

HW5 Proposition Logic

(Due at the beginning of the class on Thursday, March 29)
total 25 points

Use your own paper, type your answers and show work as much as possible.

- (6 points) Determine whether the following sets of propositional formulas are valid, satisfiable (but not valid), or unsatisfiable by giving a truth table for each. Be sure to label each table with your conclusion (valid, etc.), and indicate which truth assignments are satisfying.
 - $\{moving \wedge breathing \rightarrow alive, breathing \rightarrow moving, breathing\}$
 - $\{((M \rightarrow X) \wedge \neg X) \rightarrow \neg M\}$
 - $\{A \rightarrow B \oplus C, A \vee B, \neg A \vee \neg B, A \wedge C\}$
- (5 points) Derive a proof of the proposition A from the following set of sentences by rules of inference. Recall that a proof contains a sequence of derivations labeled with the indexes of the sentences they were derived from, along with an indication of the inference rule used.

$$\{D \wedge E \rightarrow A, F \wedge C \rightarrow D, \neg(\neg F \vee \neg C \vee B), C \vee B \rightarrow E\}$$

- (14 points) You are the proprietor of Sammy's Sport Shop. You have just received a shipment of three boxes filled with tennis balls. One box contains only yellow tennis balls, one box contains only white tennis balls, and one contains both yellow and white tennis balls. You would like to stock the tennis balls in appropriate places on your shelves. Unfortunately, the boxes have been labeled incorrectly; the manufacturer tells you that you have exactly one box of each but that each box is definitely labeled wrong. You decide to try to determine the correct labeling by looking at one tennis ball from each box.

Given the initial (incorrect) labeling of the boxes below, and the three observations, use Propositional Logic to derive the correct labeling of the middle box. Begin by writing down rules (knowledge) you will need (such as what observing a white ball drawn from box 2 implies, etc.), along with the initial facts. Use propositional symbols in the following form: *obs-1-yellow* means a yellow ball was drawn (observed) from box 1, *lab-1-white* means box 1 was initially labeled white, and *True-1-both* means box 1 should actually be labeled 'both' (if you infer that it contains both types of tennis balls).

Incorrect:

white

yellow

both

Observations:

Yellow

White

Yellow