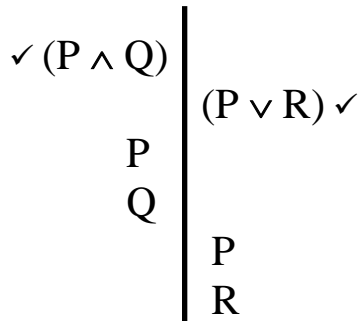


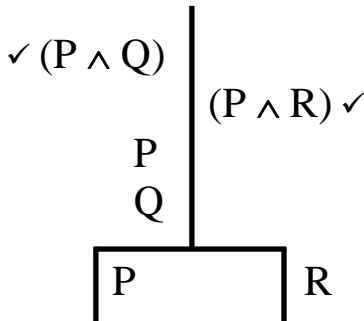
### 2.23.1. Truth Tree Problems

A. For each of the following truth trees, state for each **tree path** whether it **violates** the **Principle of Bivalence**. (If a tree path violates Bivalence, state which **sentence letter(s)** on that path are to blame.)

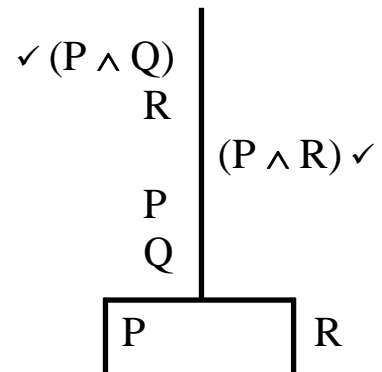
(1)



(2)

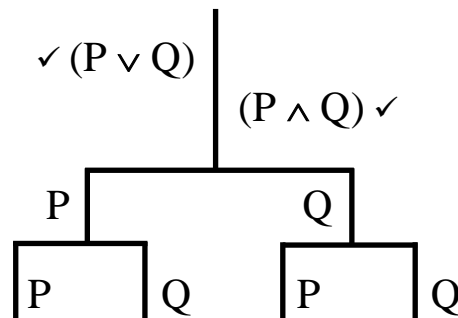


(3)



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(4)



**B.** Based on your answers to the problems in (A), state for each of the following arguments whether that argument is **valid**.

1.  $(P \wedge Q) \therefore (P \vee R)$

2.  $(P \wedge Q) \therefore (P \wedge R)$

3.  $(P \wedge Q) \cdot R \therefore (P \wedge R)$

4.  $(P \vee Q) \therefore (P \wedge Q)$

**C** For each of the following arguments, use a **truth tree** to show whether or not the argument is **valid**.

1.  $P \therefore (P \vee Q)$

2.  $P \therefore \sim(P \wedge Q)$

3.  $P \therefore (P \wedge Q)$

4.  $Q \cdot R \therefore (Q \wedge R)$

5.  $(P \wedge \sim Q) \cdot \sim R \therefore (Q \vee R)$

6.  $\sim(P \vee Q) \cdot (R \wedge \sim S) \therefore (Q \vee R)$