1. Write the truth table of the following proposition

\[(p \rightarrow q) \land (q \rightarrow r)\]

2. Show, by contradiction, that if five teams play eleven games, some pair of teams plays at least two times.

3. Determine whether the following argument is valid.

\[
\begin{align*}
&\quad p \rightarrow (q \land r) \\
&\quad p \land \neg q \\
&\quad r \lor q \\
\hline
\therefore q
\end{align*}
\]

4. Prove or disprove the logical equivalence of the following propositions

\[P : (p \rightarrow q) \lor (q \rightarrow r) \quad Q : p \rightarrow r.\]

5. Write the proposition for any x, for some y, if x < y then \(x^2 < y^2\) using quantifiers and other mathematical symbols and determine whether it is true or not.
6a. What is a tautology? Explain and give an example of one.

6b. What is a contradiction? Explain and give an example of one.

7. Use the mathematical induction to prove that the following statement is true for every positive integer $n$.

$$2^3 + 4^3 + 6^3 + \cdots + (2n)^3 = n^2(n + 1)^2$$

8a. Express the sum of the even integers between $-2003$ and $179$ in sigma notation.

8a. Compute

$$\sum_{i=0}^{2003} (1 + (-1)^i).$$