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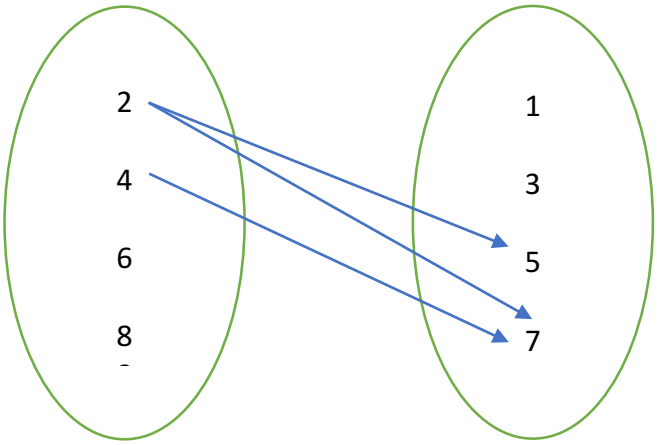
Question 1)

a)

Given $R = \{2, 4, 6, 8\}$ and $S = \{1, 3, 5, 7\}$ and xRy if (y-x) > 1
The relation = {(2,5),(2,7), (4,7)} because:
2R5 since 5-2 > 1
2R7 since 7-2 > 1
4R7 since 7-4 > 1

b)



Question 2)

a	b	$a \Rightarrow b$	$\neg b$	$\neg b \wedge (a \Rightarrow b)$	$\neg a$	$[\neg b \wedge (a \Rightarrow b)] \Rightarrow \neg a$
T	T	T	F	F	F	T
T	F	F	T	F	T	T
F	T	T	F	F	F	T
F	F	T	T	F	T	T

Thus, we have $[\neg b \wedge (a \Rightarrow b)] \Rightarrow \neg a$ is a tautology.

The use of truth table allows me to say that the expression is a tautology because the compound statement of the last column is always true regardless of the truth value of its variables, which is $a,\ b$

Question 3)

p	q	r	$p \vee q$	$p \Rightarrow r$	$q \Rightarrow r$	$(p \vee q) \wedge (p \Rightarrow r) \wedge (q \Rightarrow r)$
T	T	T	T	T	T	T
T	T	F	T	F	F	F
T	F	T	T	T	T	T
T	F	F	T	F	T	F
F	T	T	T	T	T	T
F	T	F	T	T	F	F
F	F	T	F	T	T	T
F	F	F	F	T	T	F

The compound statement $(p \vee q) \wedge (p \Rightarrow r) \wedge (q \Rightarrow r)$ holds the same truth values as r.
Therefore, the conclusion is $[(p \vee q) \wedge (p \Rightarrow r) \wedge (q \Rightarrow r)] \Rightarrow r$

Question 4)

a) The OR gate has the output of NAND gate(=PQ) and the input of P.
Hence, the Boolean expression of the circuit is $S = P + PQ$

b) Proof that the Boolean expression in a) is equivalent to t

Expression	Laws
P + PQ	Original expression
P + (P + Q)	De Morgan's Law
(P + P) + Q	Communicative, Associative Laws
T + Q	Complement Law
T	Identity Law