

Q1 Consider the table

x	y	z	output
1	1	1	1
1	1	0	1
1	0	1	1
1	0	0	0
0	1	1	0
0	1	0	0
0	0	1	1
0	0	0	0

Write the disjunctive normal form for this table.

Write out the circuit for this form

Next simplify the normal form as much as you can and write out the circuit for the new form.

Q2. Design a logic circuit that inputs the values of three variables x, y, z and outputs a 1 if and only if $x = y$ and $x \neq z$.

Q3. Use Math. Ind. to prove that if X has n elements then $P(X)$ has 2^n elements.

Q4. Let $(x_1, y_1) \sim (x_2, y_2)$ mean $y_1 = y_2$. Show this is an equivalence relation on $\mathbb{R} \times \mathbb{R}$.

Q5. On $\mathbb{N} = \{1, 2, 3, 4, \dots\} \times \mathbb{N}$

define $(n_1, m_1) \sim (n_2, m_2)$ means $\frac{n_1 + m_1}{2} = \frac{n_2 + m_2}{2}$

Show $\sim$ is an equivalence relation.

Q6. On $\mathbb{Z} \times (\mathbb{Z} \setminus \{0\})$, define

$(a_1, b_1) \sim (a_2, b_2)$ means $a_1 b_2 = a_2 b_1$

Show $\sim$ is an equivalence relation.