

[40] **Homework 1.** *Basic Logic*

Each problem is worth 10 points

[10] Make truth tables for the following statements:

1.  $p \vee (\overline{r \vee q})$ ;
2.  $(p \wedge \neg q) \rightarrow r$ .

[10] Using *logical equivalences* discussed in class prove that

$$(p \wedge q) \rightarrow (p \vee q)$$

is a tautology, that is, prove that

$$(p \wedge q) \rightarrow (p \vee q) \equiv T.$$

[10] Let

$$P(x, y) : x + y \geq 5 \text{ where } x, y \text{ positive integers.}$$

Tell whether the following statements are true or false:

- $\forall_x \forall_y P(x, y)$
- $\forall_x \exists_y P(x, y)$ .

[10] Which of the following is equivalent to  $\overline{\forall_x \exists_y P(x, y)} \equiv \neg \forall_x \exists_y P(x, y)$ :

- (a)  $\exists_x \overline{\forall_y P(x, y)}$ ;
- (b)  $\forall_x \overline{\exists_y P(x, y)}$ ;
- (c)  $\exists_x \forall_y \overline{P(x, y)}$ ;
- (d)  $\exists_x \exists_y \overline{P(x, y)}$ .