Problem 1

Consider the following three simple constraints about three unknown LTL formulas $F$, $G$, and $H$:

\[
F \equiv a \lor (G \land H)
\]
\[
G \equiv b \land \Diamond F
\]
\[
H \equiv c \land \Diamond F
\]

Find (standard non-recursive) LTL formulas to stand for $F$, $G$, and $H$ above such that the constraints are satisfied and the formulas represent the smallest set of paths satisfying the constraints.

(a) $F \equiv$

(b) $G \equiv$

(c) $H \equiv$
Problem 2

Exercise 6.2. Consider the following CTL formulae and the transition system TS outlined on the right:

\[ \Phi_1 = \forall(a \lor b) \lor \exists \lozenge (\forall \lozenge b) \]
\[ \Phi_2 = \forall \lozenge \forall(a \lor b) \]
\[ \Phi_3 = (a \land b) \rightarrow \exists \lozenge \exists \lozenge \forall(b \mathcal{W} a) \]
\[ \Phi_4 = (\forall \lozenge \exists \lozenge \Phi_3) \]

Determine the satisfaction sets \( \text{Sat}(\Phi_i) \) and decide whether \( TS \models \Phi_i \) (1 ≤ i ≤ 4).