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

$\overline{\bar{A} \downarrow B}$ $\qquad$ $\bar{A}\bar{A} \uparrow \bar{B}\bar{B}$

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

$A\bar{B}$ $\qquad \equiv \qquad$ $\overline{A\bar{B}}$

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

$\bar{A} \uparrow (\overline{A\bar{B}} \uparrow \overline{A\bar{B}}) \uparrow (\overline{A\bar{B}} \uparrow \overline{A\bar{B}})$

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

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

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

3) $B \Rightarrow A$

$A\bar{B}$ is false

$\bar{B} + \bar{A}$ is true

$B = \bar{A}B$

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

F F T F T T F T

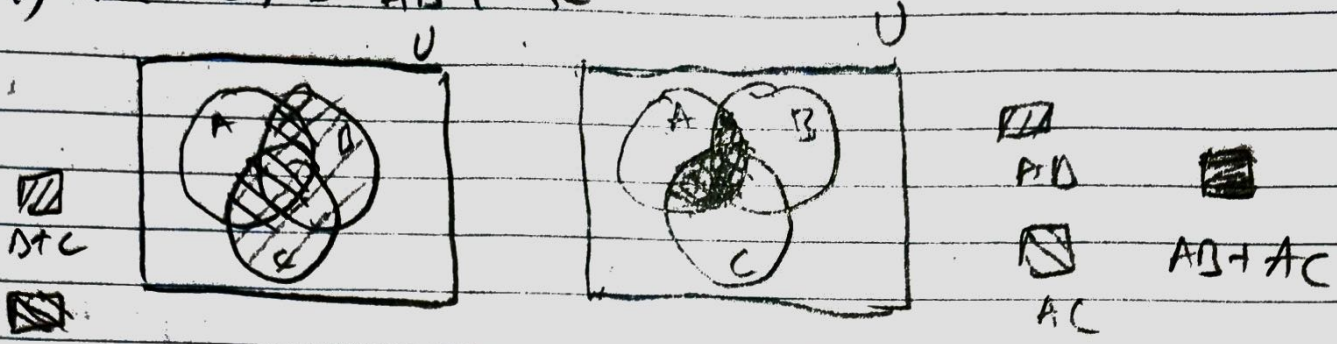
F T T

F

$F + T = T$

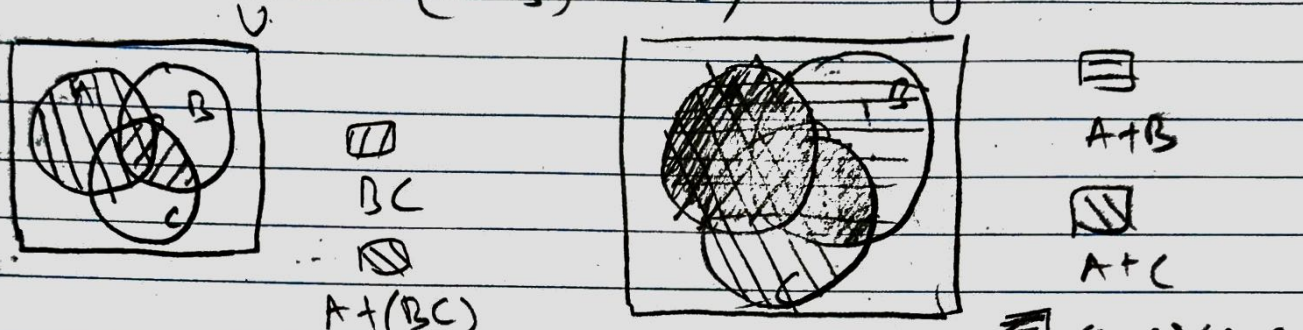
$\therefore (A+\bar{B})(\bar{A} + A\bar{B}) + \bar{A}B(A+B)$ is T

4) $A(B+C) = AB + AC$



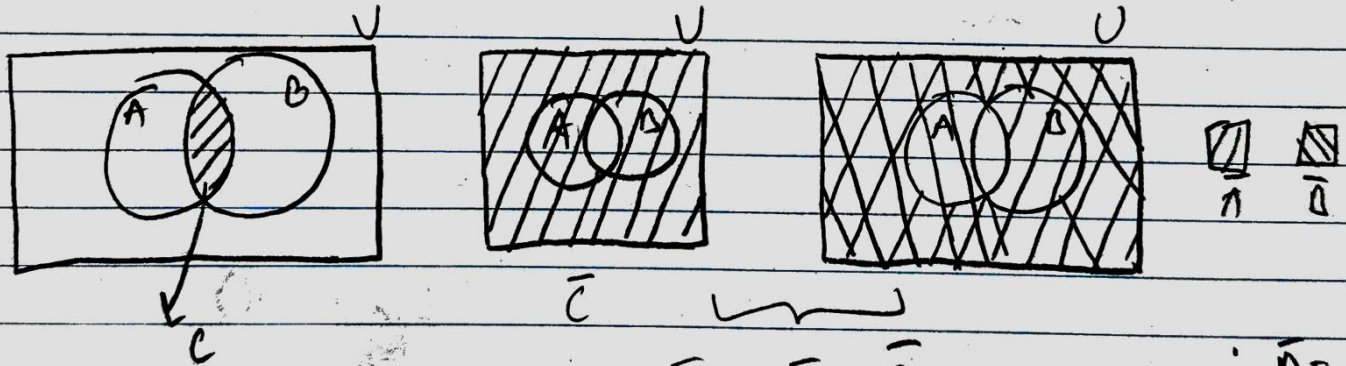
$\therefore A(B+C) = AB + AC$

$A + (BC) = (A+B)(A+C)$



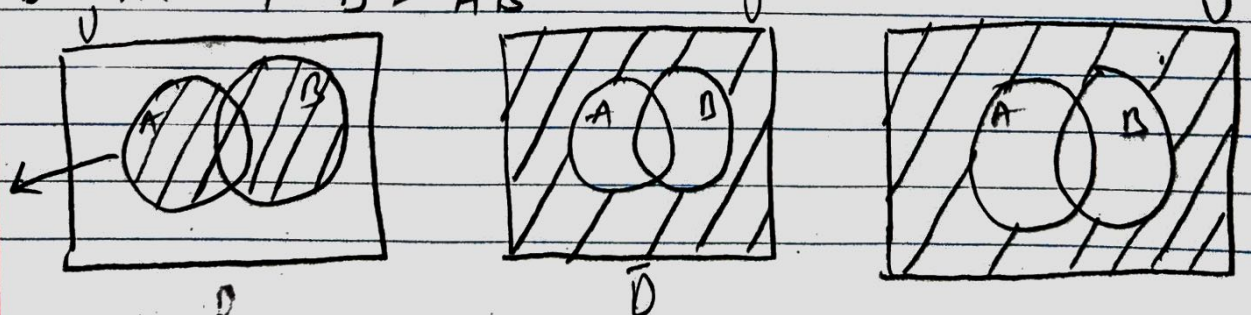
$\therefore A+(BC) = (A+B)(A+C)$

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



$\therefore \bar{D} = \bar{A}\bar{B}$

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



5) $A(B+C) = AB + AC$

A	B	C	A(B+C)	AB	AC	AB + AC
T	T	T	T	T	T	T
T	T	F	T	T	T	T
T	F	T	T	T	T	T
T	F	F	T	T	T	T
F	T	T	T	T	T	T
F	T	F	F	T	F	F
F	F	T	F	F	T	F
F	F	F	F	F	T	F

$\therefore A(B+C) = AB + AC$

$A + (BC) = (A+B)(A+C)$

A	B	C	A + (BC)	(A+B)(A+C)
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	F	F
F	T	T	F	F
F	T	F	F	F
F	F	T	F	F
F	F	F	F	F

$\therefore A + (BC) = (A+B)(A+C)$

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

A	B	C	AB	$\bar{C}$	$\bar{A} + \bar{B}$
T	T	T	T	F	F
T	T	F	T	T	T
T	F	T	T	F	F
T	F	F	T	T	T
F	T	T	T	F	F
F	T	F	T	T	T
F	F	T	F	F	F
F	F	F	F	T	T

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

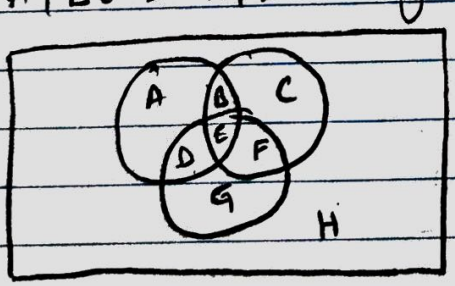
$D = A + B$ $\quad \bar{D} = \bar{A}\bar{B}$

A	B	D	$\bar{D}$	$\bar{A}\bar{B}$	A+B
T	T	T	F	F	T
T	F	F	T	T	T
F	T	F	T	T	T
F	F	F	T	T	F

$\therefore \bar{D} = \bar{A}\bar{B}$

6) $B|C' > B|C$ $\quad AB|C' \geq AB|C$

$A|BC' = A|BC$



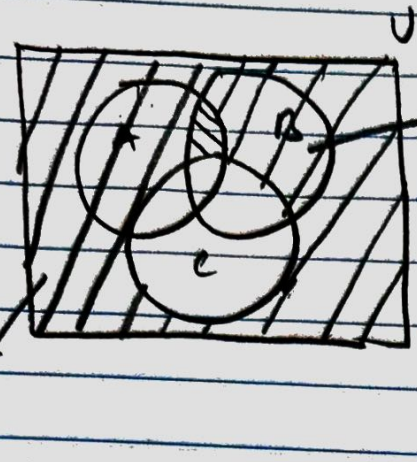
$\frac{B+C}{A+B+C+H} > \frac{E+F}{D+E+F+G}$ ① , $\frac{B}{B+C} = \frac{E}{E+F}$ ②

From $\frac{B}{A+B+C+H} \geq \frac{E}{D+E+F+G}$

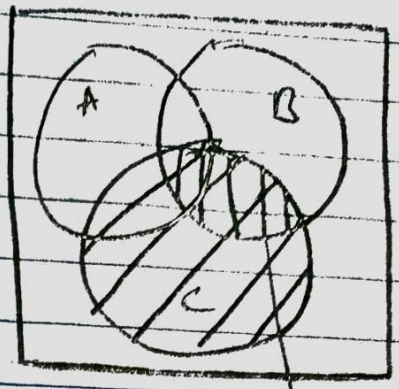
$\frac{B+C}{E+F} = \frac{B}{E}$ (From ① & ②)

$\frac{B}{E} \geq \frac{A+B+C+H}{D+E+F+G} \Rightarrow$ $\boxed{\frac{B}{A+B+C+H} \geq \frac{E}{D+E+F+G}}$ Hence proved

i) $B/C' = \frac{B \cap C'}{C'}$



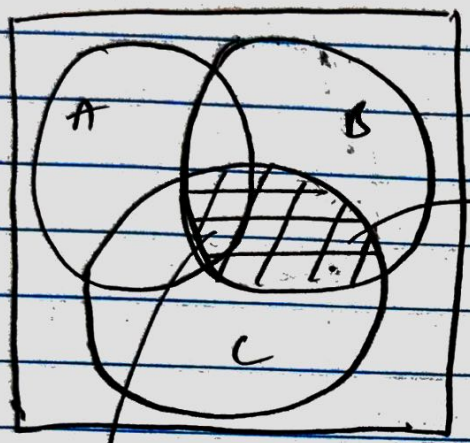
$B \cap C'$



$C \cap B$

$B/C = \frac{B \cap C}{C}$

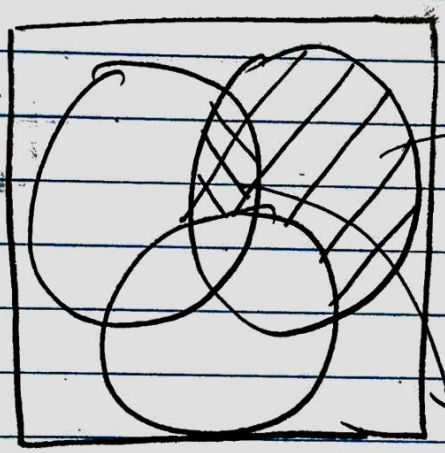
ii)



$B \cap C$

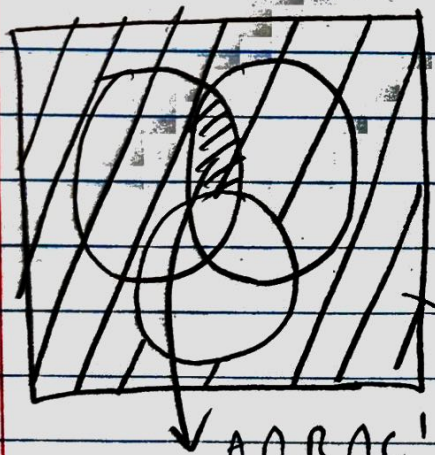
$A \cap B \cap C$

$A/BC = \frac{A \cap B \cap C}{B \cap C}$



$B \cap C'$

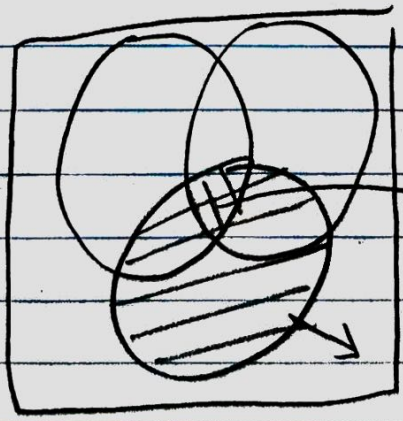
$A \cap B \cap C'$



C'

$A \cap B \cap C'$

$AB/C' = \frac{A \cap B \cap C'}{C'}$



$A \cap B \cap C$

C

$AB/C = \frac{A \cap B \cap C}{C}$