Constraint: $n=7$ $k=4$

$\boxed{\text{Inclusion-Exclusion}}$

↳ Each kid needs to have at least "1" cookie

↳ 2^{nd} kid can have atmost "1" cookie.

Pre allocation = "1" for each kid = "4" cookies preallocated.

Remaing = n - preallocated = $7-4=3$

Illegal State : 2^{nd} kid having ≥ 2 cookies. $n=3$ $k=4$

Total combinations $= \binom{n+k-1}{k-1} = \binom{4+3-1}{4-1} = \binom{6}{3} = 20$ combinations

↳ This will also contain $\boxed{\text{illegal state}}$ where "2^{nd}" kid has ≥ 2 cookies. ie $x_2 \geq 2$.

→ Problem can be deduced to how "3" cookies can be distributed to "4" kids.

Calculating no. of illegal states:

How to induce illegal state? Few things to consider

↳ Already pre allocation is done. So, need to take 3 cookies only in consideration

↳ To induce illegal state, for 2^{nd} kid, $x_2 \geq 1$

↳ Pre allocate the extra cookie to the 2^{nd} kid

Updated cookies = 3 − 1 = 2 (Done using minimum shift)

Now, $n = 2$ $\quad k = 4$ $\quad$ Total selections = $n + k - 1 = 2 + 4 - 1 = 5$

No. of combinations = $\binom{n+k-1}{k-1} = \binom{5}{3} = {}^{5}C_{3} = 10$ ways

Originally: 7 cookies $\quad$ 4 kids

7 (Stars) $\quad$ $k - 1 = 3$ (bars)

↳ Out of "7" → "3" pre allocated to accomodate at least 1 constraint

↳ Out of "3" → "1" pre allocated to find illegal states

Original = $n + k - 1 = 7 + 4 - 1 = 10$

Already selected = $\underset{\text{(preallocate)}}{\underset{\downarrow}{\cancel{3}4}} + \underset{\text{(induce illegal)}}{\underset{\downarrow}{1}} \cancel{+} = \cancel{6} = 5$

Remaining cookies/stars = $7 - 5 = 2$

Bars = $k - 1 = 4 - 1 = 3$

Finally → Total Combinations − Illegal Combinations

$= 20 - 10 = 10$ ways