SWM. 202135592 한웅재.

#1.

a)

	101	1110
	010	0001
OR	111	1111
AND	000	0000
XOR	111	1111

b)

	1111	0000
	1010	1010
OR	1111	1010
AND	1010	0000
XOR	0101	1010

c)

	00	0111	0001
	10	0100	1000
OR	10	0111	1001
AND	00	0100	0000
XOR	10	0011	1001

d)

	11	1111	1111
	00	0000	0000
OR	11	1111	1111
AND	00	0000	0000
XOR	11	1111	1111

#2.

p	q	$\neg p$	$\neg q$	$p \wedge q$	$p \vee q$	$p \to q$	$\neg(p \to q)$
T	T	F	F	T	T	T	F
T	F	F	T	F	T	F	T
F	T	T	F	F	T	T	F
F	F	T	T	F	F	T	F

↳ Application

a) $(p \wedge q) \to p$

T → T T
F → T T
F → F T
F → F T

b) $p \to (p \vee q)$

T → T T
T → T T
F → T T
F → F T

c) $\neg p \to (p \to q)$

F → T T
F → F T
T → T T
T → T T

d) $(p \wedge q) \to (p \to q)$

T → T T
F → F T
F → T T
F → T T

e) $\neg(p \to q) \to p$

F → T T
T → T T
F → F T
F → F T

f) $\neg(p \to q) \to \neg q$

F → F T
T → T T
F → F T
F → T T

#3.

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

#4.

Let $P(x)$ is "x is a positive number", $Q(x)$ is "x is a negative number", the domain U are nonzero integers. In $\forall x P(x) \vee \forall x Q(x)$, what $\forall x P(x)$ means to determine if x is a positive number about nonzero integers. If $\forall x P(x)$ is true, all values are positive numbers. But nonzero integers include negative numbers. So $\forall x P(x)$ has false value. $\forall x Q(x)$ also has false value because nonzero integers include positive numbers. In Conclusion, Truth value of $\forall x P(x) \vee \forall x Q(x)$ is false.

Next, Let's look at the truth value of $\forall x (P(x) \vee Q(x))$ under the Same Condition. $\forall x (P(x) \vee Q(x))$ means that x is positive or negative number about nonzero integers. At this point, whether x is positive or negative number, $P(x) \vee Q(x)$ is true by disjunction. In Conclusion, $P(x) \vee Q(x)$ is true about nonzero integers. So $\forall x (P(x) \vee Q(x))$ is true.

If $\forall x P(x) \vee \forall x Q(x)$ and $\forall x (P(x) \vee Q(x))$ are logically equivalent, these have to be same under the same condition. But these are not equal. So two expressions are not logically equivalent.

#5.

a) some student has sent an e-mail message to some student.

b) some student has sent an email message to Every student.

c) Every student has sent an e-mail message to some student.

d) An e-mail massage has been sent to some student by Every student.

e) An e-mail massage has been sent to every student by some student.

f) Every student has sent an e-mail message to every student.

6.

a) x, y are positive real numbers. Some y belong to $0<y<x$ for some number x, for every number y. when square of some y in $0<y<x$ are smaller than x in $y<x$, Many y exist under the same conditions. For example, when $x=4, y=2$, it satisfies $x \le y^2$. but if the range of y is $0<y<2$, these don't satisfy $x \le y^2$. so $\exists x \forall y (x \le y^2)$ is false.

b) If $x=0$, y^2 is always same or greaterthan 0. $\exists x \forall y (x \le y^2)$ is true.

c) If $x<0$, y^2 is always greater than 0. $\exists x \forall y (x \le y^2)$ is true.