

O problema do prisioneiro viajante



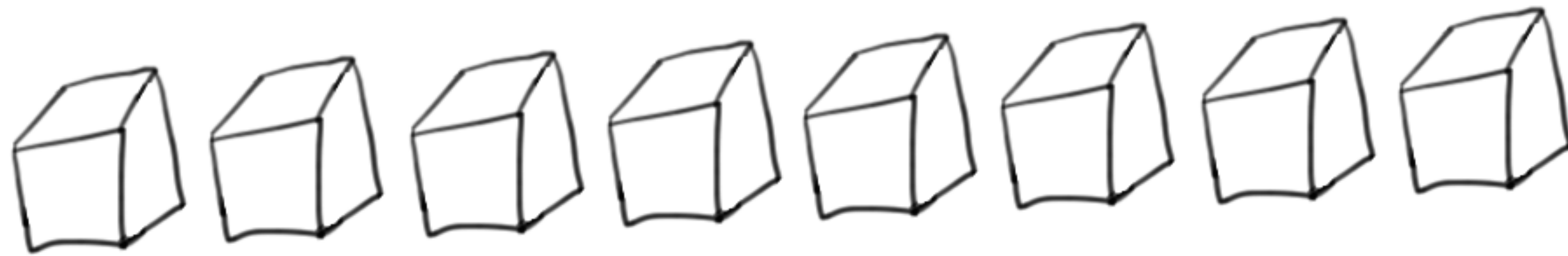
Seminário
de coisas legais

8/11/2013

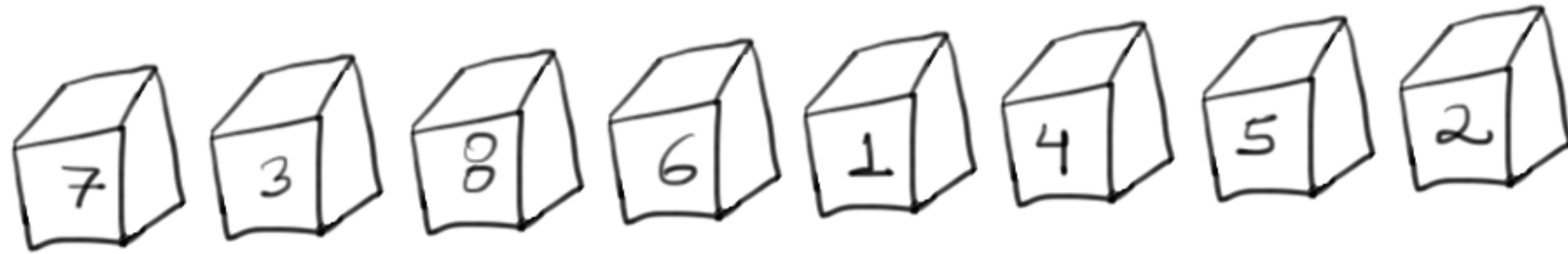
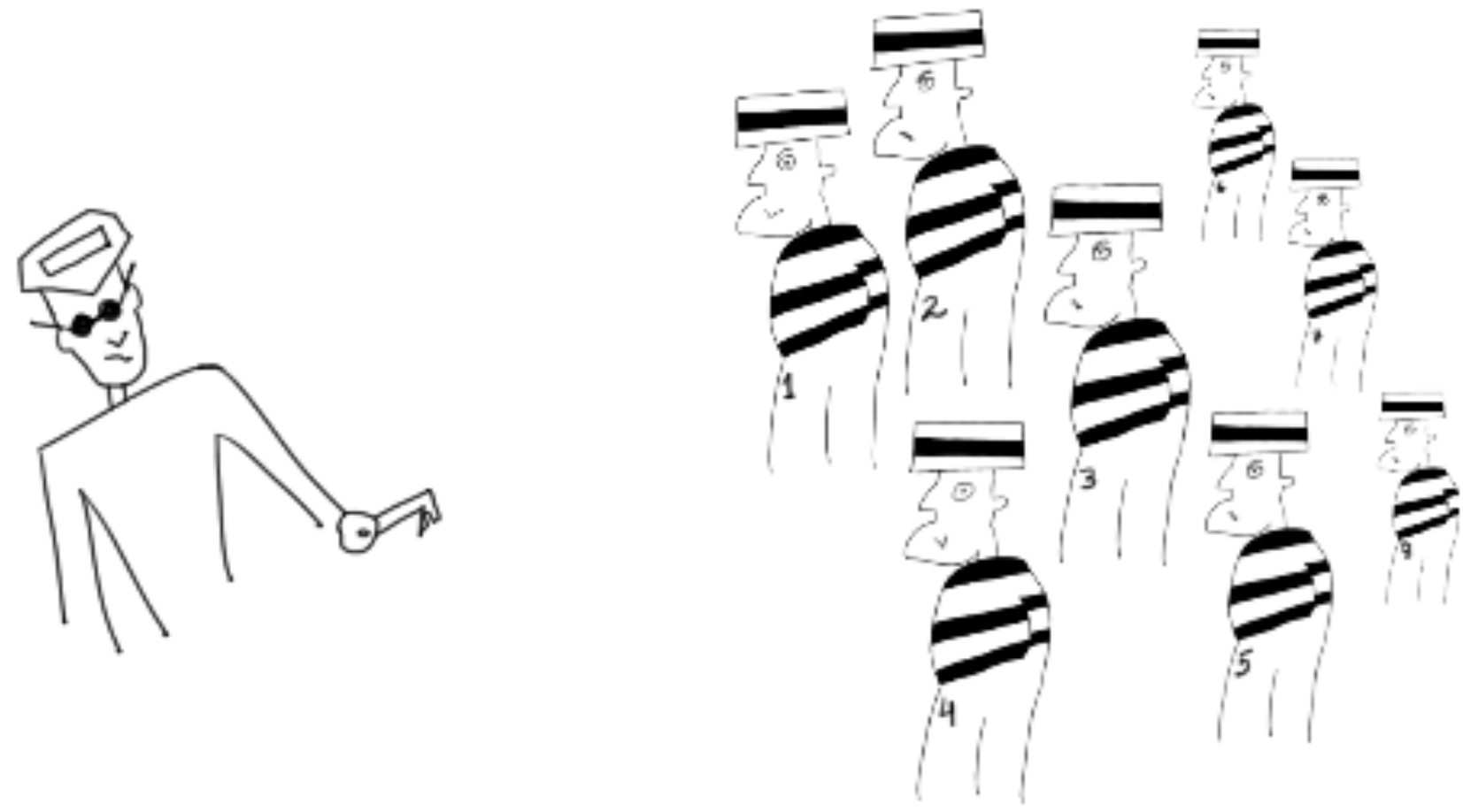
Do you wanna play a game ?



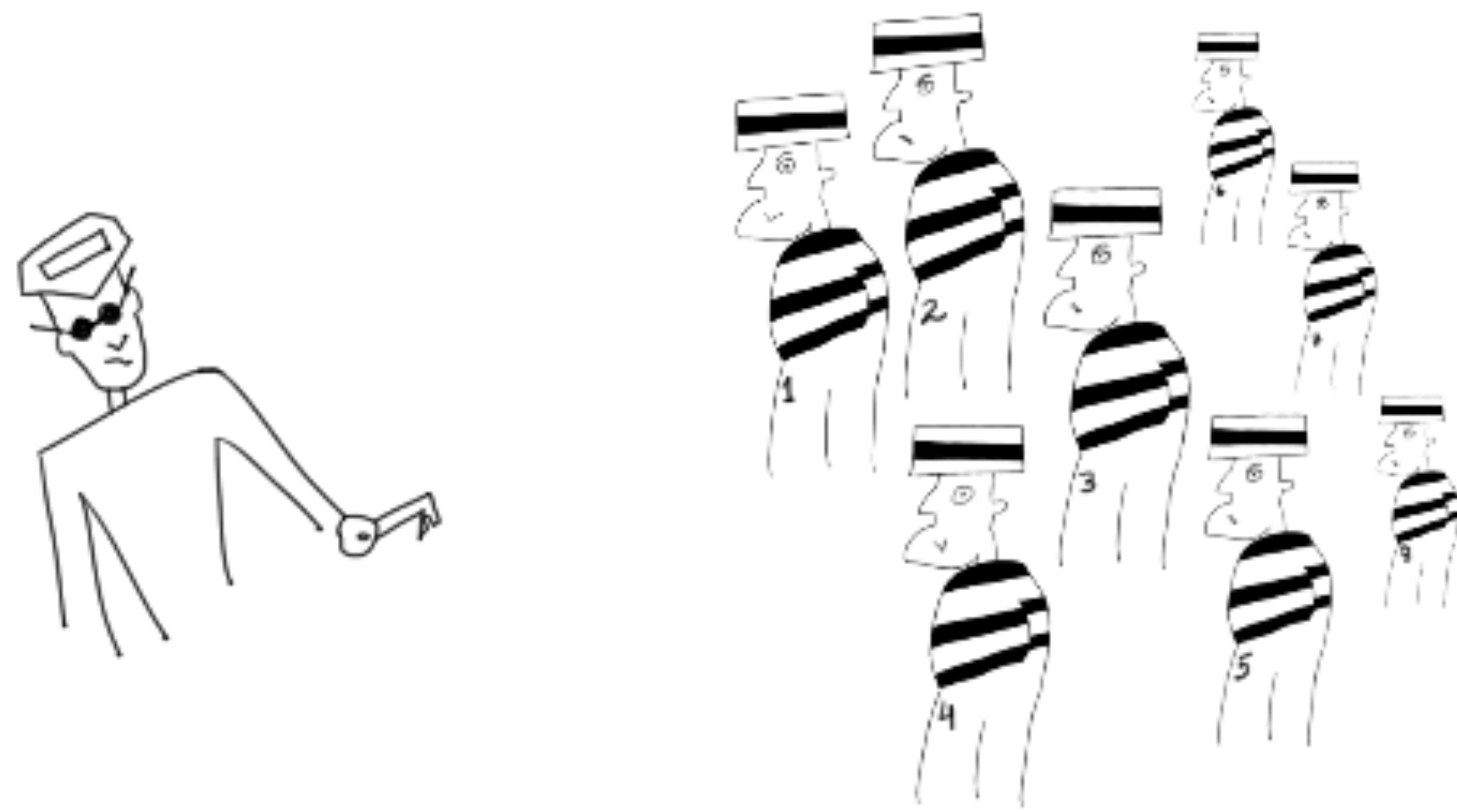
Do you wanna play a game ?



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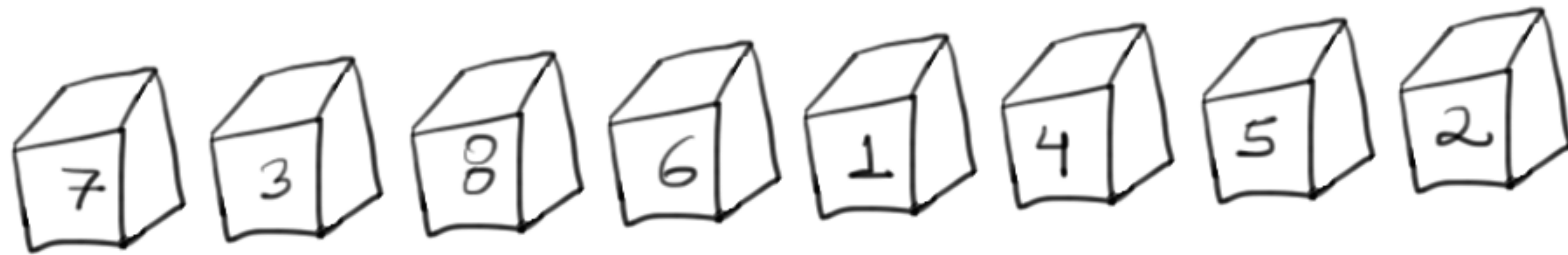


Do you wanna play a game ?

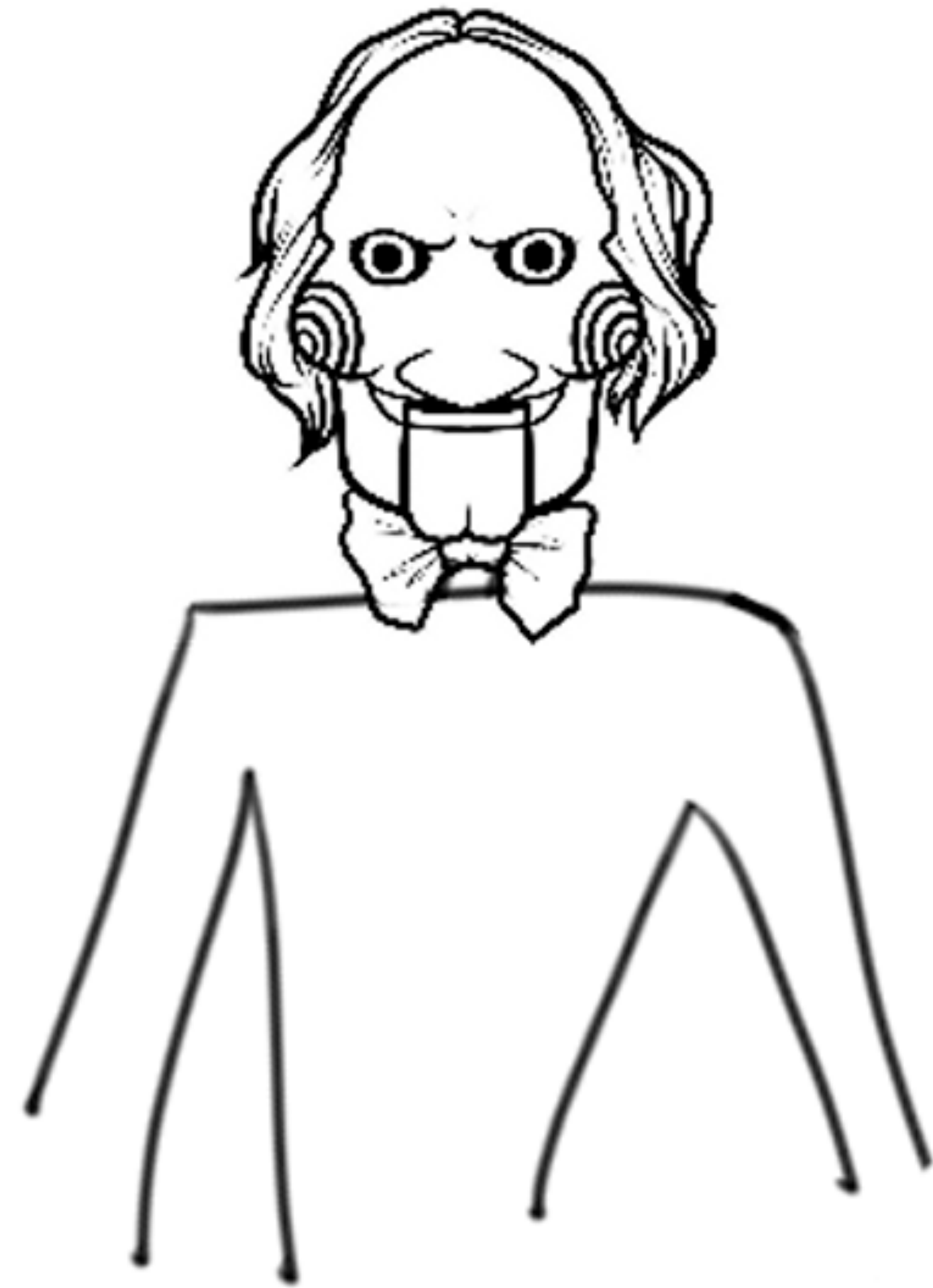


Regras:

- * Cada prisioneiro escolhe 4 ($n/2$) caixas
- * Se todos encontrarem seus números, todos livres



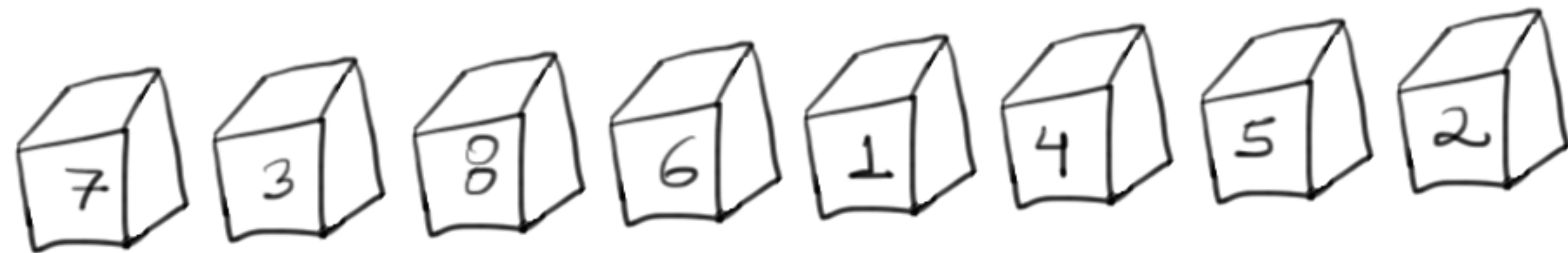
Caso contrário...



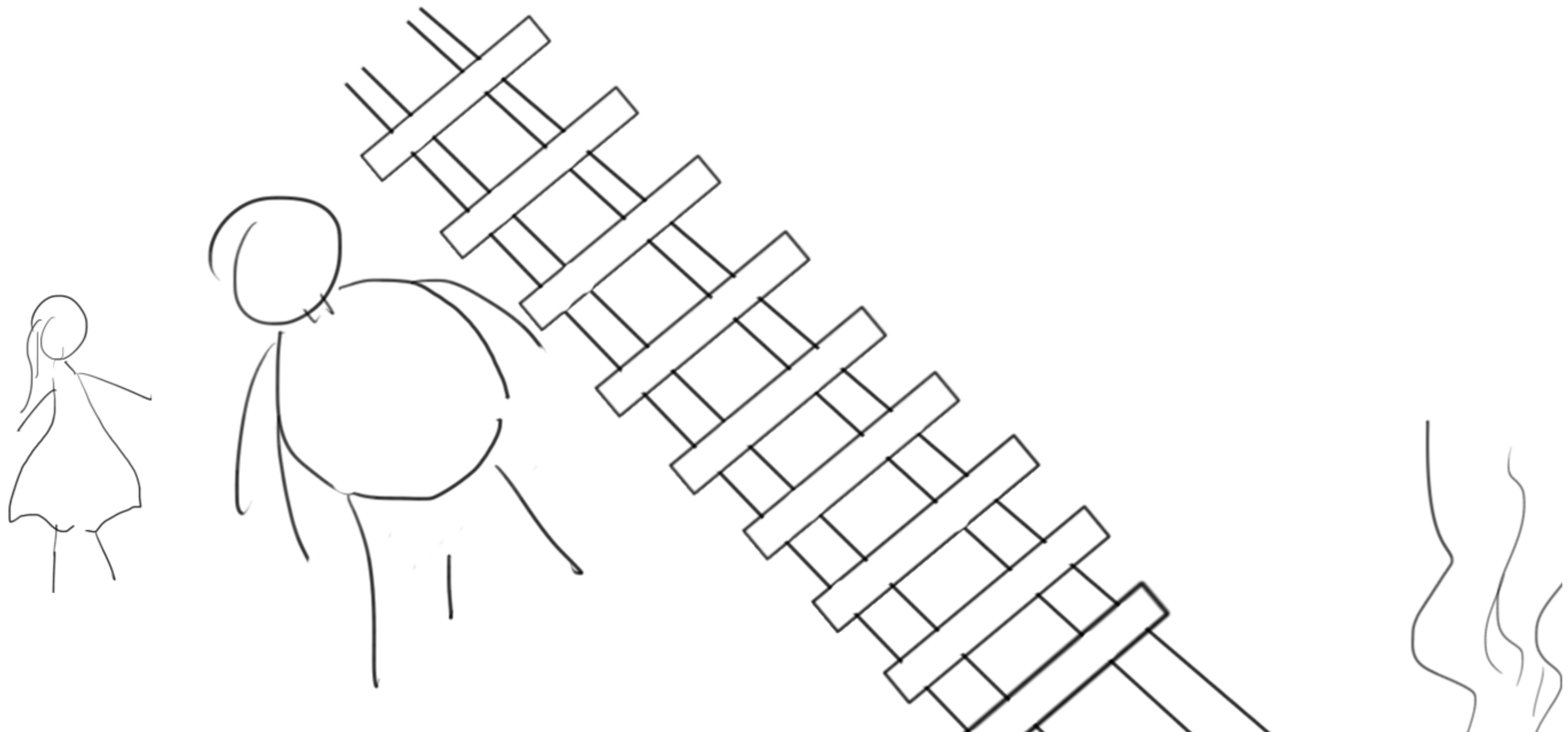
Que dilema ?

1 prisioneiro) $\frac{4}{8} = \frac{1}{2}$

8 prisioneiros) $(\frac{1}{2})^8 < 0,4\%$



E o gordo ?



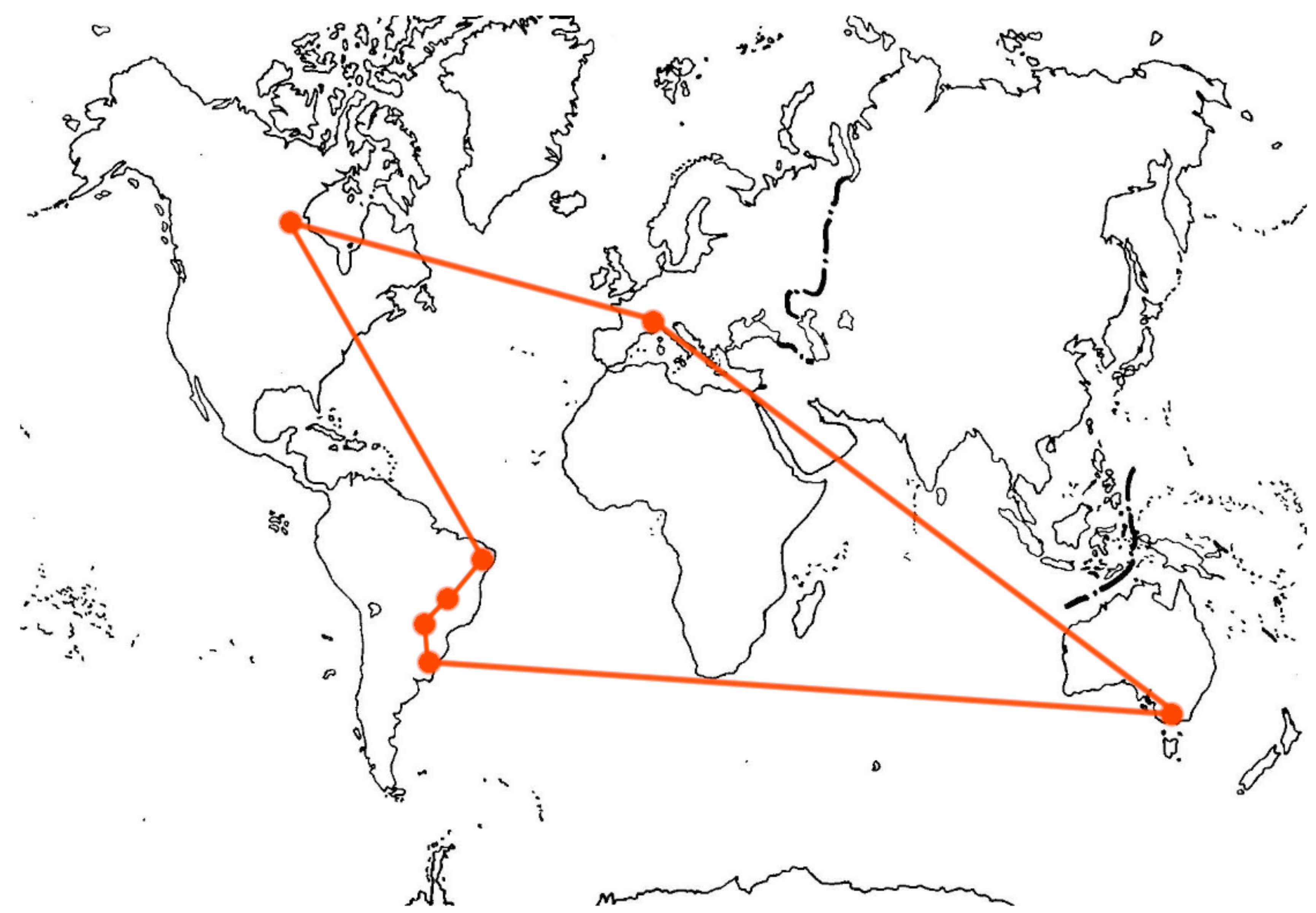
O problema do caixeiro viajante



O problema do caixeiro viajante



O problema do caixeiro viajante



Um problema curioso

HELP! WE'RE LOST!

HELP "CAR 54" ... AND WIN CASH
54...\$1,000 PRIZES
ONE...\$10,000 GRAND PRIZE

START and FINISH

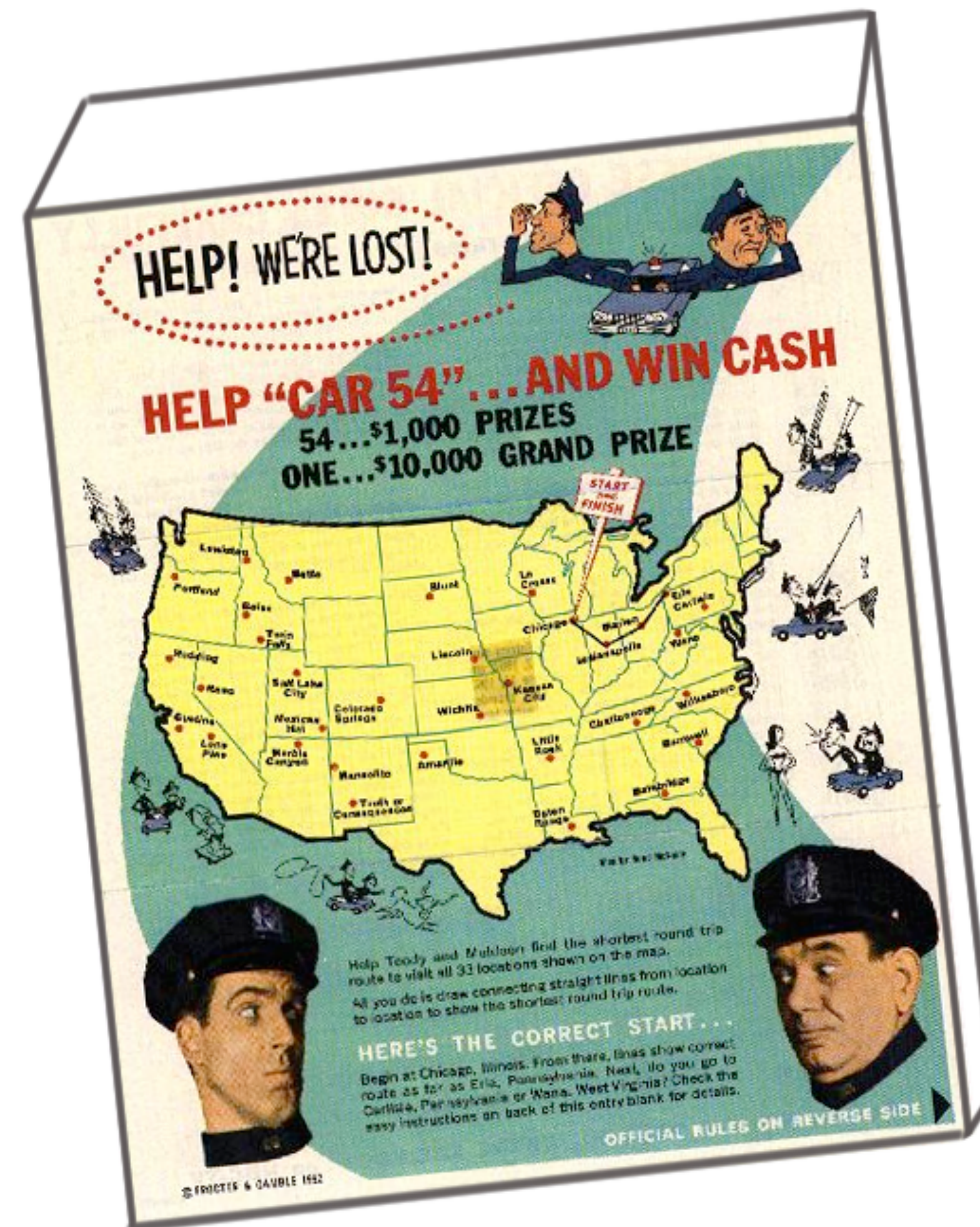
Help Teedy and Mulholland find the shortest round trip route to visit all 33 locations shown on the map. All you do is draw connecting straight lines from location to location to show the shortest round trip route.

HERE'S THE CORRECT START...
Begin at Chicago, Illinois. From there, lines show correct route as far as Erie, Pennsylvania. Next, do you go to Carlisle, Pennsylvania or Wana, West Virginia? Check the easy instructions on back of this entry blank for details.

OFFICIAL RULES ON REVERSE SIDE

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Um problema simples



Um problema **muito** simples

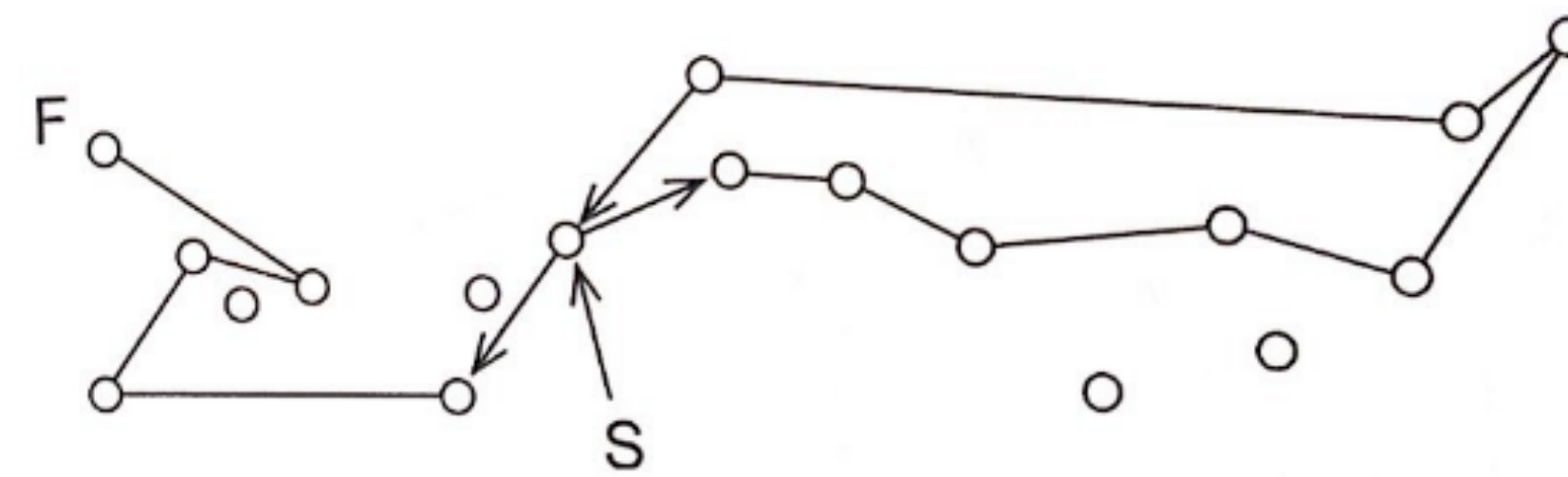


Figure 1.40 Chimpanzee tour (Bido).

Um problema **muito muito** simples



Um problema **muito muito** simples

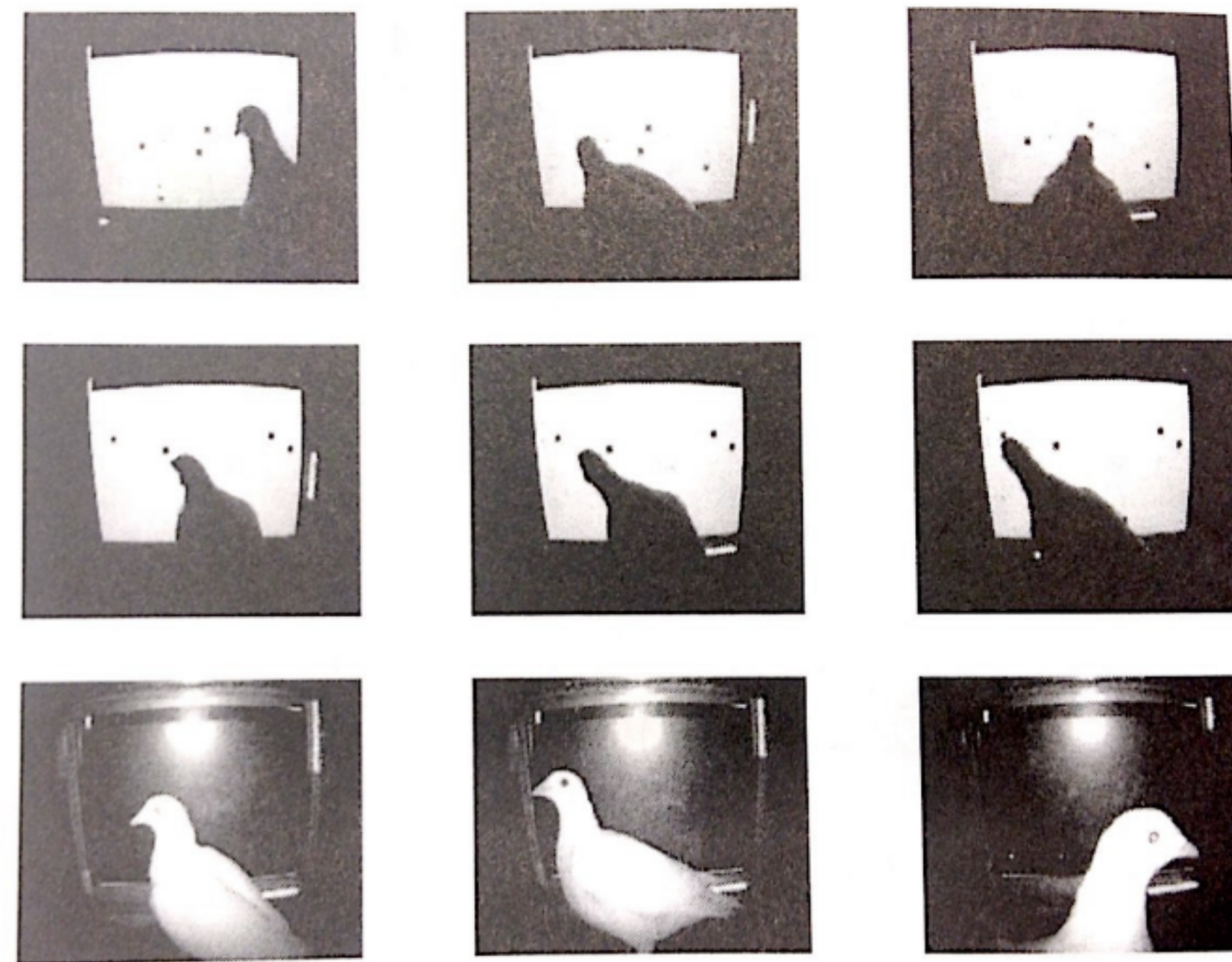


Figure 1.41 Pigeon solving a TSP. Images courtesy of Brett Gibson.

Um amor de problema



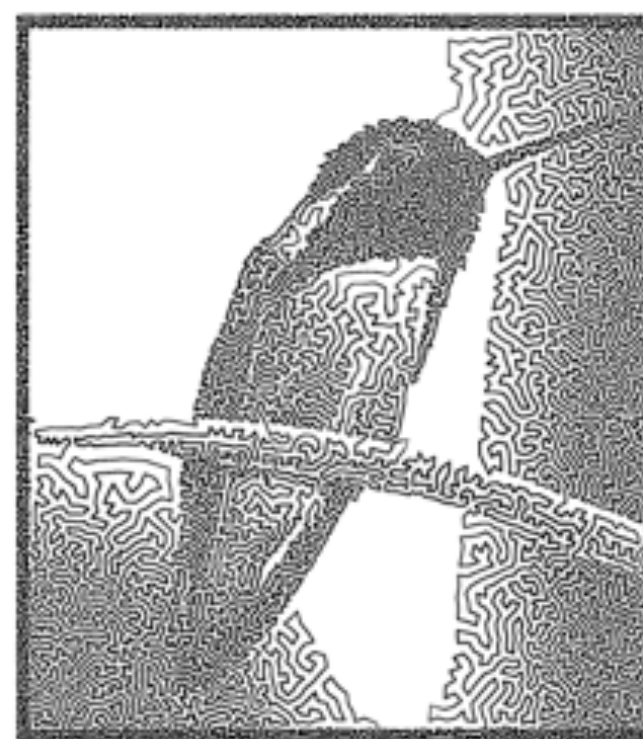
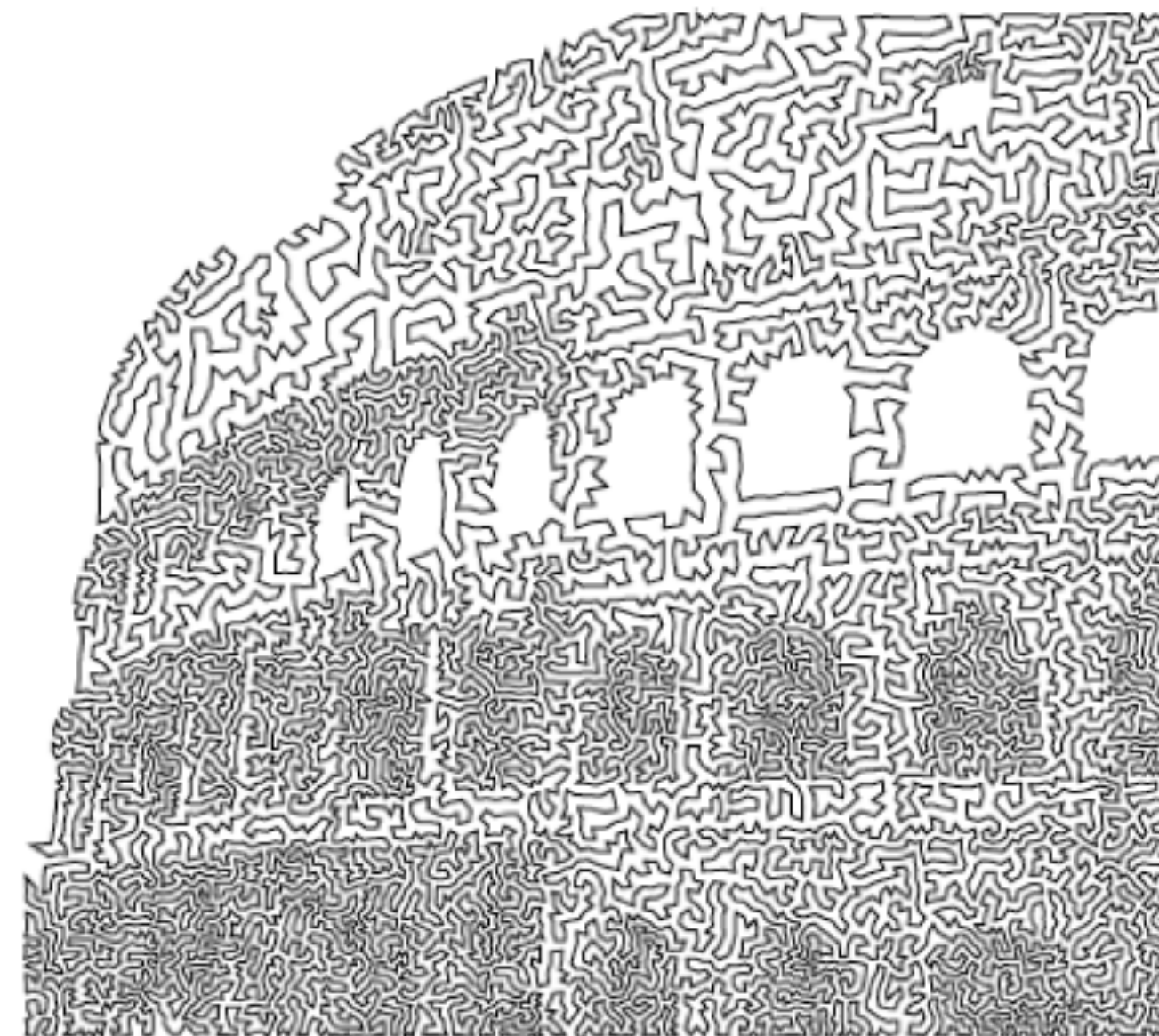
Um amor de problema

Table 1.3 Average tour quality found by participants. van Rooij et al. [485].

Number of Cities	7-Year-Olds	12-Year-Olds	Adult
5	3.8%	2.5%	1.7%
10	5.8%	3.4%	1.7%
15	9.4%	5.0%	2.7%



Um amor de problema



Um amor de problema

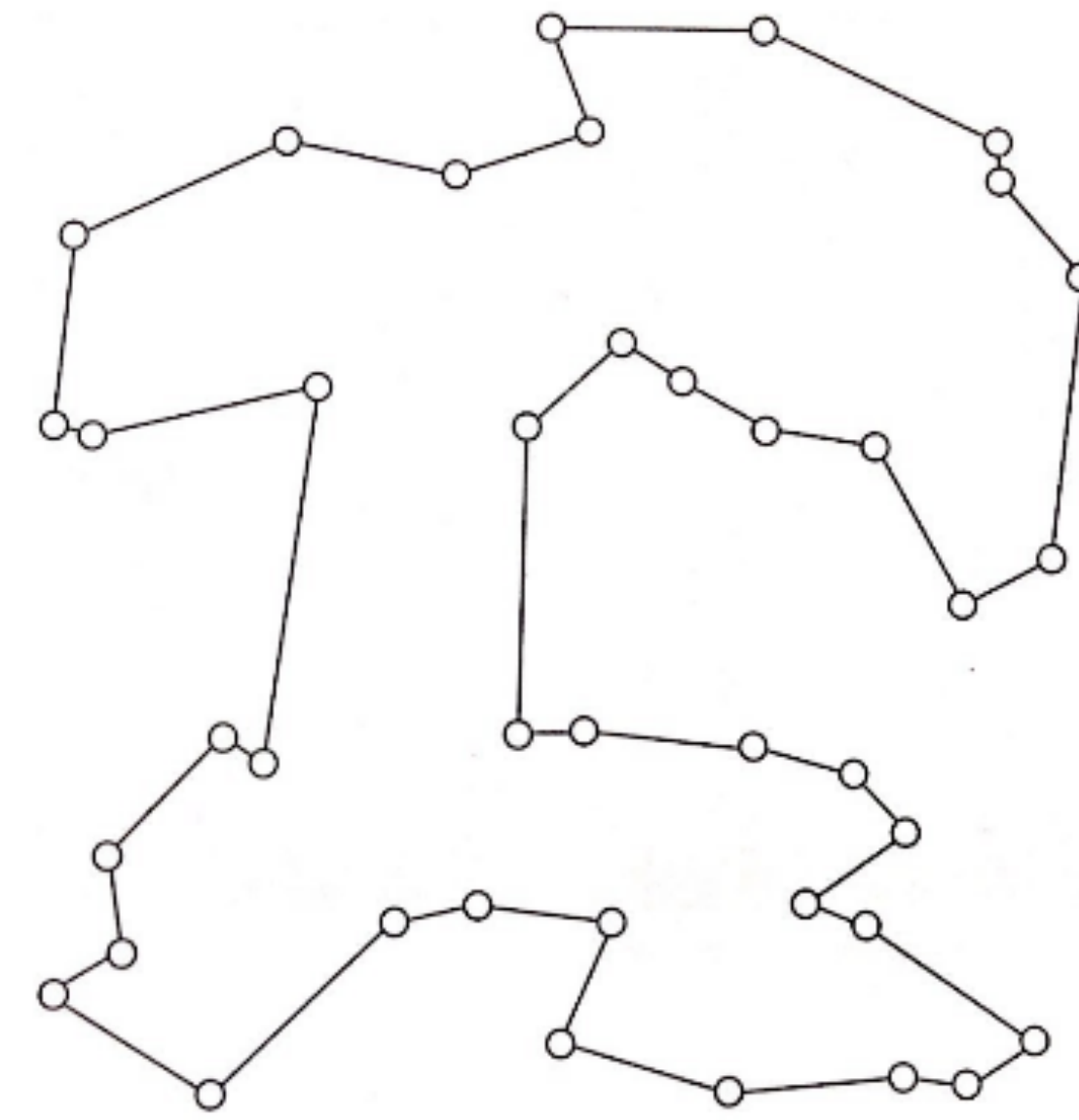
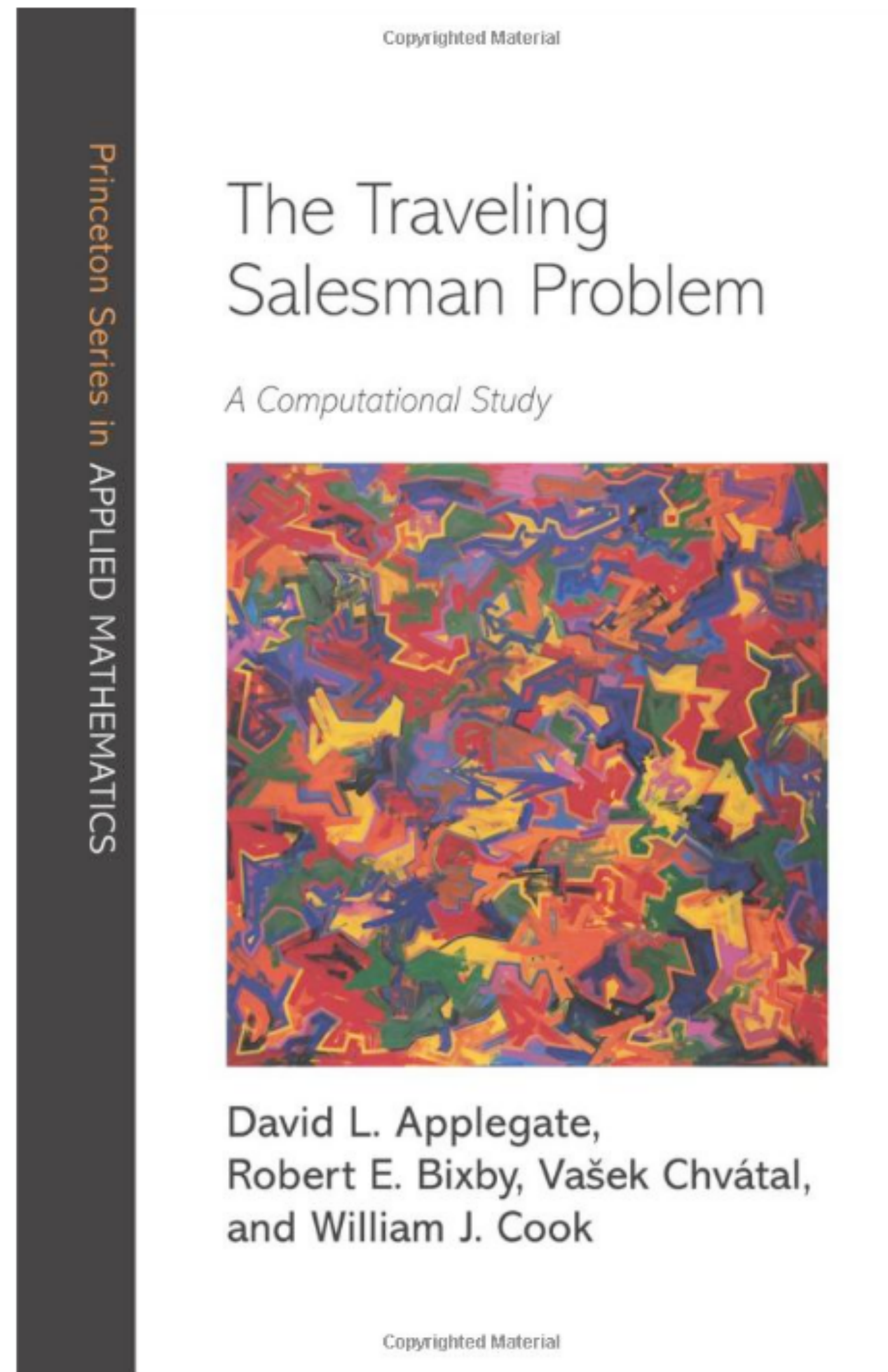


Figure 1.32 Tour found by member of the Gestalt group. Vickers et al. [539].



Um amor de problema



Um problema complicado

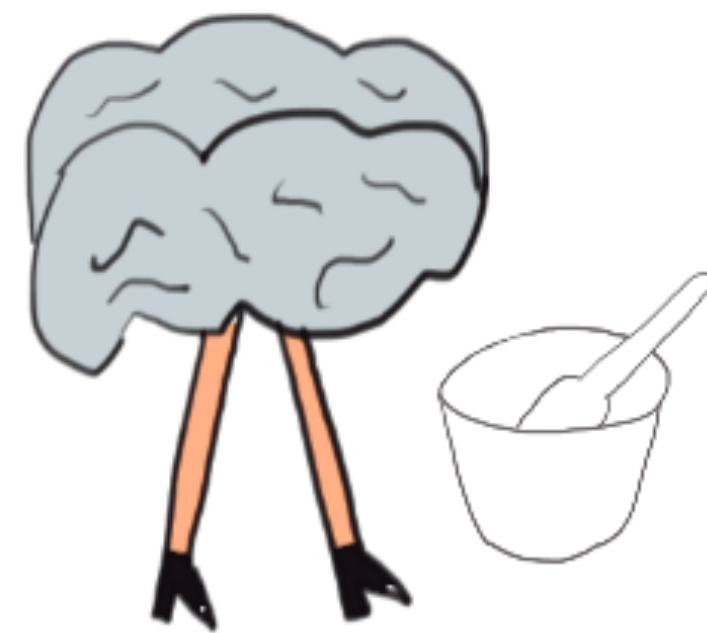
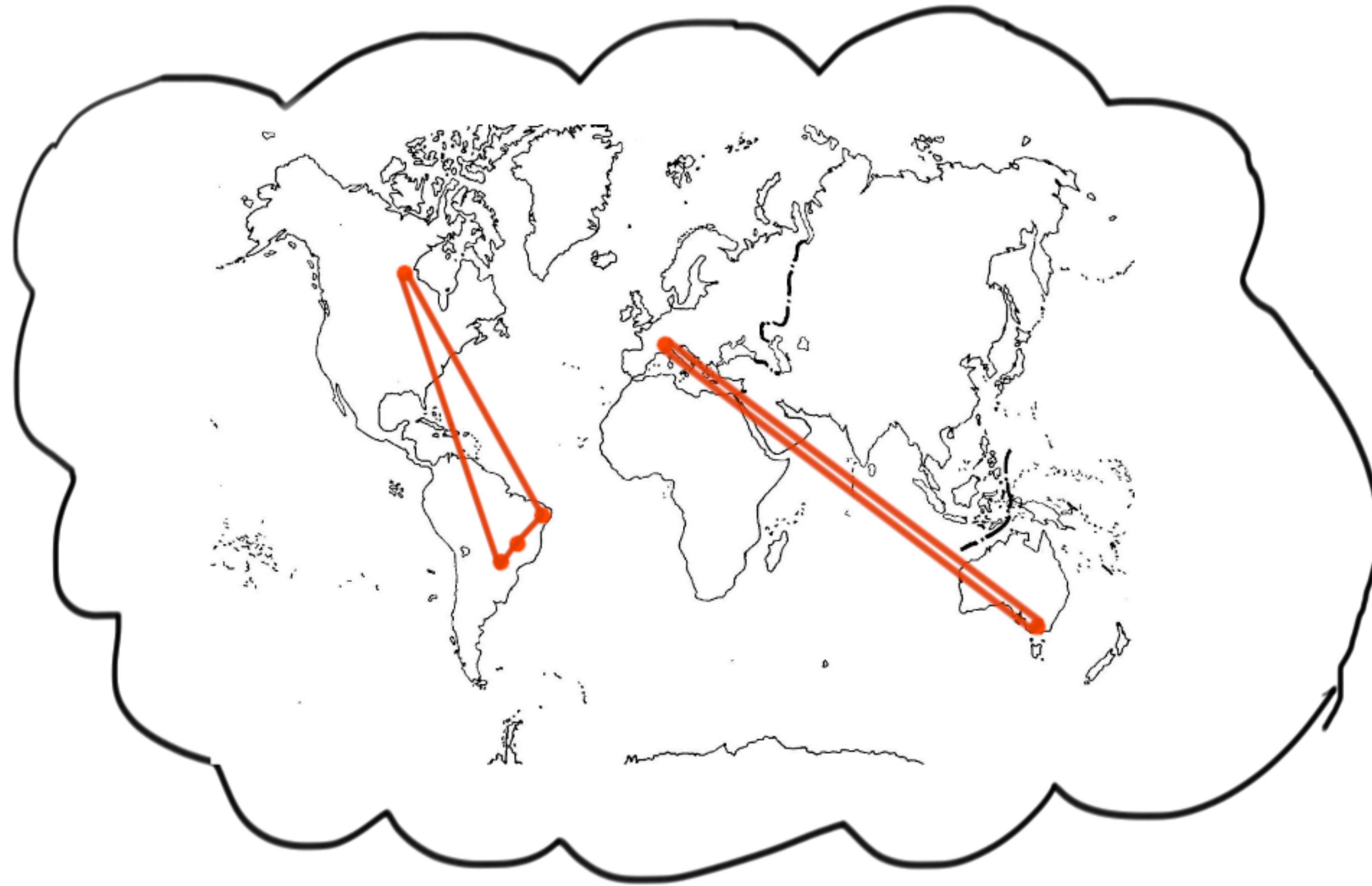


Um problema complicado



Um problema complicado

$$\sum_{j=1}^n x_{ij} = 1, \quad i \in N$$
$$\sum_{i=1}^n x_{ij} = 1, \quad j \in N$$



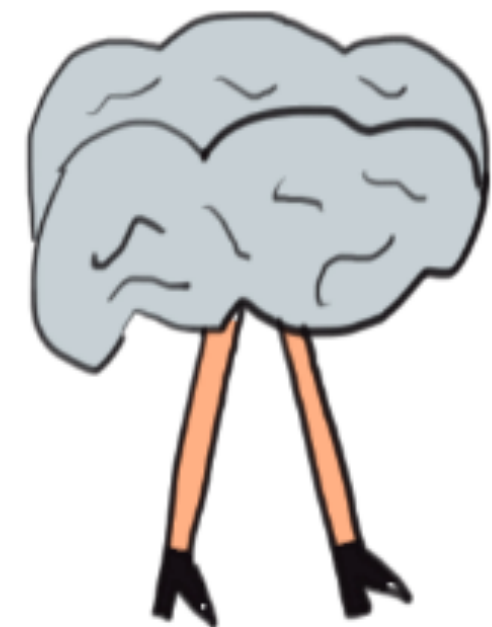
Um problema complicado



$$\sum_{j=1}^n x_{ij} = 1, \quad i \in N$$

$$\sum_{i=1}^n x_{ij} = 1, \quad j \in N$$

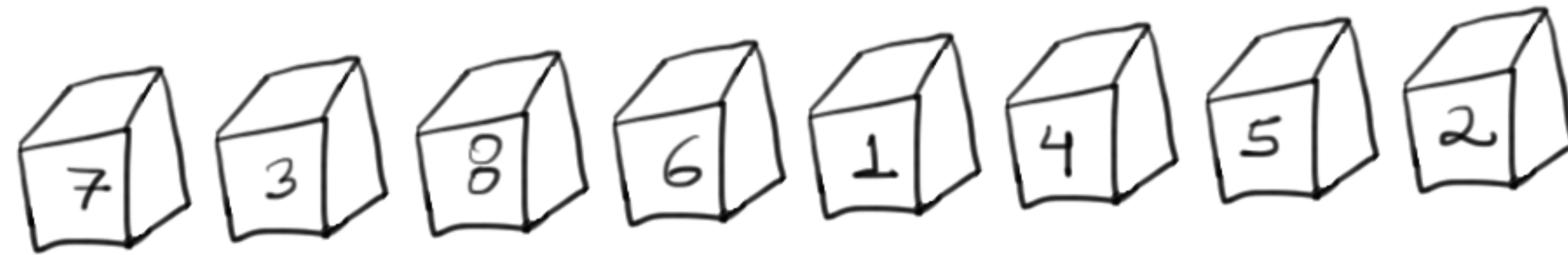
$$\sum_{i,j \in S} x_{ij} \leq |S| - 1, \quad S \subseteq N \setminus \{1\}$$



+ Fulkerson & Johnson (1954)

E daí?

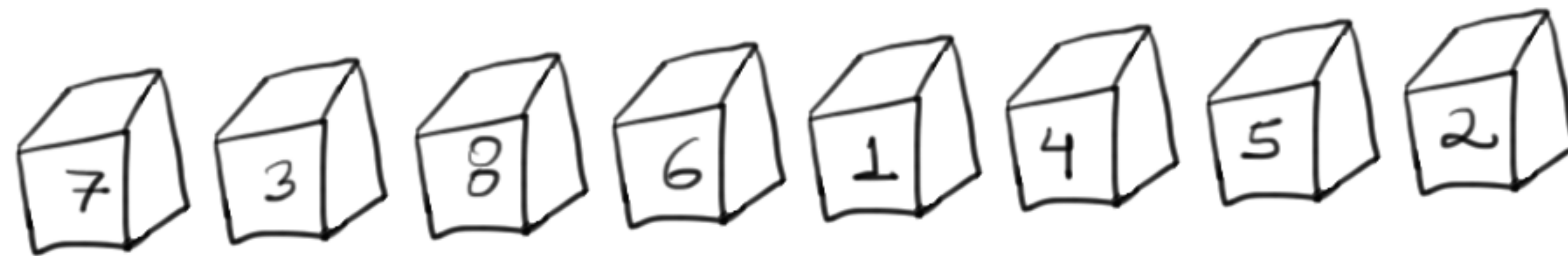
Eu tenho um plano!



Plano

Estratégia:

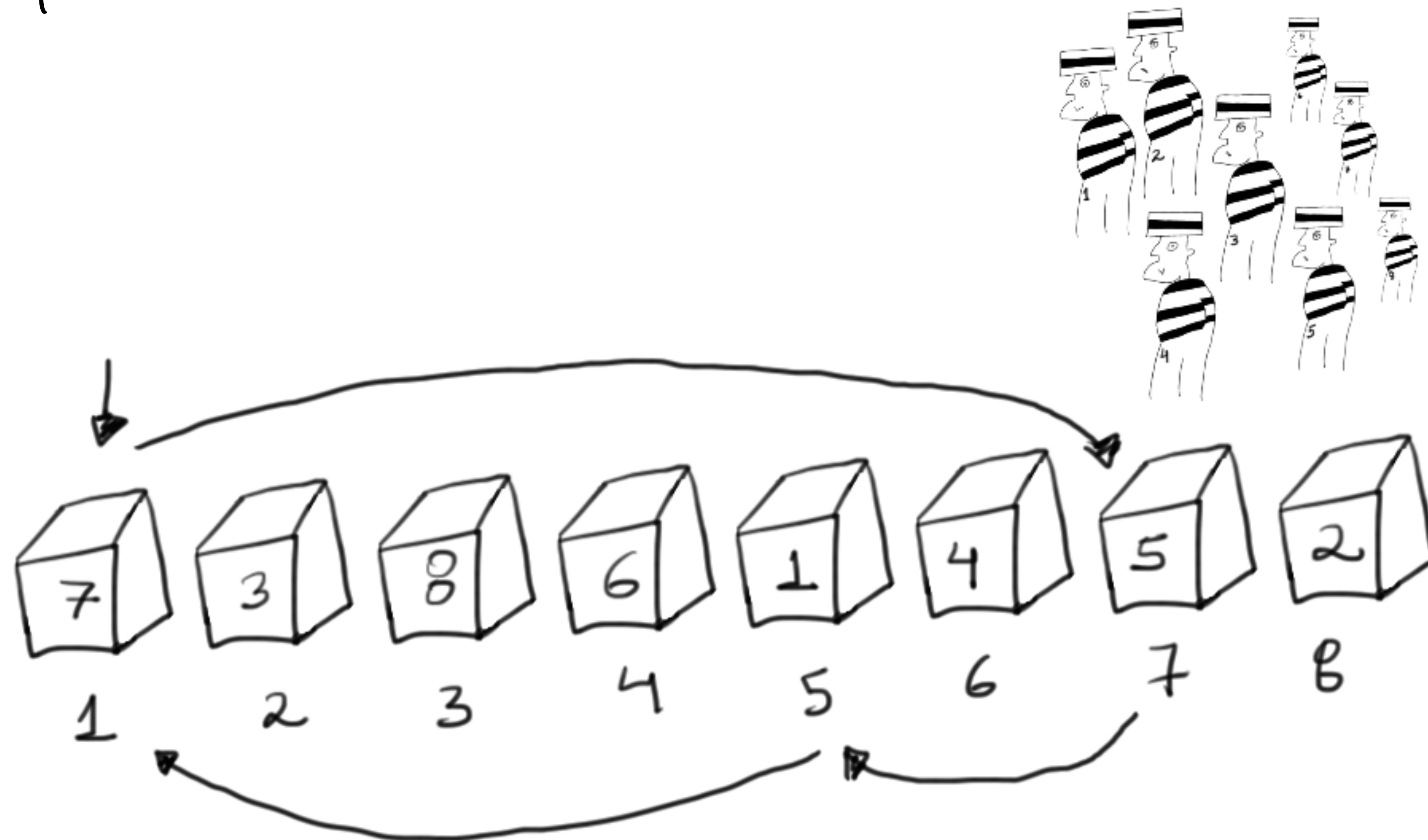
- * numere as caixas em ordem
- * olhe o número dentro da sua caixa e siga para esta caixa.



Plano

Encontrou seu número.

Por quê ?



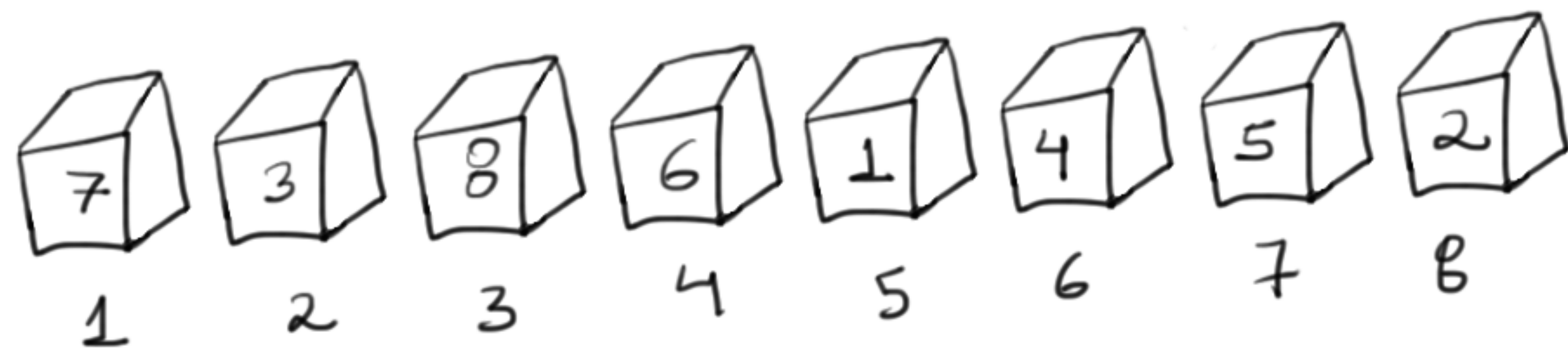
de configurações c/ ciclos de tamanho 5)

$$\binom{8}{5} \cdot (5-1)! \cdot 3! = \frac{8!}{5! 3!} \cdot 4! \cdot 3! = \frac{8!}{5}$$

6) $8!/6$

7) $8!/8$

8) $8!/8$



de configurações c/ ciclos de tamanho 5)

$$\binom{8}{5} \cdot (5-1)! \cdot 3! = \frac{8!}{5!3!} \cdot 4! \cdot 3! = \frac{8!}{5}$$

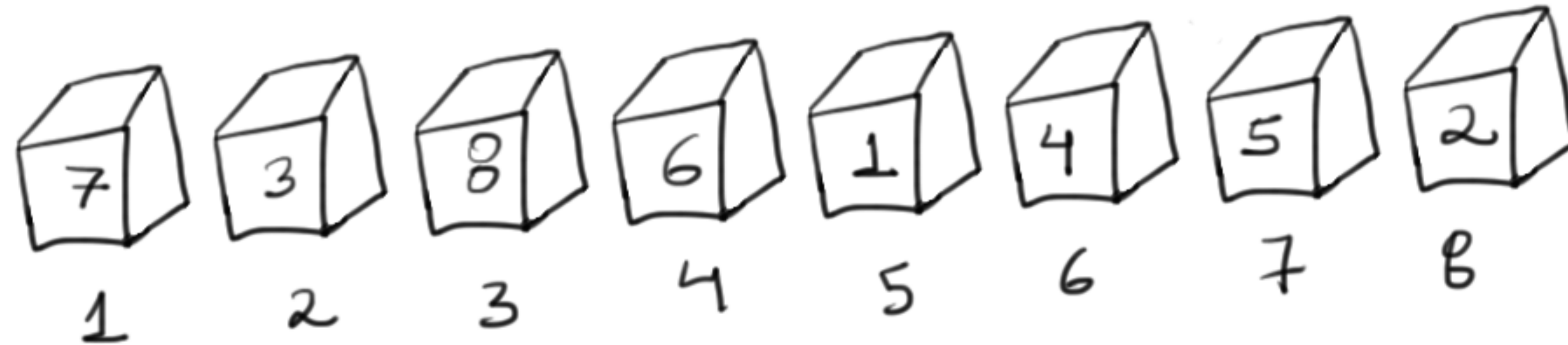
6) $8!/6$

7) $8!/8$

8) $8!/8$

total de configurações

$$8!$$



Probabilidade da estratégia falhar:

$$\frac{8!}{5} + \frac{8!}{6} + \frac{8!}{7} + \frac{8!}{8}$$

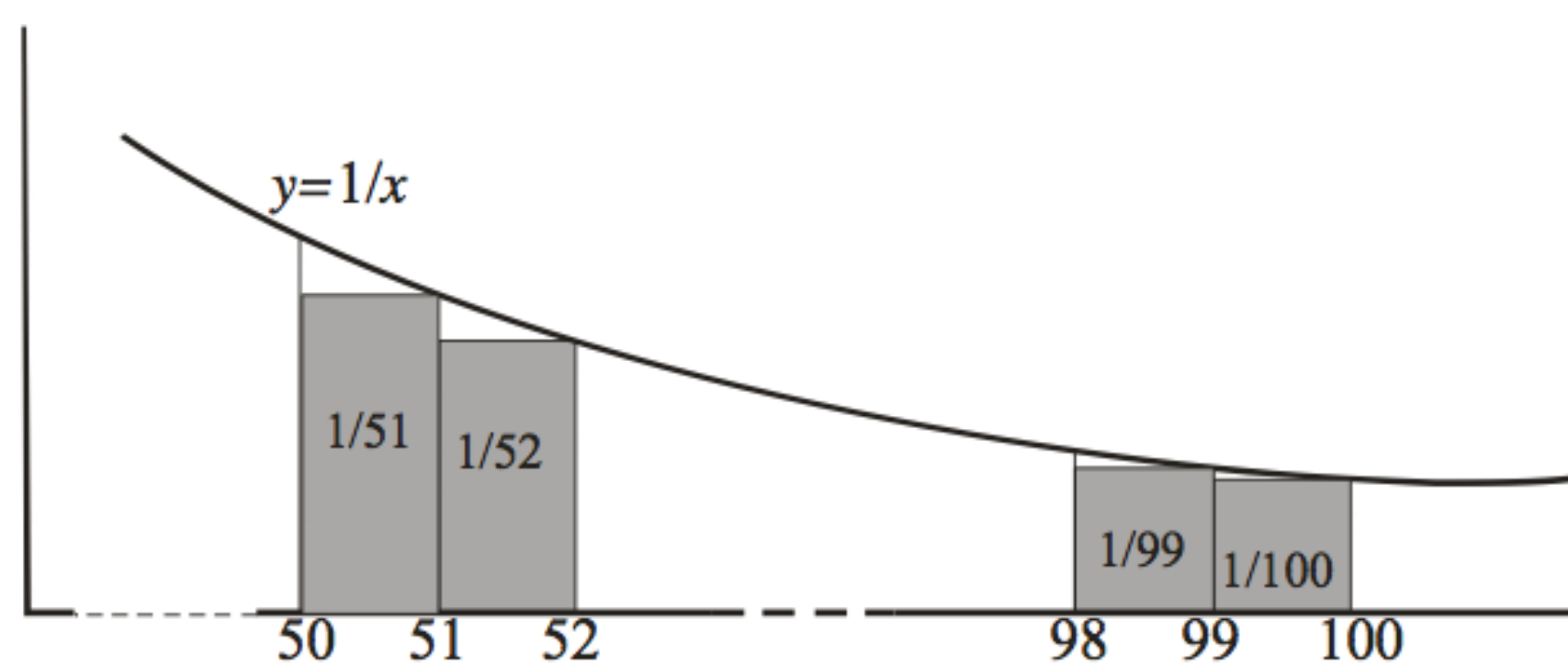
$$\frac{\quad}{8!} =$$

$$\frac{1}{5} + \frac{1}{6} + \frac{1}{7} + \frac{1}{8} \approx 63\%$$

37% >> 0,37%
de sucesso

Para 100 prisioneiros:

$$\frac{1}{51} + \frac{1}{52} + \frac{1}{53} + \dots + \frac{1}{100}$$

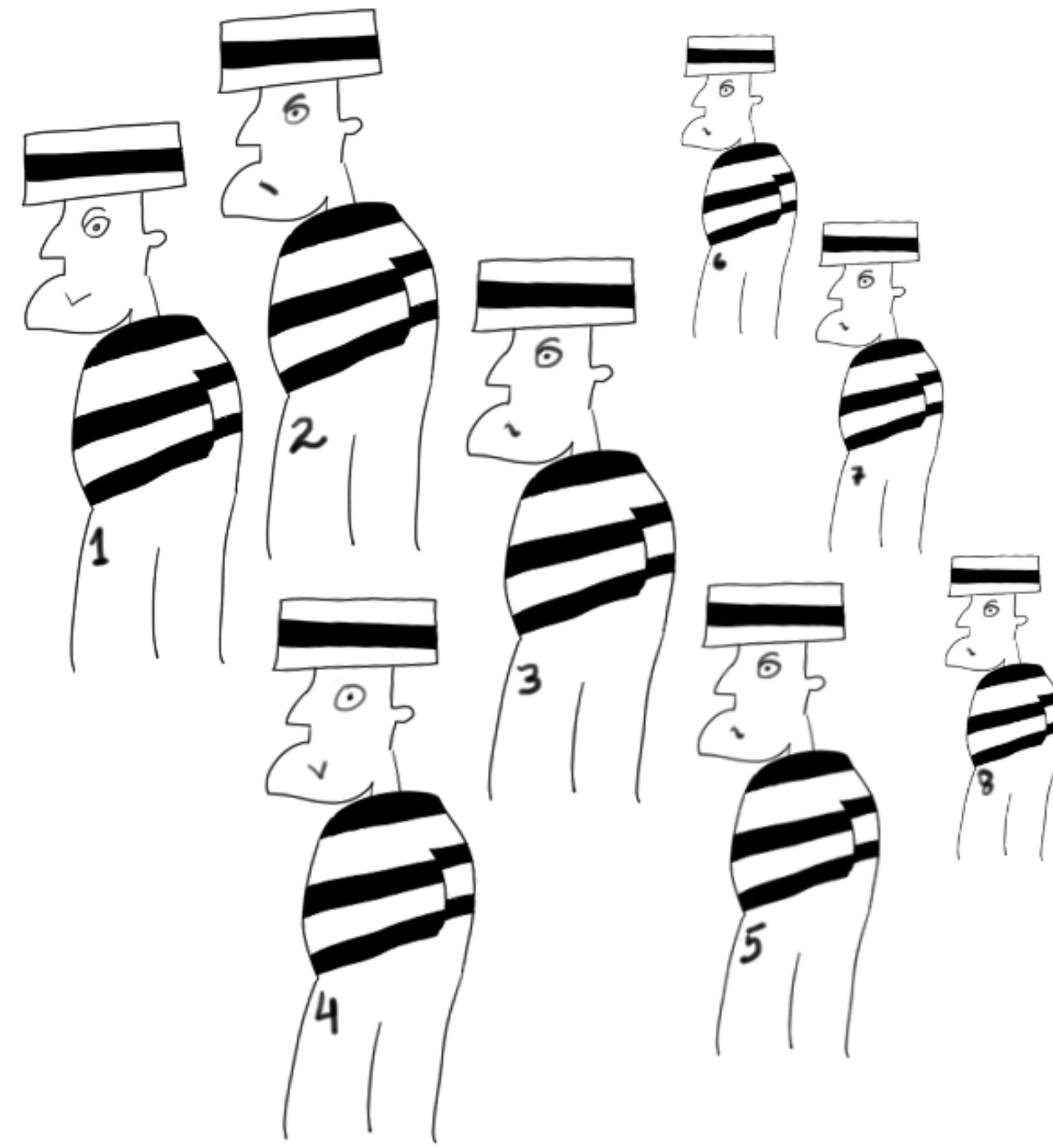


limitado por:

$$\int_{50}^{100} \frac{1}{x} dx = \ln 100 - \ln 50 = \ln 2 < 70\%$$

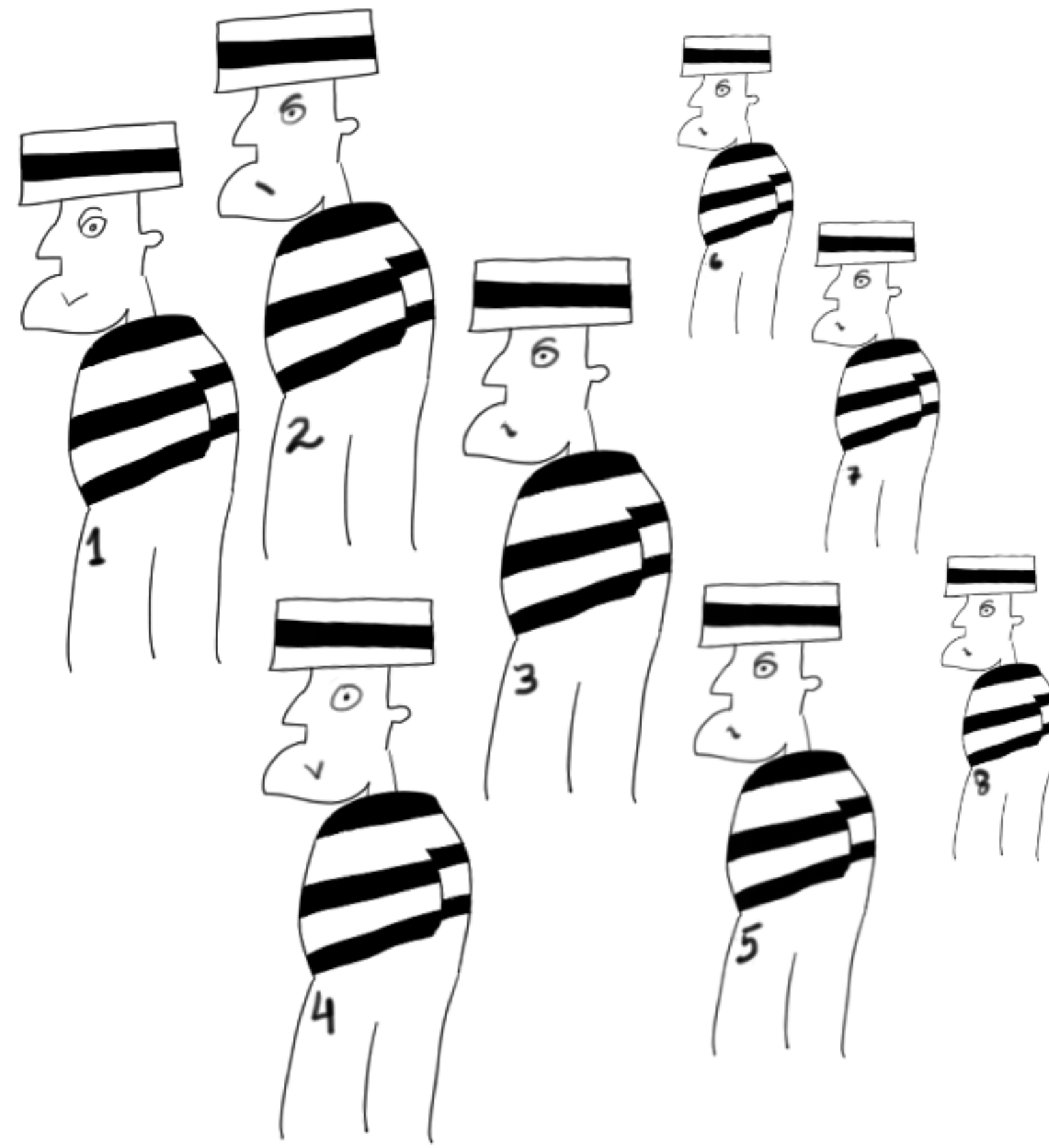
→ Sucesso > 30% \ggg $(1/2)^{100}$

Ερώ?



→ Successo > 30%

Εώ?



→ Successo > 30%



Algumas referências

Prisoners and boxes

<http://www.mast.queensu.ca/~peter/inprocess/prisoners.pdf>

The traveling salesman problem: a computational study
Applegate, Bixby, Chvátal, Cook.

Wikipedia

