1. Let \( p \) and \( q \) be the propositions:
   - \( p \): I bought a lottery ticket this week.
   - \( q \): I won a million dollars

Express the following propositions as English sentences:

(a) \( \overline{p} \)
(b) \( p \lor q \)
(c) \( p \rightarrow q \)
(d) \( p \land q \)
(e) \( p \leftrightarrow q \)
(f) \( \overline{p} \rightarrow \overline{q} \)
(g) \( \overline{p} \land \overline{q} \)
(h) \( \overline{p} \lor (p \land q) \)

2. Explain, without using truth tables, why \((p \lor q) \land (q \lor r) \land (r \lor \overline{p})\) is true when \( p, q, \) and \( r \) have the same truth value and not otherwise.

3. When planning a gathering to watch the Cardinals, you want to know whom to invite. Among the people you would like to invite are three touchy friends. You know that if Jasmine attends, she will become unhappy if Samir is there. Samir will attend only if Kanti will be there. Kanti will not attend unless Jasmine also does. Which combinations of these three friends can you invite so as to not make someone unhappy.

4. Five friends have access to a chat room. Is it possible to determine who is chatting if the following information is known? Either Kevin or Heather, or both, are chatting. Either Randy or Vijay, but not both, are chatting. If Abby is chatting, so is Randy. Vijay and Kevin are either both chatting or neither is. If Heather is chatting, then so are Abby and Kevin. Explain your reasoning.

5. Show that \((p \rightarrow q) \lor (p \rightarrow r)\) and \(p \rightarrow (q \lor r)\) are logically equivalent.

6. Show that \((p \lor q) \land (\overline{p} \lor r) \rightarrow (q \lor r)\) is a tautology.