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CPSC 300

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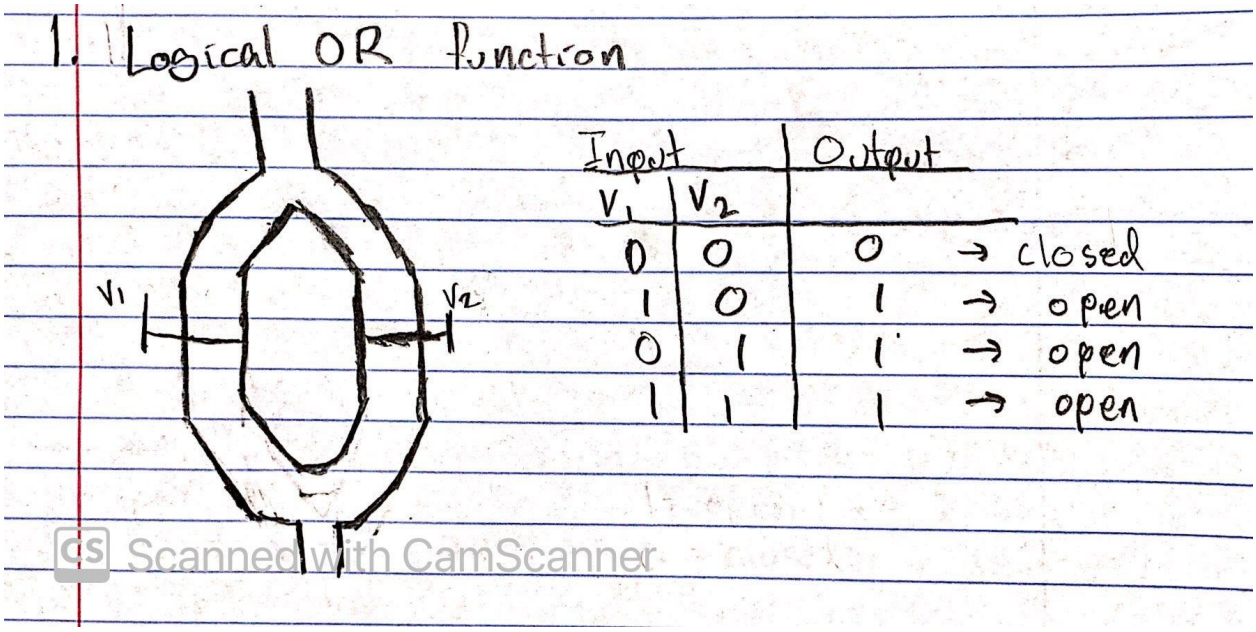
Homework Two

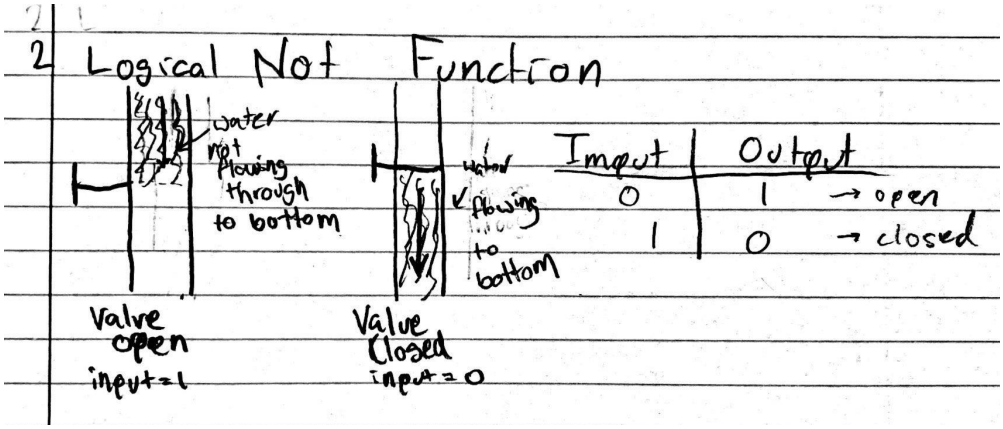
1. You watched a video which compared a transistor to a valve. The instructor showed how to construct a logical AND function using such valves. Show how to construct a logical OR function using the valves. Draw your scheme. [10]

Here is my scheme of the logical OR function. Essentially the "water" will be able to flow to the bottom as long as one of the "valves" is open. If both are closed, then the "water" will not flow through to the bottom. I included an input/output truth table to help explain the idea.



2. Draw a valve-based scheme for logical NOT function. [10]

The logical NOT function essentially inverts the signal it is getting. If the input is a 1, then the output is 0. If the input is 0, the output is 1. So if the valve is open (1) then no "water" will flow through the pipe (0). This idea really does not work for pipes, valves, and water method of explanation, but here is my attempt at it. Basically, whatever the input is, the output will be the opposite. This is also shown in my input/output truth table.



3. Clock frequency of processor A is 2.2 ghz and processor B is 1.85 ghz. What is the minimum time required for executing an instruction in each of the processor? [5]

CPU time is calculated as: $number\ of\ instructions\ \times\ Avg.\ CPI\ \times\ clock\ period$

If we are looking for the minimum time of execution of *an instruction* (meaning one singular instruction) then we must assume that the Avg. CPI is the lowest possible (I assume this is 1 clock cycle per instruction). So if both of these things are one, then we are just looking at the clock period for our performance. ($1\ \times\ 1\ \times\ clock\ period$) Clock period is equal to 1/clock frequency. Now our equation looks like this: $1\ \times\ 1\ \times \frac{1}{clock\ frequency}$

Then processor A's minimum execution time of one instruction is $1/2.2GHz\ \approx .45\ ns$ and processor B's minimum execution time of one instruction execution time is $1/1.85GHz\ \approx .54\ ns$.

4. What is meant by clock cycle or clock cycle time?[5]

Clock cycle time (or clock period) is the amount of seconds it takes to complete one clock cycle, which is a single pulse of a CPU. Essentially, clock cycle time is the amount of time between two of these pulses. Clock cycle time is also the reciprocal of clock frequency. $\frac{1}{clock\ frequency}$ will give us our clock cycle time, which tells us how many seconds it takes to complete a one clock cycle.