LAWRENCE NAIDU
CPE 185
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Homework #1

1) Machine 1 performs 10 times better than machine 2, in terms of execution, but time (cycle time) of machine 1 ~~b~~ is only 3 times faster than machine 2 ~~could~~ because of few different reasons. For example the CPI and also how fast a computer works (Processor). Not only that but we have to keep in mind of the ~~backgroung~~ background activities happening with the CPU.

CPU time/performance is determined by $\Rightarrow \left(\frac{\text{CPI} \times \text{\# of instructions}}{\text{clock rate}} \right)$

2) $\frac{\text{number of instructions}}{\text{sec}} = \frac{10^9}{T}$

Computer #1 $T = 4$ nsec $= \frac{10^9}{4} \Rightarrow$ 250 million instruction

Computer #2 $T = 2$ nsec $= \frac{10^9}{2} \Rightarrow$ 500 million instruction

~~th~~ With just these information, Computer 2 is faster because it can execute more instructions than computer 1.
However, these aren't the only contribution towards the speed. CPI, Instruction time, and clock rates are needed.

3) iPod, Television, Printers, watch

A CPU is generally made up of: Control Unit, ALU, Registers.

watch, iPod } they have CPU, which functions as user interface controller

Printers → they fetch information, stores in temp memory and the executes the printing.

4) loading ALU = 1 nsec

running ALU = 4 nsec

storing result = 1 nsec

total data path for 1 cycle = 1 + 4 + 1 => 6 nsec

MIPS = $\frac{10^9}{T_{total}}$ => $\frac{10^9 \text{ nsec}}{6 \text{ nsec}}$ => 166.667 MIPS

166.7 MIPS is the maximum without pipelinging

5) 106 elements (pixels) 3 primary color = 64 intensities $\rightarrow 2^6 = 64$

$t_{resolution}$ = 100 msec

each color $\rightarrow 3(6) = 18$

$\frac{(106 \times 18)}{100 \text{ msec}}$ = 19.06 b/s

6) nucleotide = 3×10^9 30,000 genes.

4 possible values = 2 bits/value => total value = 8 bits

Total value = $\frac{3 \times 10^9}{4}$ = 75×10^7 bytes

Average gene => $\frac{\cancel{3} \times 10^9}{\cancel{3} \times 10^4}$ => $\frac{3 \times 10^5}{\cancel{3}}$ = 10^5

Assuming Average gene/byte

Max = $\frac{75 \times 10^7 \text{ byte}}{10^5 \text{ byte}}$ = 75×10^2 bytes.

7) 1024 Sectors/track
rotation 7200 RPM

As Moore's Law states, the transfer rate will vary and increase as hardware advances.
transfer rate depends on disk density, use of cache, and mechanical performance.

8) bus = 5-nsec   Ultra4 bus = 160 Mb/s
r/w = 32-bit mem   CPU → 32bit / 1 nsec

$\left(\frac{1}{0.16}\right) \times 10^{-9} = 6.25$ nsec. $\frac{1}{32} \cdot 8 \cdot 160 \cdot 10^{6} = 4 \times 10^{7}$ s

Percentage slowed $= \frac{6.25 - 5}{5} \cdot 100 = 25\%$

9) Camera $= 24 \times 10^{6}$ pixel   each 6 bytes/pixel
1GB = 230 bytes.   8-GB flash
8GB $\cdot \frac{230 \text{ byte}}{\text{GB}} = 1840$ bytes.   compression factor = 5x

24×10^{6} px $\times$ 6 b/pix $= 144 \times 10^{6}$ bytes.
$144/5 = 28.8 \times 10^{6}$ b

$\frac{1840}{28.8} = 63.8$