Meeting #21:

After doing CW7 you should answer these questions in the logbook:

**What is the connection between Assembly Code; Programming Language, and Compiler?**

**What is a binary representation? How many bits would be needed to represent a decimal number such as 2003?**

**How to do A/D and D/A conversions?**

**What is the decimal number that corresponds to a binary representation of 0101 1010 1101 0010?**

**How to write 0.5 in binary using 8 bits with a "dot" and without A "dot"?**

Similar to a decimal representation that uses powers of 10 and coefficients between 0 and 9:

$188 = \underline{0} \times 10^7 + \underline{0} \times 10^6 + \underline{0} \times 10^5 + \underline{0} \times 10^4 + \underline{0} \times 10^3 + \underline{1} \times 10^2 + \underline{8} \times 10^1 + \underline{8} \times 10^0$

A binary representation uses powers of 2 and coefficients 0 or 1:

$188 = \underline{1} \times 2^7 + \underline{0} \times 2^6 + \underline{1} \times 2^5 + \underline{1} \times 2^4 + \underline{1} \times 2^3 + \underline{1} \times 2^2 + \underline{0} \times 2^1 + \underline{0} \times 2^0$

$= \underline{1} \quad \underline{0} \quad \underline{1} \quad \underline{1} \quad \underline{1} \quad \underline{1} \quad \underline{0} \quad \underline{0}$

The advantage is that electrically a computer works more efficiently with 0 and 1, the disadvantage is with eight bits of information (8 digits as shown above), the highest integer we can represent in binary is only 27+26+25+24+23+22+21+20=255, while with the same number of decimal digits that number is much higher: 99 999 999.

To represent 0.5 with eight bits we convene, for example, that the highest number (1111 1111 or 255) corresponds to 1 and the lowest number (0000 0000) to 0, obviously. Then Half of the highest number (127.5) rounded to the next integer will represent 0.5

An alternative method for representing fractional numbers is to use a "binary dot" similar to the decimal dot:

$13.125 = \underline{0} \times 10^3 + \underline{0} \times 10^2 + \underline{1} \times 10^1 + \underline{3} \times 10^0 \quad \bullet \quad \underline{1} \times 10^{-1} + \underline{2} \times 10^{-2} + \underline{5} \times 10^{-3} + \underline{0} \times 10^{-4}$

A binary representation would use negative powers of 2 after the dot:

$13.127 = \underline{1} \times 2^3 + \underline{1} \times 2^2 + \underline{0} \times 2^1 + \underline{1} \times 2^0 \quad \bullet \quad \underline{0} \times 2^{-1} + \underline{0} \times 2^{-2} + \underline{1} \times 2^{-3} + \underline{0} \times 2^{-4}$

$= \underline{1} \quad \underline{1} \quad \underline{0} \quad \underline{1} \quad \bullet \quad \underline{0} \quad \underline{0} \quad \underline{1} \quad \underline{0}$

Estimation (HW3.4):

**How to estimate total mass of air passing through your lungs per day?**

The data is the air density, from research, you will find the normal condition air density is 1kg/m3 =1g/L. This indicates that Density=Mass/Volume, so Mass = Density x Volume. So all we need is an estimate of the total volume of air through our lungs a day.

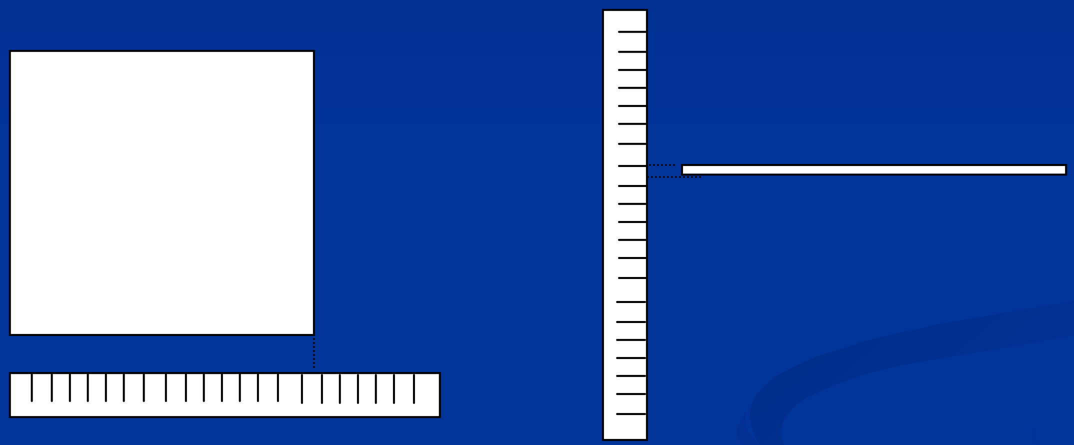
We you have an inspiration, you increase your torax volume, decrease the interior pressure to let air in. And you can measure yourself how many times this is done a minute, assume I get an average of 10 times/minute. Now you can also, by visual inspection, on an average torax volume, estimate it to be __x___x___=_____$m^3$. So the total volume of air through your lungs can be estimated to be:

_____ x 10 x 60 x 24 = ______ $m^3$

Then the total mass of air through your lungs a day is 1kg/m3 x _____ m3 =_____ kg

## **What is a dimensioned sketch with tolerance table?** (HW3.3):

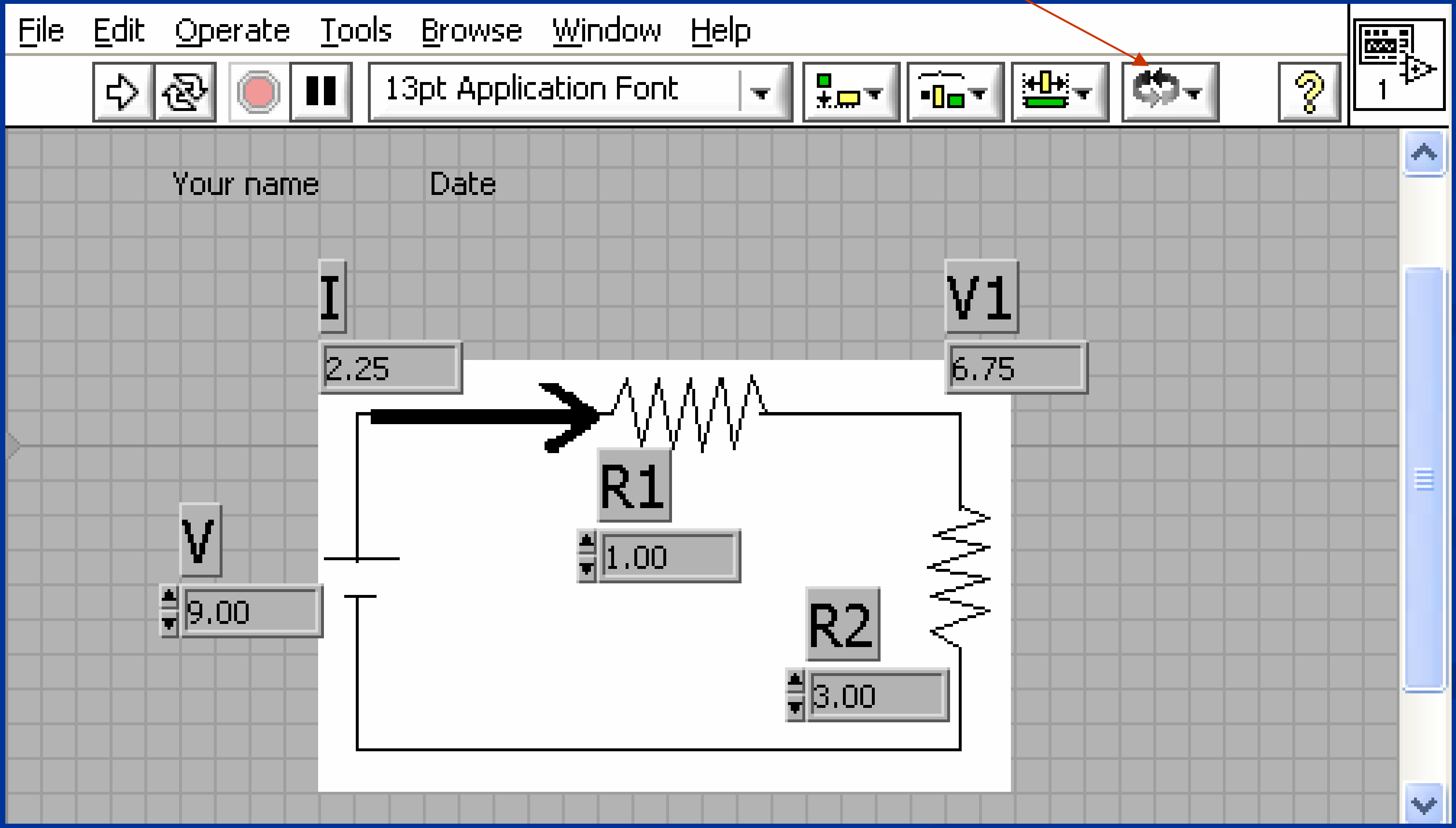
Suppose to use a same ruler with mm divisions to measure the different dimensions of a floppy disk, for example:



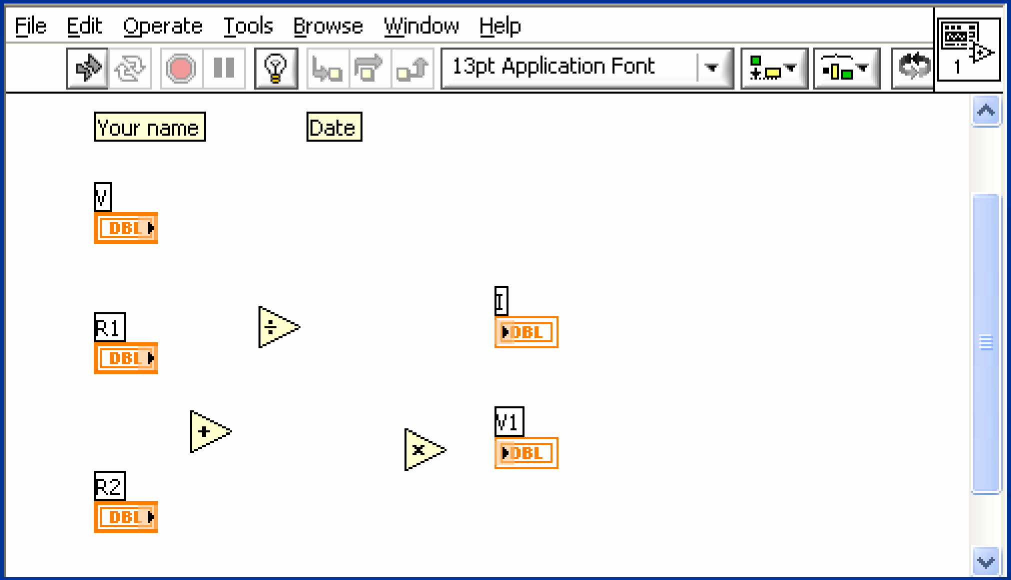
The tolerance for the side dimension X.X is 0.1cm; while for the thickness, it is easier for the eyes to appreciate a half division, i.e. the tolerance for the thickness X.XX is 0.05cm.

LabVIEW Circuit #2 (related to HW3.8)

Step 1: **What should I put into the Front Panel?**
Make a sketch of the circuit shown using Paint, then copy into LabVIEW Front Panel
Put in 3 numeric controls for V and R1 and R2 (type in label after each insert);
2 numeric indicators, one for I, one for V1
To show icons on top of circuit, select circuit, then "reorder"/"move to back"

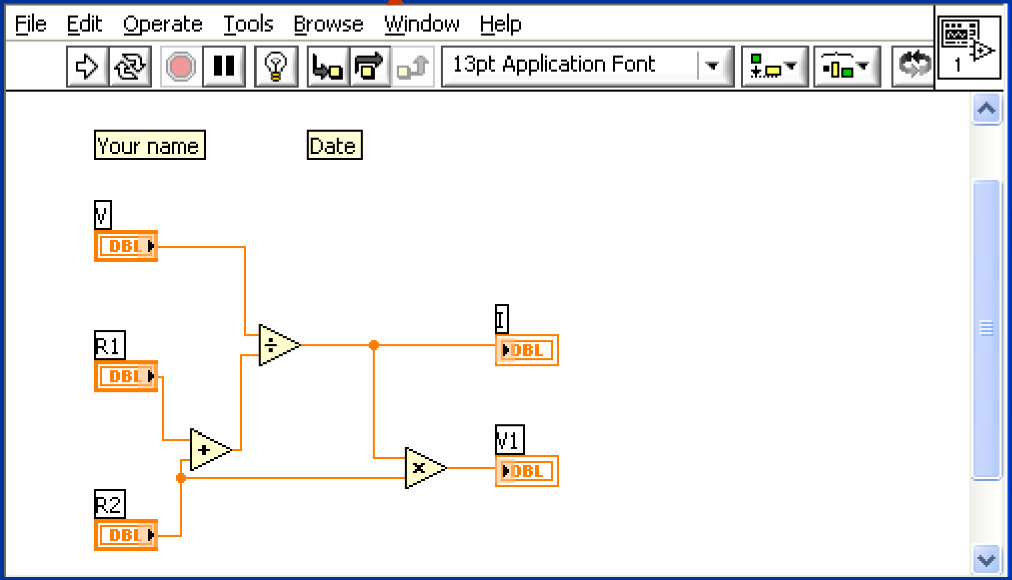


Step 2: **What should I put into the Block Diagram? How should I arrange the icons?** In the Block Diagram arrange the inputs in the left, output in the right, and put in the Needed operations:



Step 3: **How should I connect the icons in the Block Diagram?**

To complete the VI, use the Wiring Tool (in Tools Pallette: Window/Show Tools Palette) to connect the icons



Step 4: **Why and How should I test the program?**

Check the VI's results against numbers you can obtain from the formulas and using "easy numbers" such as V=9V; R1=1 Ohm; R2=3 Ohm, then I=V/(R1+R2)=2.25A and V1=I*R2=6.75V. This may be trivial here, but it is very important to do this check when we work with a larger circuit!