Computers in Medical Imaging

- 1 bit is smallest form of data, 8 bits is a byte, 1000 bits is a Kilobyte, etc.
- Micro=10^{-6}, Macro=10^{6}, Giga=10^{9}, Tera=10^{12} (former board question).
- Digital representation of data is binary (0's and 1's, the computer assigns different voltages to each value, i.e. 0V represents 0, 0.5V represents 1).
- Two types of data: Analog & digital. Analog data can be CONVERTED to digital information (analog is transmitted quicker, but digital is more resistant to errors).
- Data can be transferred in serial (multiple pulses over a SINGLE wire), or in parallel (all pulses over SEVERAL wires).
- A "Bus" is a bundle of wires used in parallel data transfers.

- Computer parts
  - RAM (random access memory): the more you have, the more programs/images can be open at once. Example: if your computer station has a large amount of RAM, it will be able to run fast with multiple images open (all requiring a certain amount of memory to open). If it's an old computer, you'll notice it's slow at opening multiple programs/images. RAM gets reset when you restart your computer (and also loses all information that is not saved, it's only temporary).
  - CPU (microprocessor): This is the "Pentium" part of your computer. This executes programs. A program gives instructions to the CPU for execution.
  - Storage devices: RAM (temporary), hard disks, optical disks (CD-ROM, DVD-ROM), magnetic tape. ROM=read only memory (cannot overwrite).
  - Modems convert digital signals into frequency coded signals for transmission over phone lines.
  - Operating System: manages all the programs on the computer (i.e. Windows, Mac OS)

- Digital Images
  - A pixel (picture element) is an addressable location on the screen by gray scale level, Hounsfeld unit, digital value, etc.
  - Images are stored in a 2D array (columns and rows), to give each pixel an address.
  - Higher bits/pixel means better resolution.
- Image display
  - Gray scale for more contrast
  - 12bit CT image: only 256 of 4096 levels displayed at any one time
  - Altering window(contrast)/level(brightness) uses look-up table
  - Narrower windows produce more saturation in toe/shoulder regions of LUT curve