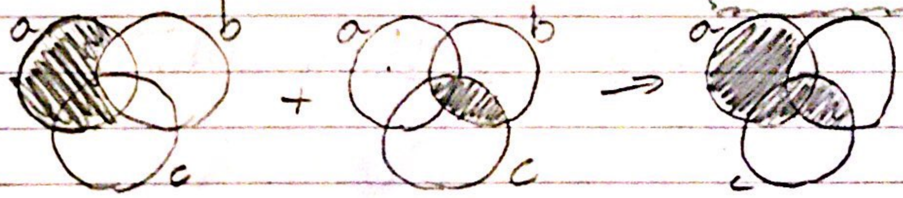
Ex. 1

All digigent students are successfull
All ignorant students are unsuccessfull
∴ Some diligent students are ignorant
a = diglent b = successfull
c = ignorant

KEY:
- Empty
- Occupied Area

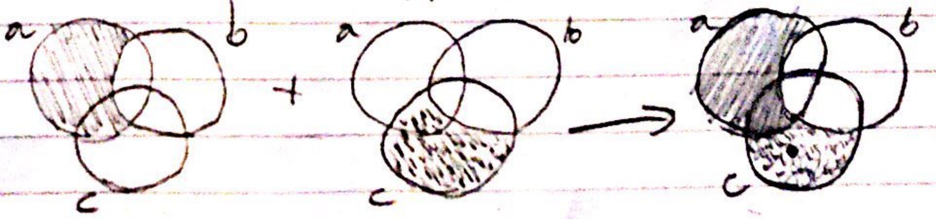
$$\rightarrow \frac{a \vDash b \quad c \vDash \neg b}{a \nvDash \neg c}$$



Not Sound → Counter Example: someting both a & c
→ it would be both b and ¬b

Every eagle can fly
Some pigs cannot fly
∴ Some pigs are not eagles
a = eagle b = fly
c = pigs

$$\rightarrow \frac{a \vDash b \quad c \nvDash b}{c \nvDash a}$$



This is <u>Sound</u>

Proof:

$$\frac{a \vDash b \quad b \vDash c}{a \vDash c} \rightarrow \frac{a \nvDash c \quad b \vDash c}{a \nvDash b} \rightarrow \frac{c \nvDash b \quad a \vDash b}{c \nvDash a} \quad \Big| \quad \frac{a \vDash b \quad c \nvDash b}{c \nvDash a}$$

Ex 2.

No animals are unicorns
All unicorns are horses
∴ some horses are not animals

a = animal b = unicorns
c = horses

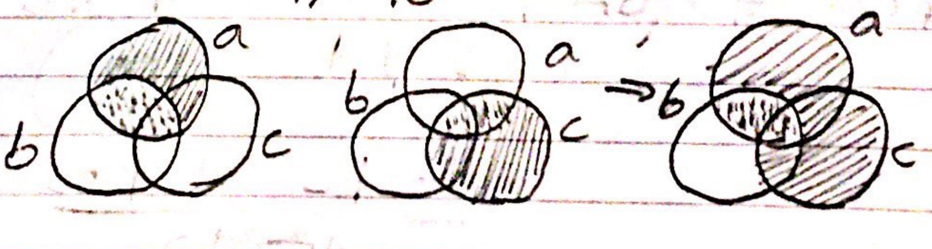
$$\frac{a \vDash \neg b \qquad b \vDash c}{c \nvDash a}$$

Not sound, as a sound syllogism will always have an even number of ($\neg$) and ($\vDash$) symbols.

Ex3.

"some a is a" $\Rightarrow a \nvDash \neg a \Leftrightarrow a \vDash a$

$$\frac{a \vDash b \qquad c \vDash a}{c \nvDash \neg b}$$



$$\frac{a \vDash b \qquad b \vDash c}{a \vDash c} \Rightarrow \frac{c \vDash a \qquad a \vDash b}{c \vDash b}$$

$$\Rightarrow \frac{a \vDash b \qquad c \vDash a}{c \vDash b}$$

$$\Rightarrow \frac{a \vDash b \qquad c \vDash a}{c \nvDash \neg b}$$

Ex 4.

1. isBig, isAber $\not\models$ hasThickBorder
2. isSmall $\not\models$ ¬ isDisc
3. isSmall, isSquare $\models$ ¬ isAmber

Ex 5, 6: In file Things.hs

Ex 7.

This property does hold, as every Venn diagram with 3 predicates can be represented with a unique set of propositions gathered from the relationships of any 2 predicates, which can be represented as a 2 predicate Venn.