P1. Consider the following traces (ω-strings) involving systems with state variables x, y

\[
\begin{array}{c|cccccccccc}
   x & 1 & 0 & 1 & 0 & -1 & 0 & 1 & 0 & -1 & 1 & -1 & 1 & (-1 & 1)\omega & \cdots \\
   y & 0 & -1 & 0 & -1 & -1 & 0 & 2 & 0 & -1 & 2 & -1 & 2 & (-1 & 2)\omega & \cdots \\
\end{array}
\]

For each of the temporal formulas below, explain whether or not they hold on the trace. Write a short justification.

(a) \(\Box (x > 0)\)
(b) \(\Diamond (x \leq 0)\)
(c) \(\Diamond \Box (y \leq x)\)
(d) \(\Box \Diamond (y = x)\).
(e) \(\Diamond \Box (|x - y| \leq 1)\)
(f) \((y \leq x)\)
(g) \((y \leq x) \mathcal{U} (y = 2)\)
(h) \((|x - y| \leq 1) \mathcal{U} (|x - y| = 2)\).
(i) \(\Diamond (x - y = 1)\).

P2 Draw \(\omega\)-automata for formulae (a), (c), (e), (g) and (i) above.

P3 Consider the following system:

state x : int initially 0;
state y : int initially 0;
  if ( x == 1) 
    x := 0; y := 0;
  else
    x := 1; y := -1;

For each of the formulae (a) - (i) in P1, explain whether they hold on the system or not with a short justification.