MATHEMATICS 300 — FALL 1998

Introduction to Mathematical Reasoning

H. J. Sussmann

HANDOUT NO. 8

October 14, 1998

A REMINDER

The **first midterm exam** is going to be on **Monday, October 19**. (*NOTE: The exam was originally scheduled for Wednesday, October 14. The date has been changed.*)

The **topics to be covered in the first midterm exam** are: all the material in Chapter 1 of the book, and in Handouts No. 1 through 7, **including in particular the review questions.** EXCEPTION: the review questions from No. 88 on, which deal with the material of Chapter 2, are **not** included.

OFFICE HOURS

The **instructor's office hours** (in Hill 704), are: *Mondays and Thursdays, 4th period (1:10 to 2:30 p.m.)*. Other times also possible, by appointment. *If you are planning to go see the instructor during office hours you should let him know by e-mail ahead of time, so he will have the option not to stay in the office if nobody is coming.* The instructor's e-mail address is **sussmann@math.rutgers.edu** .

The **teaching assistant's office hours** (in Hill 101) are: Fridays, 2 p.m. to 3 p.m. The T.A.'s name is **James Taylor**. His e-mail address is **jostylr@math.rutgers.edu** . *If you are planning to go see him during office hours you should let him know by e-mail ahead of time, so he will have the option not to stay in the office if nobody is coming.*

READING FOR OCTOBER 21-26-28

Book, Sections 2.1, 2.2 and 2.4, and Handout No. 9. (NOTE: we will be *skipping* Section 2.3.)

HOMEWORK ASSIGNMENT NO. 5
DUE ON WEDNESDAY, OCTOBER 21

a. Problems 11 (nonstarred parts only), in pages 56-57.
b. Problems 3(b),(d),(f),(h),(j), 4(b),(d),(f),(h),(j), (l), 11, and 19(a),(b),(d),(e),(f), in pages 65-66-67.

plus the following:

c. If, for assignment no. 4, you did problem 9 in page 56 incorrectly, *find your mistake.* (In particular: if you *proved* the statement then, now that you know it is false, *find the mistake in your proof*; if you claimed it was false but gave a wrong argument for that, *find the mistake in your proof.* If you did it right—that is, if you said it was false and correctly explained why—then there is no need for you to do anything. In order to make it possible for the grader to grade this problem, *please hand in Homework No. 4 together with Homework No. 5.*)

d. Let us work with a predicate calculus intended to talk about kinship. The symbols are:

1. letter variables, such as x, y, a, b, etc.;
2. the left and right parentheses, (and) ;
3. the comma;
4. the quantifiers, $\forall$ and $\exists$;
5. the logical connectives $\wedge$, $\vee$, $\Longrightarrow$ and $\sim$;
6. binary predicate letters S, D, standing for "son of" and "daughter of" (that is, "$S(x, y)$" means "x is a son of y", and "$DS(x, y)$" means "x is a daughter of y");
7. the binary predicate symbol $=$, standing for "equal to," and written BETWEEN the letters rather than in front of them (so we write "$x = y$" rather than "$= (x, y)$", and "$x = y$" stands for "x and y are the same person");

and nothing else.

d1. Define, in terms of an expression in this formal language, each of the following five predicates: male, female, father, mother, sister. (Do not allow half-sisters to count as sisters.) *NOTE: in order to define a predicate you first have to figure out what kind of a predicate (unary, binary, etc.) it is. For example, if I asked you to define "smaller than," you would first have to see that "smaller than" is a* **binary** *(i.e. two-variable) predicate, so your definition will say, for example, something like "let x, y be real numbers; we say that x is* **smaller than** *y if $y - x$ is positive."*

d2. Translate each of the following statements into the formal language (using **only** the symbols in the above list):

1. Everybody has a mother.
2. Not everybody has a sister.
3. Some people have a brother.

d3. Translate each of the following formal statements into plain English **without using any letter variables**, and indicate whether the statement is true or false:

1. $(\forall x)(\exists y)\Big(D(x, y) \vee S(x, y)\Big)$;
2. $(\forall x)(\exists y)\Big(D(y, x) \vee S(y, x)\Big)$;
3. $(\exists y)(\forall x)\Big(D(y, x) \vee S(y, x)\Big)$;
4. $(\exists y)\Big((\forall x)D(y, x) \vee (\forall x)S(y, x)\Big)$.

END OF HANDOUT NO. 8