CSE 331

Computer Organizations

Homework 1

Due Date 30/10/2020 Friday 17:00

1. Assume that, today, a wafer containing 120 processor dies costs 10000$. The yield decreases by 10% at 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? Show your computations. Edit: Assume, today, there is a yield of 80%.

   To calculate yield of wafer,

   Result of first year:

   Cost = 10000$ * 0.8 = 8000$

   Yield = 80 * 0.9 (it decreases %10 each year so %90 of dies works) = 72%

   Result of fourt year:

   Cost = 10000$ * $(0.8)^4$ = 4096$

   Yield = 80 * $(0.9)^4$ = 52.488%

   Amount of dead processor = Total processor * yield

   = 120 * 52.488% = 62.986

   Cost of a single chip = Cost / Amount of dead processor

   = 4096$/62.986 = 65.031$

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

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

	R-type ($x10^6$)	I-Type ($x10^6$)	J-Type ($x10^6$)
Compiler A	50	10	2
Compiler B	80	5	1

	R-type	I-Type	J-Type
Required Cycles	2	4	3

To calculate total cycle, we need to multiply each instruction by their cycle times.

For compiler A :

$2*50 + 4*10 + 3*2 = 146 * 10^6$

For compiler B:

$2*80 + 4*5 + 3*1 = 183 * 10^6$

183/146 = 1.253. So, compiler A is better than compiler B 1.253 times.

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

Compiler A executes $146 * 10^6$ cycles.

0.1s(100 ms) = Cycle / Clock Rate

Clock Rate = Cycle / 0.1

Clock Rate = $(146 * 10^6) / 0.1$

Clock Rate = $146 * 10^7$

1 GHz executes 10^9 cycle

Clock Rate = $146 * 10^7 / 10^9$ = 1.46 GHz