

[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 $\overline{\forall x \exists y P(x, y)}$:

- (a) $\exists x \overline{\forall y P(x, y)}$;
- (b) $\forall x \exists y \overline{P(x, y)}$;
- (c) $\exists x \forall y \overline{P(x, y)}$;
- (d) $\exists x \exists y \overline{P(x, y)}$.