$S = \{$ June, Janet, Jill, Justin, Jeff, Jello, Sally, Molly, Jolly $\}$

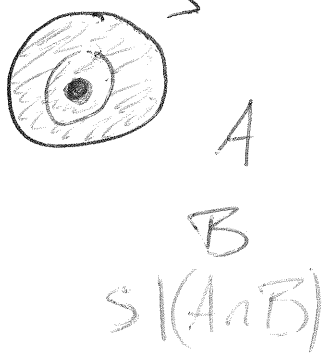
$A = \{$ June, Janet, Jill, Justin, Jeff, Jello $\}$,

$B = \{$ Janet, Jello, Justin $\}$

$C = \{$ Sally, Molly, Jolly, Jello $\}$

$S \setminus (A \cap B) = S \setminus \{$ Janet, Jello, Justin $\}$ $(= S \setminus B)$

$= \{$ June, Jill, Jeff, Sally, Molly, Jolly $\}$.



DeMorgan's Laws (For Sets)

Given a set S and two subsets A and B.

$$S \setminus (A \cap B) = S \setminus A \cup S \setminus B$$

$$S \setminus (A \cup B) = S \setminus A \cap S \setminus B$$

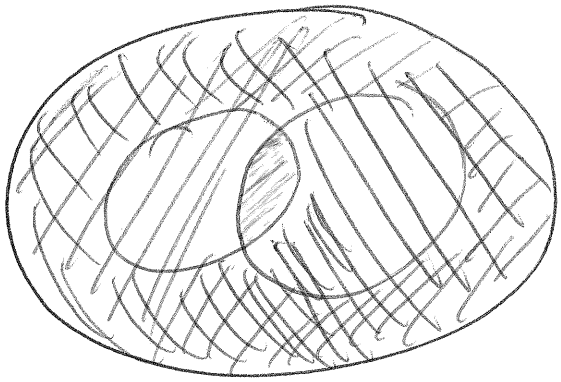
$$S \setminus (A \cap B) = \{ s \in S \mid s \notin A \cap B \}$$

$$= \{ s \in S \mid \neg (s \in A \wedge s \in B) \}$$

$= \{ s \in S \mid s \notin A \vee s \notin B \}$ ②

$= \{ s \in S \mid s \notin A \} \cup \{ s \in S \mid s \notin B \}$

$= S \setminus A \cup S \setminus B.$



$S \setminus (A \cup B) = \{ s \in S \mid s \notin (A \cup B) \}$ ## $S \setminus (A \cap B)$

$= \{ s \in S \mid \neg (s \in (A \cup B)) \}$

$= \{ s \in S \mid \neg (s \in A \vee s \in B) \}$

$= \{ s \in S \mid s \notin A \wedge s \notin B \}$

$= \{ s \in S \mid s \notin A \} \cap \{ s \in S \mid s \notin B \}$

$= S \setminus A \cap S \setminus B.$

A

B

$A \cup B$

$S \setminus A$

$S \setminus B$

~~$S \setminus (A \cup B)$~~

E.g.: $\{1, 2, 3, 4, 5, 6, 7, 8\} = S$

$A = \{1, 2, 3\}$ $\quad A \cup B = \{1, 2, 3, 4, 5\}$

$B = \{3, 4, 5\}$ $\quad A \cap B = \{3\}$

$S \setminus A = \{4, 5, 6, 7, 8\}$

$S \setminus B = \{1, 2, 6, 7, 8\}$

$S \setminus (A \cup B) = \{6, 7, 8\} \overset{\text{same}}{\longleftrightarrow} S \setminus A \cap S \setminus B = \{6, 7, 8\}$

$S \setminus (A \cap B) = \{1, 2, 4, 5, 6, 7, 8\}$

same $\hookrightarrow S \setminus A \cup S \setminus B = \{1, 2, 4, 5, 6, 7, 8\}$

Stops in Thailand, Singapore, Hong Kong, Bali. (4)
(T) (S) (H) (B)

How many itineraries end in Thailand?

①

②

③

④ Thailand

S	S	H	H	B	B
H	B	S	B	S	H
B	H	B	S	H	S
T	T	T	T	T	T

$C(7,2) = \binom{7}{2}$

$C(n,r) = \frac{n!}{(n-r)!\,r!}$

$P(n,r) = \frac{n!}{r!}$

$C(7,2) = \frac{7!}{(7-2)!\,2!} = \frac{7!}{5!\,2} = \frac{7\cdot 6\cdot 5!}{5!\,2}$

$= \frac{42}{2} = 21.$

0				1				
1			1		1			
2		1		2		1		
3	1		3		3		1	
4	1	4		6		4	1	
5	1	5	10		10	5	1	
6	1	6	15	20	15	6	1	
7	1	7	21	35	35	21	7	1