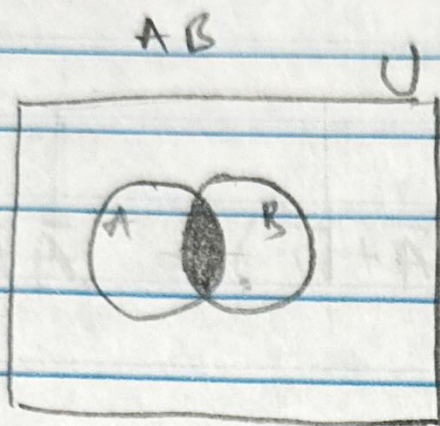
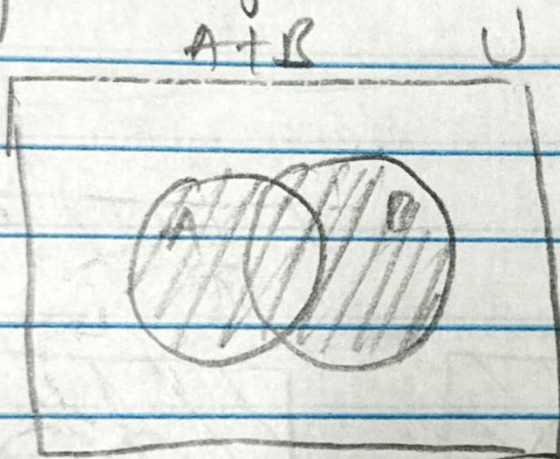


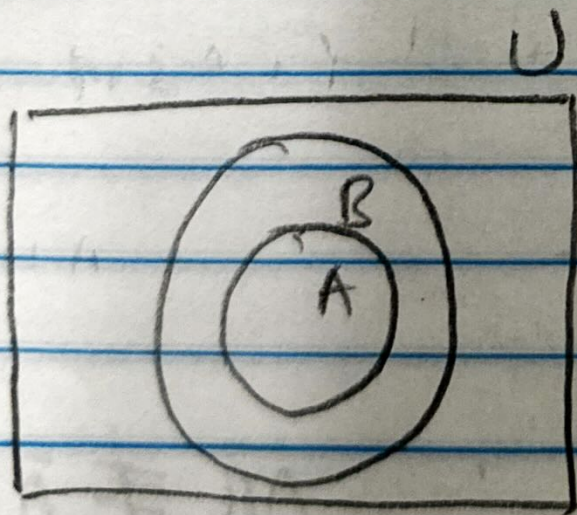
7) Logical conjunction -  $AB$



8) Logical Disjunction -  $A+B$



10)  $A \Rightarrow B$





$$11) \overline{C(A+B)} = \overline{CA + CB}$$

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

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

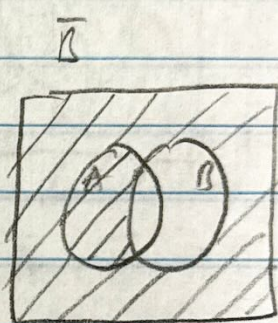
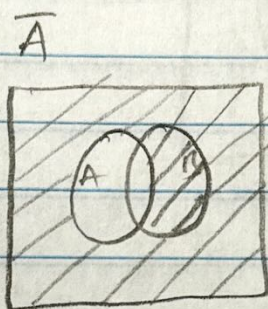
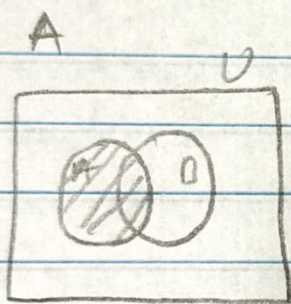
$$= \bar{C}(\bar{A} + \bar{B})$$

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

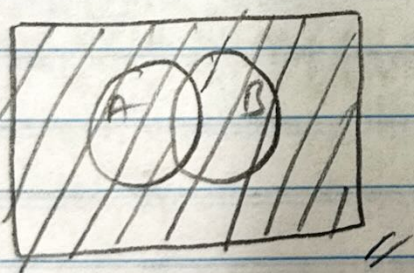
$$= \bar{C}(\bar{A}\bar{B})$$

$$\therefore \overline{C(A+B)} = \bar{C}(\bar{A}\bar{B})$$

$$12) \overline{AB} \neq \bar{A}\bar{B}$$

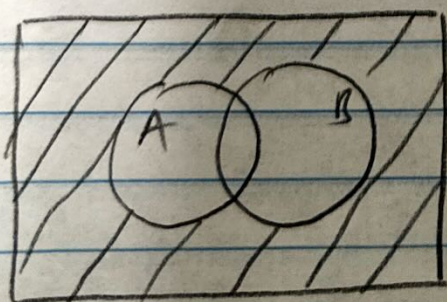


$\overline{AB}$



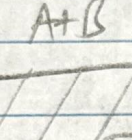
$\bar{A}\bar{B}$

$$\therefore \overline{AB} \neq \bar{A}\bar{B}$$

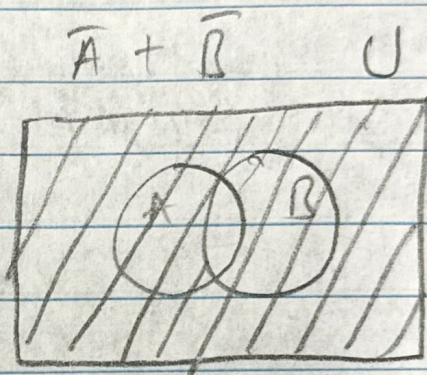




$\overline{A+B}$  U



A Venn diagram illustrating the complement of the union of two sets,  $\overline{A+B}$ . A large rectangle is filled with diagonal lines, representing the universal set. Inside the rectangle, two overlapping circles are labeled 'A' and 'B'. The area outside both circles, which is the complement of the union of A and B, is shaded with diagonal lines.



$$\overline{A+B} \neq \overline{A} + \overline{B}$$

$$14) (A \uparrow A) \uparrow (\underbrace{((A \uparrow B) \uparrow (A \uparrow B))}_{AB} \uparrow \underbrace{((A \uparrow B) \uparrow (A \uparrow B))}_{AB}) = A$$

$$\Rightarrow \bar{A} \uparrow AB \uparrow AB$$

2      A



$$\begin{array}{lcl}
 15) & (A \uparrow A) \downarrow (B \uparrow B) \equiv (\bar{A} \downarrow \bar{A}) \uparrow (\bar{B} \downarrow \bar{B}) & \\
 & \begin{array}{cc} \downarrow & \downarrow \\ \bar{A} & \bar{B} \end{array} & \begin{array}{cc} \downarrow & \downarrow \\ \bar{A} & \bar{B} \end{array} \\
 & \overline{A \downarrow B} & \overline{A \uparrow B} \\
 = & \overline{A + B} & \Rightarrow \overline{AB} \\
 = & \boxed{AB} & = \boxed{AB}
 \end{array}$$

$$(A \uparrow A) \downarrow (B \uparrow B) \equiv (\bar{A} \downarrow \bar{A}) \uparrow (\bar{B} \downarrow \bar{B})$$

$$16)$$

A, B	TT	TF	FT	FF
$f_1(A, B)$	T	F	F	F
$f_2(A, B)$	F	T	F	F
$f_3(A, B)$	F	F	T	F
$f_4(A, B)$	F	F	F	T

$$f_1(A, B) + f_3(A, B) + f_4(A, B) \equiv A \Rightarrow B$$

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

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

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

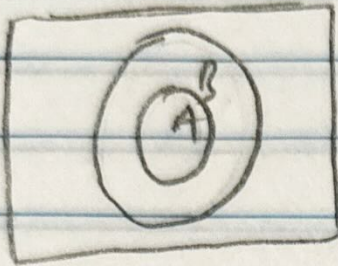
$$f_1(F, F) + f_3(F, F) + f_4(F, F) = T$$

$$\begin{array}{lcl}
 A \Rightarrow B & A \Rightarrow B & f_1(A, B) + f_3(A, B) + f_4(A, B) \\
 (T, T) & T & \\
 (T, F) & F & \\
 (F, T) & T & \\
 (F, F) & T & \\
 & & \equiv A \Rightarrow B
 \end{array}$$

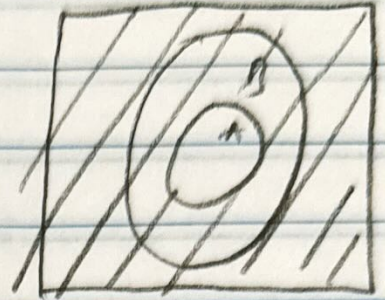


$$17) (A \Rightarrow B) \equiv (\bar{B} \Rightarrow \bar{A})$$

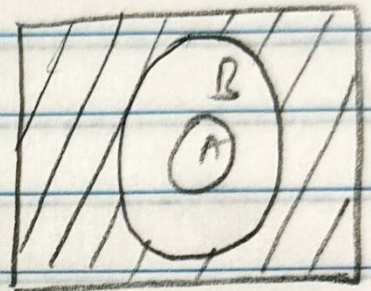
↓



$\bar{A} =$



$\bar{B} =$



for every True value of A  
B is True

But for every false value of A  
B is not necessarily false

Similarly,

for every True value of  $\bar{B}$   
 $\bar{A}$  is true

But for every false value of  $\bar{B}$   
 $\bar{A}$  is not necessarily false.

$$\therefore A \Rightarrow B \equiv \bar{B} \Rightarrow \bar{A}$$