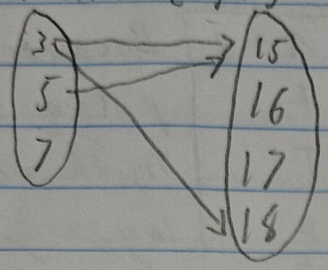
Discrete Structures

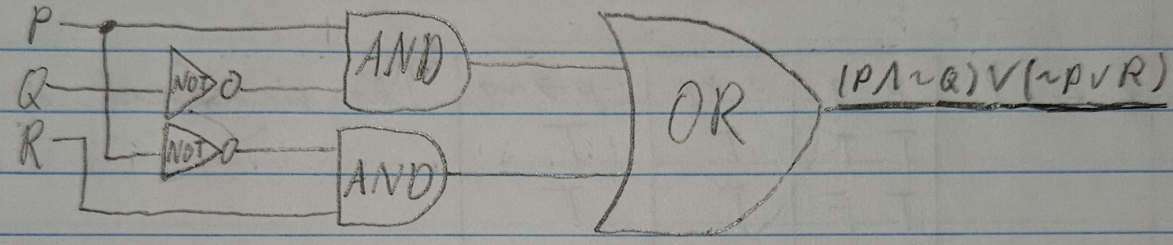
9/22/23 **Quiz 1** Josiah Schmitz

1. a. Yes. No. No. Yes. b. $\{(3,15),(3,18),(5,15)\}$
c. Domain: $\{3,5\}$ Co-domain: $\{15,18\}$
d.



e. No, because 3 has two corresponding elements in the co-domain.

2.



3. a. 1101 1100 1010 1111 → 1101 1110 0010 1111 → (6E2F)
b. 1001 0000 1011 → 0001 0010 0011 0111 → (1237)

4. a. FA90 → 1111 1010 1000 1001 1101 → (1111101010001001 1101)
b. 76ECB → 0111 0110 1110 1100 1011 → (01110110 11101100 1011)

5. c and d

6. a.

p	q	(p ∧ q)	(p ∨ ~q)	(p ∧ q) ∨ (p ∨ ~q)
T	T	T	T	T
T	F	F	T	T
F	T	F	F	F
F	F	F	T	T

6. b.

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

7. a.

p	q	r	$(q \rightarrow r)$	$(p \rightarrow q)$	$p \rightarrow (q \rightarrow r)$	$(p \rightarrow q) \rightarrow r$
T	T	T	T	T	T	T
T	T	F	F	T	F	F
T	F	T	T	F	T	T
T	F	F	T	F	T	T
F	T	T	T	T	T	T
F	T	F	F	T	T	F
F	F	T	T	T	T	T
F	F	F	T	T	T	F

They are not logically equivalent.

b.

p	q	$\sim(p \vee q)$	$\sim p \vee \sim q$
T	T	F	F
T	F	F	T
F	T	F	T
F	F	T	T

They are not logically equivalent.

8. a.

p	q	$(p \wedge q)$	$(p \wedge q) \rightarrow p$
T	T	T	T
T	F	F	T
F	T	F	T
F	F	T	F

$(p \wedge q) \rightarrow p$ is not a tautology.

8.b.

p	q	(p → q)	(q → p)	(p → q) ∨ (q → p)
T	T	T	T	T
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

$(p \to q) \vee (q \to p)$ is a tautology.

9. b. No, because the formulas do not equivocate.

$$F(x) = (x+1)(x-3) = x^2 - 2x - 3 = x^2 - 2x + 4 - 7 \neq (x-2)^2 - 7 = G(x)$$

10. $\{(a,x), (a,y), (b,x), (b,y)\}$