A. Symbolize, taking the domain of quantification to be persons, and using:

\[ Sx \equiv x \text{ is a soprano.} \quad Tx \equiv x \text{ is a tenor.} \]
\[ Lxy \equiv x \text{ is louder than } y. \quad Rxy \equiv x \text{ respects } y. \]

1. No tenor who is louder than all sopranos respects any soprano.
2. A tenor who is louder than some soprano is also louder than some tenor.
3. There are sopranos who respect only those tenors who are louder than they.
4. If a tenor respects all sopranos who respect him, then that tenor is respected by all sopranos.

B. Symbolize, taking the domain of discourse to be persons, and using only the following vocabulary:

\[ Pxy \equiv x \text{ is a parent of } y \quad Mx \equiv x \text{ is male} \quad Ixy \equiv x \text{ is identical to } y \]
\[ Txy \equiv x \text{ is taller than } y. \]

1. \( x \) and \( y \) are first cousins.
2. \( x \) has at most two daughters.
3. \( x \) has (exactly) two grandfathers.
4. \( x \) is the tallest child of \( y \).

C.

1. Show that there is a sentence of propositional logic that is not logically equivalent to any sentence whose only connective is “\( \rightarrow \)”. (Hint: Use proof by induction.)
2. Show that the inference rule \( \lor \)-Elimination is sound; that is, if line \( n \) results from lines \( i, j, k, l, m \) by \( \lor \)-Elimination, and lines \( i, k, m \) are “good”, then line \( n \) is good. (Definition: A line is good if the sentence to the right of the line number is a semantic consequence of the sentences on the dependency lines. A sentence \( B \) is a semantic consequence of sentences \( A_1, \ldots, A_n \) if: for any valuation \( v \), if \( v \) assigns true to \( A_1, \ldots, A_n \) then \( v \) assigns true to \( B \). We denote this by \( A_1, \ldots, A_n \models B \). A propositional logic valuation is an assignment of truth values to sentences that obeys the truth-table relationships.)