1. (4 pts) Let p, q, and r be the following propositions.
   p: You have the flu.
   q: You miss the final exam.
   r: You pass the course.
   Express each of the following propositions as English sentences.
   (a) \( q \rightarrow \neg r \)
   (b) \((p \land q) \lor (\neg q \lor r)\)

2. (4 pts) Determine if these conditional statements are true or false.
   (a) if \( 5+1 = 7 \) then Durham is the capital of NC.
   (b) if Durham is not the capital of NC then \( 5+1 = 7 \)

3. (3 pts) Show that \((p \rightarrow r) \lor (q \rightarrow r)\) is logically equivalent to \((p \land q) \rightarrow r\) with a truth table.

4. (3 pts) There is an island of knights and knaves. The knights always tell the truth. The knaves always lie. You encounter two people, A and B, and they both make a statement. Determine if you can tell what type of people each is or not and reason why.
   A says ”I am a knight”, B says ”I am a knight”

5. (3 pts) Same problem setup as 4) but now there is also a third type of person, a spy who can either lie or tell the truth.
   You encounter three people A, B, and C. You know one is a knight, one is a knave and one is a spy. Each of the three people knows the type of person each of the other two people is. Determine if there is a unique solution of who the knight, knave or spy is. If not list at least two possibilities.
   A says ”I am the knight.”, B says ”A is not the knave”, C says ”B is not the knave”.

6. (3 pts) Determine if the following is satisfiable.
   \((p \lor q \lor \neg r) \land (p \lor \neg q \lor \neg s) \land (p \lor \neg r \lor \neg s) \land (\neg p \lor \neg q \lor \neg s) \land (p \lor q \lor \neg s)\)

7. (3 pts) Show that \((p \rightarrow r) \lor (q \rightarrow r)\) is logically equivalent to \((p \land q) \rightarrow r\) by developing a series of logical equivalences.

8. (3 pts) Show that \(((p \lor q) \land (p \rightarrow r) \land (q \rightarrow r)) \rightarrow r\) is a tautology by developing a series of logical equivalences.