CMSC 313 Quiz 1
Name (please print clearly):

2 problems (front and back of this sheet).
No electronics allowed.

1.
We are given a value in signed magnitude form as input. The inputs are the magnitude of the value and the sign bit of the value.
Let A be the 2-bit magnitude:

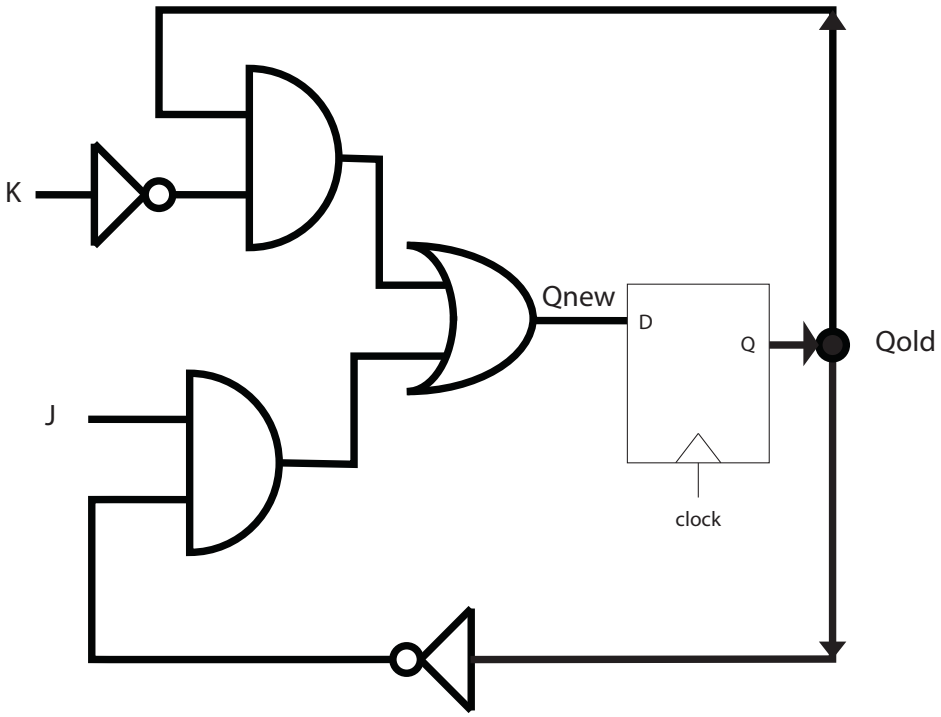
- A_1A_0 = 00 in binary: represents magnitude of 0 in decimal
- A_1A_0 = 01 in binary: represents magnitude of 1 in decimal
- A_1A_0 = 10 in binary: represents magnitude of 2 in decimal
- A_1A_0 = 11 in binary: represents magnitude of 3 in decimal

Let S be the sign bit.
For example, if A=2 and S=1, the value is -2. If A=1 and S=0, the value is +1.

Compute the equations for converting the signed magnitude value to 2's complement value (supporting range from -3 to +3). In 2's complement form, there needs to be 3 bits for the output value. Let $Z=Z_2Z_1Z_0$ be the 3-bit 2's complement value output. 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 Z_2 as $f(A_1,A_0,S)$, Z_2 as $g(A_1,A_0,S)$, Z_2 as $h(A_1,A_0,S)$.

Hint: For an input value of -2, Z=110 (2 in decimal is 010 in binary. 1's complement of 2 is 101. Adding 1 to it gives 110). For an input value of +1, Z=001 (no need to perform 2's complement for a positive number).
2nd Hint: In signed magnitude form, 0 can be represented as +0 (A=0 and S=0) or as -0 (A=0 and S=1).

2.
For the circuit given below, write the truth table. Give a brief explanation of how J and K inputs affect the output (i.e., how is Q_{new} related to Q_{old} when JK=00, 01, 10 and 11?).



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