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

   $CPU_{time} = \frac{CPI * \# \text{ of instructions}}{\text{clock rate}}$

2. $\frac{\# \text{ of instructions}}{sec} = \frac{10^9}{T}$

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

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

   With just this 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, Watch, Printers
   A CPU is generally made up of: Control Unit, ALU, and Registers,
   Watch and iPod – they have CPU, which functions as user interface controller
   Printers – they fetch information, stores in temp memory and then executes the job submitted

4. Loading ALU = 1 *nsec*
   Running ALU = 4 *nsec*
   Storing result = 1 *nsec*
   Total data path for 1 cycle = loading ALU + running ALU + storing ALU
   = (1 + 4 + 1) *nsec* = 6 *nsec*

   $MIPS = \frac{10^9}{T_{total}} = \frac{10^9}{6} = 166.67$ MIPS

   166.67 MIPS is the maximum without pipelining

5. 106 elements (pixels)
   3 primary color = 2^6 intensities = 64 intensities
   $T_{resolution}$ = 100 *msec*
   $total_{bytes} = total_{color}$*6 bytes = 18 bytes
   $\frac{106*18}{100\ msec} = 19.06\ {}^{bytes}/_{sec}$

6. nucleotide = $3.0 * 10^9$ 4 possible values = 2 ${}^{bits}/_{value}$ = total value = 8 bits

   Total value = $\frac{3.0*10^9}{4} = 75 * 10^7$ bytes

   Average gene = $\frac{3.0*10^9}{3.0*10^4} = 10^5$

   Assuming Average $\frac{gene}{byte}$ → max = $\frac{75*10^7}{10^5} = 75 * 10^2$ bytes

7. $1024 \frac{sectors}{truck}$ 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 = $160 \frac{Mb}{s}$

r/w = 32 bit memory $\rightarrow \frac{1}{0.16} * 10^{-9} = 6.25$ *nsec*

CPU = $32 \frac{b}{nsec} \rightarrow \frac{1}{32} * 8 * 160 * 10^6 = 4.0 * 10^7$s

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

9. Camera = $24 * 10^6$ pixel each pixel = 6 bytes

1 GB = 230 bytes 8 GB flash drive compression factor = 5x

8 GB * $\frac{230\ bytes}{GB}$ = 1840 bytes

$24 * 10^6$ pixel * 6 $\frac{bytes}{pixel} = 144 * 10^6$ bytes $\rightarrow \frac{144 * 10^6}{5} = 28.8*10^6$ bytes

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