

Dz 1

$$1) \neg(P \rightarrow R) \rightarrow ((P \rightarrow (R \rightarrow Q)) \rightarrow (P \rightarrow R)) =$$

P	R	Q	$P \rightarrow R$	$P \rightarrow (R \rightarrow Q)$	$P \rightarrow R$	$(P \rightarrow (R \rightarrow Q)) \rightarrow (P \rightarrow R)$	$\neg(P \rightarrow R)$	$\neg(P \rightarrow R) \rightarrow ((P \rightarrow (R \rightarrow Q)) \rightarrow (P \rightarrow R))$
0	0	0	1	1	1	1	0	1
0	0	1	1	1	1	1	0	1
0	1	0	1	1	1	0	1	1
0	1	1	1	1	1	0	1	1
1	0	0	0	1	0	1	1	1
1	0	1	0	1	0	1	1	1
1	1	0	1	0	1	0	1	1
1	1	1	1	1	1	0	1	1

$$C\varphi \wedge \psi = \bar{P}\bar{R}\bar{Q} \vee \bar{P}\bar{R}Q \vee \bar{P}R\bar{Q} \vee \bar{P}RQ \vee P\bar{R}\bar{Q} \vee P\bar{R}Q \vee PR\bar{Q} \vee PRQ$$

$$C\varphi \wedge \psi = (C\varphi \wedge \psi(A)) = \text{mem}, \tau \wedge \tau \equiv \tau$$

$$2) (\bar{x} \rightarrow \bar{y}) \rightarrow ((y \wedge z) \rightarrow (x \wedge z))$$

x	y	z	$\bar{x}$	$\bar{y}$	$\bar{x} \rightarrow \bar{y}$	$y \wedge z$	$x \wedge z$	$(\bar{x} \rightarrow \bar{y}) \rightarrow ((y \wedge z) \rightarrow (x \wedge z))$
0	0	0	1	1	1	0	0	1
0	0	1	1	1	1	0	0	1
0	1	0	1	0	0	0	0	1
0	1	1	1	0	0	0	0	1
1	0	0	0	1	1	0	0	1
1	0	1	0	1	1	0	0	1
1	1	0	0	0	1	0	0	1
1	1	1	0	0	1	1	1	1

$$C\varphi \wedge \psi = \bar{x}\bar{y}z \vee \bar{x}\bar{y}\bar{z} \vee x\bar{y}z \vee x\bar{y}\bar{z} \vee \bar{x}yz \vee \bar{x}y\bar{z} \vee x\bar{y}z \vee x\bar{y}\bar{z}$$

$$C\varphi \wedge \psi = (C\varphi \wedge \psi(A)) = \text{mem}, \tau \wedge \tau \equiv \tau$$

$$3) (\bar{x} \rightarrow \bar{y}) \rightarrow (y \vee z)$$

x	y	z	$\bar{x}$	$\bar{y}$	$y \vee z$	$\bar{x} \rightarrow \bar{y}$	$(\bar{x} \rightarrow \bar{y}) \rightarrow (y \vee z)$
0	0	0	1	1	0	0	1
0	0	1	1	1	0	0	1
0	1	0	1	0	1	1	1
0	1	1	1	0	1	1	1
1	0	0	0	1	1	0	0
1	0	1	0	1	1	0	0
1	1	0	0	0	1	1	1
1	1	1	0	0	1	1	1

$$C\varphi \wedge \psi = \bar{x}\bar{y}z \vee \bar{x}\bar{y}\bar{z} \vee x\bar{y}z \vee x\bar{y}\bar{z}$$

$$C\varphi \wedge \psi = (C\varphi \wedge \psi(A)) = \bar{x}\bar{y}z \vee \bar{x}\bar{y}\bar{z} \vee x\bar{y}z \vee x\bar{y}\bar{z} = (\bar{x} \vee \bar{y} \vee z)(\bar{x} \vee \bar{y} \vee \bar{z})$$

$$(\bar{x} \vee \bar{y} \vee z)(\bar{x} \vee \bar{y} \vee \bar{z})$$

$$4) (P \rightarrow Q) \rightarrow (P \wedge R) = (\overline{P \vee Q}) \vee (P \wedge R)$$

P	Q	R	$P \rightarrow Q$	$P \wedge R$	$\neg(P \vee Q)$	$(P \wedge R)$
0	0	0	1	0	1	0
0	0	1	1	0	1	0
0	1	0	1	0	0	0
0	1	1	1	0	0	0
1	0	0	0	0	0	0
1	0	1	0	1	0	1
1	1	0	1	0	0	0
1	1	1	1	1	0	1

$$CP \wedge Q = \overline{P} \overline{Q} \overline{R} \vee \overline{P} \overline{Q} R \vee P \overline{Q} R$$

$$CK \wedge R = \overline{P} \overline{Q} R \vee \overline{P} Q \overline{R} \vee \overline{P} Q R \vee P \overline{Q} R \vee P \overline{Q} \overline{R} = (\overline{P} \overline{Q} R) \vee (\overline{P} Q \overline{R}) \vee (\overline{P} Q R) \vee (P \overline{Q} R) \vee (P \overline{Q} \overline{R})$$

5.1

$$a) (a \wedge b) \vee (c \wedge d) = (a \vee c) \wedge (b \vee d)$$

$$b) (a \vee b) \wedge (c \vee d) = (a \wedge c) \vee (a \wedge d) \vee (b \wedge c) \vee (b \wedge d) = (a \wedge c) \vee (a \wedge d) \vee (b \wedge c) \vee (b \wedge d)$$

$$g) (a \wedge b) \vee (c \wedge d) = (a \wedge b) \vee (c \wedge d) \vee (a \wedge c)$$

$$(a \wedge b) \vee (c \wedge d) = (a \vee c) \wedge (b \vee d) = (a \wedge b) \vee (a \wedge c) \vee (b \wedge c) \vee (b \wedge d) \vee (c \wedge d) \vee (a \wedge d)$$

$$X = \{1, 1, 0, 1, 0, 1, 1, 0, 1, 0\}$$

$$Y = \{1, 0, 1, 1, 1, 0, 1, 1, 0, 1\}$$

$$Z = \{1, 0, 1, 0, 0, 1, 1, 1, 0, 0\}$$

$$a) A = [(X \vee Y) \wedge Z] \wedge [(X \wedge Z) \vee (Y \wedge Z)]$$

XYZ	XUY	X \ Z	Y \ Z	0	1	A
0	1	0	0	0	0	0
0	0	0	0	1	1	0
0	1	0	0	0	0	0
1	1	1	1	1	1	0
0	1	0	0	0	0	0
1	0	0	0	0	0	0
1	1	1	1	0	0	0
0	1	0	0	1	1	0
0	1	0	0	1	1	0

$$b) B = (\bar{X} \vee Y) \wedge (\bar{Y} \vee Z) \wedge (\bar{Z} \vee X)$$

XYZ	$\bar{X}\bar{Y}\bar{Z}$	$\bar{X}Y\bar{Z}$	$\bar{Y}YZ$	$\bar{Z}ZX$	B
1 1 1	0 0 0	1	1	1	1
1 0 0	0 1 1	0	1	1	0
0 1 1	1 0 0	1	1	0	0
1 1 0	0 0 1	1	0	1	0
0 1 0	1 0 1	1	0	1	0
1 0 1	0 1 0	0	1	1	0
1 1 1	0 0 0	1	1	1	1
0 1 1	1 0 0	1	1	0	0
1 0 0	0 1 1	0	1	1	0
0 1 0	1 0 1	1	0	1	0

$$c) C = [X \setminus (Y \cap Z)] \vee [Y \setminus (X \cap Z)]$$

XYZ	$Y \cap Z$	$X \cap Z$	$Y \setminus (X \cap Z)$	$X \setminus (Y \cap Z)$	C
1 1 1	1	1	0	0	0
1 0 0	0	0	0	1	1
0 1 1	1	0	1	0	1
1 1 0	0	0	1	1	1
0 1 0	0	0	1	0	1
1 0 1	0	1	0	1	1
1 1 1	1	1	0	0	0
0 1 1	1	0	1	0	1
1 0 0	0	0	0	1	1
0 1 0	0	0	1	0	1

$$d) D = [(X \cap Z) \setminus (X \cap \bar{Z})] \vee (Y \cap Z)$$

XYZ	$X \cap Z$	$X \cap \bar{Z}$	$Y \cap Z$	D
1 1 1	1	0	1	1
1 0 0	0	1	0	0
0 1 1	0	0	1	1
1 1 0	0	1	0	0
0 1 0	0	0	0	0
1 0 1	1	0	0	1
1 1 1	1	0	1	1
0 1 1	0	0	1	1
1 0 0	0	1	0	0
0 1 0	0	0	0	0

$$e) A \setminus (B \cup C) = (A \setminus B) \cap (A \setminus C) \quad f) (A \setminus B) \setminus C = (A \setminus C) \setminus (B \setminus C)$$

ABC	$A \setminus B$	$A \setminus C$	$B \setminus C$	①	②	$A \setminus (B \cup C)$	$(A \setminus B) \setminus C$	$(A \setminus C) \setminus (B \setminus C)$
0 0 0	0	0	0	0	0	0	0	0
0 0 1	0	0	0	0	0	0	0	0
0 1 0	0	0	0	0	0	0	0	0
0 1 1	0	0	0	0	0	0	0	0
1 0 0	1	1	0	1	1	1	1	1
1 0 1	1	0	0	1	0	1	1	0
1 1 0	0	1	1	0	1	0	0	0
1 1 1	0	0	1	0	0	0	0	0



$$e) A \setminus (B \cap C) = (A \setminus B) \cup (A \setminus C)$$

ABC	$B \cap C$	$A \setminus B$	$A \setminus C$	①	②
1 1 1	1	0	0	0	0
1 1 0	0	0	1	1	1
1 0 1	0	1	0	1	1
1 0 0	0	1	1	1	1
0 1 1	1	0	0	0	0
0 1 0	0	0	1	1	1
0 0 1	0	1	0	1	1
0 0 0	0	0	0	0	0

$$u) A \setminus (B \cup C) = (A \setminus B) \cap (A \setminus C) \quad \text{и} \quad (A \cup B) \setminus C = (A \setminus C) \cup (B \setminus C)$$

ABC	$B \cup C$	$A \setminus B$	①	②	ABC	$A \cup B$	$A \setminus C$	$B \setminus C$	①	②
1 1 1	1	0	0	0	1 1 1	1	0	0	0	0
1 1 0	1	0	0	0	1 1 0	1	1	1	1	1
1 0 1	1	1	0	0	1 0 1	1	0	0	0	0
1 0 0	0	1	1	1	1 0 0	1	1	0	0	0
0 1 1	1	0	0	0	0 1 1	1	0	1	1	1
0 1 0	1	0	0	0	0 1 0	1	0	1	1	1
0 0 1	1	1	0	0	0 0 1	0	0	0	0	0
0 0 0	0	0	0	0	0 0 0	0	0	0	0	0

$$u) A \cap (B \cap C) = (A \cap B) \cap (A \cap C)$$

ABC	$B \cap C$	$A \cap B$	$A \cap C$	①	②
1 1 1	1	1	1	1	1
1 1 0	0	1	0	0	0
1 0 1	0	0	1	0	0
1 0 0	0	0	0	0	0
0 1 1	1	0	0	0	0
0 1 0	0	0	0	0	0
0 0 1	0	0	0	0	0
0 0 0	0	0	0	0	0

$$u.s. M = \{a, b, c, d, e, f, g, h, i\}$$

$$A = \{a, b, e, f, i\} \quad B = \{b, c, d, f, h\} \quad C = \{a, d, g, h, i\}$$

$$1) (A \setminus B) \cup (B \cap C) \cup \bar{B} \cap C$$

$$1) \bar{B} = \{a, e, f, i\}$$

$$2) A \setminus \bar{B} = \{b\}$$

$$3) B \cap C = \{d, g, h\}$$

$$4) \bar{B} \cap C = \{e, f\}$$

$$5) (A \setminus \bar{B}) \cup (B \cap C) \cup (\bar{B} \cap C) = \{b, d, e, f, g, h\}$$

NC.1

а) да б) да в) не да г) да д) не да е) да

NC.2

а)  $\bar{A} = \{ \sqrt{3} \in \mathbb{Z} \}$  б)  $\bar{B} = \{ \sqrt{3} \text{ не є целое число} \}$

в)  $\sqrt{2}$  не є цел. число 10

NC.5

а)  $U$  б)  $U$  в)  $U$  г)  $U$

6.14

$$\overline{A \vee B \vee C} = \bar{A} \wedge \bar{B} \wedge \bar{C} \quad 0; 4$$

NC.15

$$f(x_1, x_2) = [x_1 \oplus (\bar{x}_2 \vee x_1)] \leftrightarrow [x_1 \oplus (x_1 \vee x_2)]$$

$x_1$	$x_2$	$x_1 \vee x_2$	$\bar{x}_2$	$\bar{x}_2 \vee x_1$	①	②	f
0	0	0	1	1	0	1	1
0	1	1	0	0	0	1	1
1	0	1	1	1	1	0	1
1	1	1	0	1	1	1	1

NC.16

$$f(x_1, x_2, x_3) = (x_1 \rightarrow \bar{x}_2) \vee [x_2 \oplus (x_1 \rightarrow x_3)]$$

$x_1$	$x_2$	$x_3$	$\bar{x}_2$	$x_1 \rightarrow \bar{x}_2$	$x_1 \rightarrow x_3$	①	f
0	0	0	1	1	0	0	0
0	0	1	1	1	0	0	0
0	1	0	0	0	0	1	0
0	1	1	0	0	0	1	0
1	0	0	1	1	1	1	1
1	0	1	1	1	1	1	1
1	1	0	0	0	1	0	0
1	1	1	0	0	0	1	0

NC.17

$$а) \bar{A} = [(\bar{P} \wedge Q) \oplus (\bar{P} \wedge \bar{Q})] \oplus (P \wedge Q)$$

P	Q	$P \wedge Q$	$\bar{P} \wedge Q$	$\bar{P} \wedge \bar{Q}$	①	②
0	0	0	0	1	0	0
0	1	0	1	0	1	1
1	0	0	0	0	0	0
1	1	1	0	0	1	1



$$d) B = (P \rightarrow R) \rightarrow [(P \rightarrow (R \rightarrow Q)) \rightarrow (P \rightarrow R)]$$

~~| P | Q | R | P → R | R → Q | P → (R → Q) | B |
|---|---|---|-------|-------|-------------|---|
| u | u | u | u     | u     | u           | u |
| u | u | l | u     | l     | l           | u |
| u | l | u | l     | u     | l           | u |
| u | l | l | l     | u     | l           | u |
| l | u | u | u     | u     | u           | u |
| l | u | l | u     | l     | u           | u |
| l | l | u | u     | u     | u           | u |
| l | l | l | u     | u     | u           | u |~~

P	Q	R	P → R	R → Q	P → (R → Q)	B
u	u	u	u	u	u	u
u	u	l	u	l	l	u
u	l	u	l	u	l	u
u	l	l	l	u	l	u
l	u	u	u	u	u	u
l	u	l	u	l	u	u
l	l	u	u	u	u	u
l	l	l	u	u	u	u

N 6.18

$$b) (A \rightarrow \bar{B}) \wedge (A \rightarrow C) = (\bar{A} \vee \bar{B}) \wedge (\bar{A} \vee C) = \bar{A} \vee (\bar{A} \wedge C) \vee (\bar{B} \wedge C)$$

$$g) (A \rightarrow B) \rightarrow A \wedge C = (\bar{A} \vee B) \rightarrow A \wedge C = A \wedge \bar{B} \vee A \wedge C = A \wedge (\bar{B} \vee C)$$

$$m) (A \rightarrow B) \wedge (B \rightarrow A) \wedge (A \vee B) = (\bar{A} \vee B) \wedge (\bar{B} \vee A) \wedge (A \vee B) = \bar{A} \bar{B} \vee A B \wedge (A \vee B) = A B \vee A B = A B$$

$$n) (A \rightarrow B) \wedge (B \rightarrow \bar{A}) = (\bar{A} \vee B) \wedge (\bar{B} \vee \bar{A}) = (\bar{A} \wedge \bar{B}) \vee (\bar{A} \wedge A) = \bar{A} \wedge \bar{B} = \bar{A} \wedge \bar{B}$$

$$o) (P \rightarrow Q) \wedge (P \rightarrow R) = (\bar{P} \vee Q) \wedge (\bar{P} \vee R) = \bar{P} \vee \bar{P} R \vee Q \bar{P} \vee Q R$$

$$m) (\bar{A} B) \wedge (B \vee C) \wedge (A \vee D) = (\bar{A} B \vee \bar{A} B C) \wedge (A \vee D) = \bar{A} B C \vee \bar{A} B D = \bar{A} B (C \vee D)$$

$$y) (\bar{x} \bar{y} \vee \bar{x} y z) \wedge (\bar{x} \vee \bar{x} y \vee \bar{y}) = (\bar{x} \bar{y} \vee \bar{x} y z) \wedge (\bar{x} \vee (\bar{x} \vee \bar{y}) \wedge y) = (\bar{x} \bar{y} \vee \bar{x} y z) \wedge (\bar{x} \vee \bar{x} y) = \bar{x} \bar{y} \vee \bar{x} y z$$

$$q) (A B \wedge (A \vee B)) \vee (A B \wedge (A \vee B)) = (A B) \wedge (A \vee B) \vee (A B) \wedge (A \vee B) = A B \vee A B \vee A B = A B = A \vee B$$

$$r) (A B \wedge (A \vee B)) \wedge (\bar{A} \vee \bar{B}) = (A B \wedge (\bar{A} \vee \bar{B})) \wedge (\bar{A} \vee \bar{B}) = A B \wedge (\bar{A} \vee \bar{B}) = \bar{A}$$

N 7.6

x	y	z	(z → x)	(y → x)	⊕
l	l	l	u	u	u
l	l	u	u	u	l
l	u	l	u	l	l
l	u	u	u	l	l
u	l	l	u	u	u
u	l	u	u	u	u
u	u	l	u	u	u
u	u	u	u	u	u

$$(p \vee q) \vee (x y z \vee \bar{x} y \bar{z} \vee \bar{x} \bar{y} z \vee \bar{y} \bar{z} \bar{x} \bar{y})$$

$$b) (z \wedge y) \rightarrow (y \rightarrow x)$$

$x$	$y$	$z$	$z \wedge y$	$y \rightarrow x$	$\Phi$
1	1	1	1	1	1
1	1	0	0	1	1
1	0	1	0	1	1
1	0	0	0	1	1
0	1	1	1	0	0
0	1	0	0	1	1
0	0	1	0	1	1
0	0	0	0	1	1

$$C \Phi H \Phi = xyz \vee xy\bar{z} \vee x\bar{y}z \vee x\bar{y}\bar{z} \vee$$

$$\vee \bar{x}yz \vee \bar{x}\bar{y}z \vee \bar{x}\bar{y}\bar{z}$$

9.13

$$a) (x \vee y) \rightarrow (\bar{z} \leftrightarrow y)$$

$x$	$y$	$z$	$x \vee y$	$\bar{z} \leftrightarrow y$	$\Phi$	$\bar{\Phi}$
1	1	1	1	0	0	1
1	1	0	1	1	1	0
1	0	1	1	0	0	1
1	0	0	1	1	1	0
0	1	1	1	0	0	1
0	1	0	1	1	1	0
0	0	1	0	0	0	1
0	0	0	0	1	1	0

$$C \Phi H \Phi = xyz \vee x\bar{y}\bar{z} \vee \bar{x}yz$$

$$f = \{1, 0, 1, 1, 0, 0, 0\}$$

$$b) (\overrightarrow{x \leftrightarrow y} \rightarrow \bar{z}) \rightarrow y$$

$x$	$y$	$z$	$x \leftrightarrow y$	$\overrightarrow{x \leftrightarrow y}$	$\Phi$	$\bar{\Phi}$
1	1	1	1	0	0	1
1	1	0	1	0	0	1
1	0	1	0	1	1	0
1	0	0	0	1	1	0
0	1	1	0	1	1	0
0	1	0	1	0	0	1
0	0	1	1	0	0	1
0	0	0	1	0	0	1

$$C \Phi H \Phi = xyz \vee xy\bar{z} \vee \bar{x}\bar{y}\bar{z}$$

$$f = \{1, 1, 0, 0, 0, 1, 0, 0\}$$