Discrete Structures
Practice Problems for Midterm 1
June 16, 2017

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1. For sets A, B, C, and D, suppose that $A \setminus B \subseteq C \cap D$ and $x \in A$. Prove that if $x \notin D$ then $x \in B$.

2. How many sequences of bits are there that have all of the following properties:

- Their length is either 5 or 7 or 9.

- Their middle bit is a 1.

- The number of 0's they have equals the number of 1's they have minus one.

(Give the answer and an explanation of how you obtained it. No proofs required.)

3. You are choosing a sequence of five characters for a license plate. Your choices for characters are any letter in PERM and any digit in 1223. Your five-character sequence can contain any of these characters at most the number of times they appear in either PERM or 1223. If there are no other restrictions, how many such sequences are possible?

4. Let A, B be arbitrary sets. Prove by contradiction that

$$A \subseteq B \implies A \setminus (A \cap B) = \varnothing.$$

5. Prove that if for some integer a, $a \geq 3$, then $a^2 > 2a + 1$.