* concepts and formulas to Remember *

concepts:- Quesion can be solve by both way direct formula and geometric approach which is venn diagram.

main formula:-

(PIE): Given X is finite set and $A_1, \dots A_n$ be non-empty subsets of X then

$$\left| X - \bigcup_{i=1}^{n} A_i \right| = \sum_{I \subseteq [n]} (-1)^{|I|} |A_I|$$

where $A_I = \bigcap_{i \in I} A_i$

and $A_\phi \coloneqq X$.

where $[n] = \{1, 2, \dots n\}$.

above formula is used very rarely so only for $n=2$, and $n=3$ we have to know.

indirect formula can be say it is.

$n=2$

$$|X - (A \cup B)| = |X| - (|A| + |B| - |A \cap B|)$$
$$= |X| - |A| - |B| + |A \cap B|$$

$n=3$

$$|X - (A \cup B \cup C)| = |X| - (|A| + |B| + |C| - |B \cap A| - |B \cap C| - |C \cap A| + |C \cap A \cap B|)$$

$$= |X| - |A| - |B| - |C| + |A \cap B| + |B \cap C| + |C \cap A| - |A \cap B \cap C|$$

(PIE) Principle of inclusion and Exclusion

direct formula:-

for $n=2$.

$$|A \cup B| = |A| + |B| - |A \cap B|$$

for $n=3$

$$|A \cup B \cup C| = |A| + |B| + |C| - |A \cap B| - |B \cap C| - |C \cap A| + |A \cap B \cap C|$$