PROBLEM D

Toving Liles

Julius Schmück, Richard Bondarev

The computer science Professor Toving Liles loves the floor tiles in his office so much that he wants to protect them from damage by careless students. Therefore, he would like to buy cheap small rectangular carpets from the supermarket and cover the floor such that:

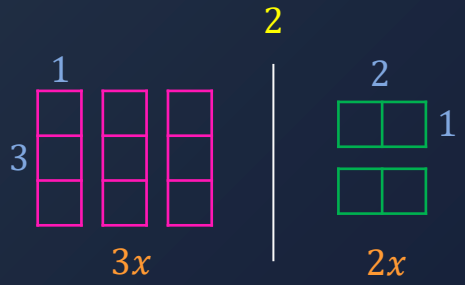
- The entire floor is covered
- The carpets do not overlap
- The carpets are rotated arbitrarily
- No carpet is cut into pieces

But when checking the supermarket's stock, he begins to wonder whether he can accomplish his plan at all. Can you help him?

Input

Sample Input

```
2 4
2
3 1 3
2 2 1
```



Output

print “yes” if it is possible to cover the room, otherwise “no”

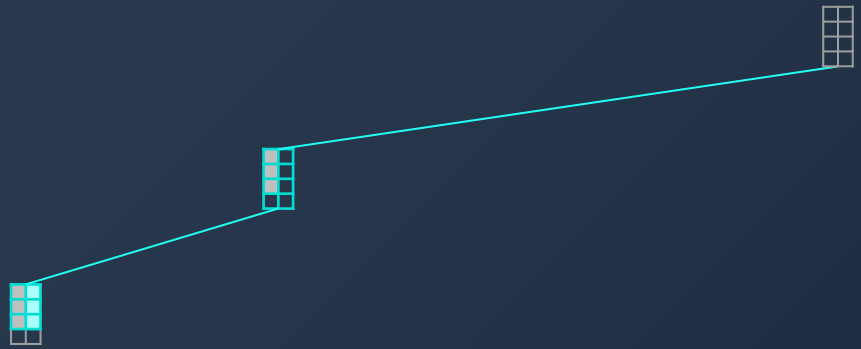
Sample Output

yes

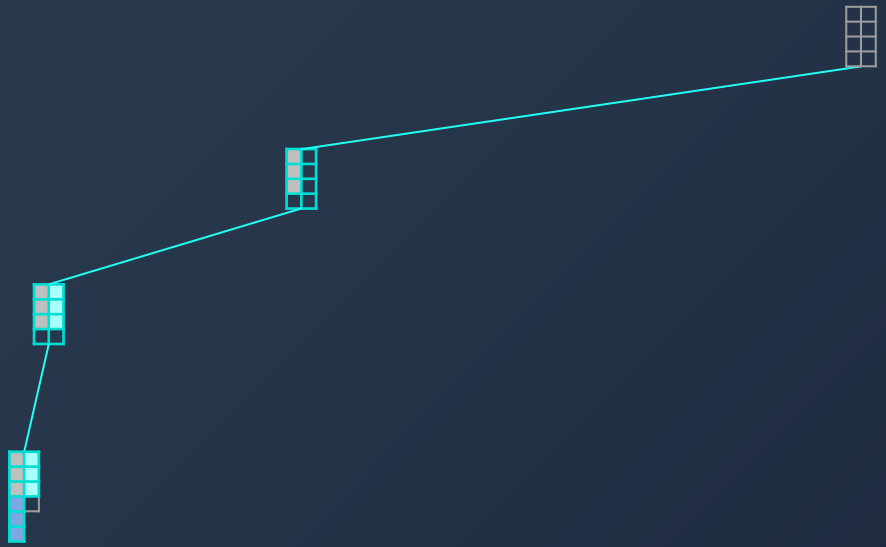
Solution Idea

Solution Idea

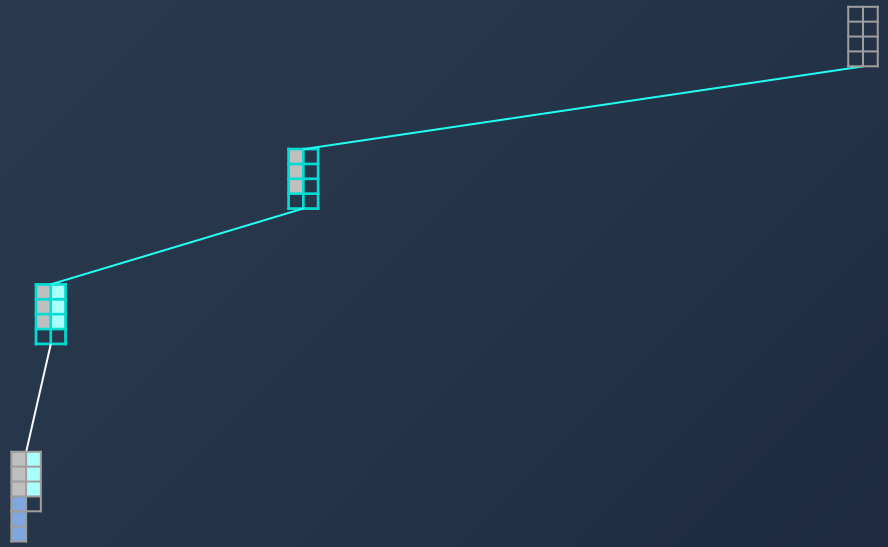
Solution Idea



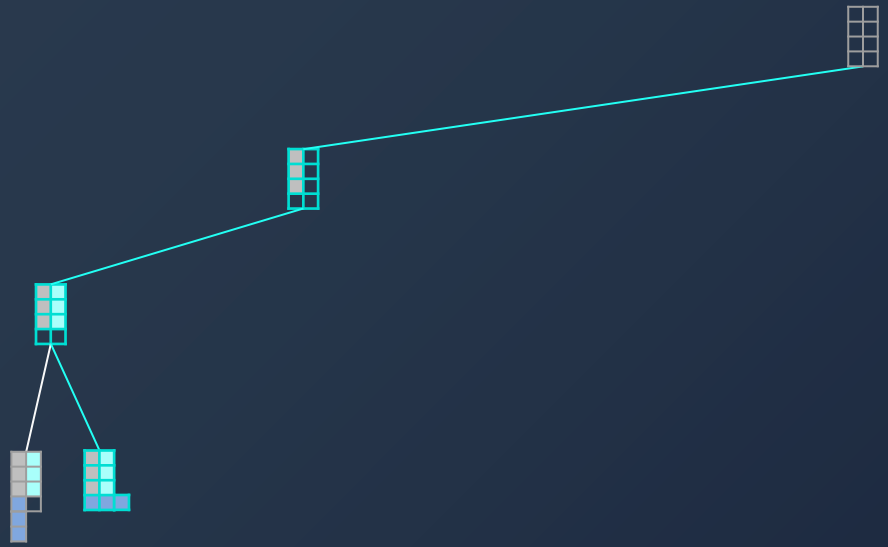
Solution Idea



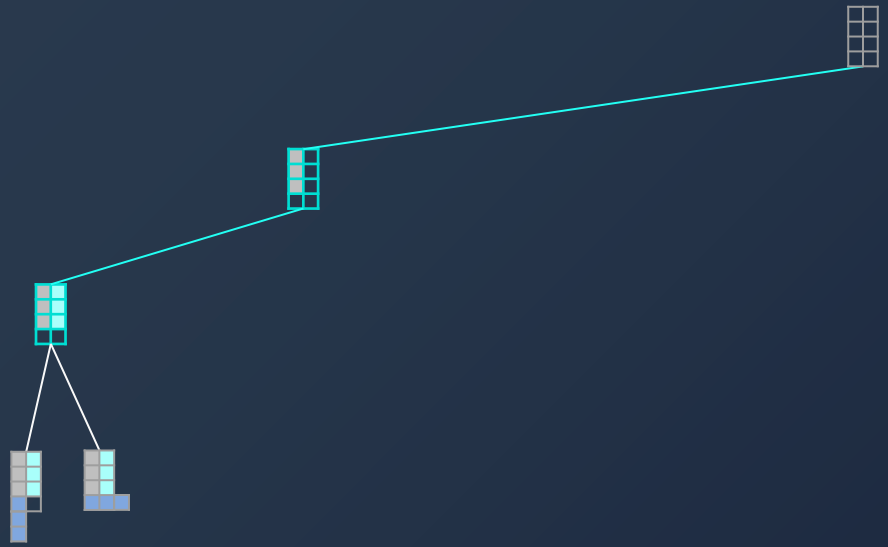
Solution Idea



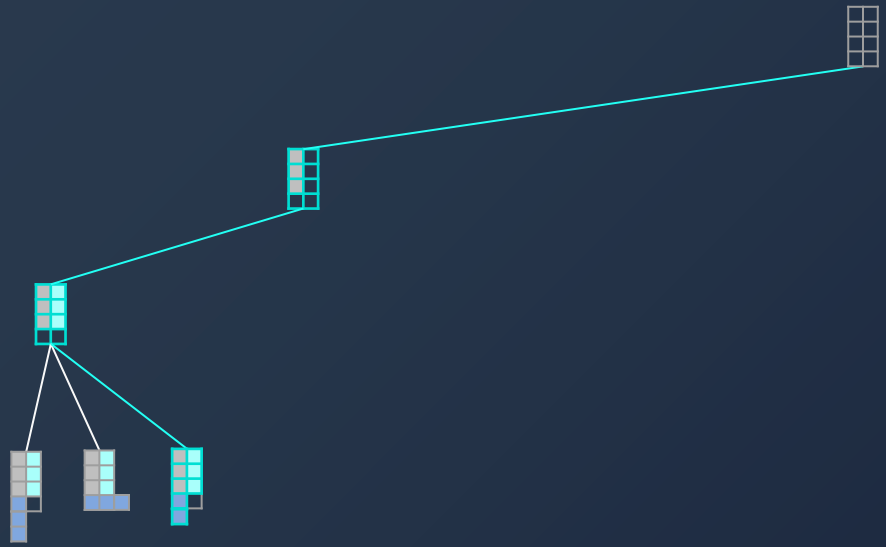
Solution Idea



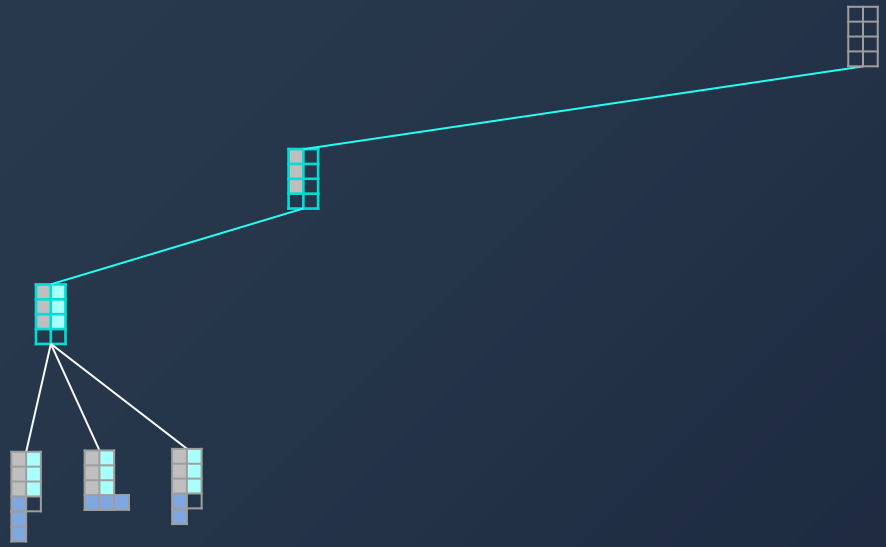
Solution Idea



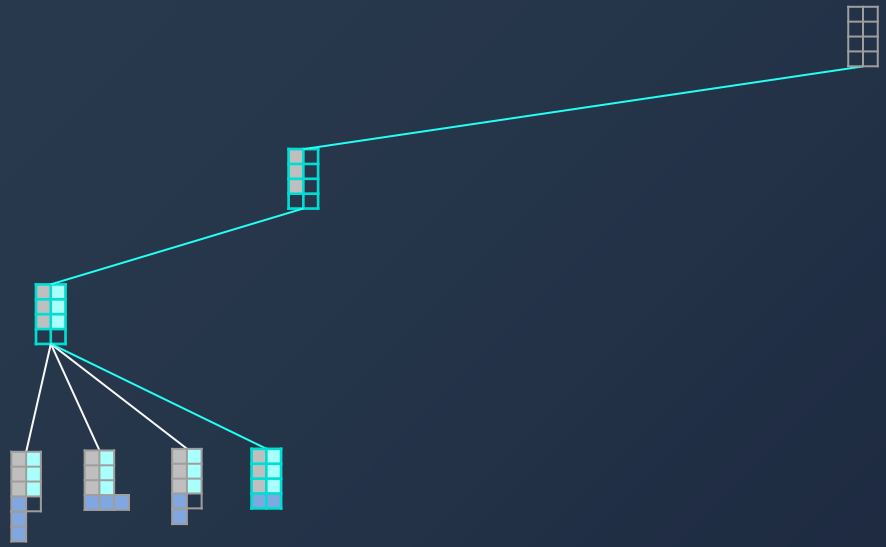
Solution Idea



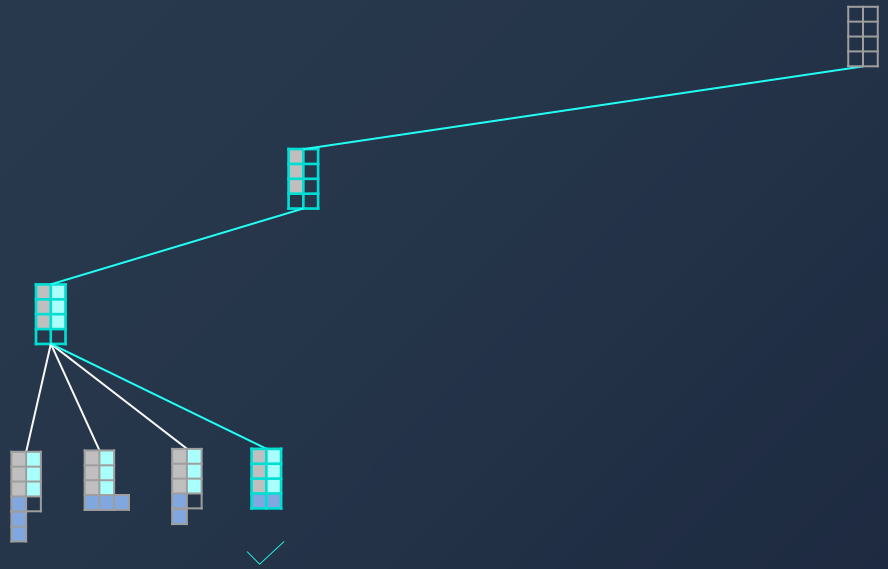
Solution Idea



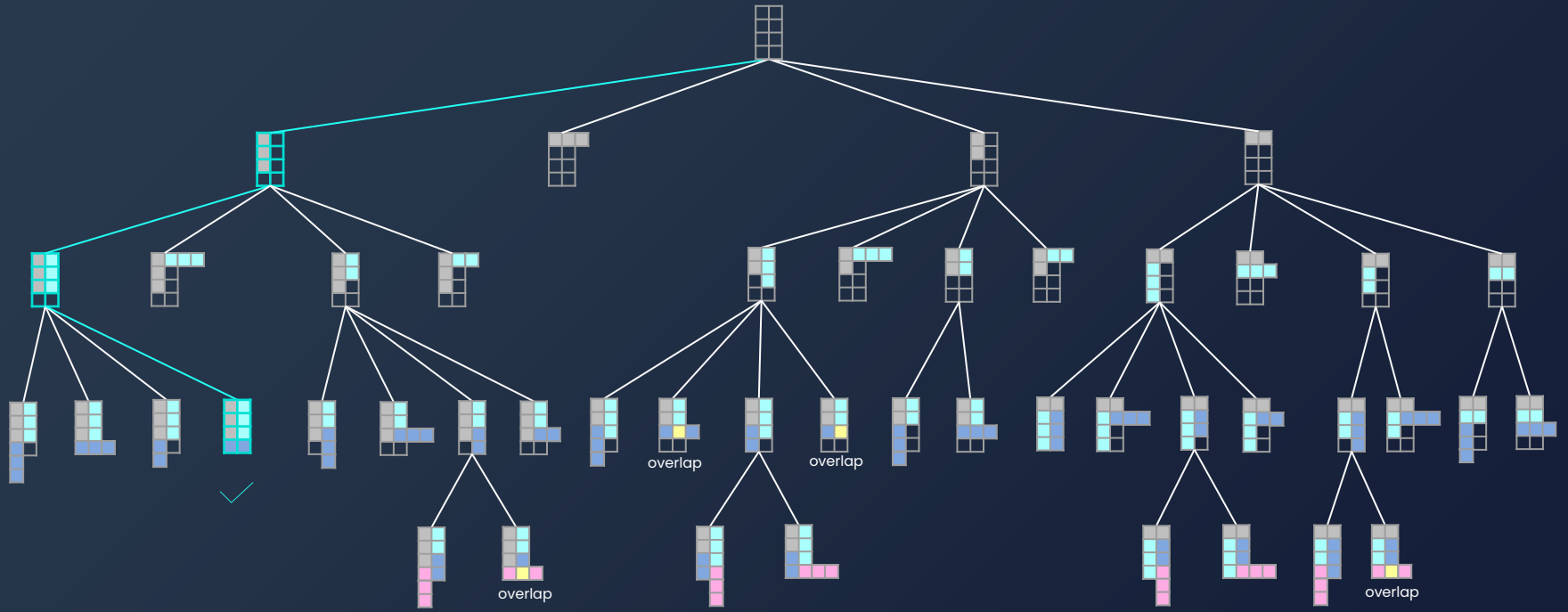
Solution Idea



Solution Idea



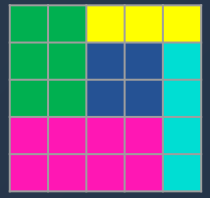
Solution Idea



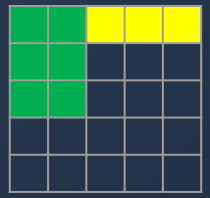
Solution Idea

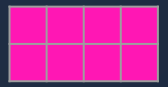
```
boolean findSolution(Level, Room):
    repeat as long as there are still new partial solution steps:
        choose a new partial solution step;
            if choice is valid:
                add choice to Room;
                if room is full: return true;                              // solution found!
                otherwise:
                    if (FindSolution(Level + 1, Room)): return true;       // solution!
                    otherwise undo choice;                                 // dead end (backtracking)!
    since there is no new partial solution step: return false              // no solution!
```

Correctness

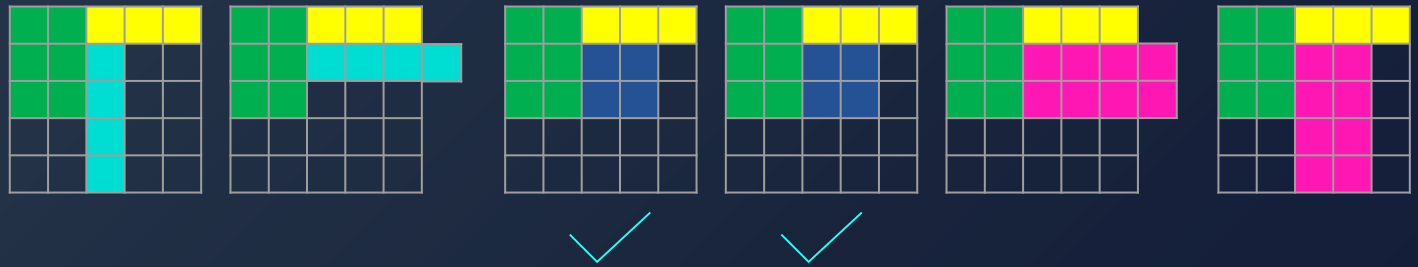


correct solution



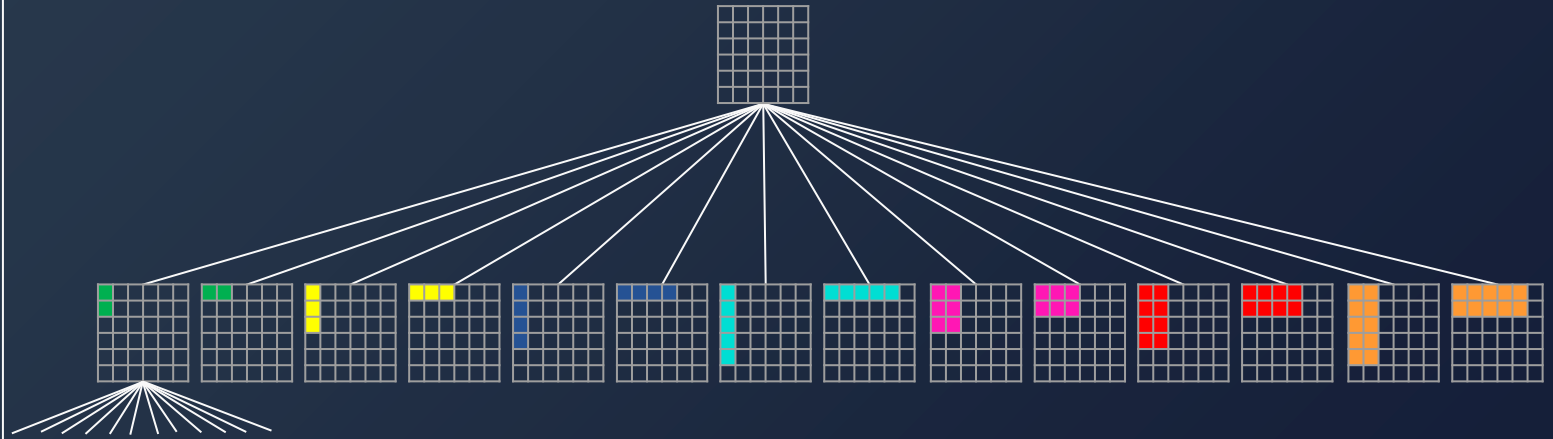


correct partial solution
with still available carpets



Runtime

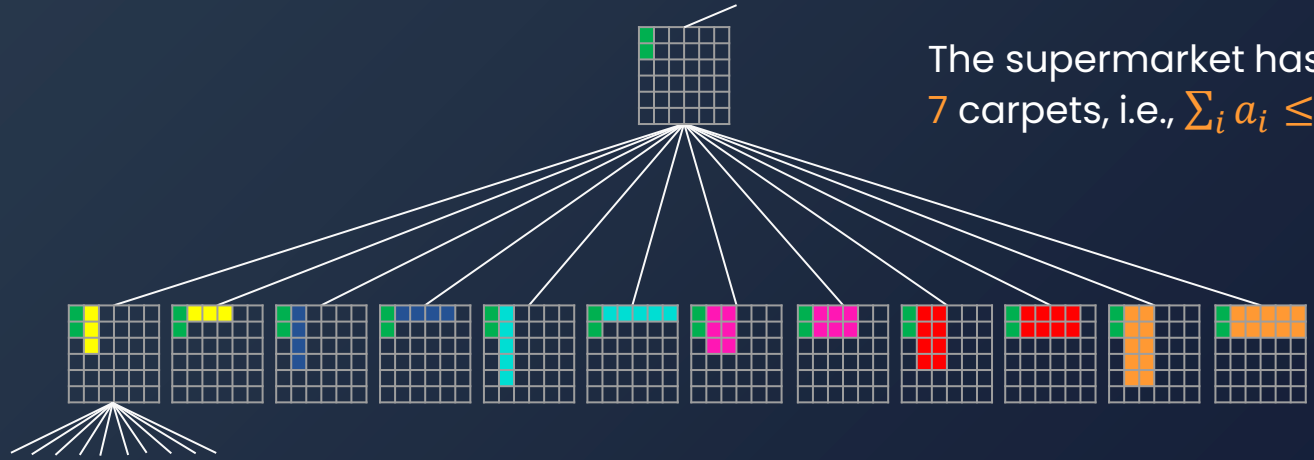
Input: The second line contains an integer c, denoting the number of different carpet colors the supermarket has in stock ($1 \leq c \leq 7$).



$$N_{\text{max, Level 1}} = 14$$

Runtime

Input: The second line contains an integer c, denoting the number of different carpet colors the supermarket has in stock ($1 \leq c \leq 7$).



The supermarket has at most 7 carpets, i.e., $\sum_i a_i \leq 7$.

$$N_{\text{max, Level 2}} = 14 * 12 = 168$$

Runtime

$$N_{\text{max, Level } l} = 2^l \frac{c!}{(c-l)!} \qquad c \geq l$$

1st. Level: $2^1 \frac{7!}{(7-1)!} = 14$

2nd. Level: $2^2 \frac{7!}{(7-2)!} = 168$

3rd. Level: $2^3 \frac{7!}{(7-3)!} = 1680$

4th. Level: $2^4 \frac{7!}{(7-4)!} = 13440$

5th. Level: $2^5 \frac{7!}{(7-5)!} = 80640$

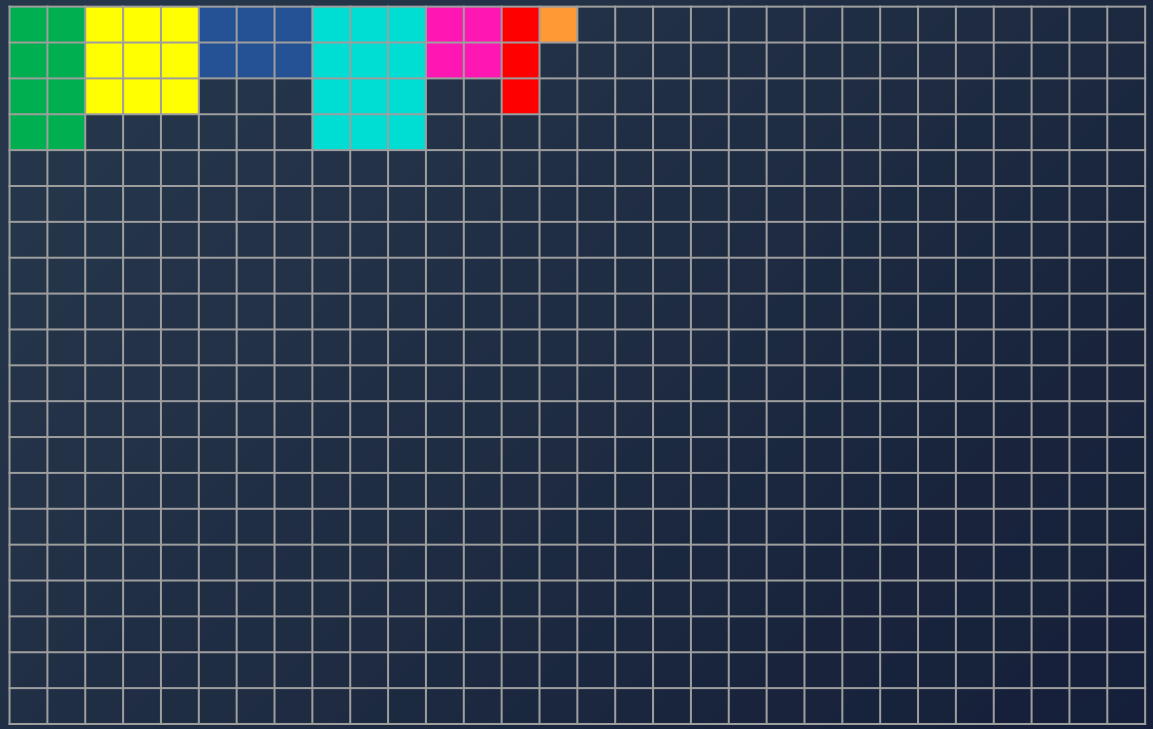
6th. Level: $2^6 \frac{7!}{(7-6)!} = 322560$

7th. Level: $2^7 \frac{7!}{(7-7)!} = 645120$

Runtime

$$N_{\max} = \sum_{l=1}^{7} 2^l \frac{7!}{(7-l)!} = 1063622$$

Runtime



GOOD LUCK


When your code compiles after 253 failed attempts
I'm still worthy!