Relation between Permutation and Combination

Mathematical Relation: $^nC_r = \frac{\lfloor n}{\lfloor n-r \lfloor r}$ | $^nP_r = \frac{\lfloor n}{\lfloor n-r}$

① So, $\boxed{^nP_r = {}^nC_r \times \lfloor r}$

② Total count of characters in power set: power set $= (1+1)^n = 2^n$

$$2^n = {}^nC_0 + {}^nC_1 + {}^nC_2 + {}^nC_3 + \cdots + {}^nC_{n-3} + {}^nC_{n-2} + {}^nC_{n-1} + {}^nC_n$$

n-char

n-char

n-char

n-char

Since there are 2^n terms, and 2 terms togeter gives 'n' char.

So, total number of chars in power set = ((2^n)/2)*n = 2^(n-1)*n

Permuation and combination in terms of arrangment :

Permuation: Arranging 'r' distinct items at 'n' positions. Eg. Arranging 2 distinct items(a,b) at 3 positions. $^3P_2 = 6$

Combination: Arranging 'r' identical items at 'n' positions. Eg. Arranging 2 (i,i) at 3 positions $\rightarrow$ $^3C_2 = 3$

permutation of 2 identical items at 3 positions nCr

$^3C_2 =$

i	i	_
i	_	i
_	i	i

permutation of 2 distinct items at 3 positions nPr

1	2	_	2	1	_
1	_	2	2	_	1
_	1	2	_	2	1

$^3P_2 = 6$

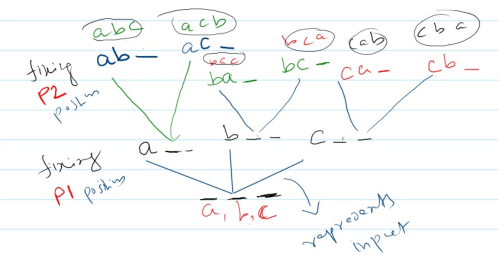
Since r =2, it means against each combination there will be r! copies(2!=2) of permuation.

$2^2 \times$ -

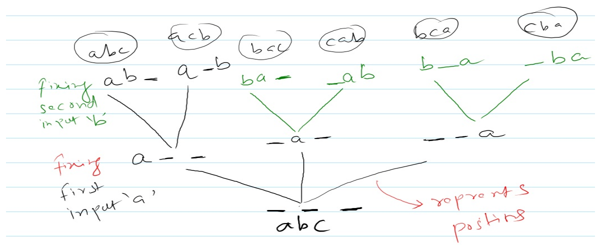
Approach for permuation tree formation:

1. By fixing the position and taking input elements as options
2. By fixing the input elemnt and taking pisitions as options

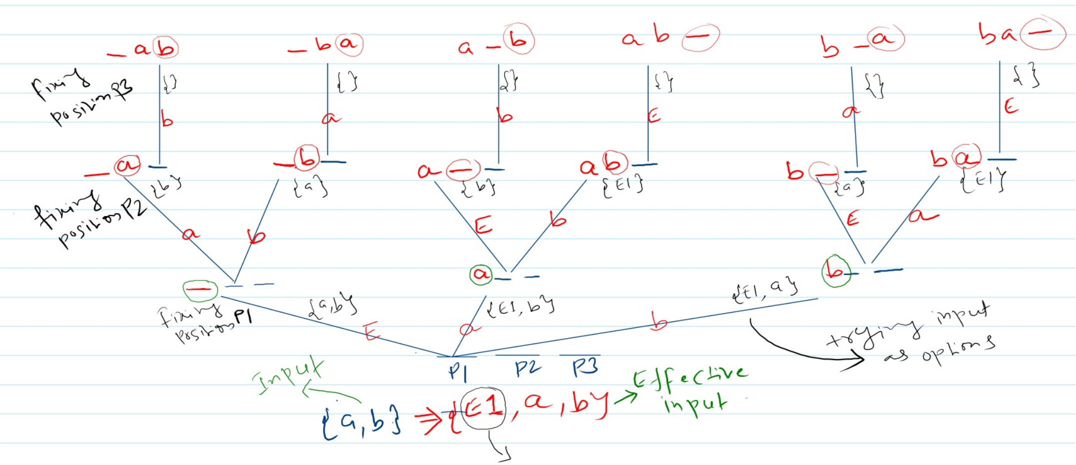
1A. By fixing the position and taking input elements as options where input_count == position_count



2.By fixing the input elemnt and taking pisitions as options where input_count <= position_count



1B. By fixing the position and taking input elements as options where input_count < position_count



Empty_count = 3 -2 = 1

EMPTY_COUNT = POSITION_COUNT - INPUT_COUNT

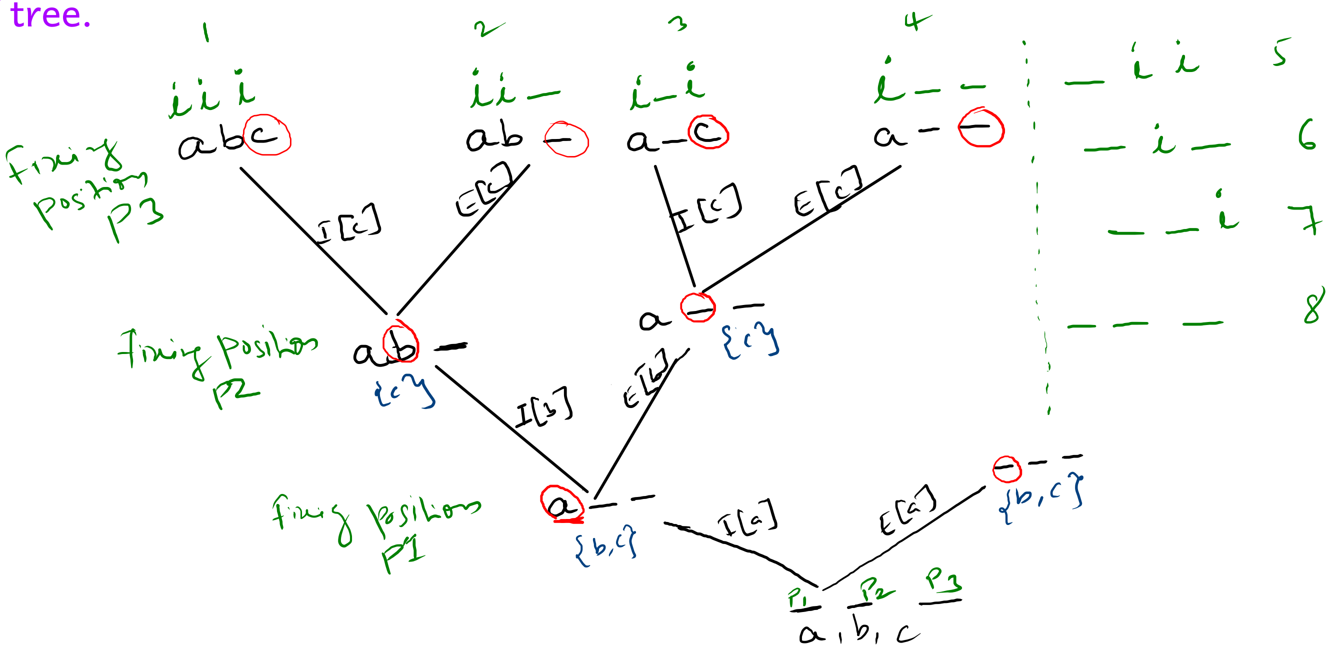
Approaches for Combination tree formation:

1. Pascal_Identity based Include_Exclude_Tree tree by fixing position
2. Pascal_Identity_Expansion based Include_Tree by fixing position

1. Pascal_Identity based Include_Exclude_Tree tree by fixing position where

input_count <= postion_count

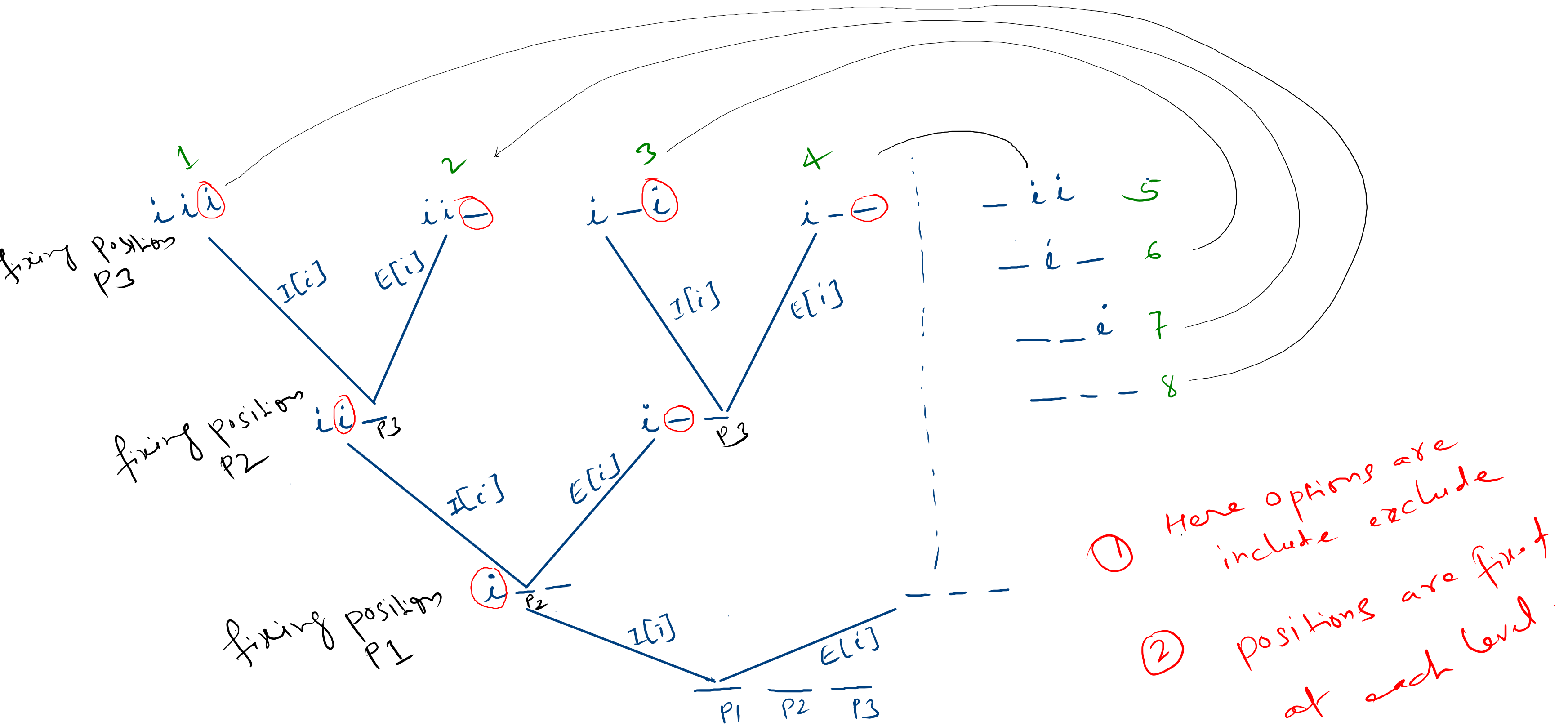
Note: Position is fixed at each level, and include(i) & exclude(i) are taken as options i.e. branches of tree.



1. Pascal_Identity based Include_Exclude_Tree tree by fixing position where

input_count <= postion_count

power set by placing 'i' on n given position



2. Pascal_Identity_Expansion based Include_Tree by fixing position where

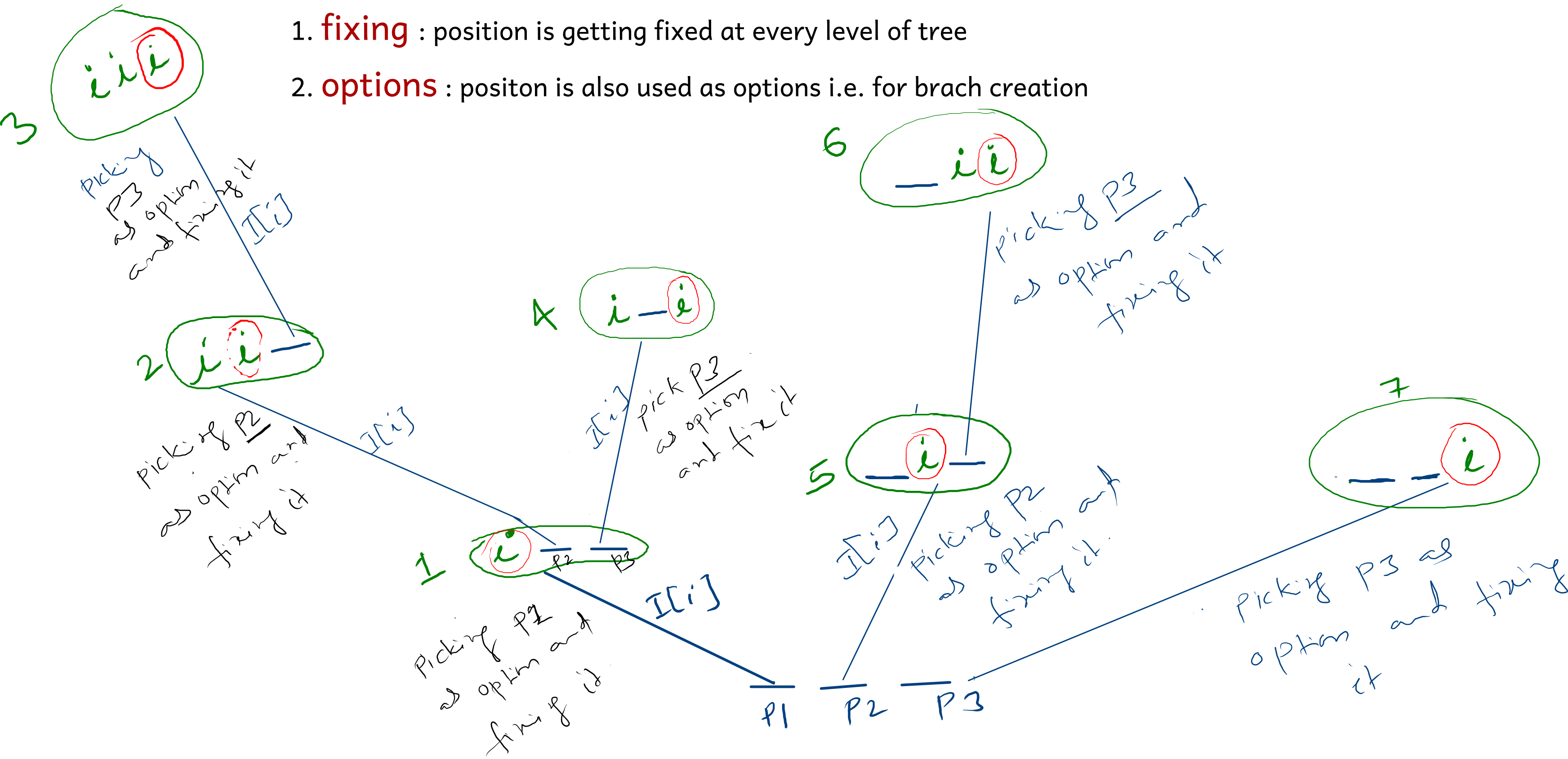
input_count <= position_count

Power set by placing 'i' at 'n' given positions

In pascal identity Expansion strategy position is used for both :

1. **fixing** : position is getting fixed at every level of tree

2. **options** : positon is also used as options i.e. for brach creation



Relation between Permutation and Combination

Question : Print combination using prermuation strategy of fixing input and taking position as options

Note: If we allow only to place the input in lexicographic order, then we will get combinations from permutation strategy.