The following will be added to, and modified, as the course progresses.

The Rules:

- Exercises should be neatly written or typed. *Pencil is not acceptable.*
- *Exercises should be double or triple spaced* (so I have space to write nasty comments between your lines).
- Unless indicated otherwise, exercises are to be handed in. Some of them will be corrected with a numerical score assigned.

Note.

- Homework is approximately 40% of the grade and should be taken seriously.
- Some of the homework problems are difficult and you will benefit greatly by allowing enough time to work on them. Starting the homework the night before they are due will not work. Even if you are unable to solve a problem completely, you benefit much more by trying hard and not succeeding than by not trying. Some of the more difficult problems have a prize that goes to the first person who provides a solution.

Assignments

1. The Size of Sets

Date	*Material*	*Exercises*	*Date due*
Sept 3-5	*A&C*: pages 77-88		
Sept 5-12	*A&C*: pages 1-8	0.18	Sept 12

The material in A&C, pages 77-88 is review material (it is taken from Math 3283W). It includes basic material on mathematical terminology and proofs by mathematical induction. There will be a lot of proofs by mathematical induction.

There is a link to *Finite and Infinite Sets* on my web site. These pages are identical to pages 1-8 of A&C.

There are two books on elementary set theory on reserve in the Math Library: Kamke, *Theory of Sets*, and Hamilton, *Numbers, Sets, and Axioms.* If you feel like some additional reading material on enumerable (also called *denumerable*) sets, etc. you can read Kamke, pages 1-11 (or more), or Hamilton, pages 51-63 (or more).

Exercise 1.1. (**Due Sept 12**) Show that ${}^{N}\{0,1\}$ is uncountable. (See Definition 0.21). Here N is the set of nonnegative integers.

Exercise 1.2. (Due Sept 12) If you are able to do the previous exercise, then try to do Exercise 0.23 from A&C. This is rather tricky.

Exercise 1.3. (Due Sept 12) Let $f\colon \mathbb{N} \xrightarrow{\text{1-1}} \mathbb{N}$, and

$$A = \{n : \forall y > n\ [f(n) < f(y)]\}\ .$$

Must A be infinite? Justify your answer.

2. Sentential Logic

Remark 2.1. The definition I use of a truth assignment is slightly different than that used by Enderton. I assume that a truth assignment is defined at *every* sentence symbol, whereas Enderton does not require this.

Remark 2.2. In class we gave several different forms of proofs by induction. In the exercises below (in spite of what Enderton asks for) you can choose the form of proof by induction that you use.

Remark 2.3. The *Notes on Sentential Logic* (abbreviated *NOSL*) material below should be read simultaneously with Enderton.

Date	*Material*	*Exercises*	*Date due*
Sept. 12-19	*Enderton*: 11-29	p19:1,3	Sept. 19
	Enderton	p27:1,2(a),3,4,5	Sept. 19
	N0SL:1-4	p3:2.1	Sept. 19
Sept. 19-26	*Enderton*	p28-29:7,8,9,12,13,15	Sept 26
	Enderton	p66:12	Sept 26
	Enderton:	p28:10	Sept 29
	NOSL:4-7	3.4,3.5,3.6,3.7	Sept 29
	Enderton: 59-65		

Remark 2.4.

(1) Skip Enderton, pages 31,32(parsing algorithm, and Polish notation). Also skip Sections 1.4, 1.5, and 1.6. (*But you should know the definitions of conjunctive normal form, and disjunctive normal form, and be able to put a wff in each of these forms.)*

(2) Page 29, problem 10 of *Enderton* is hard. If nobody gets it there may be a prize for a nicely written correct solution.

Date	*Material*	*Exercises*	*Date due*
Oct. 10-17	*Enderton*:	Read Chapter 2 to p 95	
Oct. 10-17	*Enderton*:	p79:1 (c), (d), 3, 4, 5(b), 10(a)	Oct 17
Oct. 10-17	Exercises 2.2, 2.3, below		Oct 17

Exercise 2.5. The following quotation is attributed to Benjamin Franklin, who was apparently trying to impress London society.

The grand leap of the whale up the Falls of Niagara is accounted, by all who have seen it, one of the finest spectacles of Nature.

Let $\mathbb{L}$ be the first-order language with unary relation symbols P and Q. Let $\mathfrak{A} = (|\mathfrak{A}|, P^{\mathfrak{A}}, Q^{\mathfrak{A}})$ be the structure for this language where:

$|\mathfrak{A}|$ is the set of all people;
$P^{\mathfrak{A}}$ is the set of all people who have seen the grand leap of the whale up the Falls of Niagara;
$Q^{\mathfrak{A}}$ is the set of all people who believe the grand leap of the whale up the Falls of Niagara is one of the finest spectacles of nature.

Translate Benjamin Franklin's statement into the language $\mathbb{L}$ and then interpret it in the structure $\mathfrak{A}$. In particular, was Benjamin Franklin telling the truth? Explain why.

Exercise 2.6. Students in a fifth grade class are told to grade their own homework. However, some students do not want to grade their own homework. So Sarah, a student in the class, has been told to grade exactly those students who do not grade themselves. Consider the following:

Premise: Sarah grades exactly those students who do not grade themselves.

Conclusion: Sarah grades Sarah.

Is the conclusion a logical consequence of the premise? Explain why by choosing an appropriate first-order language $\mathbb{L}$, translating the statements into this first-order language, and then looking at structures for $\mathbb{L}$.

Date	*Material*	*Exercises*	*Date due*
Dec 3-8	*A&C*: pages 19-20	1.32,1.33,1.34,1.35	Monday, Dec 8