

n -box, r -items (non-identical), print all possible arrangement

$$n = 3$$

$$r = 2 \rightarrow \{1, 2\}$$

— — —

→	<u>1</u>	<u>2</u>	0
→	1	0	2
→	<u>2</u>	<u>1</u>	0
→	2	0	1
→	0	1	2
→	0	2	1

arrangement is same but permutated

level and options

level - items }
option - boxes }

$${}_n P_r = \frac{n!}{(n-r)!} = (n-0)(n-1)(n-2) \dots (n-(r-1))$$

$$n = 4, r = 2,$$

$${}_4 P_2 = \frac{4!}{2!} = \frac{4 \times 3 \times \cancel{2!}}{\cancel{2!}} = \textcircled{12}$$

$$n=4, \{r=2.$$

level- items-

option- boxes

non-identical object
all possibilities } → permutation

1 2 0 0
1 0 2 0
1 0 0 2
2 1 0 0

0 1 2 0
0 1 0 2

2 0 1 0

0 2 1 0

0 0 1 2

2 0 0 1

0 2 0 1

0 0 2 1

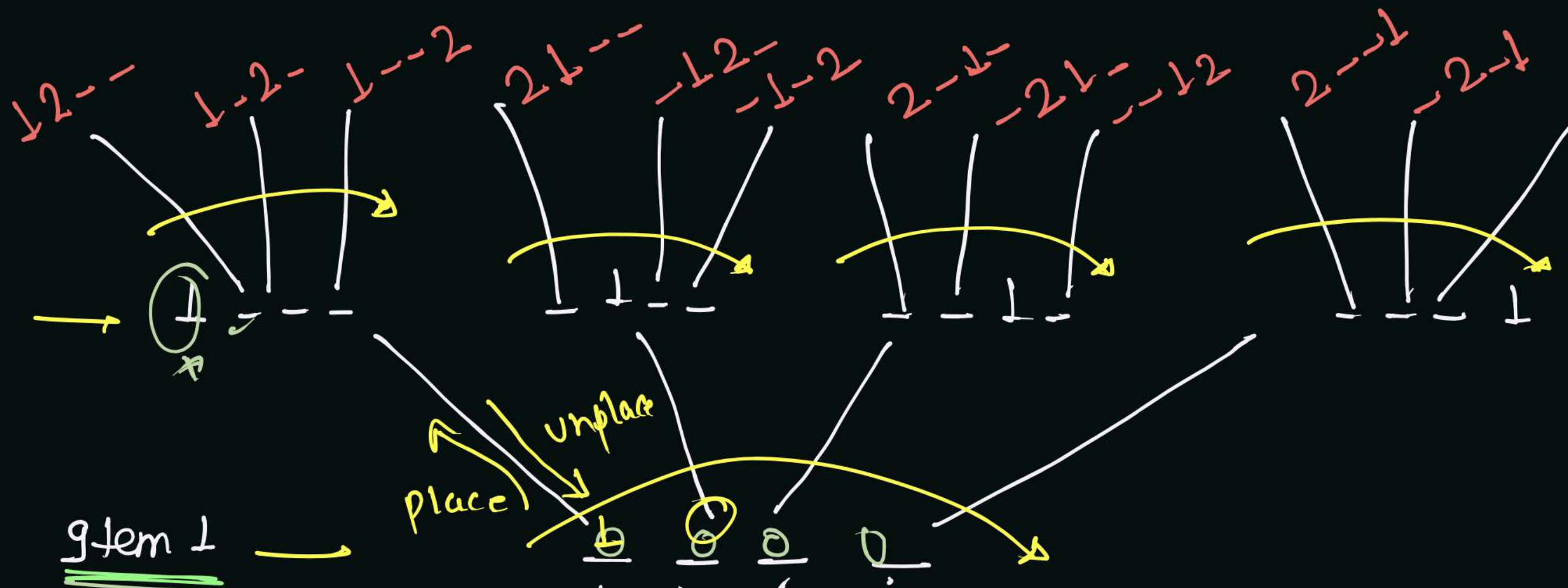
Journal++
Linux
windows

Item 3

Item 2

Item 1

Current Item > total
Item



$n = \text{boxes}$, $r = \text{identical items}$, print all possibilities
to arrange r items in n boxes.

level - places

options - choice of items.

$n = \text{boxes} = 4$, $r = 2$ (items)

$${}^n C_r = \frac{n!}{(n-r)! r!} \Rightarrow {}^4 C_2 = \frac{4!}{2! 2!} = \frac{\cancel{4} \times 3 \times \cancel{2} \times 1}{2! \times 2!} = 6$$

$${}^n P_r = {}^4 P_2 = \frac{4!}{2!} = \frac{4 \times 3 \times \cancel{2} \times 1}{\cancel{2} \times 1} = 12$$

Permutations

permuted

1 2 0 0

1 0 2 0

1 0 0 2

0 1 2 0

0 1 0 2

0 0 1 2

2 1 0 0

2 0 1 0

2 0 0 1

0 2 1 0

0 2 0 1

0 0 2 1

combinations

{ 0 0 1 1
0 1 0 1
0 1 1 0
1 0 0 1
1 0 1 0
1 1 0 0

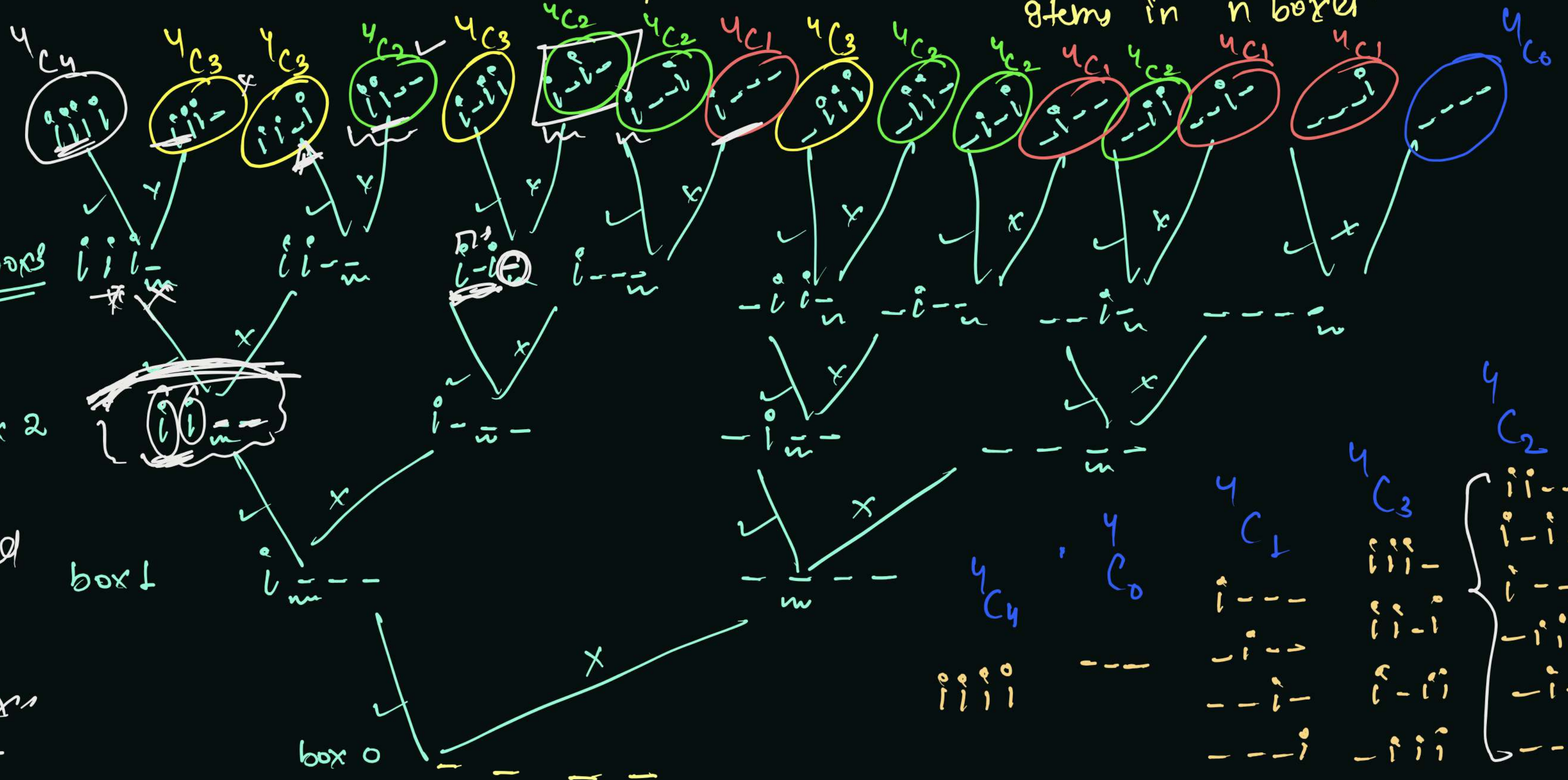
$$2^n = {}^nC_0 + {}^nC_1 + {}^nC_2 + {}^nC_3 + \dots + {}^nC_n$$

nC_r = possible no. of way to place r identical items in n boxes

$$n=4$$

$$2^4 = {}^4C_0 + {}^4C_1 + {}^4C_2 + {}^4C_3 + {}^4C_4$$

Level \rightarrow box
options \rightarrow choice of items
Yes or No



Base case

(1) item selected so far

(2) No. of boxes

n -box and r non identical items.
print all possible arrangement

$${}^nC_r = \frac{n!}{(n-r)! r!}$$

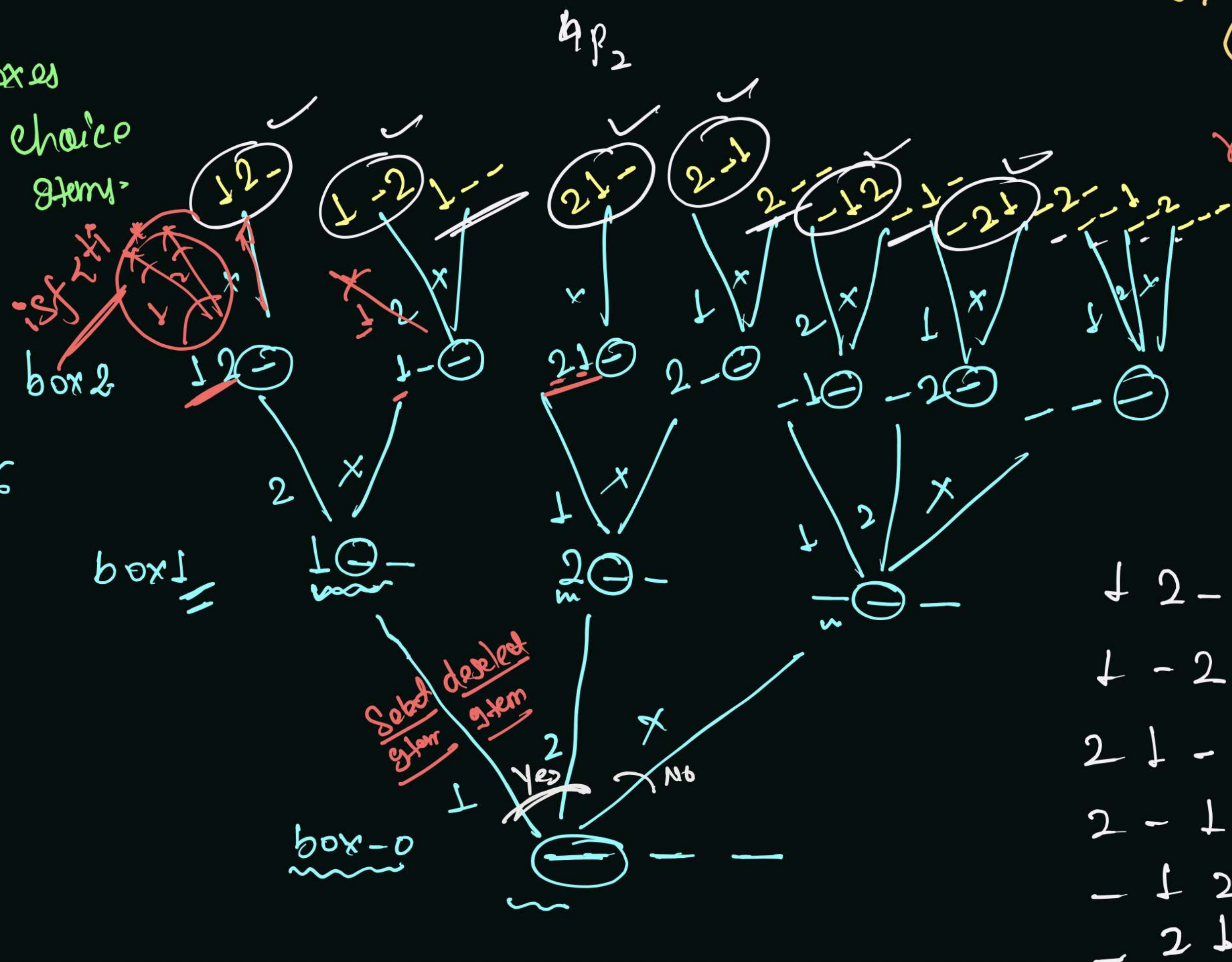
$${}^nP_r = \frac{n!}{(n-r)!}$$

level \rightarrow boxes

option \rightarrow choice of items

$n=3$
 $r=2$

$${}^nP_r = \frac{3!}{1!} = 6$$



relation b/w Perm. and Comb.

$${}^nP_r = {}^nC_r \times r!$$

Permute all combinations to achieve permutation.

$${}^3P_2 = \frac{3!}{1!} = 3 \times 2 \times 1 = 6$$

n -boxes, r -identical items, find all possibilities to arrange them

permutation

boxes = 3, item = 2

$${}^n P_r = (n-0)(n-1)(n-2)(n-3)\dots$$

$$\dots (n-(r-1))$$

$${}^3 P_2 = \frac{3!}{1!} = \underline{\underline{6}}$$

$\begin{matrix} 1 & 2 & 0 \\ 1 & 0 & 2 \\ 0 & 1 & 2 \end{matrix}$
 \longleftrightarrow
 $\begin{matrix} 2 & 1 & 0 \\ 2 & 0 & 1 \\ 0 & 2 & 1 \end{matrix}$

Combination

boxes = 3, item = 2

$${}^n C_r = \frac{n!}{(n-r)! r!} = \frac{{}^n P_r}{r!}$$

$${}^3 C_2 = \frac{3!}{2! 1!} = \frac{3 \times 2 \cancel{1}}{\cancel{2} \times 1} = \textcircled{3}$$

$\begin{matrix} \bullet & \bullet & - \\ | & | & \\ \bullet & - & \bullet \\ | & & | \\ - & | & | \end{matrix}$

4 boxes, 3 stars $\rightarrow \{1, 2, 3\}$

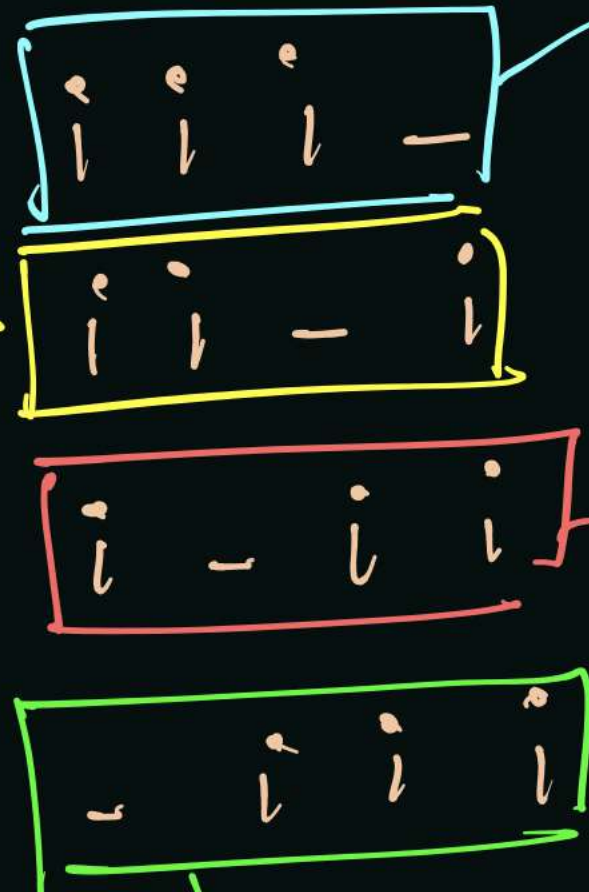
4 boxes, 3 stars $\rightarrow \{i, i, i\}$

$${}^4P_3 = \frac{4!}{1!} = 4 \times 3 \times 2 = 24$$

$${}^4C_3 = \frac{4!}{1!3!} = 4$$

$\left. \begin{array}{l} 1 \ 2 \ 0 \ 3 \\ 1 \ 3 \ 0 \ 2 \\ 2 \ 1 \ 0 \ 3 \\ 2 \ 3 \ 0 \ 1 \\ 3 \ 1 \ 0 \ 2 \\ 3 \ 2 \ 0 \ 1 \end{array} \right\}$

$\left. \begin{array}{l} 0 \ 1 \ 2 \ 3 \\ 0 \ 1 \ 3 \ 2 \\ 0 \ 2 \ 1 \ 3 \\ 0 \ 2 \ 3 \ 1 \\ 0 \ 3 \ 1 \ 2 \\ 0 \ 3 \ 2 \ 1 \end{array} \right\}$



$\left\{ \begin{array}{l} \underline{1 \ 2 \ 3 \ 0} \\ 1 \ 3 \ 2 \ 0 \\ 2 \ 1 \ 3 \ 0 \\ 2 \ 3 \ 1 \ 0 \\ 3 \ 1 \ 2 \ 0 \\ 3 \ 2 \ 1 \ 0 \end{array} \right.$

$\left\{ \begin{array}{l} 1 \ 0 \ 2 \ 3 \\ 1 \ 0 \ 3 \ 2 \\ 2 \ 0 \ 1 \ 3 \\ 2 \ 0 \ 3 \ 1 \\ 3 \ 0 \ 1 \ 2 \\ 3 \ 0 \ 2 \ 1 \end{array} \right.$

24 permutations
from

4 combinations

let us figure out combination form permutation →

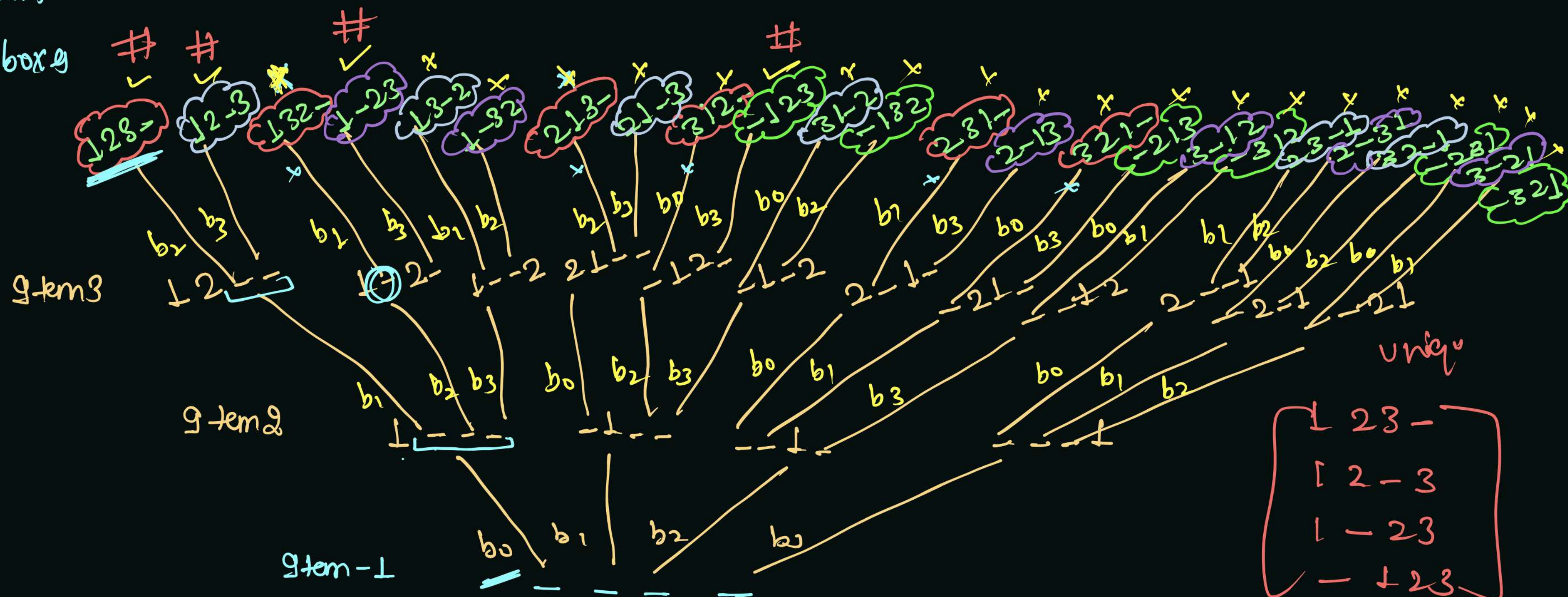
$${}^4P_3 = \frac{4!}{1!} = 24$$

Permutation

Make calls in sorted
order Index →

Level → 9 items

options → boxes



$${}^4C_3 = \frac{4!}{3!1!} = \frac{4 \times \cancel{3!}}{\cancel{3!}} = 4.$$

Level \rightarrow items
options \rightarrow boxes

Handwritten examples of the letter 'i' in various styles and positions, including lowercase 'i', uppercase 'I', and combinations like 'ii' and 'ii-'. The examples are arranged in three rows:

- Row 1: *ii*, *ii*, *ii-*
- Row 2: *i*, *i*, *-i*, *i*
- Row 3: *i*, *-i*, *i*, *i*

box - for placing'

$c_i \rightarrow$ for level i

$$x_i \rightarrow \text{for base case}$$

1b → for make a loop
in sorted order
from previous lens.

