

# 1. Homework

Due **9/11/13** at the beginning of class

## 1. Propositions (6 points)

Consider the following propositions:

$p$ : You get an  $A$  on the final exam.

$q$ : You do every exercise in the book.

$r$ : You get an  $A$  in this class.

Write the propositions below using  $p, q, r$  and logical operators.

- (a) You get an  $A$  in this class, but you do not do every exercise in the book.
- (b) To get an  $A$  in this class, it is necessary for you to get an  $A$  on the final.
- (c) You get an  $A$  on the final, but you don't do every exercise in this book; nevertheless, you get an  $A$  in this class.

## 2. Equivalences (8 points)

Consider the following equivalence:  $(p \rightarrow q) \vee (p \rightarrow r) \equiv p \rightarrow (q \vee r)$

- (a) Show the equivalence using truth tables.
- (b) Show the equivalence by establishing a sequence of equivalences. You may only use equivalences in Table 6 and the first equivalence in Table 7. Show your work by annotating every step.

## 3. NAND (8 points)

Consider the NAND operator  $\uparrow$ , which is defined as  $p \uparrow q \equiv \neg(p \wedge q)$ .

- (a) Show that  $\uparrow$  is not associative, i.e.,  $p \uparrow (q \uparrow r)$  and  $(p \uparrow q) \uparrow r$  are not equivalent.
- (b) Find a compound proposition equivalent to  $p \rightarrow q$  that uses only the operator  $\uparrow$ .

## 4. Logic puzzle (8 points)

Five friends have access to a chat room. Is it possible to determine who is chatting, if the following is known:

- (a) Either Kevin or Heather, or both, are chatting.
- (b) Either Randy or Vijay, but not both, are chatting.
- (c) If Abby is chatting, so is Randy.
- (d) Vijay and Kevin are either both chatting or neither is.
- (e) If Heather is chatting, then so are Abby and Kevin.

Explain your reasoning.