Don’t Cares

1. Observability Don’t Cares:
   For which settings of \( x, y \) does the output of U1 “not matter” for the final output of the circuit?

   When \( y = 1 \), the output of U1 does not matter, since the output of U3 will always be 0.

2. Satisfiability Don’t Cares:
   Which setting of the input wires to U1 cannot occur?

   Top wire = 0 and bottom wire = 1 can never occur, since top wire is \( x \), bottom wire is \( xy \).

Universal Gates

1. Prove that the 3-input gate \( f(x, y, z) = x\bar{y}z + x + y\bar{z} \) is universal.

   \[
   \begin{align*}
   Not(x) &= f(0,1,x) \\
   OR(x, y) &= f(x, y, 0) \\
   AND(x, y) &= f(0, x, \bar{y}) = f(0, x, f(0,1, y))
   \end{align*}
   \]