Guerra
Standard Young Tableaux

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What is a Standard Young Tableaux?

- A way to encode certain patterns and arrangements of numbers or symbols into a specific shape.
- Properties
  - Each row and each column is strictly increasing.
  - There are no repeated numbers or symbols within each row or column.

Examples

- Example
  - Shape (5,4,1) ✅

1	2	4	7	8
3	5	6	9	
10				

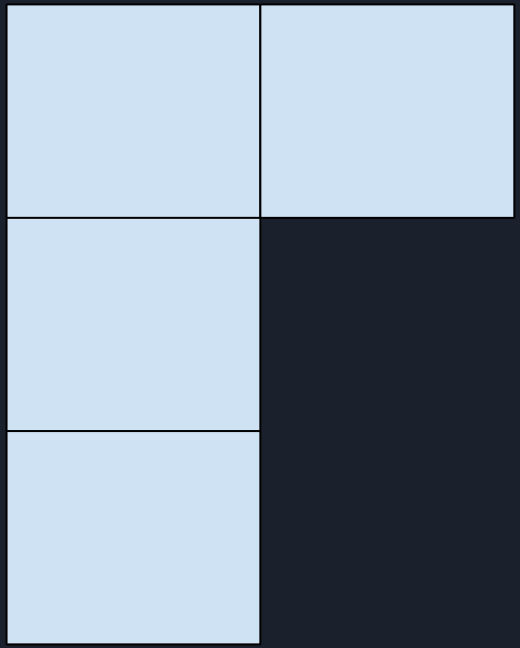
- Non-Example
  - 3 appears before 2❌

1	3	2
4	5	
6		

Research Question

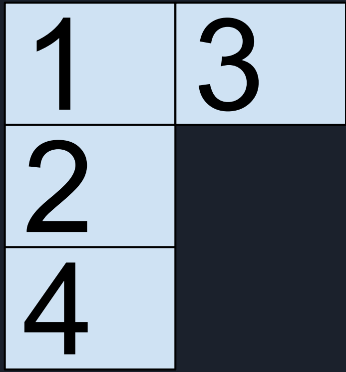
- Our research Question
  - **How many standard Young Tableaux are there of L shape with a total of n boxes?**

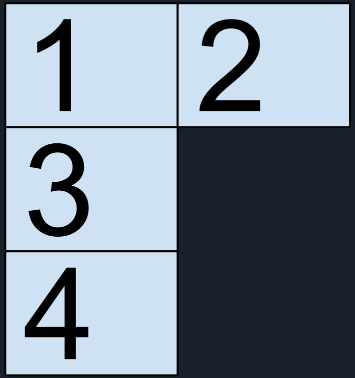
- Example
  - With 4 boxes how many L shaped standard young Tableaux

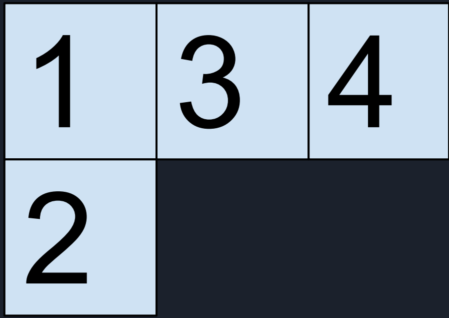


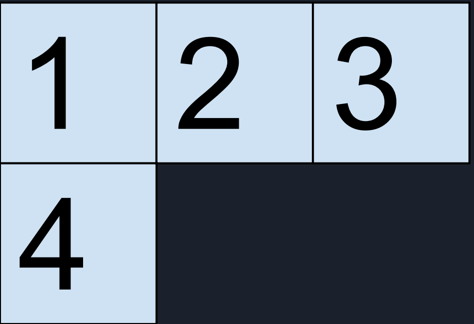
Example

- Rules
  - Each row and each column is strictly increasing.
  - There are no repeated numbers or symbols within each row or column.
- All the possibilities with 4 number of boxes









How can we verify?

Conjecture: For L shaped boxes, 2 to the power of (n minus one) minus two gives you the total number of tableaux.

To prove our conjecture, we decided to use the binomial theorem:

Consider 2^{n-1}

Binomial Theorem

Rewrite as $(a+b)^{n-1}$

$$\binom{n-1}{0}a^{n-1} + \binom{n-1}{1}a^{n-2}b + \binom{n-1}{2}a^{n-3}b^{2} + \dots \binom{n-1}{n-2}b^{n-1} + \binom{n-1}{n-1}b^{n-1}$$

Simplify

$$2^{n-1} = \binom{n-1}{0} + \binom{n-1}{1} + \binom{n-1}{2} + \dots + \binom{n-1}{n-2} + \binom{n-1}{n-1}$$

$$\boxed{1 + \binom{n-1}{1} + \binom{n-1}{2} + \dots + \binom{n-1}{n-2} + 1}$$

represents the number of ways

How does this relate:

Original $= 2^{n-1} - 2$ binomial $\binom{n-1}{k}$ (-2)

n	=	
3	2	$\binom{2}{0} + \binom{2}{1} + \binom{2}{2} = 4 - 2 = 2$
4	6	$\binom{3}{0} + \binom{3}{1} + \binom{3}{2} + \binom{3}{3} = 8 - 2 = 6$
5	14	$\binom{4}{0} + \binom{4}{1} + \binom{4}{2} + \binom{4}{3} + \binom{4}{4} = 16 - 2 = 14$

Reflection

- Some Challenges we faced:
  - Equation was incorrect for our formula
    - Example: we originally had our equation as a(n) = (2^n)-2 which was incorrect
    - Realized we had to subtract 1 from n
  - Didn’t use our time wisely
    - Ran into the issue of procrastination which led to small setbacks
    - Decided to all work in the project in study hall

Positive Experiences

- Helped with teamwork
  - Learned how to work with others
  - Good for professional environments

- Introduced us to new topics
  - Learned a lot of new material
  - Helped open up ideas that connects computer science with math

Advice For Future Project Groups

- Start early
- Know it will take time
- Suggest if you have a lot of time or are invested in it
- Work on the project in the Learning Center