

MAU11602 Assignment 3  
Due 2026-02-19

1. Commutativity of  $\vee$  is expressed by the tautology  $p \vee q \rightarrow q \vee p$ , which was proved in lecture. Associativity of  $\vee$  is expressed by the two tautologies  $p \vee (q \vee r) \rightarrow (p \vee q) \vee r$  and  $(p \vee q) \vee r \rightarrow p \vee (q \vee r)$ . Prove the first of these using a diagram where each step is justified by the inference rules.
2. Similarly, associativity of  $\wedge$  is expressed by the two tautologies  $p \wedge (q \wedge r) \rightarrow (p \wedge q) \wedge r$  and  $(p \wedge q) \wedge r \rightarrow p \wedge (q \wedge r)$ . Prove the first of these using a diagram where each step is justified by the inference rules.