MATH 240 Practice Problems

Propositional Logic

1. Translate each statement into propositional logic. Let B represent the sky being blue, let G represent the grass being green, and let L represent the lights being on.

   (a) The sky is blue, or the grass is green.

   (b) The sky is blue, and the lights are on.

   (c) The lights are off and the sky is not blue.

   (d) Because the lights are on, the sky is not blue.

Sets

2. Let A, B, and C represent the following sets:

$$A = \{1, 2, 3\}$$
$$B = \{4, 5, 6\}$$
$$C = \{2, 4, 6\}$$

   Evaluate each of the following:

   (a) $B \cap C$

   (b) $A \cup B$

   (c) $\mathcal{P}(C)$

   (d) $(A \cup B) \cap C$

Functions

3. Determine whether each function below is injective, surjective, both, or neither; prove your claim.

   (a) $f : \mathbb{Z} \to \mathbb{Z}$; $f(x) = x + 5$

   (b) $f : \mathbb{Z} \to \mathbb{Z}$; $f(x) = 3x + 49$

   (c) $f : \mathbb{Z} \to \mathbb{Z}$; $f(x) = 2x^2$

Combinatorics

4. How many ways are there to arrange the letters in the word "COMPUTER"?

5. How many 4-digit numbers are there that do not have any repeating digits? (Careful: remember that numbers can contain 0, but cannot *start* with 0.)