Assignment 4

Math 351

Please upload the `.tex`, `.sty`, and `.pdf` files to the solutions to these exercises by Sunday.

Exercise 1. Create a `.sty` file which does the following:

1. Loads the usual `amssymb`, `amsmath`, `amsthm`, and `hyperref` packages, with custom colors and fields defined in the `hyperref` package.
2. Selects the Bookman font for roman text, Times font for mathematics, Courier font for typewriter text, and a scaled version of Helvetica for sans serif, and then sets the default font to Helvetica.
3. Sets the margins to 1 inch on all sides (these are the margins for MLA papers).
4. Uses the `amsthm` package to define a theorem environment to be set in the "definition" theorem style.
5. Defines a new command with 5 inputs, designed to create the following truth table:

A	B	`#1`
F	F	`#2`
F	T	`#3`
T	F	`#4`
T	T	`#5`

   The 5 inputs should appear where the `#1`, `#2`, `#3`, `#4`, and `#5` appear.

6. Defines a new environment which does the following:
   (a) Begins by printing an unindented *Proof by contradiction.* (That is italic Bookman font).
   (b) Ends by displaying the two consecutive math symbols $\Rightarrow\Leftarrow$ on the right margin (mimicking `\qed`).
7. Contains at least one `\newcommand` or `\newenvironment` command of your creation; hopefully coming up with commands that you imagine might be useful. An exemplary example will earn the LaTeXer of the week distinction.

Exercise 2. Call the `.sty` file described in Exercise 1 to produce a document which contains the type found on the next page and also uses your custom commands.

Introductory courses on mathematical reasoning usually include the topics of truth tables and proofs by contradiction. We display one such truth table below, defining the logic operation of the Sheffer stroke.

A	B	$A \uparrow B$
F	F	T
F	T	T
T	F	T
T	T	F

The Sheffer stroke alone can be used to create each of the logic operations of and, or, not, and implies. For example, we display two equivalent truth tables representing "or", centered and separated by a `\qquad`:

A	B	$A \vee B$
F	F	F
F	T	T
T	F	T
T	T	T

A	B	$(A \uparrow A) \uparrow (B \uparrow B)$
F	F	F
F	T	T
T	F	T
T	T	T

We display one of the oldest known proofs by contradiction in the proof of Theorem 1.

Theorem 1. There is no largest prime.

Proof by contradiction. If p is the largest prime, then all primes divide $p!$. This implies $p!+1$ does not have a prime divisor. $\Rightarrow\Leftarrow$