Exam 1

Student Name:_____
Student ID#:_____

Each problem is worth 5 point. Give a complete solution to receive the full credit!

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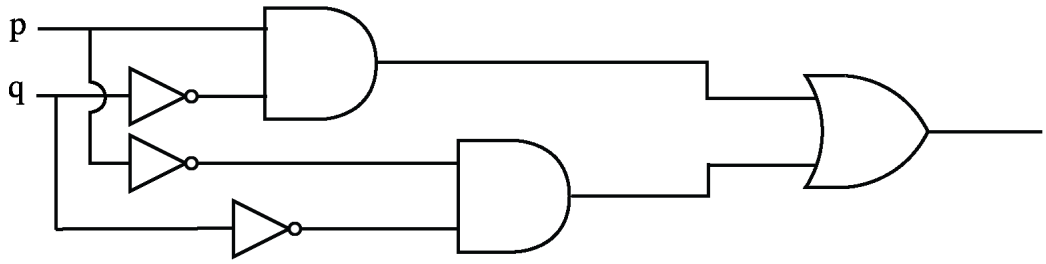
1. Prove that if r is rational and x is irrational then $r + x$ is an irrational number.

2. Is the function $(p \wedge q) \vee r$ equal to the function $p \wedge (q \vee r)$?

3. Construct a logic circuit for the Boolean function $S(p, q, r)$ given by the following table.

p	q	r	$S(p, q, r)$
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

4. Find the normal disjunctive form for a Boolean function $S(p, q)$ corresponding to the following logic circuit.



5. Compute $C_{16} - 7B_{16}$ using base-2 arithmetic.

6. Compute $33_8 - 73_8$ using 8-bit two's complement registers. Remember to check for overflow.

7. Write the contrapositive of the statement "Doing all homework assignments is necessary condition to pass CSCI 3030 course".

8. A logician tells a colleague his wife just had a baby. Is it a boy or a girl?

9. Replace the question mark by $<$, $>$, or $=$, whichever is correct.
   (a) $\left(\frac{1}{2}\right)^{-2013}$? 2^{2013}
   (b) $\frac{2}{3}$? 0.6666666666
   (c) $\sqrt[6]{2}$? $\sqrt[3]{\frac{\sqrt{18}}{3}}$
   (d) e^{-2} ? $\frac{1}{e^{-2}}$
   (e) π ? $e^{\ln(\pi)}$

10. Write the negation of the predicate:

$$(\forall x)(x \in \mathbb{R}), (\forall k)(k \in \mathbb{Z}), (\lfloor x - k \rfloor = \lfloor x \rfloor - k)).$$