Math 211

First Hour Exam

Name __________________________

Friday, September 22
95 pts. (will be normalized to 100 in the grade book)
1. (10 pts.) Let \( p \) be the statement “I study hard” and \( q \) the statement “I pass the exam”. Translate the following into symbolic form:

a) If I study hard then I pass the exam.

b) I did not study hard but I passed the exam.

c) I pass the exam only if I study hard.

2. (10 pts.) Given the statement “If two lines are parallel then they (the two lines) never meet” What is the

Sufficient condition?

Necessary condition?
Converse?

Contrapositive?

3. (10 pts.) Simplify the following expressions by moving the negation sign inside so that it appears only directly before predicate expression(s) $P(x)$ and $Q(x)$ and so that only **and**, **or**, and **not** are used in addition to the predicates and quantifiers (that is, translate implication statements using these three symbols). Also remove any double negations.

$\neg \exists x (P(x) \land \neg Q(x))$

$\neg \forall x (G(x) \rightarrow B(x))$
4. (10 pts.) Complete the following truth table for the expression 

\[ ((p \rightarrow q) \land \neg p) \rightarrow \neg q. \]

Is the expression a tautology?

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>\neg p</th>
<th>\neg q</th>
<th>p \rightarrow q</th>
<th>((p \rightarrow q) \land \neg p)</th>
<th>((p \rightarrow q) \land \neg p) \rightarrow \neg q</th>
</tr>
</thead>
</table>


5. (5 pts.) Let D(x,y) be the statement “x requests y”, P(x) the statement “x is a process”, R(x) the statement “x is a resource”, A(y) the statement "y is available", and W(x) the statement “x goes into a wait state”. Translate into predicate form the statement "If process x requests resource y and y is not available then process x goes into a wait state."
6. (5 pts.) Let M(x) stand for the statement "x is a message", MB(x) for the statement "x is a mailbox", T(x,y) for "x is sent to y", and S(x,s) for "the status of x is s", translate into English the statement
\[ \forall x \forall y ((M(x) \land MB(y) \land T(x,y) \land S(y, full)) \rightarrow S(x, fail)) \]

7. (5 pts.) Give a proof of the following, giving reasons for each step.

\[ \forall x (A(x) \rightarrow \neg B(x)) \]

B(Charlie)

\[ \therefore \neg A(Charlie) \]
8. (15 pts.) Suppose that set $A = \{3, 7\}$, and that $B = \{2, 7, 9\}$. What is the result of $A \cup B$

$A \cap B$

$A - B$

$A \times B$
9. (10 pts.) Prove that \( A \cup (A \cap B) = A \)

10. (10 pts.) What is an algorithm?

11. (5 pts.) Say something about one of the following:
   
   a. Donald Knuth
   b. George Boole
   c. Abu Ja’far Mohammed Ibn Musa Al-Khowarizmi
   d. René Descartes
   e. Charles Dodgson
   f. Ada Augusta, Countess of Lovelace