

Are the following arguments valid or invalid? For problem 1, use both the tree method and a truth table.

- Ex 1**
1. $p \leftrightarrow q$
 2. $q \vee (\sim p)$

$\therefore q \wedge p$

- Ex 2**
1. $(p \vee r) \rightarrow q$
 2. $(\sim r) \vee (\sim q)$
- $\therefore \sim r$

- Ex 3**
1. $(p \rightarrow q) \vee (\sim r)$
 2. $\sim (r \vee (q \wedge s))$
 3. $s \rightarrow ((\sim r) \rightarrow (\sim p))$
- $\therefore (p \vee q) \rightarrow (r \vee s)$