1. Consider the following UML class diagram.

![UML class diagram]

i. Express it in FOL.
ii. Express it in ALCQI or SHIQ.
iii. Express it in DL-lite, highlighting parts that are not expressible.
iv. Check whether the resulting DL-lite TBox is consistent with the ABox \{D(d)\}.

Recall that to do this check one has to verify that the boolean conjunctive query

\( q() : \neg B(x), C(x) \)

returns false.

2. Consider the following transition system:

\( T \)

Model check the following formulas:

\( \nu X.\mu Y.((a \land \langle next \rangle X) \lor \langle next \rangle Y) \quad \exists R.(\exists R.A \cap \exists R.B) \subseteq \forall R.(\exists R.A) \)

\( AG(b \rightarrow EXa) \)

3. Check using tableaux whether the following ALC subsumption holds, and if not show a counterexample:

\( \exists R.(\exists R.A \cap \exists R.B) \subseteq \forall R.(\exists R.A) \)

4. Compute the weakest precondition for getting \{x=y\} executing the following program:

\[
\begin{align*}
x &:= 10; \\
\text{if } (y>1) \text{then} &\quad x:=x-y; \\
\text{else } &\quad x := x-y; \\
&\quad x := y-1
\end{align*}
\]

5. Check whether CQ \( q1 \) is contained in CQ \( q2 \) below, reporting canonical DBs and homomorphism:

\( q1(x) : -e(x,x) \)

\( q2(x) : -e(x,y), e(y,z) , e(x,y) \)