## Math 300

## Lab Assignment #15

This lab is due at 12:30 PM on Monday, 10/28 and is worth 10 points. This part may be done individually, or in a group of 2, 3, or 4 people.

1) We will use the following list of 17 elements as the universe for problem 1:

Metals:

Sodium, Magnesium, Aluminum, Titanium, Iron, Cobalt, Copper, Strontium, Silver, Indium

Nonmetals:

Helium, Carbon, Boron, Oxygen, Sulfur, Silicon, Selenium

Of this universe,

A = the set of all metals B = the set of all elements starting with S C = the set of all elements that are 6 letters long

a) Write sets A, B, and C. Be VERY careful, since the rest of the problem depends on doing this accurately.

b) Find the complements:  $A^C$ ,  $B^C$ , and  $C^C$ .

c) Find these intersections:

 $A \cap B$   $A \cap C$   $B \cap C$   $A^{C} \cap B$   $B^{C} \cap C$   $C^{C} \cap A$ 

d) Find these unions:

A U B
A U C
B U C
$\mathrm{B}^{\mathrm{C}}$ U A
$C^C \cup B$
$A^C \cup C$

e) Show that set intersection is associative. Find all of these things, and they should be the same.

 $\begin{array}{c} (A \cap B) \cap C \\ (A \cap C) \cap B \\ (B \cap C) \cap A \end{array}$ 

f) Show that set union is associative. Find all of these things, and they should be the same.

 $\begin{array}{c} (A \cup B) \cup C \\ (A \cup C) \cup B \\ (B \cup C) \cup A \end{array}$ 

g) Show that DeMorgan's Law #1 holds. Find both of these things, and they should be the same.

 $\substack{(A \cup B)^C \\ A^C \cap B^C }$ 

h) Show that DeMorgan's Law #2 holds. Find both of these things, and they should be the same.

 $\begin{array}{c} (C \cap B)^C \\ C^C \cup B^C \end{array}$ 

i) Show that intersection distributes over union. Find both of these things, and they should be the same.

 $\begin{array}{l} A \cap (B \cup C) \\ (A \cap B) \cup (A \cap C) \end{array}$ 

j) Show that union distributes over intersection. Find both of these things, and they should be the same.

 $\begin{array}{l} B \cup (A \cap C) \\ (B \cup A) \cap (B \cup C) \end{array}$ 

k) Show that the complement of the complement gives the same set. Find  $(B^{C})^{C}$ . Is it B?

l) Find  $A^C \cup A$ . What is this? Does it surprise you?

m) Find  $C^{C} \cap C$ . What is this? Does it surprise you?

n) Find  $B \cup \emptyset$ . What is this? Does it surprise you?

o) Find A  $\cup$  U. (The set A union with the universe.) What is this? Does it surprise you?

p) Find  $C \cap U$ . What is this? Does it surprise you?

q) Find  $B \cap \emptyset$ . What is this? Does it surprise you?