CMSC 313 Quiz 1
Name (please print clearly):

2 problems (front and back of this sheet).
No reference to books/notes.
No electronics allowed.

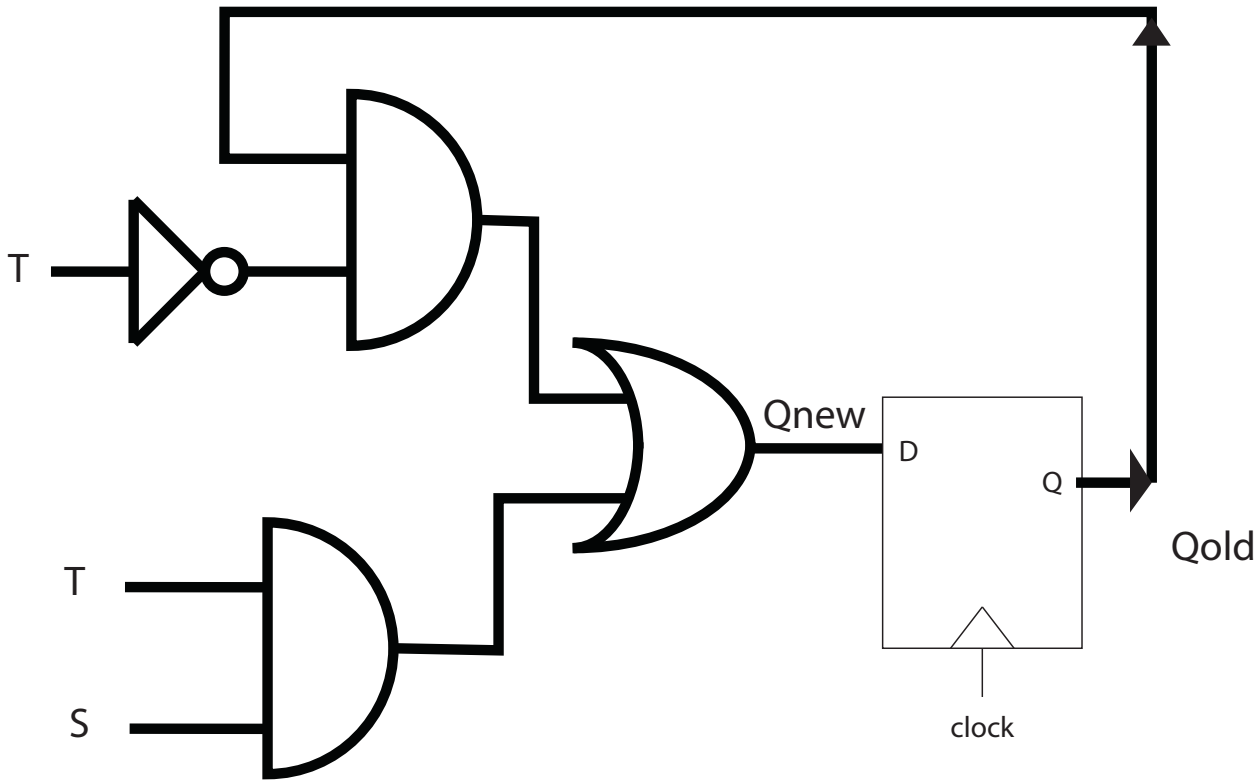
1.
We are given a value in the range of -3 to 3 in 2's complement form as 3-bit input C ($C_2C_1C_0$). For a decimal value of +2, the input is 010 (C_2=0, C_1=1, C_0=0); no need to do 2's complement for a positive number. For a decimal value of -2, the input is 110 (recall that to get the 2's complement value of a negative number, we do 1's complement of +2 and get 101. Then we add 1 to get 110).

Compute the equations for converting the 2's complement input into a 3-bit signed magnitude value. In signed magnitude form, there is a sign bit N and two bits for the magnitude M_1 and M_0. The value of +2 in signed magnitude form is expressed as N=0 (positive) and M_1M_0 = 10. The value of -2 in signed magnitude form is expressed as N=1 (negative) and M_1M_0 = 10. Just the equations for each of the 3 output bits are sufficient; no need to draw the circuit diagram or a timing diagram. In other words, write N as f(C_2,C_1,C_0), M_1 as g(C_2,C_1,C_0), M_0 as h(C_2,C_1,C_0).

As mentioned above, the input will be in the range of -3 to 3 only; so, the input value of -4 ($C_2C_1C_0$ = 100) is invalid and the output should be 0 (N=0 and M_1M_0=00).
In signed magnitude form, 0 can be represented as +0 (M=0 and N=0) or as -0 (M=0 and N=1). You can use the +0 representation.

Hint 1: Create a truth table with the inputs (C_2,C_1,C_0) and outputs (N,M_1,M_0) first. There will be 8 rows in the truth table. It might help if you first identify what the decimal value is before identifying the outputs for that row. Then use any approach to find the relation between the inputs and each of the outputs.

2.
For the circuit given below, write the truth table. Give a brief explanation of how S and T inputs affect the output (i.e., how is Q_{new} related to Q_{old} when S=0, S=1 and when T=0, T=1?).



Hint: The inputs are Q_{old}, S, T (8 rows in truth table). The output is Q_{new}.