

**Midterm Exam #1**  
Math 263  
September 21, 2001

Name \_\_\_\_\_

*Do all of your work on the blank paper provided. At the end of the exam, hand in your answers with this cover sheet. Include your name on all pages of your exam.*

**§1 Calculation**

1. Write a truth table for the statement form  $(p \wedge q) \vee (\sim p \vee (p \wedge \sim q))$ . Is it a tautology or a contradiction?
2. Use the contrapositive to write the statement "The Cubs will win the pennant only if they win tomorrow's game." in an if-then format in two different ways.
3. Write negations of the following statements.
  - a. No politicians are honest.
  - b. All computer programs are finite.
  - c.  $\forall$  computer programs  $P$ , if  $P$  is correct, then  $P$  complies without error messages.
4. Write the contrapositive, converse, and inverse of "If a real number is greater than 2, then its square is greater than 4."

**§2 Comprehension**

5. The statement "If Howard can swim across the lake, the Howard can swim to the island." is true. Can Howard swim across the lake? Explain.
6. Describe precisely the following rules of inference.
  - a. Modus ponens
  - b. Modus tollens
  - c. Disjunctive syllogism
  - d. Hypothetical syllogism
7. What are De Morgan's Laws? Choose one, and prove that it is correct with a truth table.
8. What does it mean for an argument form to be valid? If an argument is valid, are its conclusions true? Explain.

**§3 Application**

9. Use symbols to write the logical form of the following argument. If the argument is valid, identify the rule of inference that guarantees its validity. Otherwise, state what error has been made.

If this computer program is correct, then it produces the correct output when run with the test data my teacher gave me.  
This computer program produces the correct output.  
 $\therefore$  This computer program is correct.

10. Use symbols to write the logical form of the following argument. If the argument is valid, identify the rule of inference that guarantees its validity. Otherwise, state what error has been made.

Any sum of two rational numbers is rational.

The sum  $r + s$  is rational.

$\therefore$  The numbers  $r$  and  $s$  are rational.