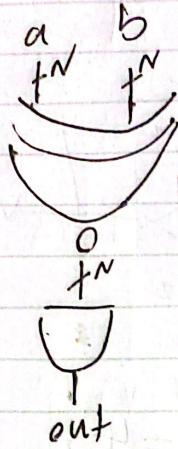


HW 5

comp-eq



0
1
10
11
100
101

comp- \neq

$$-4 \rightarrow$$

$$\begin{array}{r} 0 \\ 1 \\ - \\ 11 \end{array}$$

$$5 - 4$$

$$\begin{array}{r} 0 \\ 100 \\ - \\ 0011 \\ \hline \end{array}$$

↓

$$0100 + 0011$$

$$\begin{array}{r} 100 \\ 101 \\ 0100 \\ \hline 0011 \end{array}$$

$$B < A$$

$$5 - 6$$

$$\begin{array}{r} 0100 \\ 0101 \\ - \\ 0101 \\ \hline 0100 \end{array}$$

$$B > A$$

$$-6 \neq -4$$

$$\begin{array}{r} 1101 \\ 1101 \\ - \\ 0011 \\ \hline 1101 \end{array}$$

$$\begin{array}{r} 1101 \\ 1101 \\ 0011 \\ \hline 0110 \end{array}$$

$$B > A$$

$$\begin{array}{r} 1011 \\ 1011 \\ - \\ 0011 \\ \hline 1011 \end{array}$$

$$1011 < 0011$$

$$1011 < 0110$$

$$1011 < 1011$$

$$1011 < 1101$$

$$1011 < 0101$$

$$1011 < 0101$$

$$1011 < 1101$$

$$5 - (-4)$$

$$\begin{array}{r} 0100 \\ 0101 \\ - \\ 1101 \\ \hline 0011 \end{array}$$

$$\begin{array}{r} 0100 \\ 1101 \\ - \\ 0011 \\ \hline 0011 \end{array}$$

$$B < A$$

$$-6 \neq -4$$

$$\begin{array}{r} 1011 \\ 1011 \\ - \\ 0011 \\ \hline 1011 \end{array}$$

$$1011 < 0011$$

$$1011 < 1101$$

$$1011 < 0101$$

$$1011 < 0101$$

$$1011 < 1101$$

$$0100$$

$$0011$$

$$\hline 0011$$

$$B < A$$

$$5 - (-6)$$

$$\begin{array}{r} 0100 \\ 0101 \\ - \\ 0101 \\ \hline 0100 \end{array}$$

$$0100$$

$$0101$$

$$\hline 0100$$

$$B < A$$

$$-4 \rightarrow 5$$

$$\begin{array}{r} 0101 \\ 0100 \\ - \\ 0100 \\ \hline 0100 \end{array}$$

$$0100$$

$$0100$$

$$\hline 0100$$

$$4 = 0100$$

$$5 = 0101$$

$$-4 = 1100$$

$$-5 = \cancel{1101}$$

$$\text{neg}, 5 - 4$$

$$\begin{array}{r} 00001 \\ \uparrow \\ \cancel{0101} \\ \hline 10001 \end{array}$$

$$A > B$$

$$00001$$

$$-5 - 4$$

$$1011$$

$$1100$$

$$\hline 10111$$

$$A < B$$

$$4 - 5$$

$$\begin{array}{r} 0100 \\ + 0101 \\ \hline 1011 \end{array}$$

$$\cancel{0100}$$

$$\cancel{1011}$$

$$0\cancel{111}$$

$$A < B$$

$$0100$$

$$0101$$

$$\hline 01001$$

$$A > B$$

$$-5 - (-4)$$

$$\begin{array}{r} 0101 \\ \cancel{0100} \\ \hline 1011 \end{array}$$

$$\cancel{0100}$$

$$\cancel{1011}$$

$$0\cancel{100}$$

$$A > B$$

$$0111$$

$$A < B$$

$$-4 - (-5)$$

$$\begin{array}{r} 1100 \\ + 0100 \\ \hline 10000 \end{array}$$

$$\cancel{10000}$$

$$0\cancel{100}$$

$$A > B$$

$$5 - (-4)$$

$$\begin{array}{r} 0101 \\ + 0100 \\ \hline 01001 \end{array}$$

$$\cancel{01001}$$

$$1\cancel{0111}$$

$$A > B$$

$$(-4) - 5$$

$$\begin{array}{r} 1100 \\ + 0101 \\ \hline 10111 \end{array}$$

$$\cancel{10111}$$

$$1\cancel{0111}$$

$$A < B$$

$$A > B$$

$$A < B$$

$$00++$$

$$01++$$

$$10--$$

$$01--$$

$$01+-$$

$$10-+$$

$$01-+$$

$$10-+$$

V_s	N_s	\bar{N}_A	\bar{N}_B	Y
0	0	X	X	0
0	1	0	0	1
0	1	1	1	1
1	0	0	1	0
1	0	1	0	1

\sum

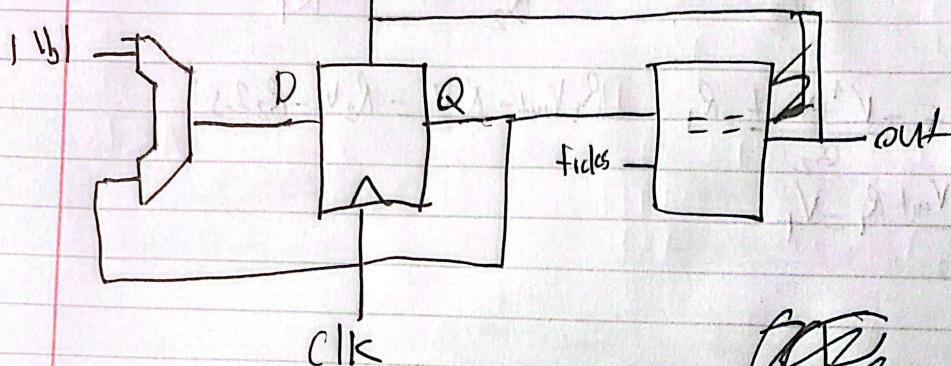
$$\bar{V}_s \cdot N_s \cdot \bar{N}_A \cdot \bar{N}_B + \bar{V}_s \cdot N_s \cdot \bar{N}_A \cdot N_B + V_s \cdot \bar{N}_s \cdot N_A \cdot \bar{N}_B$$

$$\begin{array}{r} 10++ \\ \hline 01++ \end{array}$$

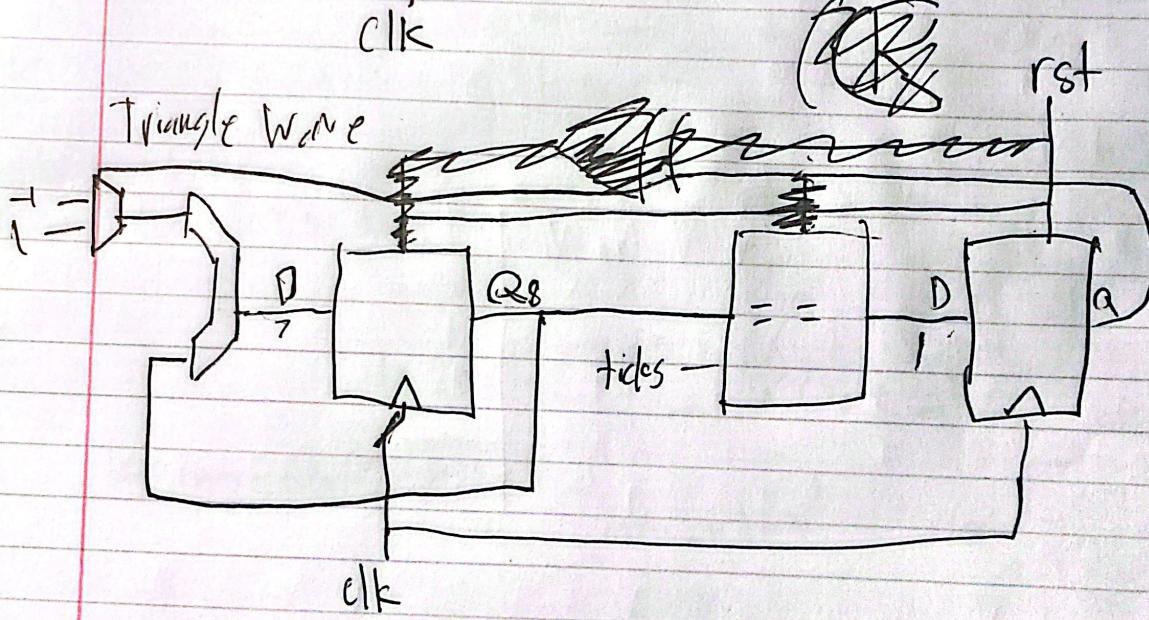
$$20 + 0.$$

$$\bar{V}_s$$

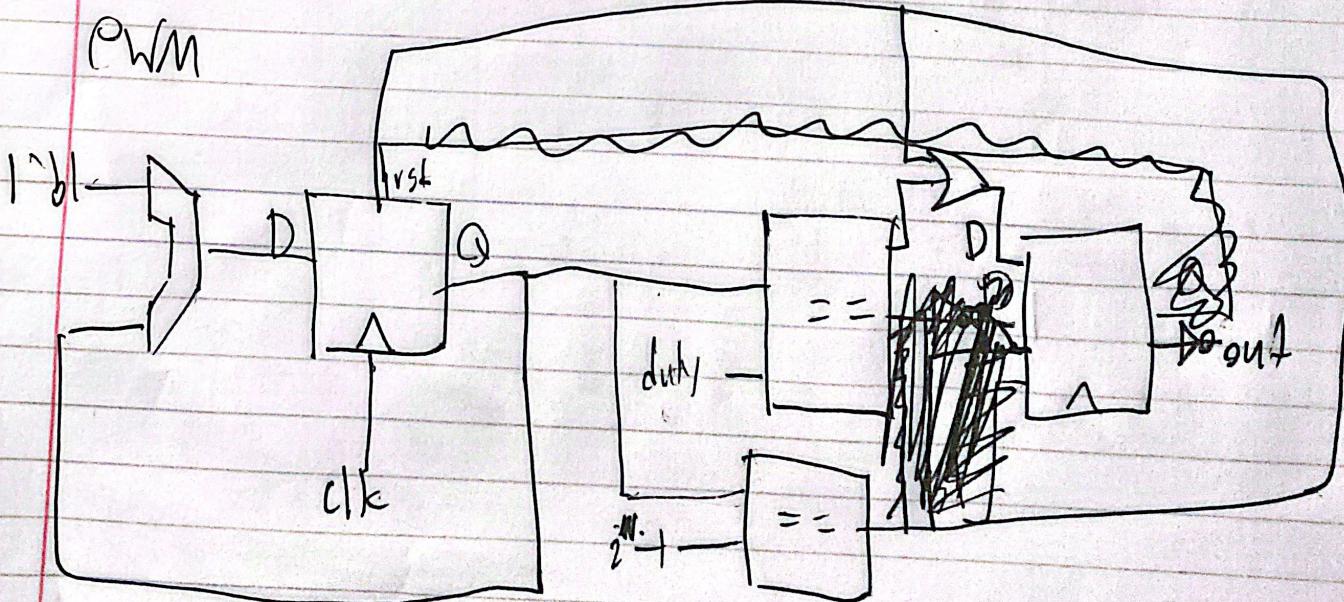
Pulse generator



Triangle Wave



PWM



- a) Describe at least one situation in which you had to use or measure more bits than were useful to a problem.

While playing piano, there can appear phrases that describe the expression of a piece (sad, happy, etc.) I'd argue that those expressions don't need to be there (extra information) because the piece should already be played in a specific style in the first place.

- b) Have you ever had a situation where you didn't use enough bits?

All the time while playing chess. Technically, there isn't an upperbound on the number of bits I should use to play perfect chess, but then and again I miss a checkmate or a free pawn because I'm not using all of the information that is right in front of me on the board.

- c) How many bits did you use to answer the previous question?

I thought of the fact that I play chess (1 chunk), the fact that I miss checkmates (1 chunk) and free pawns (1 chunk), that there's no upperbound on perfect chess (1 chunk), and the fact that I don't use all the information on the board (1 chunk). 5 chunks so 3 bits.

- d) In your own words, what is the difference between a bit and a chunk?

I think of a chunk as an item that is distinguishable by humans but may vary in bits. For example, a number and a word have different amounts of information but are equally memorable by humans.

- e) How are the generalizations from this paper still applicable half a century later? Alternatively, what do you feel no longer applies?

The fact that humans have a limit to the amount of information we can juggle at one time is even more applicable today where there is so much information available to us. Not only do we not have the bandwidth to deal with this information in the moment, but compared to the amount of information we need to remember, we are severely limited by the "magic number 7".

- f) (optional) This is a paper I feel everyone should read!, do you have an equivalent must-read scientific article?