Name (please print):

Math 250 Test 1, Wednesday 24 September 2008, 3 pages, 50 points, 50 minutes

(12 points) For each statement, check either true (T) or false (F).

↓ statement domain →	real numbers		integers		explanation (not required)
	T	F	T	F	
$\forall x \forall y \exists z \;\; xy = z$	√		√		
$\forall x \forall y \exists z \;\; xz = y$		√		√	z = y / x fails when x=0
$\exists x \exists y \forall z \;\; xz = y$	√		√		Let x=y=0.

(12 points) Fill in the truth table. Use 1 for true, 0 for false, with classical two-valued logic.

P	Q	$P \to Q$	$(P \to Q) \to P$	$((P \to Q) \to P) \to P$
0	0	1	0	1
0	1	1	0	1
1	0	0	1	1
1	1	1	1	1

(4 points) Let $S = (0, 1) \cup [2, 3]$. Consider this as a subset of $\mathbb{R}$.

If $\mathbb{R}$ has the Euclidean topology, then $\operatorname{int}(S) =$ $(0,1) \cup (2,3)$

If $\mathbb{R}$ has the discrete topology, then $\operatorname{int}(S) =$ $(0,1) \cup [2,3]$

(6 points) Let $A = \{1,2,3\} \cup [5,8]$ and $B = \{2,3,4\} \cup (7,10]$. Find:

$A \cap B =$ $\{2,3\} \cup (7,8]$

$A \cup B =$ $\{1,2,3,4\} \cup [5,10]$

$A \setminus B =$ $\{1\} \cup [5,7]$

(2 points) What is the powerset of $\{1,2\}$?

$\{ \varnothing, \ \{1\}, \ \{2\}, \ \{1,2\} \}$

(2 points)

	true	false
$\varnothing \in \{\varnothing\}$	√	
$\varnothing \subseteq \{\varnothing\}$	√	

Explanation (not required):

$x \in \{x\}$ for any object x

$\varnothing \subseteq S$ for any set S

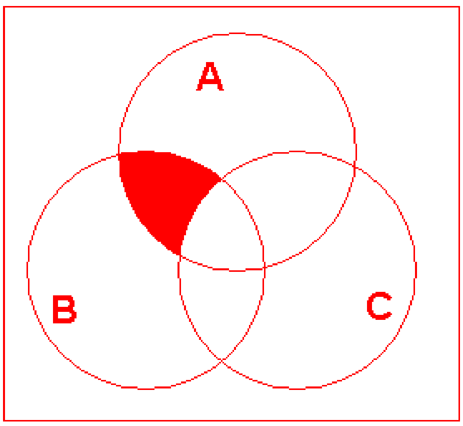
(8 points) Let $\Omega = \{1, 2, 3\}$. Then

$$\Sigma = \Big\{\varnothing,\ \{1\},\ \{2\},\ \{1,2\},\ \Omega\Big\}$$

is a topology on Ω. (You do not have to prove that fact; you can take my word for it.) List all the subsets of Ω that are not open for this topology, and for each one, give its interior with respect to this topology.

S	{3}	{1,3}	{2,3}
int(S)	$\varnothing$	{1}	{2}

(4 points) Draw a Venn diagram of $A \cap (B \setminus C)$.



(The box is a necessary part of the diagram, as I explained in the book and in class; omitting it cost a point.)