Question 1. (10 points)

Let h, h' be two propositional clauses or conjunctions. Show that $\mathsf{lgg}(h, h') = \mathsf{Lits}(h) \cap \mathsf{Lits}(h')$ is a least general generalization of h, h'.

Question 2. (15 points)

Determine if

1. $h \subseteq_\theta h'$
2. $h' \models h$

for

$$h = \mathrm{p}(x, y) \wedge \mathrm{p}(y, z) \wedge \neg\mathrm{p}(x, z)$$
$$h' = \mathrm{p}(\mathsf{a}, \mathsf{b}) \wedge \mathrm{p}(\mathsf{b}, \mathsf{c}) \wedge \mathrm{p}(\mathsf{c}, \mathsf{d}) \wedge \neg\mathrm{p}(\mathsf{a}, \mathsf{d})$$

Question 3. (5 points)

Consider the following statements

1. $X =$ non-self-resolving FOL clauses
2. $X =$ contingent FOL clauses
3. There is no $k \in \mathbb{N}$, $x \in X$ such that $h_k \models x$ and $h_k \not\subseteq_\theta x$, where h_k ($k \in \mathbb{N}$) are the hypotheses of the generalization algorithm.

Decide for each of the implications $1 \to 2$, $1 \to 3$, $2 \to 3$, whether it is true. Change the relation $h_k \models x$ in (3) so that all the implications you decided true are true when (1) and (2) assume conjunctions instead of clauses.

Question 4. (1 points)

Find two different least general generalizations of $\mathrm{p}(\mathsf{a})$ and $\mathrm{p}(\mathsf{b}) \vee \mathrm{p}(\mathsf{c})$, prove that they are indeed generalizations of the two clauses and prove that they are mutually θ-equivalent. Explain why two least general generalizations of the same pair of clauses or conjunctions must be θ-equivalent.

Question 5. (10 points)

Explain why the proof of the mistake bound n of the generalization algorithm is no longer valid when the assumption on X is changed to $X =$ non-self-resolving FOL conjunctions or non-self-resolving FOL conjunctions clauses, the relations $\subseteq, \subset$ are changed to $\subseteq_\theta, \subset_\theta$ (respectively), and we set $n = |\mathcal{P}|$. Show that the proof cannot be rectified, in particular that no finite mistake bound exists under said assumption even if $\mathcal{F} = \emptyset$.