CSCI 3030 Mathematical Structures for Computer Science Instructor: Dr. Predrag Punoševac
Section A

Exam 1

Student Name:_____
Student ID#:_____

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

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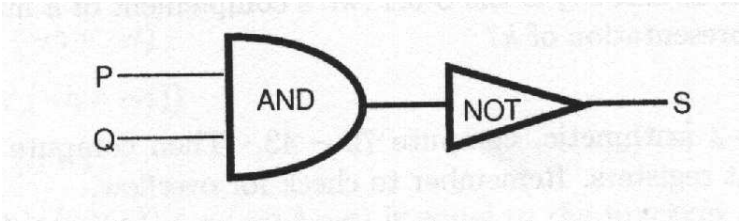
1. Is the function $(p \wedge q) \vee r$ equal to the function $p \wedge (q \vee r)$?

2. Convert 1011011111111000_2 from binary to hexadecimal.

3. Find the 8-bit two's complement of 65_{10}

4. Show that the Boolean function $(\sim P \wedge \sim Q) \vee (P \oplus Q)$ equals the Boolean function computed by the following circuit with just two logic gates (NOT and AND):



5. Compute $79 - 43$ using base-2 arithmetic.

6. Compute $79 - 43$ using 8-bit two's complement registers. Remember to check for overflow.

7. Design a circuit that represents the Boolean function S where $S(P, Q) = 0$ if and only if $(P, Q) = (1, 0)$.

8. A sufficient condition that a triangle T be a right triangle is that $a^2 + b^2 = c^2$. An equivalent statement is:

   (a) If T is a right triangle then $a^2 + b^2 = c^2$;

   (b) If $a^2 + b^2 = c^2$ then T is a right triangle;

   (c) If $a^2 + b^2 \neq c^2$ then T is NOT a right triangle;

   (d) T is a right triangle only if $a^2 + b^2 = c$.

9. Replace the question mark by $<$, $>$, or $=$, whichever is correct.

   (a) $\frac{1}{2}$? $\frac{3}{6}$

   (b) $\frac{2}{3}$? 0.6666666667

   (c) $\sqrt{2}$? $\frac{\sqrt{18}}{3}$

   (d) e ? 2.71828182

   (e) π ? $\frac{22}{7}$

10. Find all common divisors of 252 and 180 using the Euclidean algorithm.