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MTH:2310 DISCRETE MATH
QUIZ 1
DUE: FRIDAY SEPT. 12

Complete all of the following problems being as detailed as you can be. You may work in groups, but you must submit your own solutions using your own words. You must submit a physical copy of your solutions to me unless told otherwise. If there is a specific number of problems which seem unsolvable let me know first, I may have made a typo. Even if you cannot completely solve a problem, a good description of key terms and concepts relevant to the problem is sufficient for some partial credit.

Handwriting: *(4 points)*
Your ability to express your solutions is just as important as mathematical accuracy.
You will be penalized up to 2 points for arithmetic errors.
You will be penalized up to 2 points for disorganized or hard to read solutions.

Problem 1. *(9 points) Propositions*
Determine whether the following statements are propositions. If the statement **is** a proposition, indicate whether it is (T)rue or (F)alse. Otherwise, explain why the statement fails to be a proposition.

a. *(3 points)* "$1 + 2 + 3 + 4 + 5 = 20$"

b. *(3 points)* "This is a false statement."

c. *(3 points)* "If $-3 > 0$, then $(-3)^2 > 0$."

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Problem 2. *(6 points) Compound Propositions*
Translate the statement into a compound proposition using symbols (propositional variables and logic operators). Clearly define every variable you use.

"You can graduate only if you have completed the requirements of your major and you do not owe money to the university and you do not have any overdue library books."

Problem 3. *(8 points) Compound Propositions*
Let p = "The user enters a valid password," q = "Access is granted," and r = "The user has paid the subscription fee."

(a) *(4 points)* Translate the following compound propositions into words.

$$(p \wedge r) \Rightarrow q$$

(b) *(4 points)* Write the sentence corresponding to the contrapositive of the statement in part (a).

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Problem 4. *(8 points) Truth Tables*
Fill out a complete truth table for the compound proposition.

$$(\sim p \leftrightarrow \sim q) \leftrightarrow (q \leftrightarrow r)$$

Problem 5. *(6 points) Logical Equivalence*
Show that the compound propositions are logically equivalent by rewriting the expression using a series of logical equivalences. You may only use the identities from Table 6 (pg. 29) and $p \Rightarrow q \equiv\sim p \vee q$.

$$(p \Rightarrow r) \vee (q \Rightarrow r) \equiv (p \wedge q) \Rightarrow r$$