MATH 126 ASSIGNMENT #1 Name: ____________________ Section: 001

First work through the recommended practice problems listed in the following table from the 7th edition of *Discrete Mathematics and Its Applications* by K.H. Rosen. You do not need to hand these in. Once you have completed these, then do the small sampling of questions below. Write full solutions (not just the final answer) in the space provided.

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1.1 Propositional Logic	1, 3, 9, 11, 15, 17, 19, 23, 25, 27, 31(a,c,e), 33(a,c,e), 43
1.2 Applications of Propositional Logic	1, 3, 5
1.3 Propositional Equivalences	5, 7, 9(a,c,e), 11(a,c,e), 21, 25, 29, 31, 55
1.4 Predicates and Quantifiers	1, 5, 7, 9, 11, 13, 17(a,b,c), 23, 29(a,b), 43, 45, 53

Sec 1.1 #12(f): Let p, q and r be the propositions

p: You have the flu.
q: You miss the final exam.
r: You pass the course.

Express the following proposition as an English sentence: $(p \wedge q) \vee (\neg q \wedge r)$

Sec 1.1 #22(e): Write the following statement in the form "if p, then q" in English:

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Sec 1.1 #26(a): Write the following proposition in the form "p if and only if q" in English:

For you to get an A in this course, it is necessary and sufficient that you learn how to solve discrete mathematics problems.

Sec 1.1 #28(a): State the converse, contrapositive, and inverse of the conditional statement, "If it snows tonight, then I will stay at home."

Converse:

Contrapositive:

Inverse:

Sec 1.1 #32(e): Construct a truth table for the compound proposition $(q \to \neg p) \leftrightarrow (p \leftrightarrow q)$.

p	q				$(q \to \neg p) \leftrightarrow (p \leftrightarrow q)$
T	T				
T	F				
F	T				
F	F				

Sec 1.2 #4: Let w, d and s be the propositions

w: You can use the wireless network in the airport.
d: You pay the daily fee.
s: You are a subscriber to the service.

Translate the following statement into propositional logic:

To use the wireless network in the airport you must pay the daily fee unless you are a subscriber to the service.

Sec 1.3 #8(c,d): Use De Morgan's laws to find the negation of each of the following statements.

(c) James is young and strong.

(d) Rita will move to Oregon or Washington.

Sec 1.3 #10(c): Show that the conditional statement $[p \wedge (p \to q)] \to q$ is a tautology by using truth tables.

p	q			$[p \wedge (p \to q)] \to q$
T	T			
T	F			
F	T			
F	F			

Sec 1.3 #12(c): Show that the conditional statement $[p \wedge (p \to q)] \to q$ is a tautology without using truth tables. Do this (as in Examples 6-8 of the text) by developing a series of logical equivalences using only the equivalences from the handout and name the logical equivalence used at each step.

Sec 1.3 #32: Show that $(p \wedge q) \rightarrow r$ and $(p \rightarrow r) \wedge (q \rightarrow r)$ are not logically equivalent.

Sec 1.3 #40: Find a compound proposition involving the propositional variables *p*, *q*, and *r* that is true when *p* and *q* are true and *r* is false, but is false otherwise. [Hint: Use a conjunction of each propositional variable or its negation.]

Sec 1.4 #10: Let $C(x)$ be the statement "*x* has a cat," let $D(x)$ be the statement, "*x* has a dog," and let $F(x)$ be the statement "*x* has a ferret." Express each of these statements in terms of $C(x)$, $D(x)$, $F(x)$, quantifiers, and logical connectives. Let the domain consist of all students in your class.

(a) A student in your class has a cat, a dog, and a ferret.

(b) All students in your class have a cat, a dog, or a ferret.

(c) Some student in your class has a cat and a ferret, but not a dog.

(d) No student in your class has a cat, a dog, and a ferret.

(e) For each of the three animals, cats, dogs, and ferrets, there is a student in your class who has this animal as a pet.

Sec 1.4 #12: Let $Q(x)$ be the statement "$x+1>2x$." If the domain consists of all integers, what are these truth values? Briefly justify your answers.

(a) $Q(0)$

(b) $Q(-1)$

(c) $Q(1)$

(d) $\exists x Q(x)$

(e) $\forall x Q(x)$

(f) $\exists x \neg Q(x)$

(g) $\forall x \neg Q(x)$

Sec 1.4 #24(a,b,c): Translate in two ways each of these statements into logical expressions using predicates, quantifiers, and logical connectives. First, let the domain consist of the students in your class and second, let it consist of all people. Clearly define your propositional functions.

(a) Everyone in your class has a cellular phone.

Domain is all students in your class:

Domain is all people:

(b) Somebody in your class has seen a foreign movie.

Domain is all students in your class:

Domain is all people:

(c) There is a person in your class who cannot swim.

Domain is all students in your class:

Domain is all people:

Sec 1.4 #32(a,b,d): Express each of these statements using quantifiers. Be sure to define your propositional functions and identify its domain. Then form the negation of the statement so that no negation is to the left of a quantifier. Next, express the negation in simple English. (Do not simply use the phrase, "It is not the case that.")

(a) All dogs have fleas.

Statement:

Negation:

Translation:

(b) There is a horse that can add.

Statement:

Negation:

Translation:

(d) No monkey can speak French.

Statement:

Negation:

Translation:

Sec 1.4 #44: Determine whether $\forall x(P(x) \leftrightarrow Q(x))$ and $\forall x P(x) \leftrightarrow \forall x Q(x)$ are logically equivalent. Justify your answer.