

HOMEWORK 2
Due Thursday, September 13

Undergraduates should do only the unstarred problems. Graduate students should also do the starred problem.

1. Do problem 9 on page 14 of van Dalen.
2. A *binary truth function* is any function of the form:

$$f : \{0, 1\} \times \{0, 1\} \longrightarrow \{0, 1\}$$

Note that a binary truth function is defined uniquely by its truth table.

- (a) How many different binary truth functions are there?
 - (b) Define \oplus (exclusive or), $|$ (nand, the sheffer stroke), and \downarrow (nor), where $p|q$ is “not both p and q ”, and $p \downarrow q$ is “neither p nor q ”. Give the definitions by truth tables.
 - (c) Can the truth functions from part (b) be defined just in terms of \vee and \neg ? (proof!)
 - (d) Can they be defined just in terms of \vee and \wedge ? (proof!)
3. In van Dalen, do problems 1a and 2c on page 20.
 4. Use semantic arguments (rather than truth tables) to prove each of the following:
 - (a) $\varphi \vee \psi \models \neg\psi \rightarrow \varphi$
 - (b) it’s not the case that $\{p \wedge \neg q, \neg r, p \vee \neg s\} \models \neg q \rightarrow (r \vee s)$.
 - ★ 5. In van Dalen, do problem 6 on page 20.