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CSE 331

Computer Organization

Homework - 1

1- Assume that, today, a wafer containing 120 processor dies costs 10000\$. The yield decreases by 10% each year while the wafer cost also decreases by %20 at each year. Then, what will be the cost of a single chip manufacturing after 4 years? Assume today there is a yield of 80%.

$$\text{yield} = \frac{\text{No of good chips per wafer}}{\text{Total number of chips}} \times 100\%$$

after four years yield will be

$$80(1-0{,}1)^4 = 52{,}48\%$$

after four years a wafer containing 120 processor dies cost will be

$$10000(1-0{,}2)^4 = 4096\$$$

then,

$$52{,}48\% = \frac{\text{No of good chips per wafer}}{120} \times 100\%$$

$$\text{No of good chips per wafer} = \frac{52{,}48 \cdot 120}{100} = 62{,}97$$

62,97 chips costs 4096\$

then 1 chip,

$$\text{price} = \frac{4096}{62{,}97} = 65{,}04\$$$

2- A compiler designer wants to compare the performance of two different compilers he designed. The compilers generating MIPS code from a C program. He compiles the same C program using two compilers.

a- According to tables below, find which compiler is better and how many times better than the other?

	R-Type ($\times 10^6$)	I-Type ($\times 10^6$)	J-Type ($\times 10^6$)
Compiler A	50	10	2
Compiler B	80	5	1
Required Cycles	2	4	3

$$\text{CPU Clock Cycles}_A = (50.2 + 10.4 + 2.3).10^6 = 146.10^6$$

$$\text{CPU Clock Cycles}_B = (80.2 + 5.4 + 1.3).10^6 = 183.10^6$$

$$\frac{183.10^6}{146.10^6} = 1{,}25$$

Compiler A 1,25 times better than Compiler B

b- What must be the clock speed of the processors so that the program compiled with better compiler executes in 100ms?

$$\text{Execution Time} = \frac{\text{Instruction Count}}{\text{Clock Rate}} = \frac{146.10^6}{\text{Clock Rate}} = 0.1$$

$$\text{Clock Rate} = 146.10^7\ \text{Hz} = 1460\ \text{MHz}$$