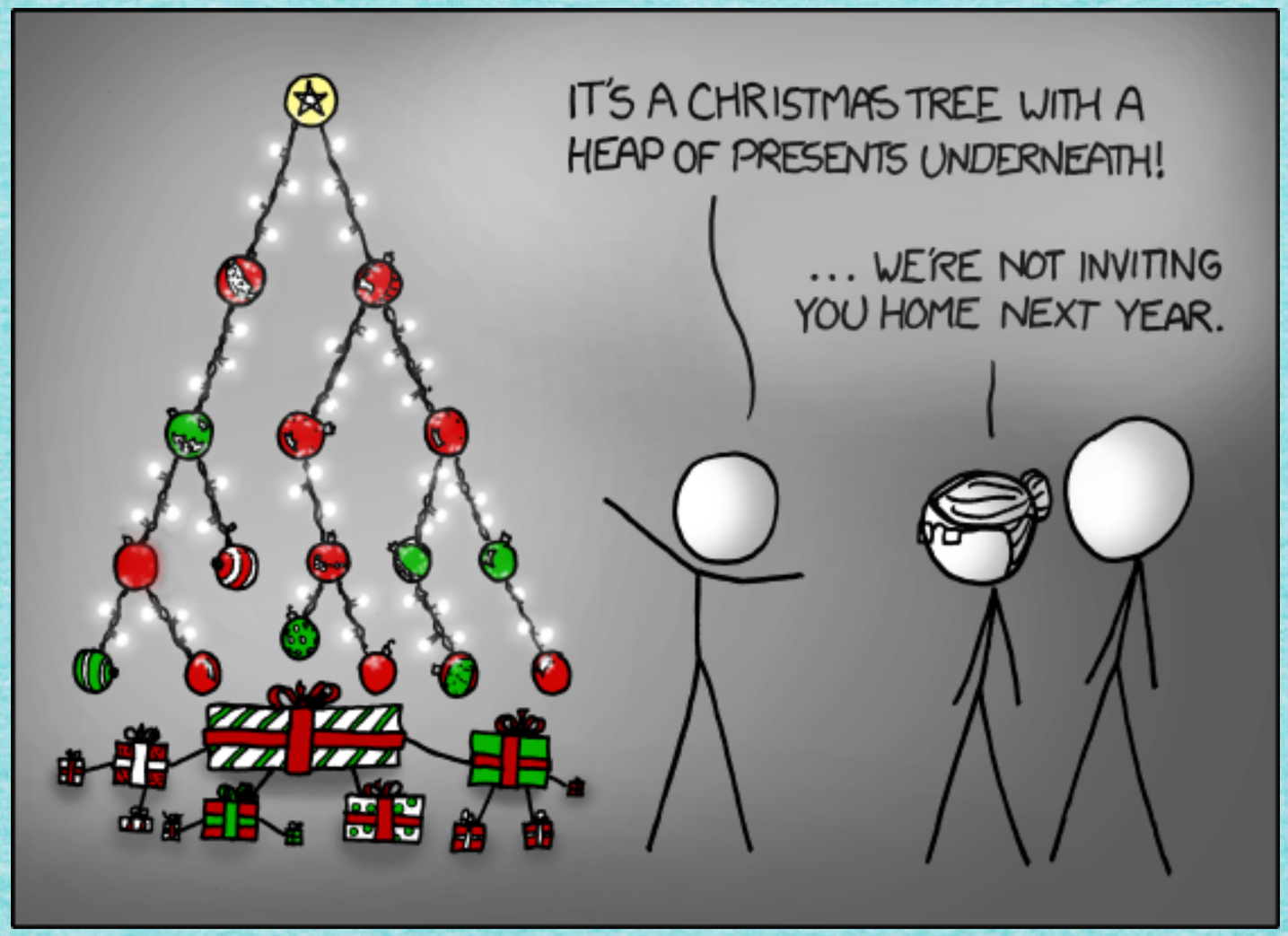
Kapitel 5: Sortieren

Algorithmen und Datenstrukturen
WS 2024/25

Prof. Dr. Sándor Fekete


IT'S A CHRISTMAS TREE WITH A HEAP OF PRESENTS UNDERNEATH!
... WE'RE NOT INVITING YOU HOME NEXT YEAR.

Wer ist eigentlich dieser knut?

Knut hat in Schweden eine fast 1.000 Jahre alte Tradition. Der **13.1.,** der St.-Knuts-Tag, hat seinen Namen von Knut IV., einem König, der von Weihnachten nicht genug bekommen konnte. Also hat er das **Fest auf 20 Tage verlängert.** Seitdem endet es jedes Jahr mit dem Knut-Tag, an dem wir **abschmücken und Platz für Neues schaffen.**

Donald Knuth

Knuth in 2005

Born	Donald Ervin Knuth January 10, 1938 (age **86**) Milwaukee, Wisconsin, U.S.

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THE CLASSIC WORK
NEWLY UPDATED AND REVISED

The Art of Computer Programming

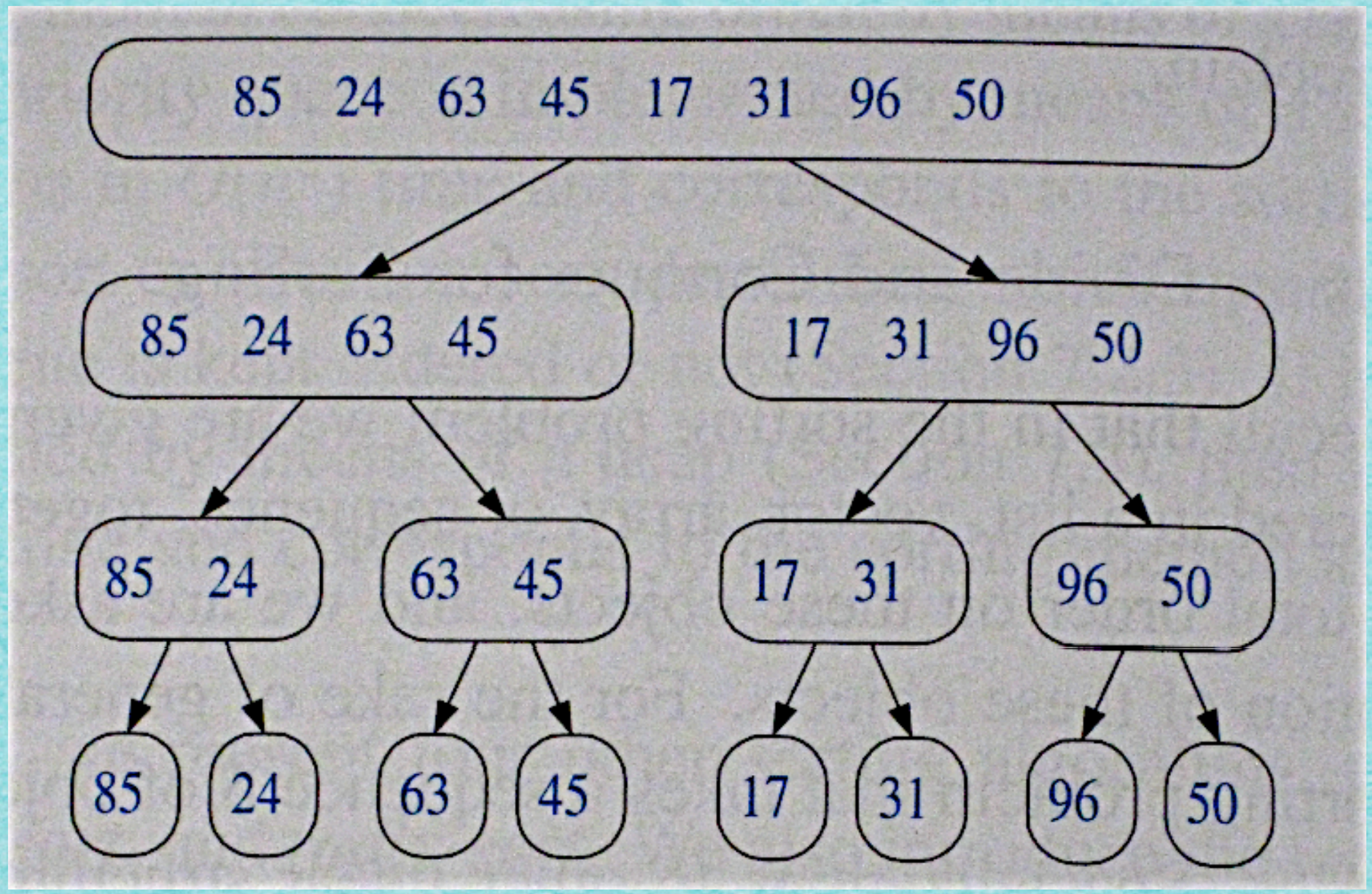
VOLUME 3

Sorting and Searching

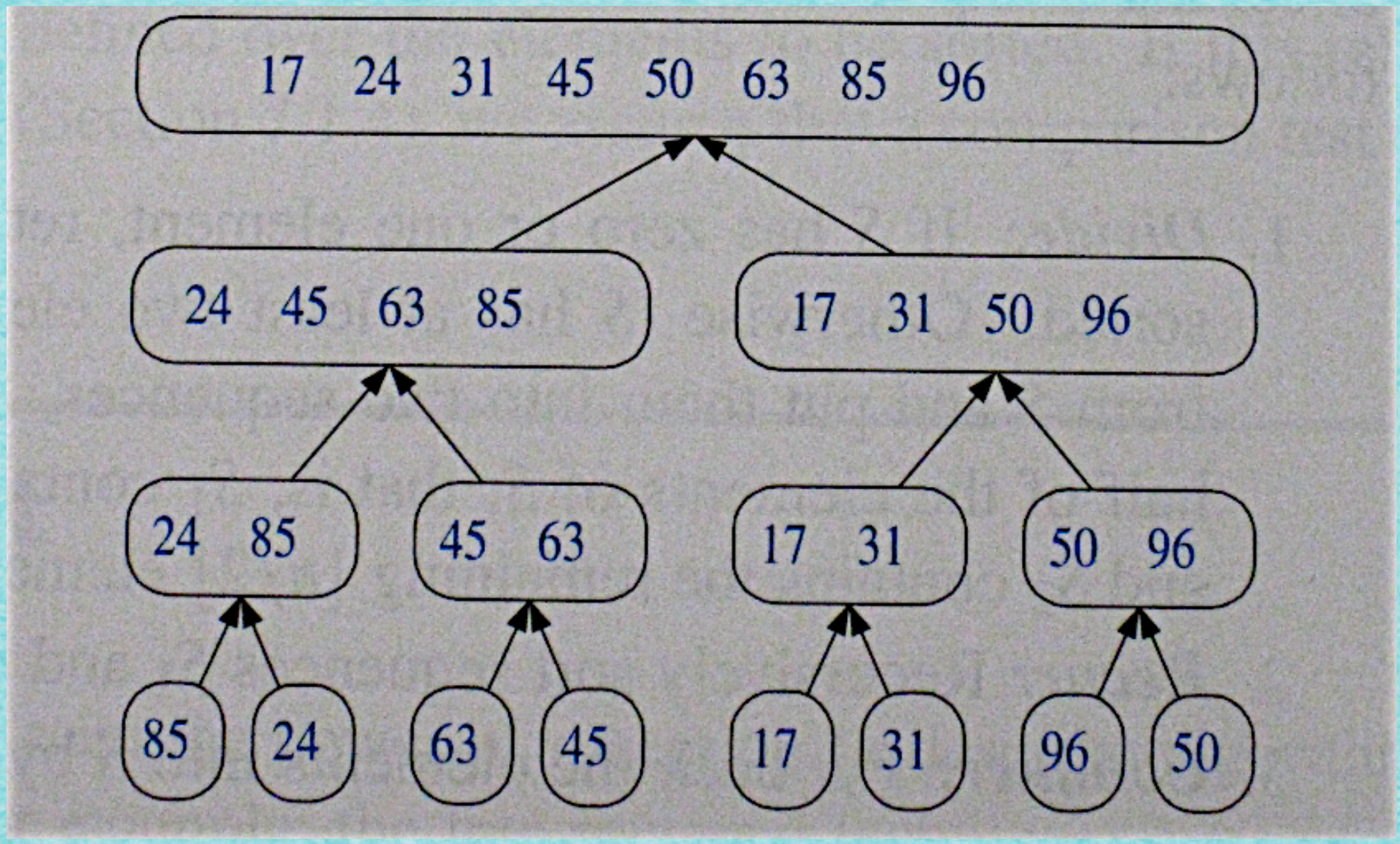
Second Edition

DONALD E. KNUTH

5.1 Mergesort



5.1 Mergesort



5.1.2 Algorithmische Beschreibung

Algorithmus 5.1

INPUT: Subarray von A=[1,...,n],
der bei Index p beginnt und bei Index r endet, d.h. A[p,...,r]

OUTPUT: Sortierter Subarray

MERGE-SORT(A,p,r)

```
1  if p < r
2      then q ← ⌊(p + r)/2⌋
3           MERGE-SORT(A, p, q)
4           MERGE-SORT(A, q + 1, r)
5           MERGE(A, p, q, r)
```

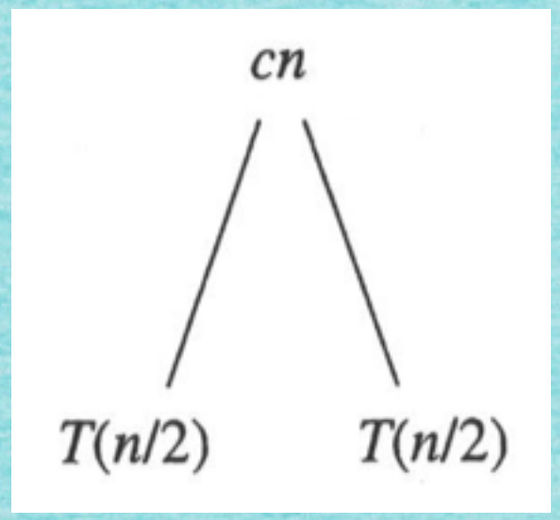
5.1.3 Laufzeit von Mergesort

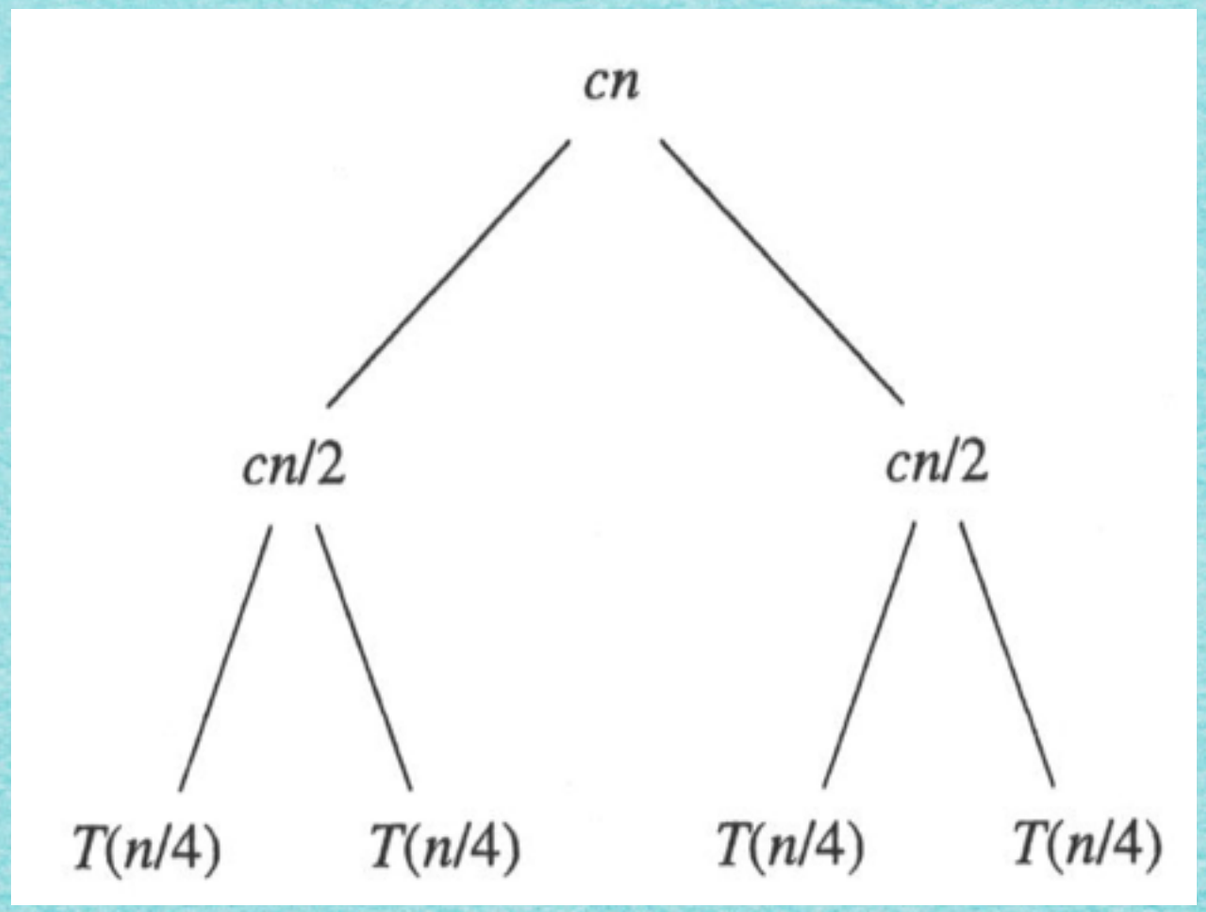
Wie viele Schritte benötigt Merge-Sort für einen Array der Länge n?

$T(n)$

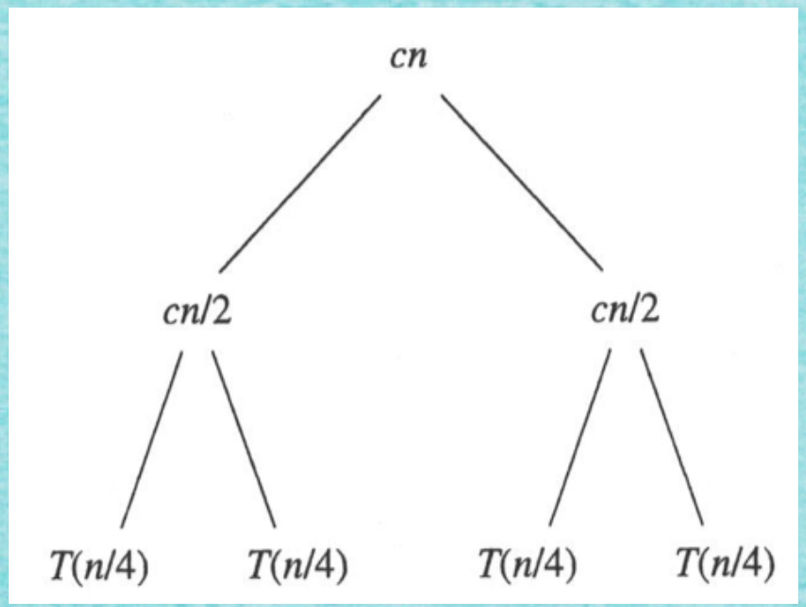
5.1.3 Laufzeit von Mergesort

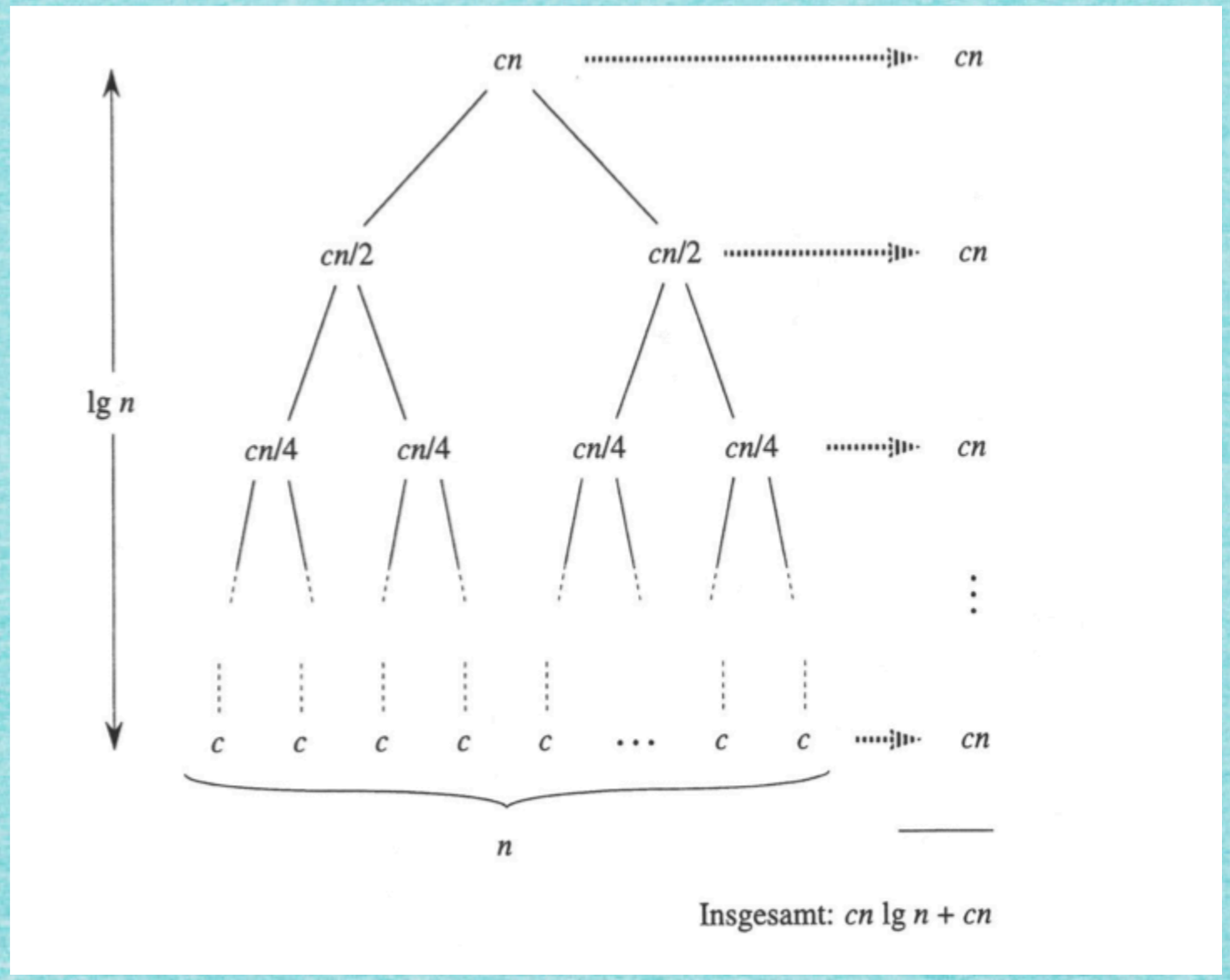
$T(n)$





5.1.3 Laufzeit von Mergesort





5.1.3 Laufzeit von Mergesort

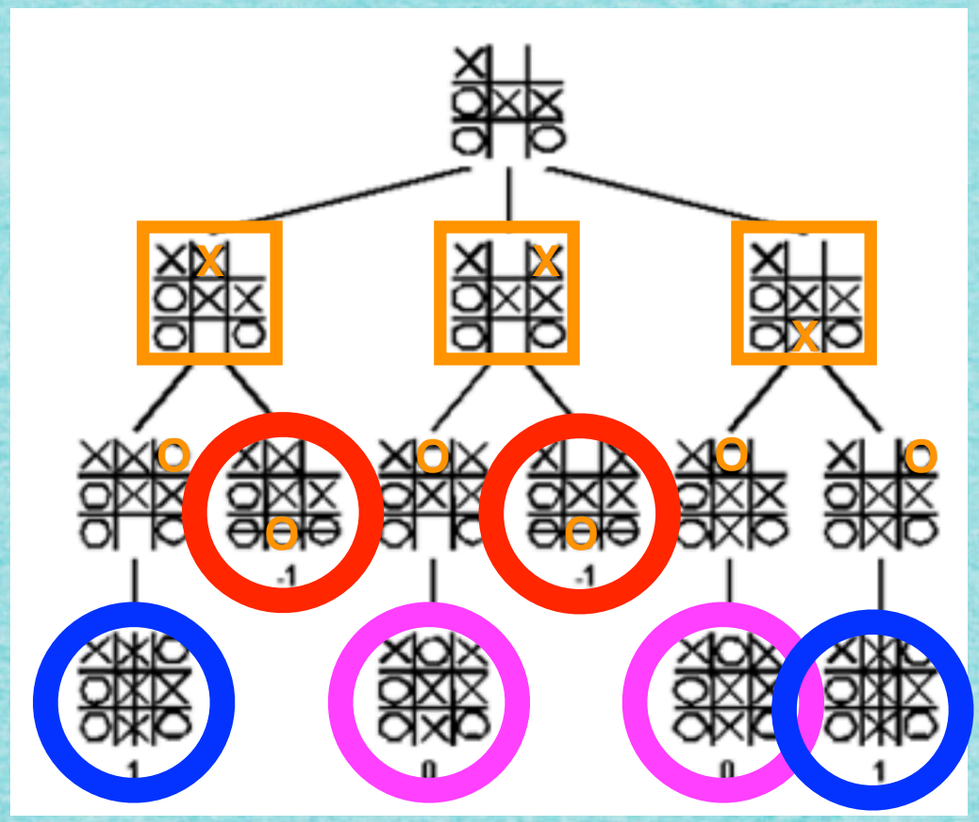
<u>Satz 5.3 (Komplexität von Mergesort)</u>
Für einen n-elementigen Array A hat Mergesort eine Laufzeit von O(n log n).

5.1.3 Laufzeit von Mergesort

Fragen:

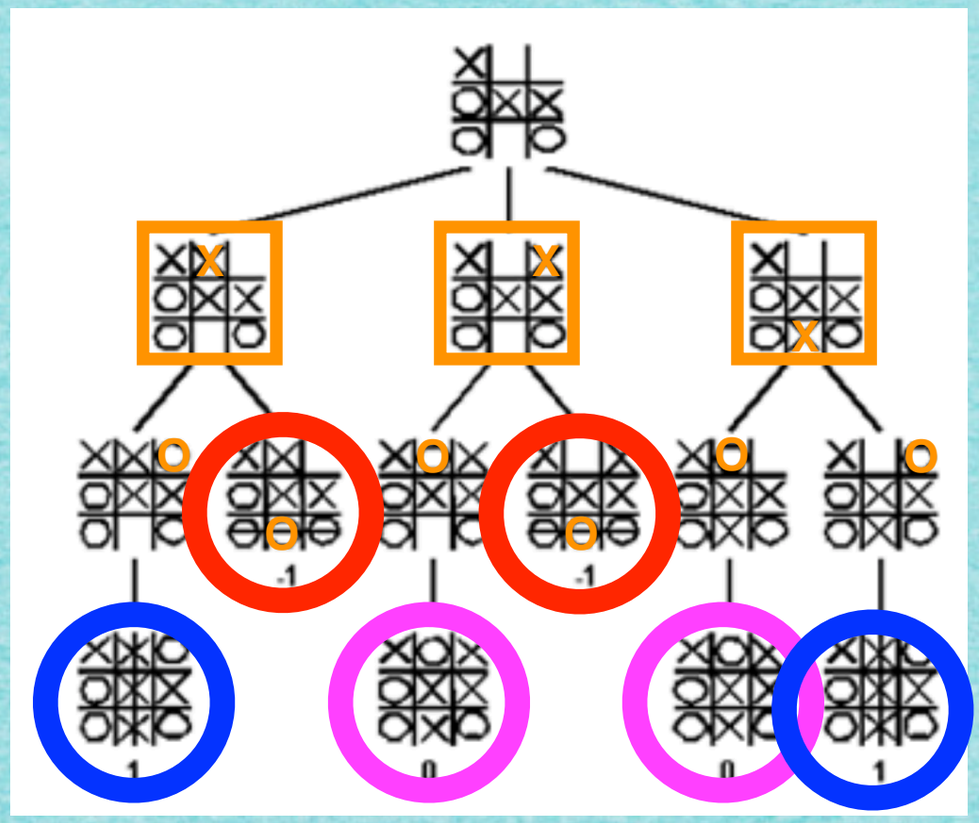
- Geht's noch schneller?
- Wie kann man sonst mit Rekursionen umgehen?

5.2 Schranken: Entscheidungsbäume



Magnus Carlsen – Photo Lennart Ootes

5.2 Schranken: Entscheidungsbäume



Wordle

Wordle

Official game logo on *The New York Times*

5.2 Schranken: Entscheidungsbäume

Wordle

Wordle

Official game logo on *The New York Times*

C	R	A	N	E
N	I	C	H	E
S	I	N	C	E
W	I	N	C	E
M	I	N	C	E

14.04.22

Wordle

Q W E R T Y U I O P

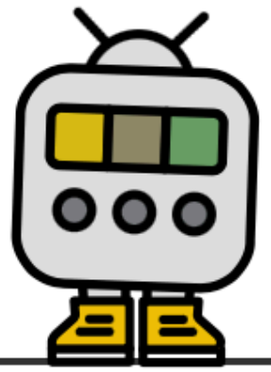
A S D F G H J K L

ENTER Z X C V B N M ⌫

The New York Times

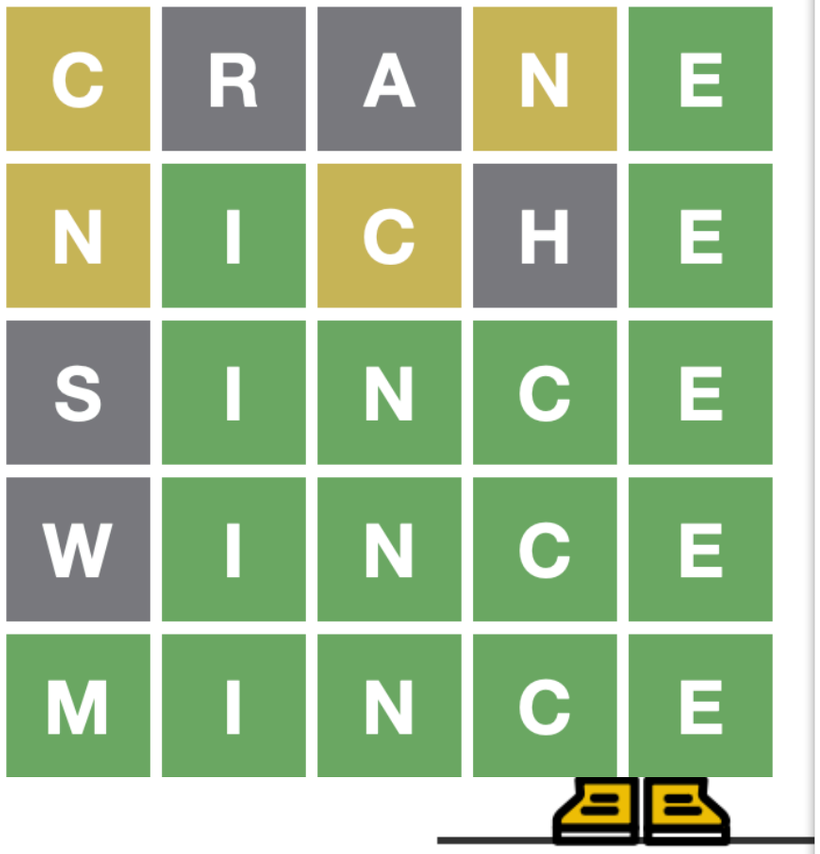
WordleBot: Improve Your Wordle Strategy

By Josh Katz and Matthew Conlen



What would you like to do?

WordleBot: I



What would

The New York Times

YOUR GROUPS, WITH NICHE

Pattern	Chance solution is among these words
	36%
FENCE	9.2%
OUNCE	9.2%
PENCE	9.2%
DUNCE	8.2%
	27%
SINCE	9.2%
WINCE	9.1%
MINCE	9%
UNCLE	9%
NICHE	9%
NIECE	9%
HENCE	9%

MY GROUPS, WITH HUMPS

Pattern	Chance solution is among these words
	28%
FENCE	9.2%
NIECE	9.2%
WINCE	9.1%
	17%
OUNCE	9.2%
DUNCE	8.2%
SINCE	9%
UNCLE	9%
NICHE	9%
HENCE	9%
PENCE	9%
MINCE	9%

WordleBot: I

C	R	A	N	E
N	I	C	H	E
S	I	N	C	E
W	I	N	C	E
M	I	N	C	E

What would

The New York Times

Your Solution

5 steps

C	R	A	N	E
N	I	C	H	E
S	I	N	C	E
W	I	N	C	E
M	I	N	C	E

49 luck

UNCLE 9%

NICHE 9%

NIECE 9%

HENCE 9%

My Solution

3 steps

C	R	A	N	E
H	U	M	P	S
M	I	N	C	E

80 luck

UNCLE 9%

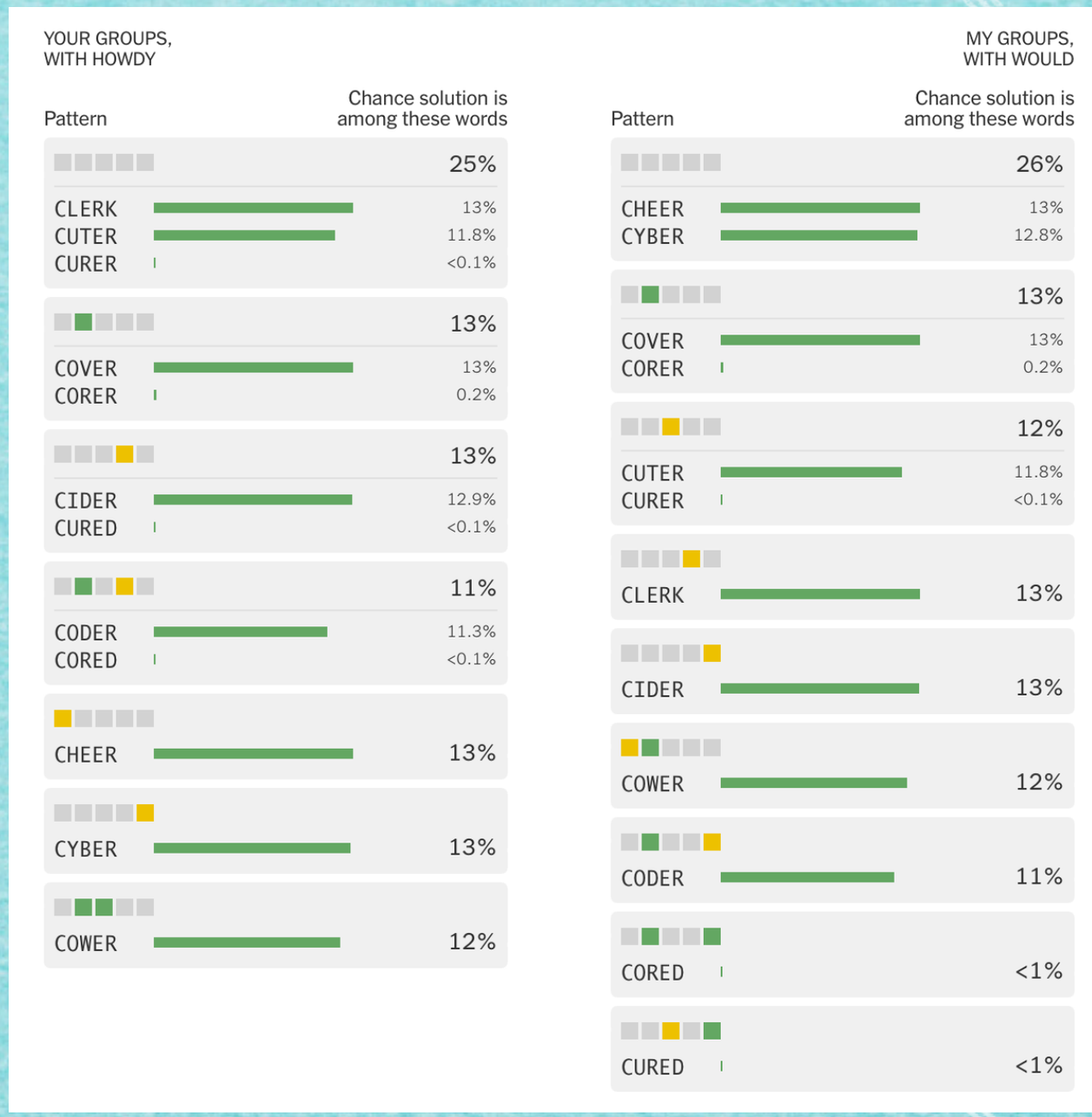
NICHE 9%

HENCE 9%

PENCE 9%

MINCE 9%

5.2 Schranken: Entscheidungsbäume



05.01.25

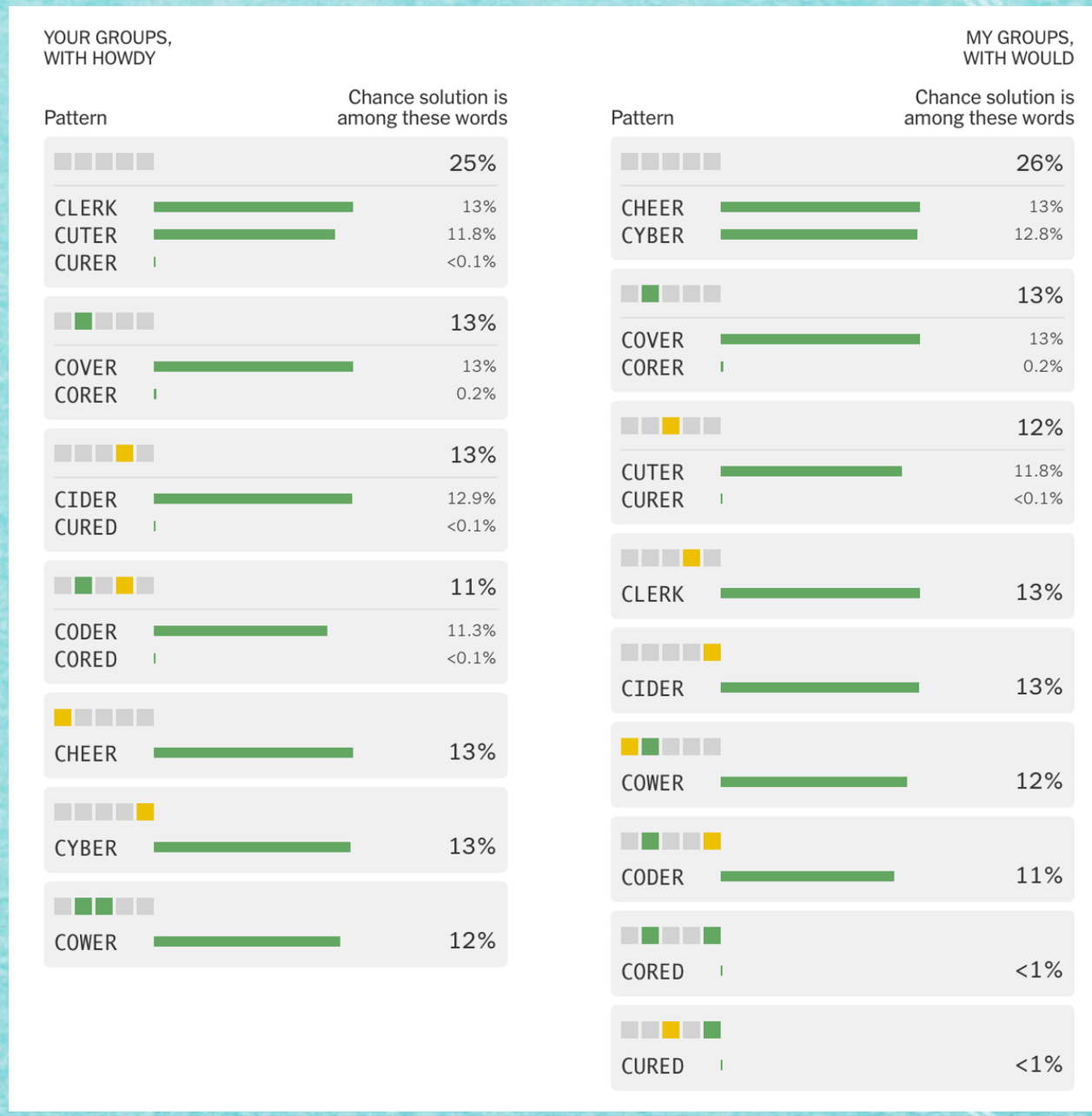
The opening move of a Wordle genius, **CRANE** is my favorite opening word of them all. On average, I can solve a Wordle in 3.5 steps when I start by guessing **CRANE**.

5.2 Schranken: Entscheidungsbäume

Wordle

Wordle

Official game logo on *The New York Times*



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Wordle

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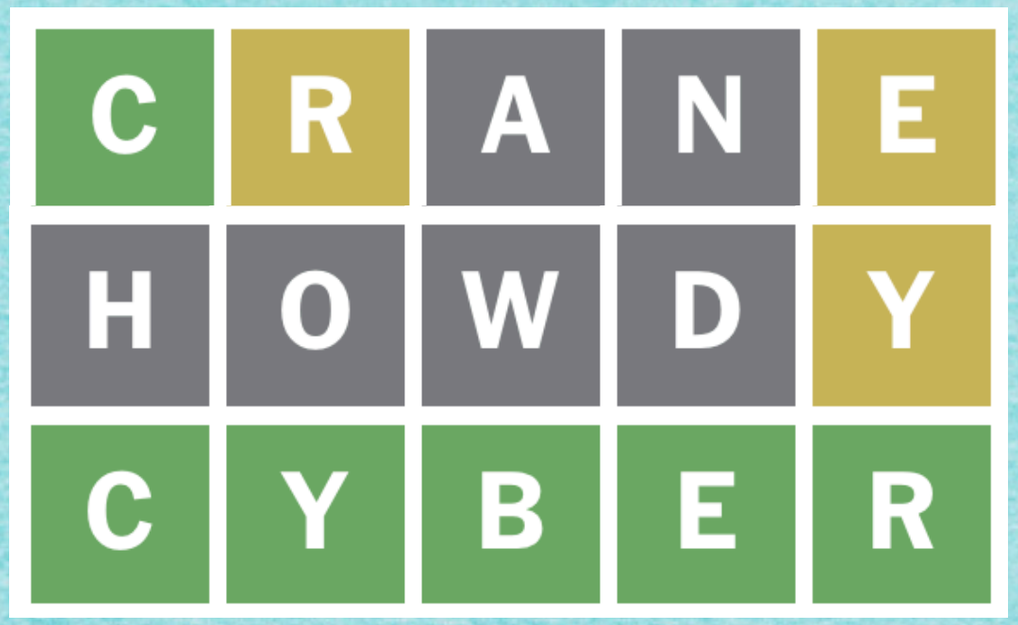

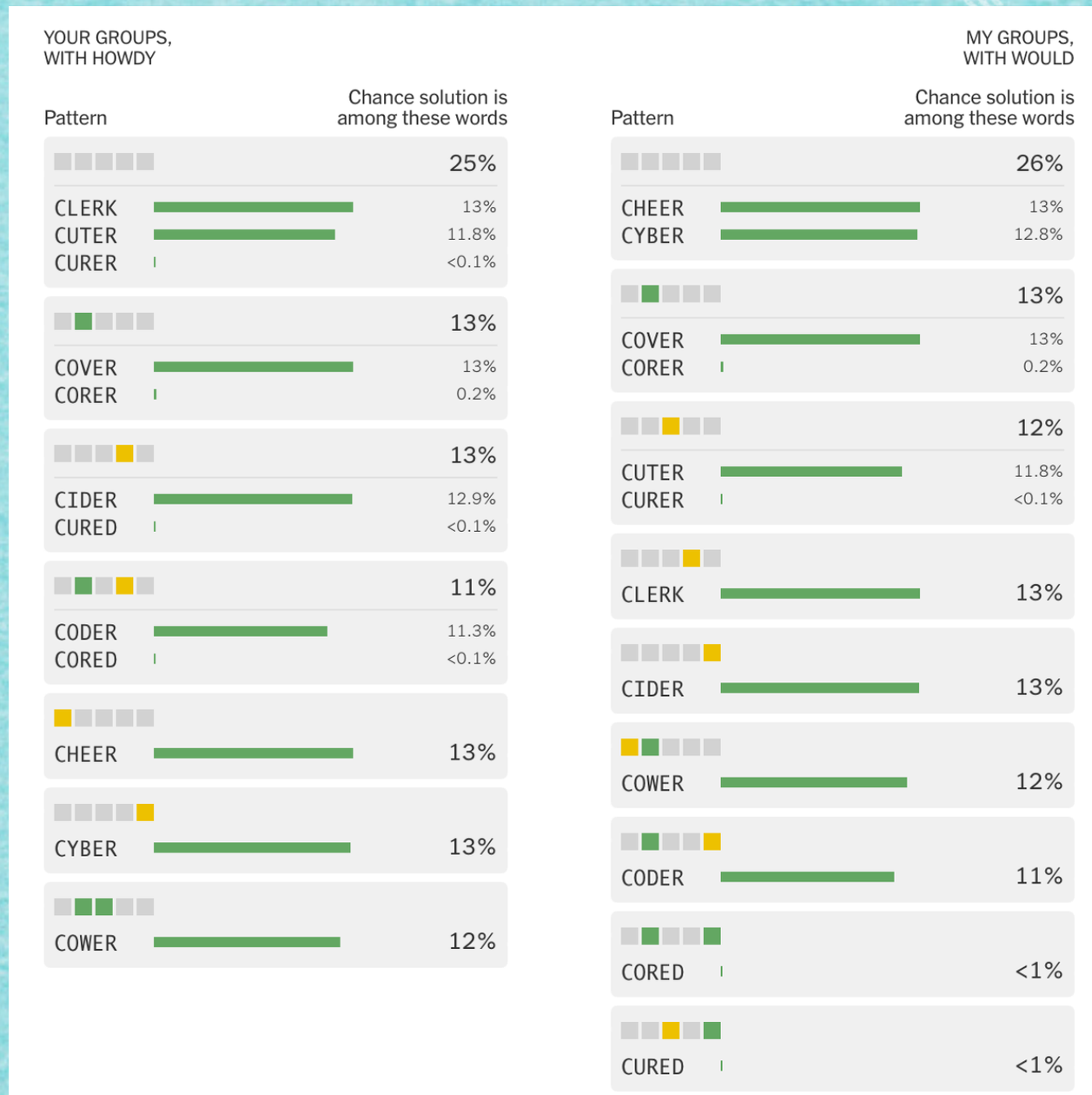

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5.2 Schranken: Entscheidungsbäume

Wordle

Wordle

Official game logo on *The New York Times*

Here's how I would have solved it on my own. You solved it faster than I did! Well done.

Your Solution

3 steps

C	R	A	N	E
H	O	W	D	Y
C	Y	B	E	R

79 luck

My Solution

4 steps

C	R	A	N	E
W	O	U	L	D
C	H	E	E	R
C	Y	B	E	R

43 luck

YOUR GROUPS, WITH HOWDY

Pattern	Chance solution is among these words
	25%
CLERK	13%
CUTER	11.8%
CURER	<0.1%
	13%
COVER	13%
CORER	0.2%
	13%
CIDER	12.9%
CURED	<0.1%
	11%
CODER	11.3%
CORED	<0.1%
CHEER	13%
CYBER	13%
COWER	12%

MY GROUPS, WITH WOULD

Pattern	Chance solution is among these words
	26%
CHEER	13%
CYBER	12.8%
	13%
COVER	13%
CORER	0.2%
	12%
CUTER	11.8%
CURER	<0.1%
CLERK	13%
CIDER	13%
COWER	12%
CODER	11%
CORED	<1%
CURED	<1%

05.01.25

The opening move of a Wordle genius, **CRANE** is my favorite opening word of them all. On average, I can solve a Wordle in 3.5 steps when I start by guessing **CRANE**.

Wordle

07.01.25

C	R	A	N	E
S	A	L	T	Y
A	T	L	A	S

Your Solution

3 steps

C	R	A	N	E
S	A	L	T	Y
A	T	L	A	S

53 luck

My Solution

3 steps

C	R	A	N	E
T	O	I	L	S
A	T	L	A	S

53 luck

Q	W	E	R	T	Y	U	I	O	P
	A	S	D	F	G	H	J	K	L
ENTER		Z	X	C	V	B	N	M	⌫

Weekend Diversion: The Logic That Stumped Brooklyn Nine Nine

Ethan Siegel Follow

May 24, 2015 · 11 min read ★

The most famous logic puzzle from the best police comedy on television, and how to (finally) solve it!


POLICE
PARTY
NYPD
LEAGUE

"There are 12 men on an island. 11 weigh exactly the same amount, but one of them is slightly lighter or heavier. You must figure out which. The island has no escapes, but there is a see-saw. The exciting catch? You can only use it three times."

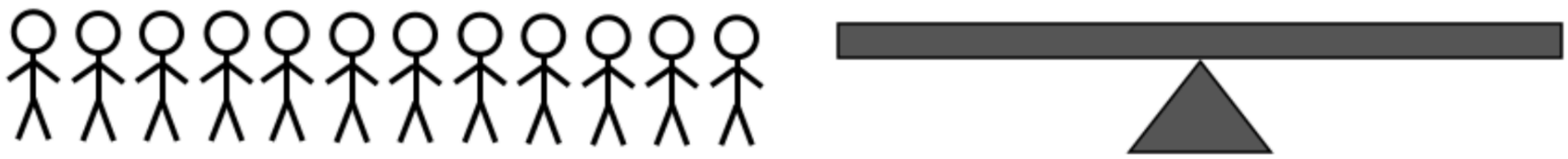
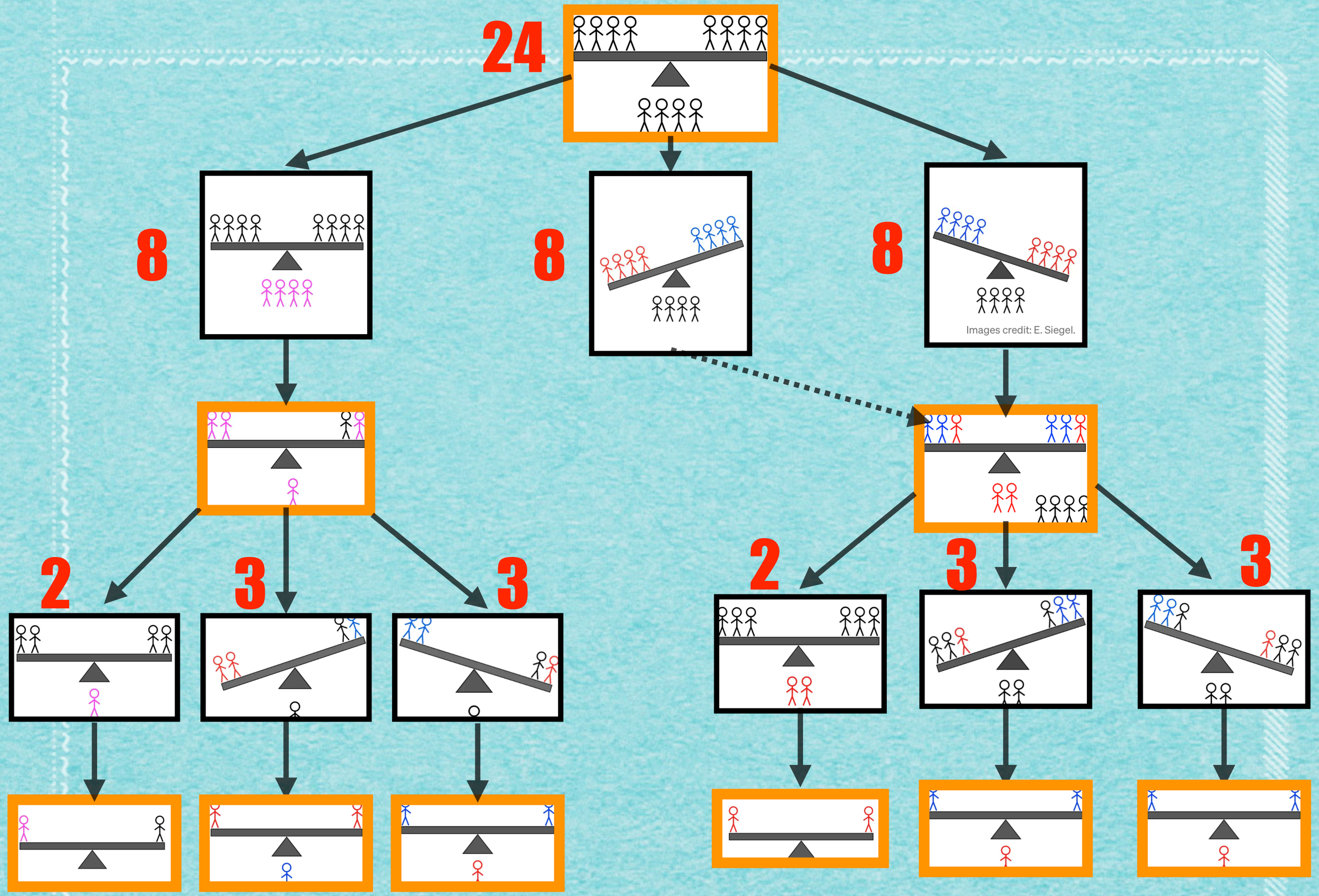


Image credit: E. Siegel, of the setup and starting materials.


24
8
8
8
2
3
3
2
3
3
Images credit: E. Siegel.

If you were able to solve it, you were able to do what Captain Holt, Amy Santiago, Terry Jeffords and the rest of the Nine-Nine couldn't do: avoid a tragic #nerdfail.

Image credit: Fox / Fremulon.

Mehr an der Tafel!

s.fekete@tu-bs.de