate [GHz]	CPI	IPS	cycles	number of instructions
P1	3.0	1.5	2.00×10^9	30×10^9	20.0×10^9
P2	2.5	1.0	2.50×10^9	25×10^9	25.0×10^9
P3	4.0	2.2	1.82×10^9	40×10^9	18.2×10^9

$$execution\ time = \frac{number\ of\ instructions \times CPI}{clock\ rate}$$

$$old\ clock\ rate = \frac{number\ of\ instructions \times old\ CPI}{old\ execution\ time}$$

$$new\ clock\ rate = \frac{number\ of\ instructions \times old\ CPI \times 1.2}{old\ execution\ time \times 0.7}$$

$$new\ clock\ rate = old\ clock\ rate \times \frac{1.2}{0.7}$$

processor	old clock rate [GHz]	new clock rate [GHz]
P1	3.0	5.14
P2	2.5	4.29
P3	4.0	6.86

1.10

wafer diameter [cm]	cost	dies/wafer	defects/cm^2
15	12	84	0.020
20	15	100	0.031

1.10.1

$$Yield = \frac{1}{(1 + (Defects\ per\ area \times Die\ area/2))^2}$$

$$Die\ area = \frac{Wafer\ area}{dies/wafer}$$

$$Wafer\ area = \frac{1}{4} \times \pi \times (wafer\ diameter)^2$$

$$Die\ area = \frac{\frac{1}{4} \times \pi \times (wafer\ diameter)^2}{dies/wafer}$$

$$Yield = \frac{1}{\left(1 + \left(Defects\ per\ area \times \left(\frac{\frac{1}{4} \times \pi \times (wafer\ diameter)^2}{dies/wafer}\right)/2\right)\right)^2}$$

$$Yield_{15\,\mathrm{cm}} = \frac{1}{\left(1 + \left(0.020 \times \left(\frac{\frac{1}{4} \times \pi \times 15^2}{84}\right)/2\right)\right)^2} = 0.9592$$

$$Yield_{20\,\mathrm{cm}} = \frac{1}{\left(1+\left(0.031\times\left(\frac{\frac{1}{4}\times\pi\times 20^2}{100}\right)/2\right)\right)^2} = 0.9093$$

1.10.2

$$cost\ per\ die = \frac{cost\ per\ wafer}{dies/wafer \times yield}$$

1.10.3 The number of dies per wafer is increased by 10% (×1.1). The defects per area increases by 15% (×1.15).

$$Yield_{15\,\mathrm{cm}} = \frac{1}{\left(1+\left(0.020\times 1.15\times\left(\frac{\frac{1}{4}\times\pi\times 15^2}{84\times 1.1}\right)/2\right)\right)^2} = 0.9574$$

$$Yield_{20\,\mathrm{cm}} = \frac{1}{\left(1+\left(0.031\times 1.15\times\left(\frac{\frac{1}{4}\times\pi\times 20^2}{100\times 1.1}\right)/2\right)\right)^2} = 0.9055$$