

**MATH 321: HOMEWORK 1**  
**DUE THURSDAY, SEPT 10 BY 11:59PM**

**Problem 1.** Do exercise 10 from section 1.4 of the textbook (page 43).

**Problem 2.** Consider the sets  $A = \{0, 1, 2, 3\}$ ,  $B = \{1, 3, 6\}$ , and  $C = \{0, 2, 4, 6\}$ . List the elements of the following sets.

- $A \cap B$
- $(A \cup C) \setminus B$
- $(A \cup B) \setminus (A \cap C)$

**Problem 3.** Analyze the logical form of the following statements by translating them into formulae in quantificational logic.

- Nobody loves everybody.
- Everyone loves someone.
- No matter who you are, if you love someone else then you love yourself.

**Problem 4.** Consider the following logical formula.

$$\forall z (z \in y \leftrightarrow [\forall w (w \in z \rightarrow w \in x)])$$

Identify the variables in this formula. Which are free and which are bound? Translate this formula into a sentence in ordinary mathematical English. [Hint: first translate it into a formula using  $\subseteq$ .]

**Problem 5.** Express the statement “ $p$  is a prime number” as a formula in quantificational logic, using the natural numbers  $\mathbb{N}$  as the universe of discourse.