MATH/CSE 1019 First midterm test
Fall 2011
Oct 17, 2011
Instructor: S. Datta

Name (LAST, FIRST): ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

Student number: ⎯⎯⎯

Instructions:

1. If you have not done so, put away all books, papers, cell phones and pagers. Write your name and student number NOW!

2. Check that this examination has 7 pages. There should be 5 questions together worth 30 points.

3. You have 75 minutes to complete the exam. Use your time judiciously.

4. Show all your work. Partial credit is possible for an answer, but only if you show the intermediate steps in obtaining the answer.

5. If you need to make an assumption to answer a question, please state the assumption clearly.

6. Points will be deducted for **vague and ambiguous** answers.

7. Your answers MUST be LEGIBLE.

8. Feel free not to use the hints supplied.

> Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

1. (6 points) Propositional Logic

    (a) (3 points) Write down the truth table for the following proposition.

$$(p \wedge q) \vee \neg r$$

    (b) (3 points) State the converse, contrapositive and inverse of the following statement: "A positive integer is a prime only if it has no divisors other than 1 and itself".

2. (6 points) Propositional equivalences

(a) (3 points) Show that $(p \to r) \lor (q \to r)$ and $(p \land q) \to r)$ are logically equivalent.

(b) (3 points) Show that $(p \land q) \to p$ is a tautology.

3. (6 points) Predicates

    (a) (3 points) Translate in 2 ways the following statement into a logical expression using predicates, quantifiers and logical connectives. First let the domain be the students in your class and second, let it consist of all people: "There is a person in your class who cannot swim".

    (b) (3 points) Express the negation of this proposition using quantifiers and then express the negation in English: "Some drivers do not obey the speed limit".

4. (6 points) Nested quantifiers A Discrete Math class contains 1 math major who is a freshman, 12 math majors who are spohomores, 15 CSE majors who are sophomores, 2 Math majors who are juniors, 2 CSE majors who are juniors, and 1 CSE major who is a senior. Express each of the following statements in terms of quantifiers and say why it is true or false.

   (a) (3 points) There is a student in the class who is neither a math major nor a junior.

   (b) (3 points) There is a major such that there is a student in the class in every year of study with that major.

5. (6 points) Inference

   (a) (3 points) Explain what rule of inference are used to infer the following: "There is someone in this class who has been to France. Everyone who goes to France visits the Louvre. Therefore, someone in this class has visited the Louvre."

   (b) (3 points) Determine whether this is valid: "If x is a positive real number, then x^2 is a positive real number. Therefore if a^2 is positive, then a is a positive real number."

LIST OF FORMULAE

You will be given Table 6 (page 27), Table 1 (page 72) and Table 2 (page 76).