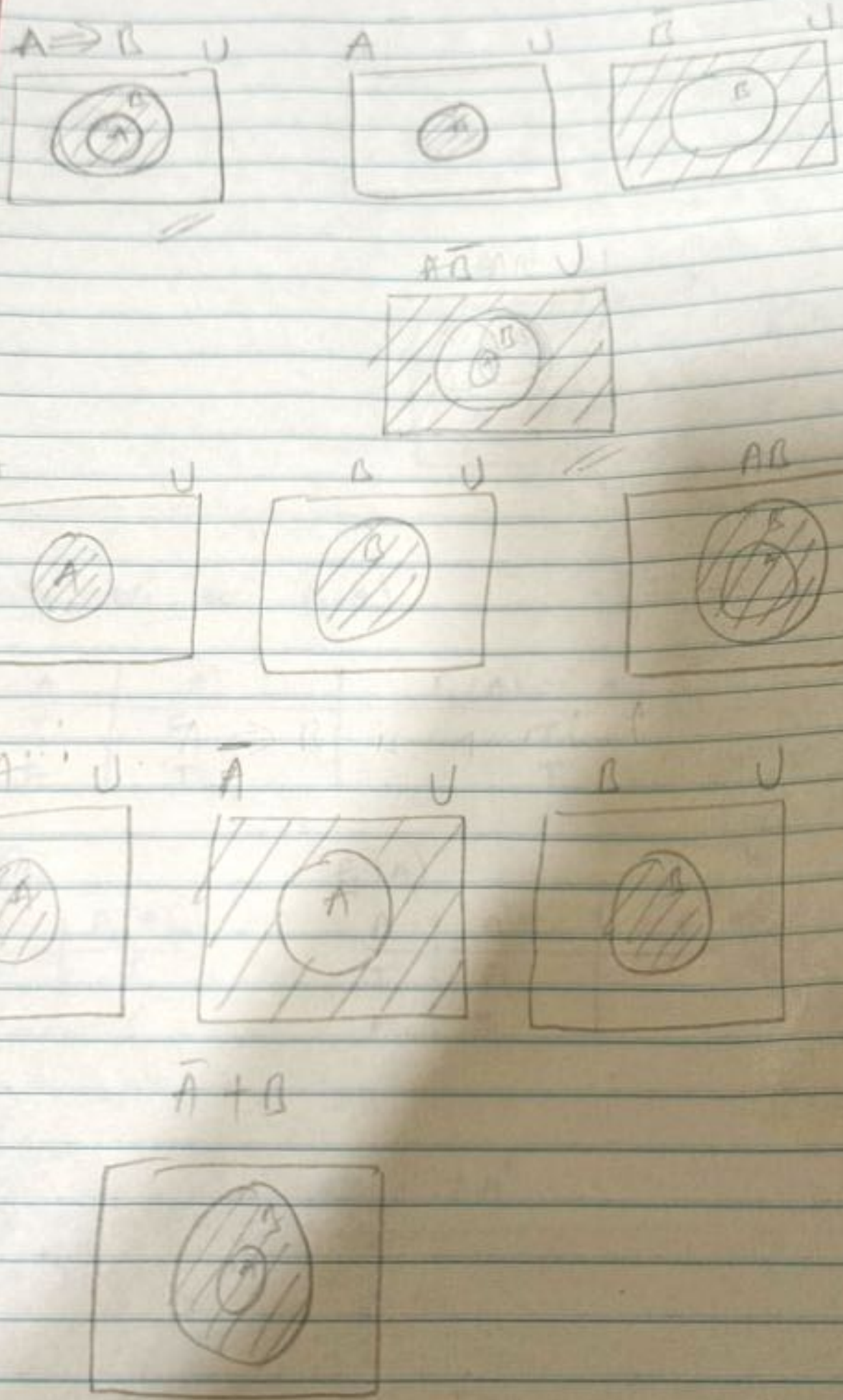
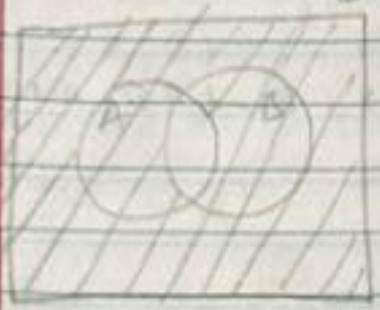
6



7)

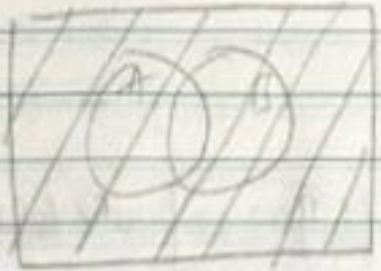
$\overline{A \cdot B}$



$\overline{A} + B$

$\overline{B}$

$A + \overline{B}$



8

Truth table for $f_1(A)$ $(\bar{A} = A')$

A	A'	$f_1(A) = A + A'$
T	F	T
F	T	T

$f_2(A)$

A	$f_2(A)$
T	T
F	F

$f_3(A)$

A	A'	$f_3(A) = A'$
T	F	F
F	T	T

$f_4(A)$

A	A'	$f_4(A) = AA'$
T	F	F
F	T	F

9) Truth table for $f_1(A,B)$

A	B	$f_1(A,B) = A\bar{B}$ → (A and $\bar{B}$ or A + $\bar{B}$)
T	T	T
T	F	F
F	T	F
F	F	F

$f_2(A,B)$

A	B	$\bar{B}$	$f_2(A,B) = A\bar{B}$
T	T	F	F
T	F	T	T
F	T	F	F
F	F	T	F

$f_3(A,B)$

A	A'	B	$f_3(A,B) = \bar{A}B$
T	F	T	F
T	F	F	F
F	T	T	T
F	T	F	F

$f_4(A,B)$

A	A'	B	B'	$f_4(A,B) = \bar{A}\bar{B}$
T	F	T	F	F
T	F	F	T	F
F	T	T	F	F
F	T	F	T	T

10) $f_5(A,B) = f_2(A,B) + f_4(A,B)$

$f_6(A,B) = f_1(A,B) + f_3(A,B) + f_4(A,B)$

$f_5(T,T) = F \quad f_5(T,F) = T \quad f_5(F,T) = F \quad f_5(F,F) = T$

$f_2(T,T) + f_4(T,T) = F+F = F$

$f_2(T,F) + f_4(T,F) = T+F = T$

$f_2(F,T) + f_4(F,T) = F+F = F$

$f_2(F,F) + f_4(F,F) = F+T = T$

Hence,

$$f_5(A,B) = f_2(A,B) + f_4(A,B)$$

$f_6(T,T) = T \quad f_6(T,F) = F \quad f_6(F,T) = T \quad f_6(F,F) = T$

$f_1(T,T) + f_3(T,T) + f_4(T,T) = T+F+F = T$

$f_1(T,F) + f_3(T,F) + f_4(T,F) = F+F+F = F$

$f_1(F,T) + f_3(F,T) + f_4(F,T) = F+T+F = T$

$f_1(F,F) + f_3(F,F) + f_4(F,F) = F+F+T = T$

Hence,

$$f_6(A,B) = f_1(A,B) + f_3(A,B) + f_4(A,B)$$

11) $A \uparrow B = \overline{AB} = \bar{A} + \bar{B}$ $\quad A \downarrow B = \overline{A+B} = \bar{A}\bar{B}$

$\boxed{\bar{A} = A \uparrow A}$

$A \uparrow A = \overline{AA} = \bar{A} + \bar{A} = \bar{A}$

$\Rightarrow \boxed{\bar{A} = A \uparrow A}$

$AB = (A \uparrow B) \uparrow (A \uparrow B) \Rightarrow \overline{AB} \uparrow \overline{AB} = (A \uparrow B) \uparrow (A \uparrow B)$

$= \overline{\overline{AB} \cdot \overline{AB}} = \overline{\overline{AB}} = AB$

$\boxed{AB = (A \uparrow B) \uparrow (A \uparrow B)}$

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$A+B = (A \uparrow A) \uparrow (B \uparrow B)$ $\rightarrow \overline{AA} \uparrow \overline{BB}$

$= (A \uparrow A) \uparrow (B \uparrow B)$

$= \bar{A} \uparrow \bar{B}$

$= \overline{\bar{A}\bar{B}}$

$= \bar{\bar{A}} + \bar{\bar{B}}$

$= A + B$

$\boxed{A+B = (A \uparrow A) \uparrow (B \uparrow B)}$

$\bar{A} = A \downarrow A$, $A \downarrow A = \overline{A+A} = \bar{A}\bar{A} = \bar{A}$

$\boxed{\bar{A} = A \downarrow A}$

$A+B = (A \downarrow B) \downarrow (A \downarrow B) = \overline{(A+B)} \downarrow \overline{(A+B)} = \overline{(A+B)} + \overline{(A+B)}$

$= \bar{\bar{A}}\bar{\bar{B}} + \bar{\bar{A}}\bar{\bar{B}} = (A+B)(A+B) = A+B$

$\boxed{A+B = (A \downarrow B) \downarrow (A \downarrow B)}$

$\boxed{(A \downarrow A) \downarrow (B \downarrow B) = A B}$ $= \overline{(A+A)} \downarrow \overline{(B+B)} = \bar{A}\bar{A} \downarrow \bar{B}\bar{B}$

$= \bar{A} \downarrow \bar{B}$

$= \bar{A} + \bar{B} = \bar{A} + \bar{B}$

$= AB$

$\boxed{AB = (A \downarrow A) \downarrow (B \downarrow B)}$

12C

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