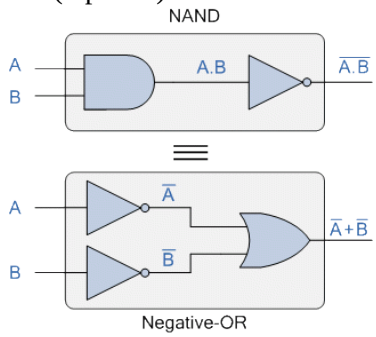
CS 3650 Homework #1 (20 points)

1. (2 pts) A machine with 4.2 GHz clock rate, what is its clock cycle time, i.e. the time for one cycle? The result must be expressed (and rounded if needed) in a whole number in proper time unit. For example, 0.12 second is not proper and it should be 120 ms (milliseconds).
   CCTime = 1 / (4.2 * 10^9) = 238 * 10^-12 = 238 ps

2. (3 pts) Suppose you wish to run a program P with $12 * 10^{11}$ instructions on a 4 GHz machine with a CPI (average CPI) of 2. What is the expected CPU time (expressed in time unit seconds)?
   12*10^11 * 2 * 1/(4*10^9) = 600 seconds

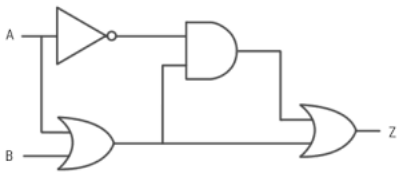
3. (5 points) Use truth-table to prove that the following two circuits are equivalent.



A	B	AB	(AB)'	A'	B'	A'+B'
0	0	0	1	1	1	1
0	1	0	1	1	0	1
1	0	0	1	0	1	1
1	1	1	0	0	0	0

From the above truth table we found out two (red) columns have the same values, i.e. (AB)' is equivalent to A'+B' (note: the blue columns are intermediate results, could be omitted unless required to show.)

4. (5 points) Given a logic circuit below,
   (a) write a logic equation for it.
   (b) when A is 1, B is 0, what is Z?

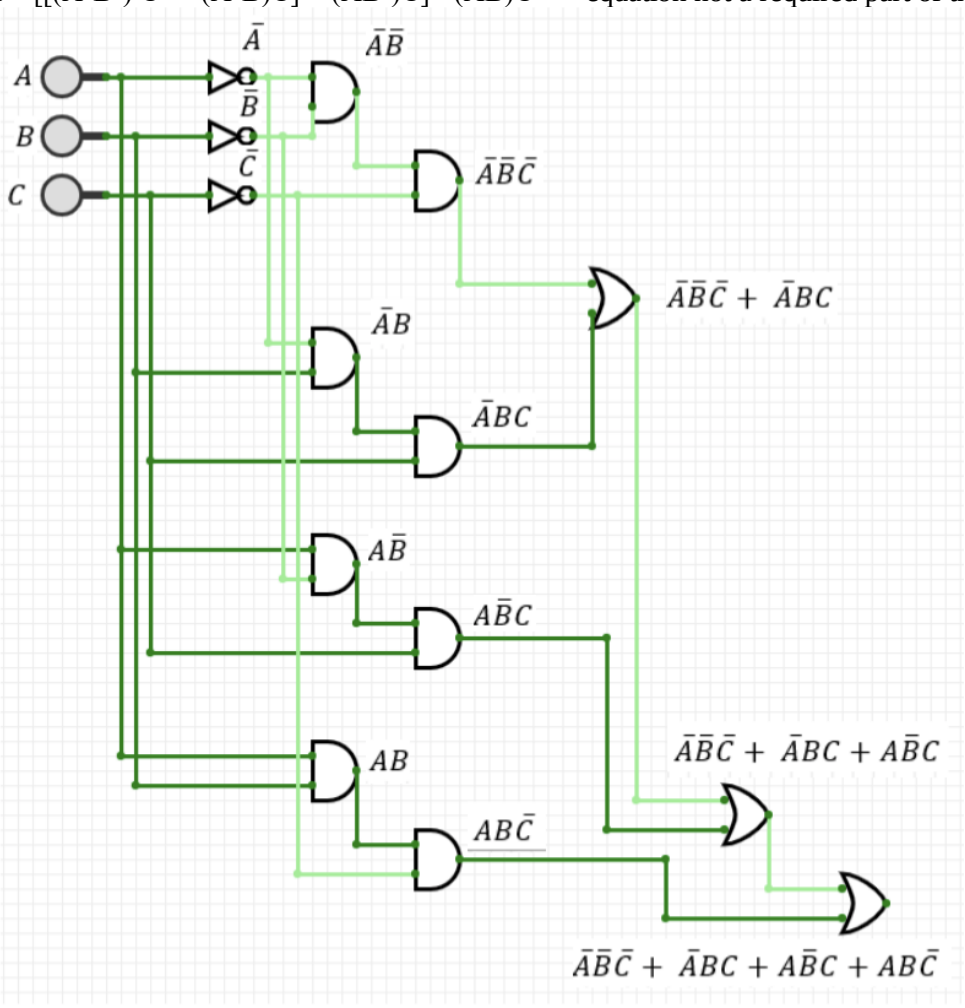


Z = A' (A+B) + (A+B) -- no simplification needed
A is. 1, B is 0, Z = 1

5. (5 points) Use 2-input AND, 2-input OR and Inverter gates only to construct a circuit based on given truth table.

Inputs			Output
A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

Answer may vary, note: (AB)C = A(BC) , (A+B)+C = A + (B+C)
X = [[(A'B') C' + (A'B)C] + (AB')C]+ (AB)C' -- equation not a required part of the answer.



Circuit credit: D. Hwang (thanks!)