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%.

After 4 years cost will be:

$10.000 * (1 - 0.2)^4 = 10.000 *(0.8)^4 = 4096$ for 120 processors included dead and marketable.

After 4 years yield will be:

$80 * (1 - 0.1)^4 = 80 * (0.6561) = \%52.488$ as new yield.

Marketable processor amount:

$120*(52.488 / 100) = 62.9856$ processors.

Cost of per processor:

$4096 / 62.9856 = 65.03$$

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

Compiler A:

CPU clock cycle = $59x2x10^6 + 10x4x10^6 + 2x3x10^6$

= $146x10^6$ cycles.

Compiler B:

CPU clock cycle = $80x2x10^6 + 5x4x10^6 + 1x3x10^6$

$= 183x10^6$ cycles.

For determinate the better compiler we need to examine CPU time in detail.

CPU Time = Clock cycle * Clock rate

Clock rate is same for both compiler because they use same hardware component, even same computer also. Therefore, the compiler which has fewer clock cycle will has much more performance and low CPU time also.

(Clock Time) Compiler B / Compiler A = **1.25**

So, **Compiler A is 1.25 times better than Compiler B.**

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

   Clock time = CPU clock cycle * (1/**clock speed (as GHz)**)

   $100*10^{-3} = 146x10^6$ * (1/clock speed)

   $10^{-7}/146$ = (1/clock speed)

   Clock Speed = $(10^{-7} * 10^9) / 146$ = **0.6849 nanosecond.**

   = **(1/0.6849) = 1.46 GHz**

Submit your answers to Moodle before the due date.