1 Logic Problems:

Find truth tables for the following statement forms:

1. $((p \to q) \wedge (q \to r)) \to (p \to r)$
2. $(p \vee q) \wedge (p \vee r)$
3. $p \vee (q \wedge r)$
4. $p \oplus q \oplus r$
5. $(p \to q) \vee (q \to p)$
6. $(p \leftrightarrow q) \leftrightarrow (\sim (p \oplus q))$

Prove the following logical equivalences and logical implications:

1. $\sim (P \vee Q) \Leftrightarrow \sim P \wedge \sim Q$
2. $(P \to Q) \Leftrightarrow [(P \wedge \sim Q) \to c]$
3. $(p \wedge q) \Rightarrow p$
4. $[(p \to q) \wedge (r \to s)] \Rightarrow [(p \wedge r) \to (q \wedge s)]$
5. $p \wedge (p \to q) \Rightarrow q$
6. $(p \vee q) \wedge \sim p \Rightarrow q$

Determine if the following arguments are valid or not:

1. Robin is a school teacher. If someone is a school teacher, then they have weekends off. Therefore, Robin has weekends off.
2. When Jeff visits family, he goes to Pennsylvania. Jeff is in Pennsylvania. Therefore, Jeff is visiting family.
3. If a bacteria is present, a rash and fever are present. A fever is present. A rash is not present. Therefore, the bacteria is not present.
4. A crime is serious if both television and paper report on it. If there is a robbery, the television reports on it. If there is a car chace, the paper reports it. There is a crime of robbery followed by a car chase. Then the crime is serious.