

# **Introduction à la science informatique**

Semaine 1

**Logistique**

# Équipe enseignante

- Chargé de CM/TD : **Antonio E. Porreca**
- Chargés de TP :
  - **Antonio E. Porreca** (groupe 3a)
  - **Yahia Idriss Benalioua** (groupe 3b)

# On va apprendre 😊

- Concevoir le **traitement informatisé** d'informations de différentes natures
- **Modéliser** un problème concret sous la forme d'un problème algorithmique connu
- **Évaluer l'efficacité et la correction** d'une solution algorithmique
- Être familiarisé avec les concepts fondamentaux de **complexité et de calculabilité**
- **Implémenter** nos algorithmes sous forme du code **Python** à l'ordinateur

# On ne va pas apprendre 😞

- Utiliser des logiciels bureautiques
- Installer Linux sur son ordinateur
- Faire du web design
- Jouer aux ou réaliser des jeux vidéos
- Sécurité informatique

# Organisation de l'UE

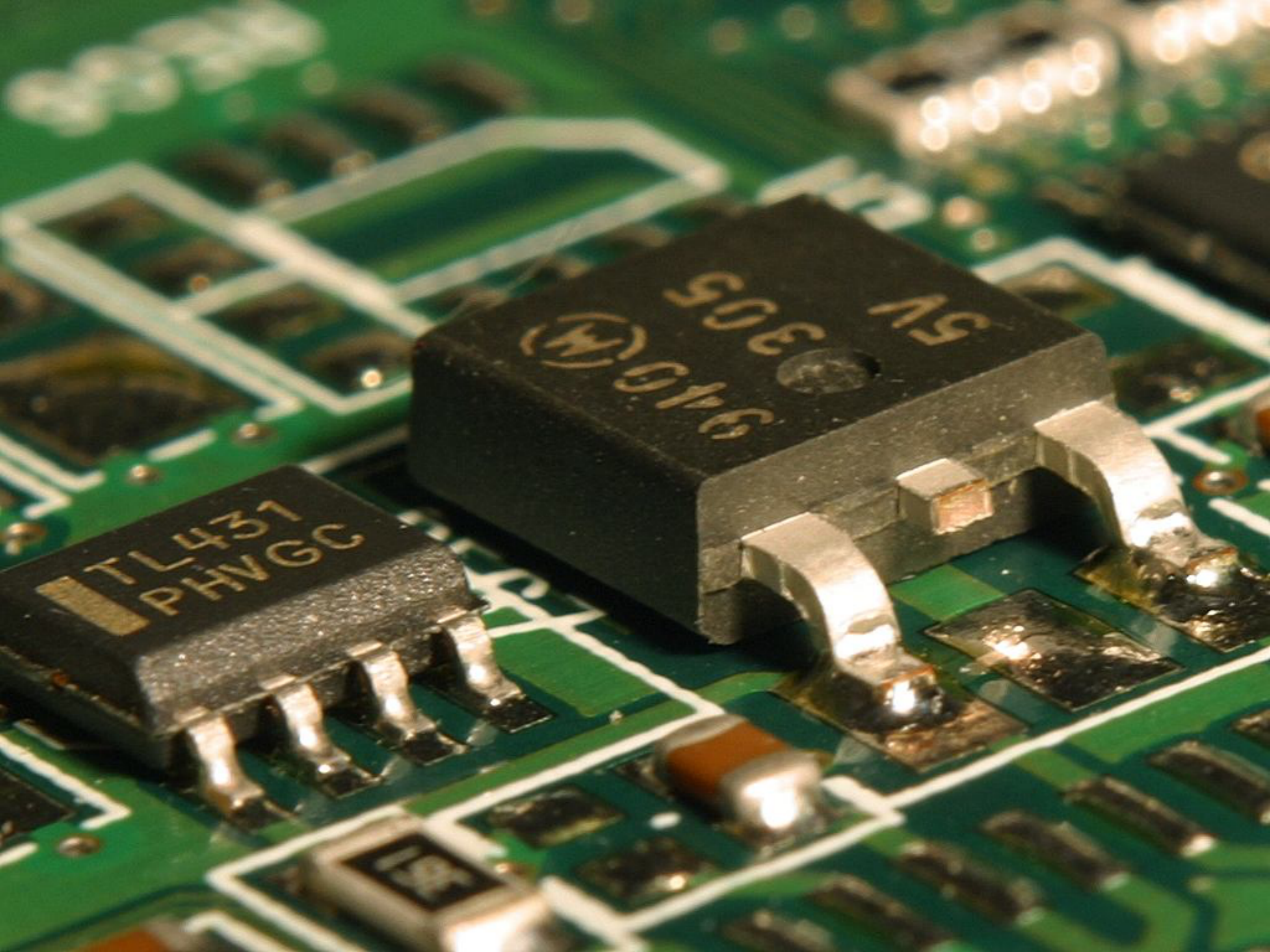
- 42h de CM/TD intégré en 21 séances de 2h
- 18h de TP en 9 séances de 2h
- Travail personnel
  - Prise de notes pendant les cours
  - Travail de révision entre les séances
- Tutorat

# Évaluation

- Un **partiel sur papier** (sans documents ni calculatrice)
- Un **partiel en salle machines** à l'ordinateur
- Un **examen terminal** en janvier
- Note =  $\max(0,3 TP + 0,7 E, 0,2 P + 0,3 TP + 0,5 E)$
- 2e session (rattrapage, en juin) : note de l'examen

**C'est quoi  
l'informatique ?**





5V 305 310

TL431 PHVGC

# C'est aussi de la science

- On définit des **modèles mathématiques** du calcul
- On **prouve** des résultats
- On peut faire des choix **techniques**

# Objets d'étude de l'informatique

- Le **stockage** de l'information
- La **transmission** de l'information
- Le **traitement** de l'information 🖱️ **algorithmes** !
- L'**information** elle-même

# Quelques personnages

# Quelques personnages

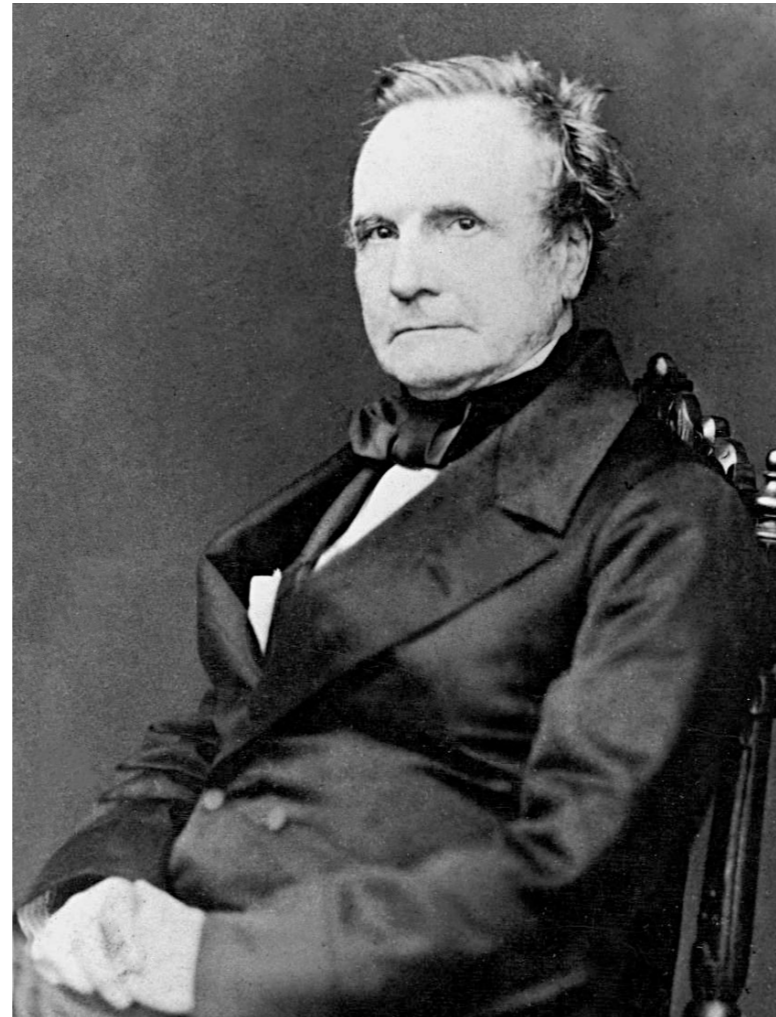


**Muḥammad ibn Mūsā  
al-Khwārizmī**

# Quelques personnages



**Muḥammad ibn Mūsā  
al-Khwārizmī**

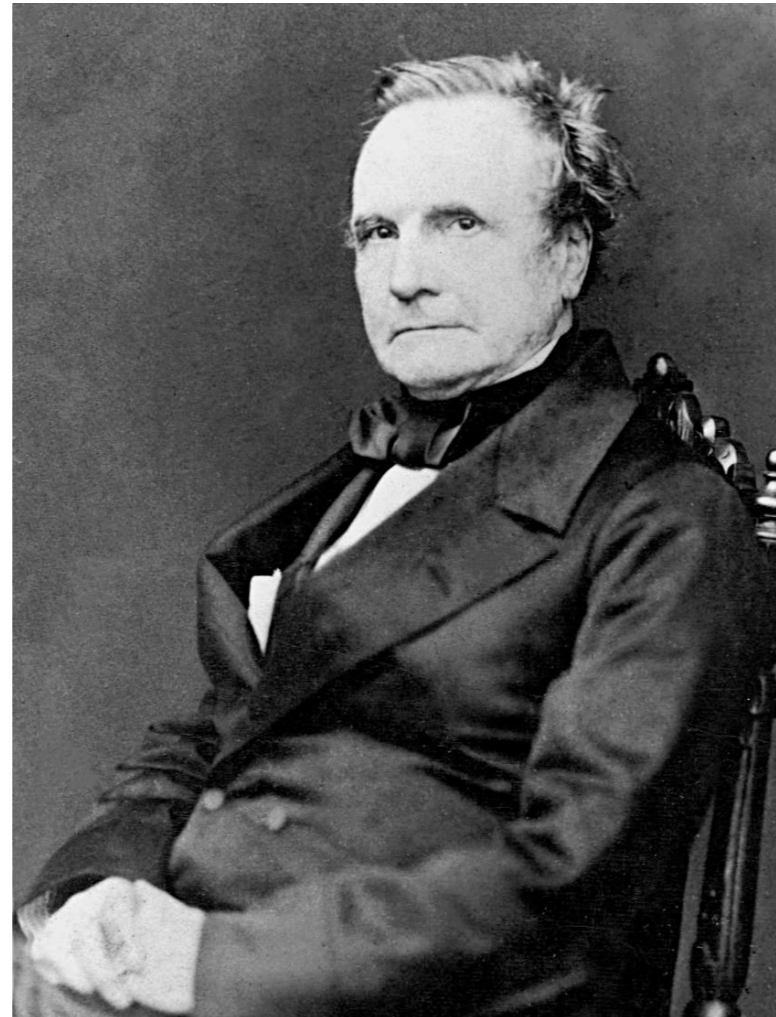


**Charles Babbage**

# Quelques personnages



**Muḥammad ibn Mūsā  
al-Khwārizmī**



**Charles Babbage**



**Ada Lovelace**

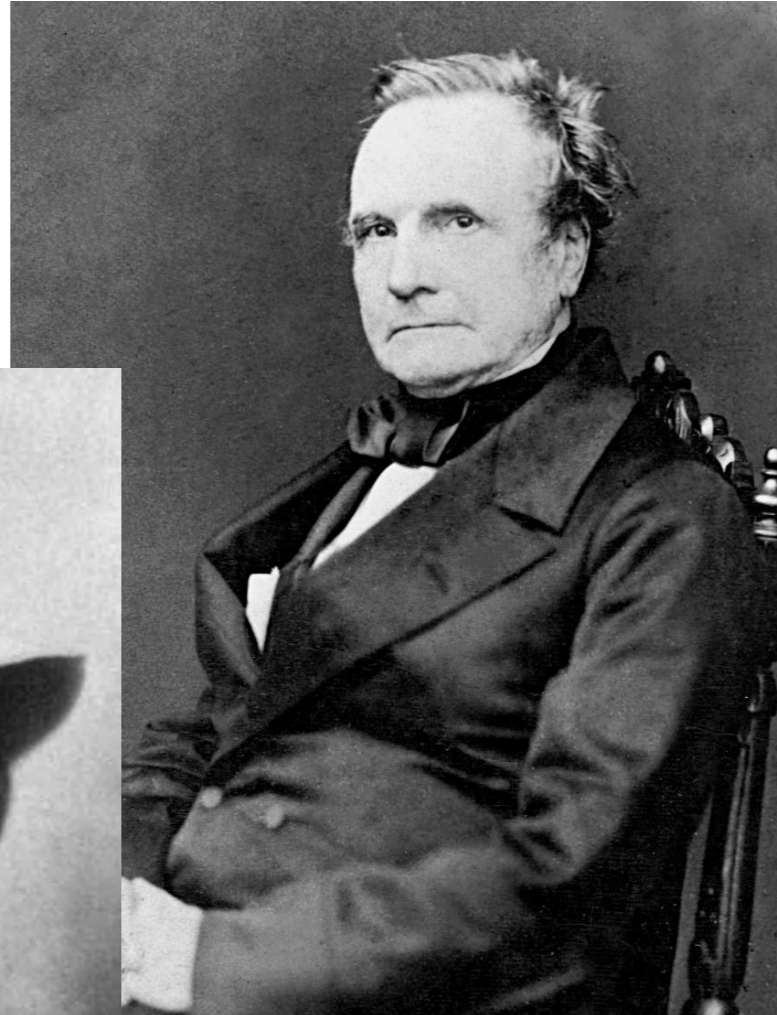
# Quelques personnages



Muh



David Hilbert



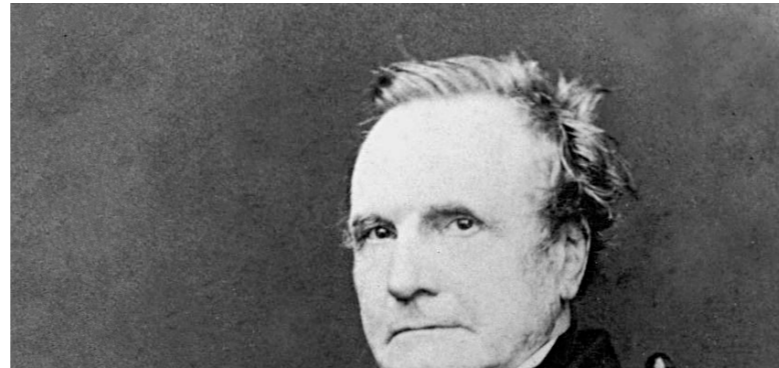
Charles Babbage



Ada Lovelace



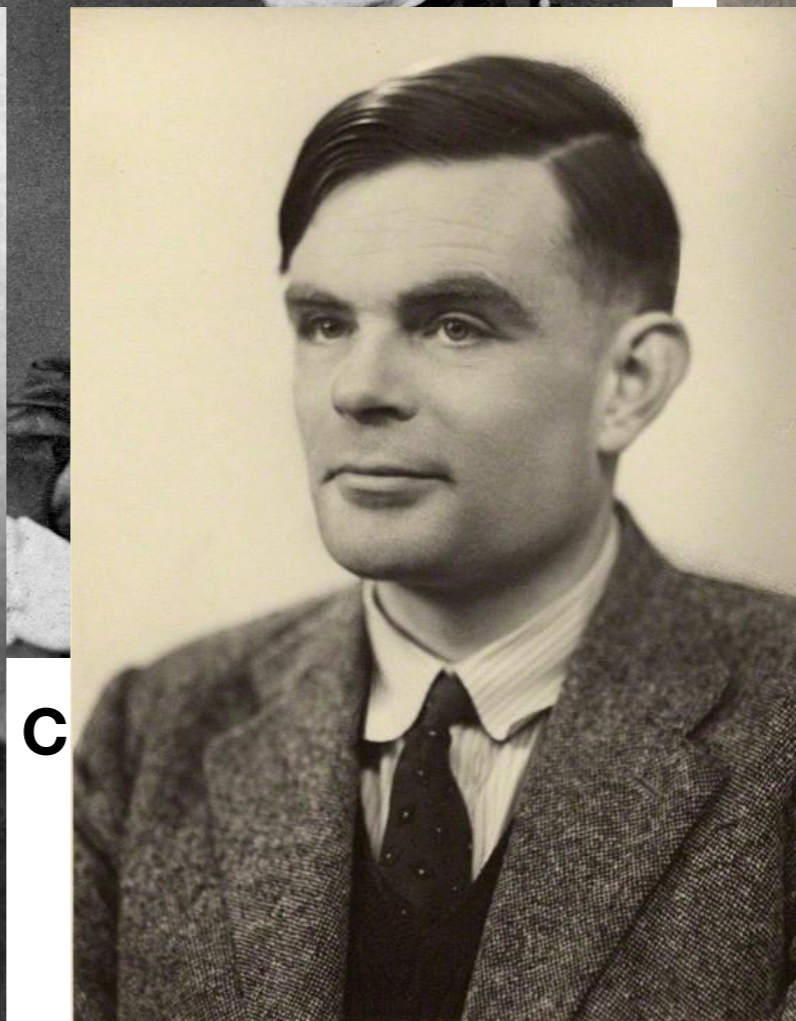
# Quelques personnages



Muh



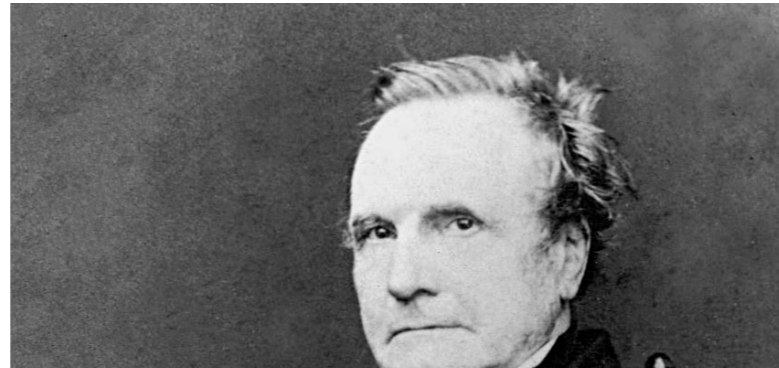
David Hilbert



Alan M. Turing

Ada Lovelace

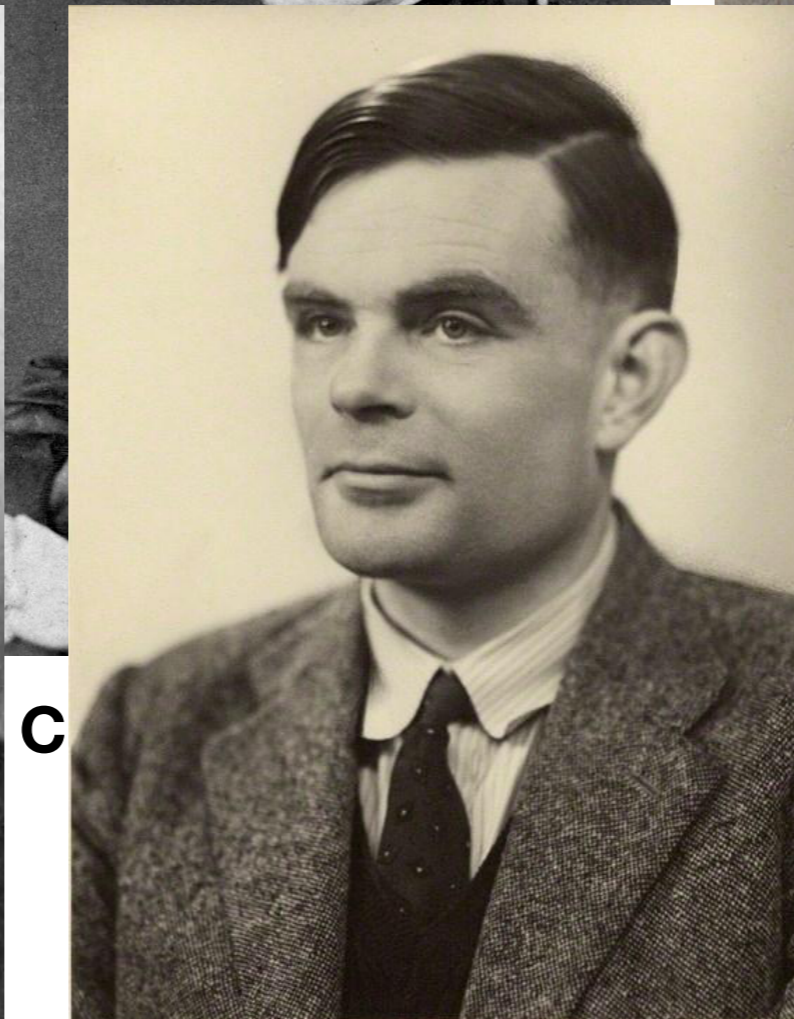
# Quelques personnages



Muh



David Hilbert



Alan M. Turing



Grace Hopper

# L'informatique : une histoire de femmes

- Les calculatrices humaines étaient souvent des femmes
- 1er algorithme pour ordinateur : Ada Lovelace (1843)
- 1er compilateur : Grace Hopper (1951)
- Invention des bases du Wifi : Hedy Lamarr (1942)
- 1ère thèse en Informatique en France : Marion Créhange (1961)

# **Algorithmes non formalisés**

# Algorithme de la somme de l'école primaire

# Opération élémentaire

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

**Calculator 1323 + 256**

**Calculator 1323 + 256**

**1 3 2 3**



**Calculator 1323 + 256**

**1 3 2 3 +**

**Calculator 1323 + 256**

**1 3 2 3 +  
2 5 6**

**Calculator 1323 + 256**

**1 3 2 3 +**

**2 5 6 =**

**Calculator 1323 + 256**

**1 3 2 3 +**

**2 5 6 =**



# Calculator 1323 + 256



1 3 2 3 +

2 5 6 =



# Calculator 1323 + 256



1 3 2 3 +

2 5 6 =



9

# Calculator 1323 + 256



1 3 2 3 +

2 5 6 =



9

# Calculator 1323 + 256



$$\begin{array}{r} 1323 + \\ 256 = \\ \hline 79 \end{array}$$



# Calculator 1323 + 256



1 3 2 3 +

2 5 6 =



7 9

# Calculator 1323 + 256



1 3 2 3 +

2 5 6 =



5 7 9

# Calculator 1323 + 256



1 3 2 3 +

2 5 6 =



5 7 9

# Calculator 1323 + 256



1 3 2 3 +

0 2 5 6 =



5 7 9

# Calculator 1323 + 256



1 3 2 3 +

0 2 5 6 =



1 5 7 9

# Calculator 1323 + 256



1 3 2 3 +

0 2 5 6 =



1 5 7 9

**Calculator 1323 + 256**

**1 3 2 3 +**

**0 2 5 6 =**



**1 5 7 9**

# Combien d'opérations élémentaires ?

$$\begin{array}{r} 1 \ 3 \ 2 \ 3 \ + \\ 0 \ 2 \ 5 \ 6 \ = \\ \hline 1 \ 5 \ 7 \ 9 \end{array}$$



# Combien d'opérations élémentaires ?

$$\begin{array}{rcccc} 1 & 3 & 2 & 3 & + \\ 0 & 2 & 5 & 6 & = \\ \hline 1 & 5 & 7 & 9 & \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{rcccc} 1 & 3 & 2 & 3 & + \\ 0 & 2 & 5 & 6 & = \\ \hline 1 & 5 & 7 & 9 & \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{r} 1 \quad 3 \quad 2 \quad 3 \quad + \\ 0 \quad 2 \quad 5 \quad 6 \quad = \\ \hline 1 \quad 5 \quad 7 \quad 9 \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{cccc} \textcircled{1} & \textcircled{3} & \textcircled{2} & \textcircled{3} & + \\ \textcircled{0} & \textcircled{2} & \textcircled{5} & \textcircled{6} & = \\ \hline 1 & 5 & 7 & 9 \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{cccc} \textcircled{1} & \textcircled{3} & \textcircled{2} & \textcircled{3} & + \\ \textcircled{0} & \textcircled{2} & \textcircled{5} & \textcircled{6} & = \\ \hline 1 & 5 & 7 & 9 \end{array}$$

4 op

# Exercice 1 du TD1

**Calculator 265 + 3761**

**Calculator 265 + 3761**

$$\begin{array}{r} 265 + \\ 3761 = \\ \hline \end{array}$$



# Calculator 265 + 3761



$$\begin{array}{r} 265 + \\ 3761 = \\ \hline \end{array}$$

# Calculator 265 + 3761



$$\begin{array}{r} 265 + \\ 3761 = \\ \hline 6 \end{array}$$

# Calculator 265 + 3761



$$\begin{array}{r} 265 + \\ 3761 = \\ \hline 6 \end{array}$$

# Calculator 265 + 3761



$$\begin{array}{r} 265 + \\ 3761 = \\ \hline 26 \end{array}$$

# Calculator 265 + 3761

1 

2 6 5 +

3 7 6 1 =



2 6

# Calculator 265 + 3761

1

2 6 5 +

3 7 6 1 =



2 6



# Calculator 265 + 3761

1

2 6 5 +

3 7 6 1 =



0 2 6



# Calculator 265 + 3761

$$\begin{array}{r} 11 \\ 265 + \\ 3761 = \\ \hline 026 \end{array}$$





# Calculator 265 + 3761

$$\begin{array}{r} 11 \\ 265 + \\ 3761 = \\ \hline 026 \end{array}$$



# Calculator 265 + 3761

$$\begin{array}{r} \phantom{0} 1 \phantom{0} 1 \\ 0 \phantom{0} 2 \phantom{0} 6 \phantom{0} 5 \phantom{0} + \\ 3 \phantom{0} 7 \phantom{0} 6 \phantom{0} 1 \phantom{0} = \\ \hline \phantom{0} 0 \phantom{0} 2 \phantom{0} 6 \end{array}$$



# Calculator 265 + 3761

$$\begin{array}{r} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \\ \phantom{0} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \\ \phantom{0} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \\ \phantom{0} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \\ \hline \phantom{0} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \end{array}$$



# Calculator 265 + 3761

$$\begin{array}{r} \phantom{0} 1 \phantom{0} 1 \\ 0 \phantom{0} 2 \phantom{0} 6 \phantom{0} 5 \phantom{0} + \\ 3 \phantom{0} 7 \phantom{0} 6 \phantom{0} 1 \phantom{0} = \\ \hline 4 \phantom{0} 0 \phantom{0} 2 \phantom{0} 6 \end{array}$$



# Calculator 265 + 3761

$$\begin{array}{r} \phantom{0} \mathbf{1} \phantom{0} \phantom{0} \phantom{0} \\ \phantom{0} \phantom{0} \mathbf{1} \phantom{0} \phantom{0} \phantom{0} \\ \phantom{0} \mathbf{0} \phantom{0} \mathbf{2} \phantom{0} \mathbf{6} \phantom{0} \mathbf{5} \phantom{0} + \\ \phantom{0} \mathbf{3} \phantom{0} \mathbf{7} \phantom{0} \mathbf{6} \phantom{0} \mathbf{1} \phantom{0} = \\ \hline \mathbf{4} \phantom{0} \mathbf{0} \phantom{0} \mathbf{2} \phantom{0} \mathbf{6} \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{r} \mathbf{1} \quad \mathbf{1} \\ \mathbf{0} \quad \mathbf{2} \quad \mathbf{6} \quad \mathbf{5} \quad + \\ \mathbf{3} \quad \mathbf{7} \quad \mathbf{6} \quad \mathbf{1} \quad = \\ \hline \mathbf{4} \quad \mathbf{0} \quad \mathbf{2} \quad \mathbf{6} \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{r} 1 \quad 1 \\ 0 \quad 2 \quad 6 \quad 5 \quad + \\ 3 \quad 7 \quad 6 \quad 1 \quad = \\ \hline 4 \quad 0 \quad 2 \quad 6 \end{array}$$

# Combien d'opérations élémentaires ?

<b>1</b>	<b>1</b>				
<b>0</b>	<b>2</b>	<b>6</b>	<b>5</b>	<b>+</b>	
<b>3</b>	<b>7</b>	<b>6</b>	<b>1</b>	<b>=</b>	
<hr/>					
<b>4</b>	<b>0</b>	<b>2</b>	<b>6</b>		



# Combien d'opérations élémentaires ?

$$\begin{array}{rcccc} 1 & 1 & & & \\ 0 & 2 & 6 & 5 & + \\ 3 & 7 & 6 & 1 & = \\ \hline 4 & 0 & 2 & 6 & \end{array}$$

# Combien d'opérations élémentaires ?

1 1  
0 2 6 5 +  
3 7 6 1 =

---

4 0 2 6

# Combien d'opérations élémentaires ?

$$\begin{array}{cccc} \textcircled{1} & \textcircled{1} & & \\ \textcircled{0} & \textcircled{2} & \textcircled{6} & \textcircled{5} & + \\ & & & & \\ 3 & 7 & 6 & 1 & = \\ \hline 4 & 0 & 2 & 6 \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{ccc} \begin{array}{c} 1 \\ 0 \\ 3 \end{array} & \begin{array}{c} 1 \\ 2 \\ 7 \end{array} & \begin{array}{c} 6 \\ 6 \end{array} & \begin{array}{c} 5 \\ 1 \end{array} & + \\ \hline 4 & 0 & 2 & 6 & = \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{cccc} \begin{array}{c} 1 \\ 0 \\ 3 \end{array} & \begin{array}{c} 1 \\ 2 \\ 7 \end{array} & \begin{array}{c} 6 \\ 6 \end{array} & \begin{array}{c} 5 \\ 1 \end{array} & + \\ \hline 4 & 0 & 2 & 6 & = \end{array}$$

6 op

# Exercice 2 du TD1

**Calculator 935 + 284**

**Calculator 935 + 284**

$$\begin{array}{r} 935 + \\ 284 = \\ \hline \end{array}$$



# Calculator 935 + 284



$$\begin{array}{r} 935 + \\ 284 = \\ \hline \end{array}$$

# Calculator 935 + 284



$$\begin{array}{r} 935 + \\ 284 = \\ \hline 9 \end{array}$$

# Calculator 935 + 284



$$\begin{array}{r} 935 + \\ 284 = \\ \hline 9 \end{array}$$

# Calculator 935 + 284



$$\begin{array}{r} 935 + \\ 284 = \\ \hline 19 \end{array}$$

# Calculator 935 + 284

1 

9 3 5 +

2 8 4 =



1 9

# Calculator 935 + 284



1

9 3 5 +

2 8 4 =



1 9

# Calculator 935 + 284



$$\begin{array}{r} 1 \quad 1 \\ 935 + \\ 284 = \\ \hline 19 \end{array}$$

# Calculator 935 + 284



1 1

9 3 5 +

2 8 4 =



2 1 9



# Calculator 935 + 284



1 1

9 3 5 +

2 8 4 =



2 1 9

# Calculator 935 + 284



$$\begin{array}{r} 1 \quad 1 \\ 935 + \\ 284 = \\ \hline 219 \end{array}$$

# Calculator 935 + 284



$$\begin{array}{r} 11 \\ 0935 + \\ 0284 = \\ \hline 219 \end{array}$$

# Calculator 935 + 284



$$\begin{array}{r} 1 \quad 1 \\ 0 \quad 9 \quad 3 \quad 5 \quad + \\ 0 \quad 2 \quad 8 \quad 4 \quad = \\ \hline 1 \quad 2 \quad 1 \quad 9 \end{array}$$

# Calculator 935 + 284



$$\begin{array}{r} 11 \\ 0935 + \\ 0284 = \\ \hline 1219 \end{array}$$

# Calculator 935 + 284

$$\begin{array}{r} 11 \\ 0935 + \\ 0284 = \\ \hline 1219 \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{r} 1 \quad 1 \\ 0 \quad 9 \quad 3 \quad 5 \quad + \\ 0 \quad 2 \quad 8 \quad 4 \quad = \\ \hline 1 \quad 2 \quad 1 \quad 9 \end{array}$$





# Combien d'opérations élémentaires ?

$$\begin{array}{rcccc} 1 & 1 & & & \\ 0 & 9 & 3 & 5 & + \\ 0 & 2 & 8 & 4 & = \\ \hline 1 & 2 & 1 & 9 & \end{array}$$

# Combien d'opérations élémentaires ?

$$\begin{array}{r} 1 \quad 1 \quad 3 \quad 5 \quad + \\ 0 \quad 9 \quad 8 \quad 4 \quad = \\ 0 \quad 2 \quad 8 \quad 4 \\ \hline 1 \quad 2 \quad 1 \quad 9 \end{array}$$

The image shows a handwritten-style addition problem. The numbers are arranged in columns. The first column contains '1' and '0'. The second column contains '1', '9', and '2'. The third column contains '3' and '8'. The fourth column contains '5' and '4'. To the right of the second and third columns are '+' and '=' signs respectively. A horizontal line is drawn under the second and third columns. Below the line, the result '1 2 1 9' is written. Red ovals highlight the numbers 1, 9, 3, 5, 8, and 4 in the original image.

# Combien d'opérations élémentaires ?

$$\begin{array}{r} 1 \\ 0 \\ 0 \end{array} \begin{array}{r} 1 \\ 9 \\ 2 \end{array} \begin{array}{r} 3 \\ 8 \end{array} \begin{array}{r} 5 \\ 4 \end{array} + =$$

---

$$1 \quad 2 \quad 1 \quad 9$$

The image shows a vertical addition problem with three numbers: 100, 192, and 385. The digits are arranged in columns: the first column has 1, 0, 0; the second has 1, 9, 2; the third has 3, 8; and the fourth has 5, 4. A horizontal line is drawn under the second and third columns. Below the line, the result 1219 is shown. Red ovals highlight the digits 1, 9, 2 in the second column, 3, 8 in the third column, and 5, 4 in the fourth column. A plus sign and an equals sign are to the right of the numbers.

# Combien d'opérations élémentaires ?

A vertical addition problem is shown. The addends are 100, 192, 38, and 54. Each digit in these numbers is enclosed in a red oval. A horizontal line is drawn under the addends. To the right of the numbers are a plus sign and an equals sign. Below the line, the sum 1219 is written.

$$\begin{array}{r} 100 \\ 192 \\ 38 \\ 54 \\ \hline 1219 \end{array} \quad + \quad =$$

# Combien d'opérations élémentaires ?

100 + 192 = 294

The diagram shows the addition of 100 and 192. Each digit is enclosed in a red oval. A horizontal line is drawn under the numbers 100 and 192. The result 294 is shown below the line. To the right of the numbers are a plus sign and an equals sign.

# Combien d'opérations élémentaires ?

$$\begin{array}{cccc} \begin{array}{c} 1 \\ 0 \\ 0 \end{array} & \begin{array}{c} 1 \\ 9 \\ 2 \end{array} & \begin{array}{c} 3 \\ 8 \end{array} & \begin{array}{c} 5 \\ 4 \end{array} & + \\ \hline 1 & 2 & 1 & 9 & = \end{array}$$

6 op

# Exercice 3 du TD1

**La bergère, le loup,  
le mouton et le chou**



# Le problème



# Le problème



# Le but



# Les règles du jeu

- Les **opérations élémentaires** :
  - 🚣 peut **traverser** la rivière toute seule
  - 🚣 peut **transporter** l'un de 🐺, 🐑, 🥬 à la fois et le déposer de l'autre côté
- Les **contraintes** :
  - 🐺 mange 🐑 s'ils sont du même côté sans 🚣
  - 🐑 mange 🥬 s'ils sont du même côté sans 🚣

# Exercice 4 du TD1

# La solution



transporter 🐑

# La solution



transporter 🐑

# La solution





transporter 🐑

# La solution



transporter 🐑

# La solution



transporter 🐑  
traverser

# La solution



transporter 🐑  
traverser

# La solution



transporter 🐑

traverser

transporter 🥬

# La solution



transporter 🐑

traverser

transporter 🥬

# La solution



transporter 🐑

traverser

transporter 🥬

# La solution



transporter 🐑

traverser

transporter 🥬

# La solution





# La solution

transporter 

traverser

transporter 

transporter 



# La solution

transporter 

traverser

transporter 

transporter 



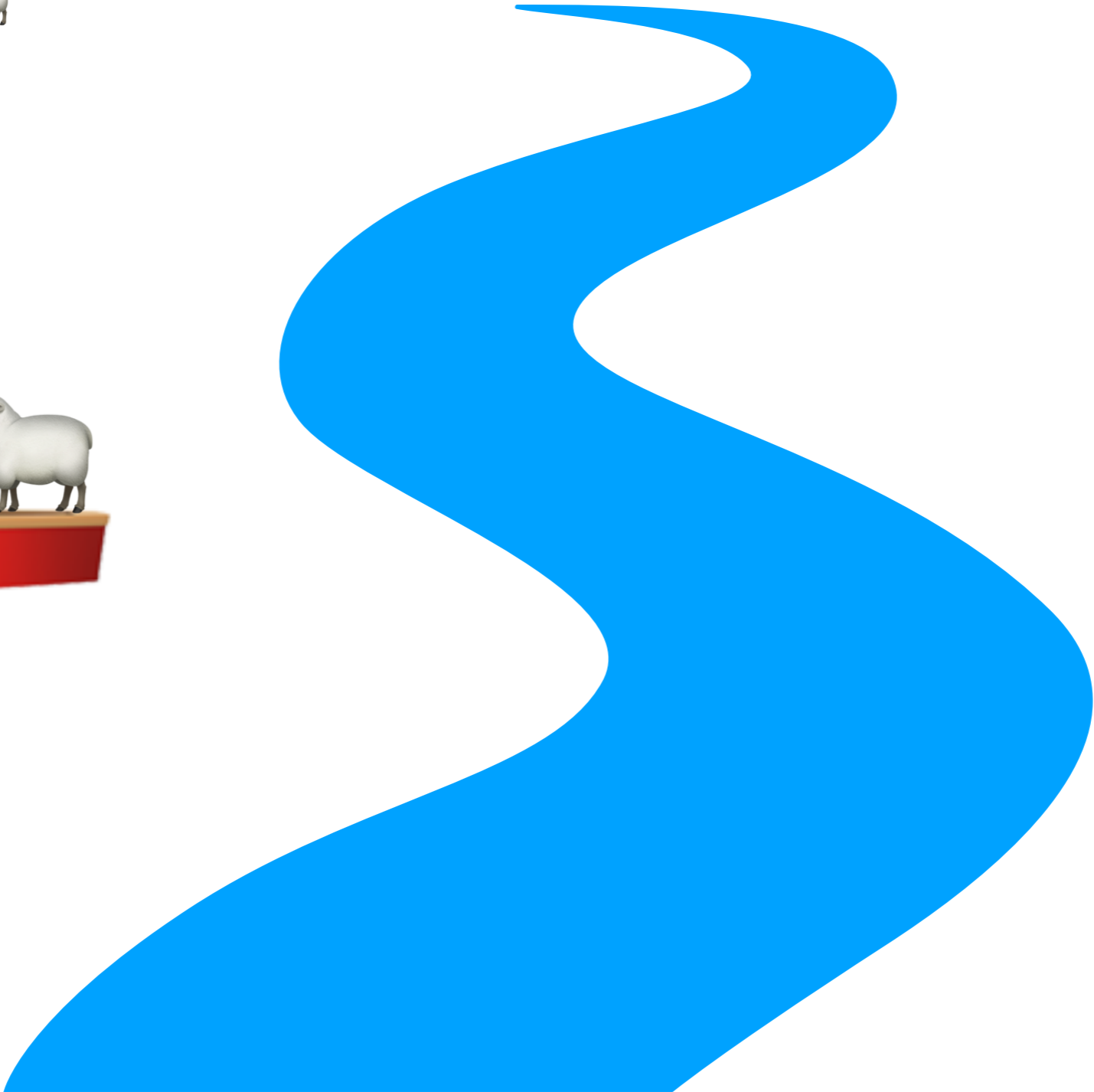
# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺





# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺

traverser



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺

traverser



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺

traverser

transporter 🐑



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺

traverser

transporter 🐑



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺

traverser

transporter 🐑



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺

traverser

transporter 🐑



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺

traverser

transporter 🐑



# La solution

transporter 🐑

traverser

transporter 🥬

transporter 🐑

transporter 🐺

traverser

transporter 🐑

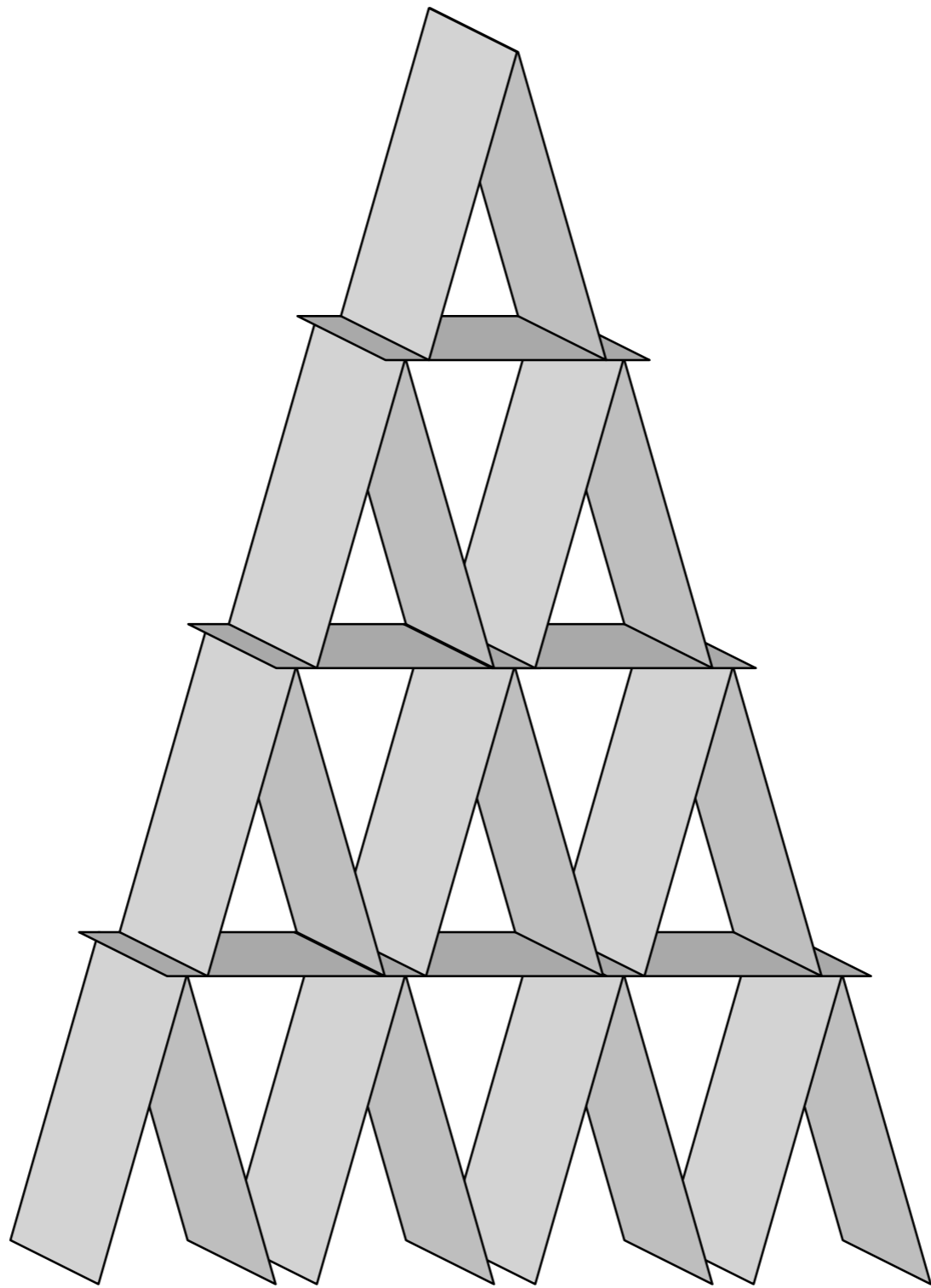


7 op

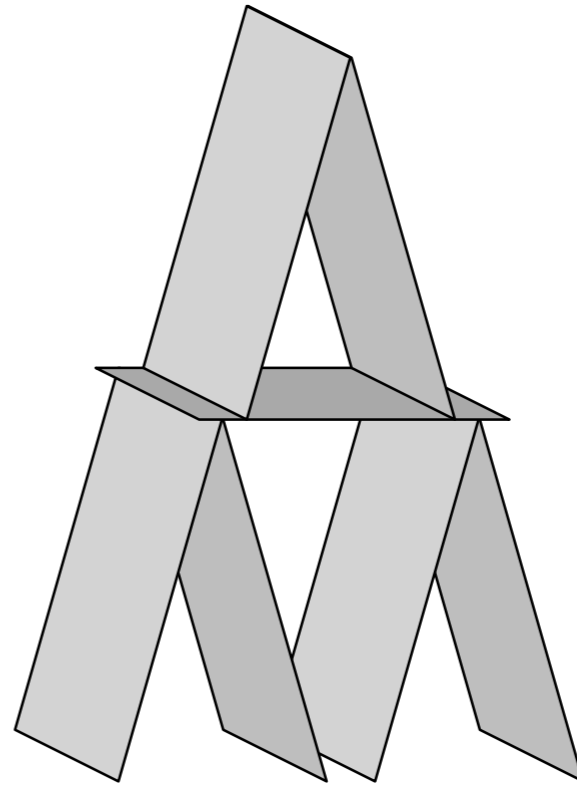
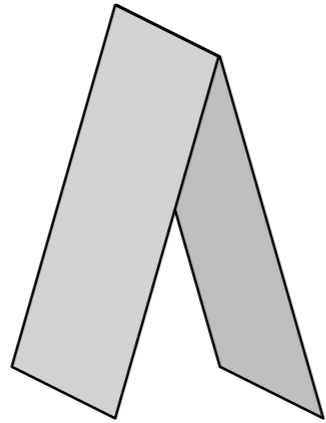


# Exercice 5 du TD1

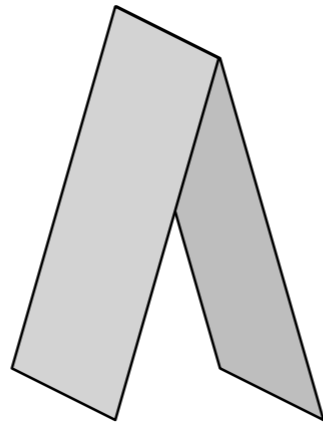
**Châteaux de cartes**



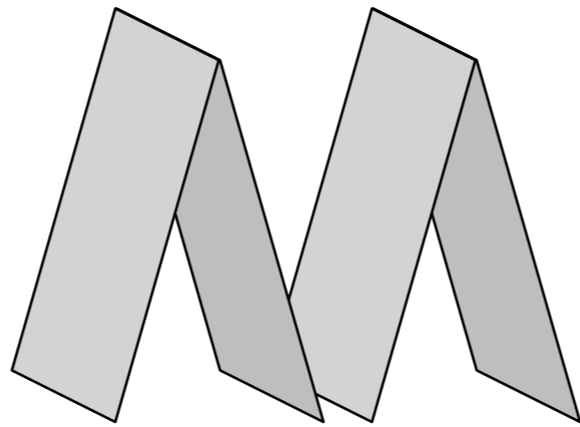
1 niveau 🙌 2 niveaux ?



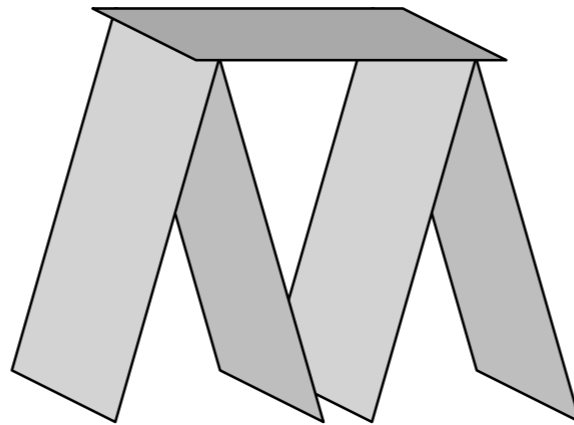
**1 niveau** 🙌 **2 niveaux**



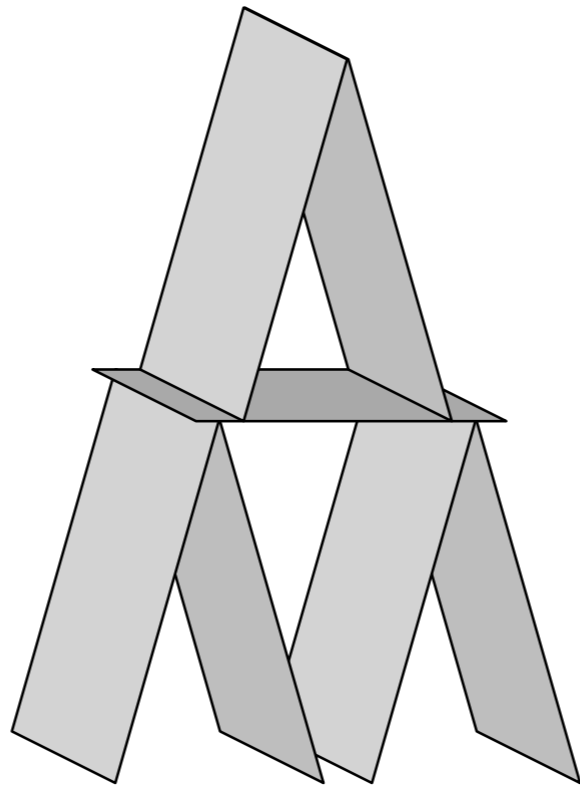
**1 niveau** 👉 **2 niveaux**



**1 niveau** 👉 **2 niveaux**

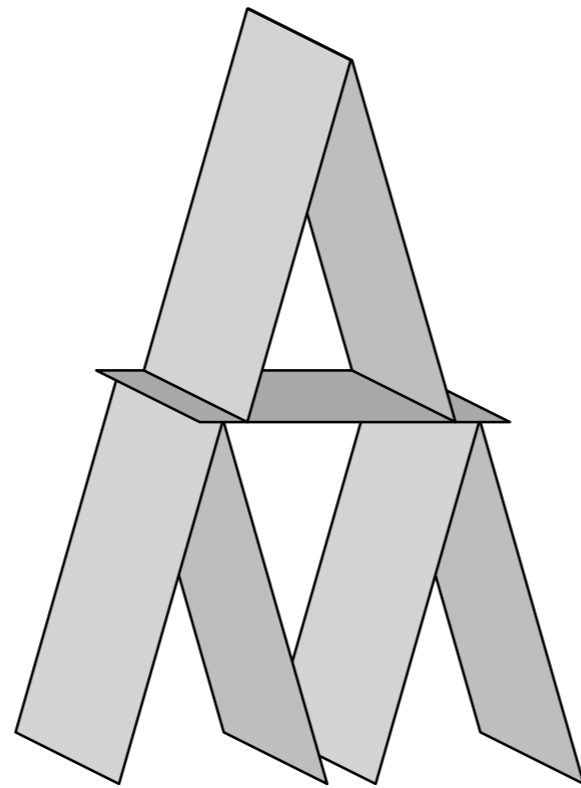


**1 niveau** 👉 **2 niveaux**

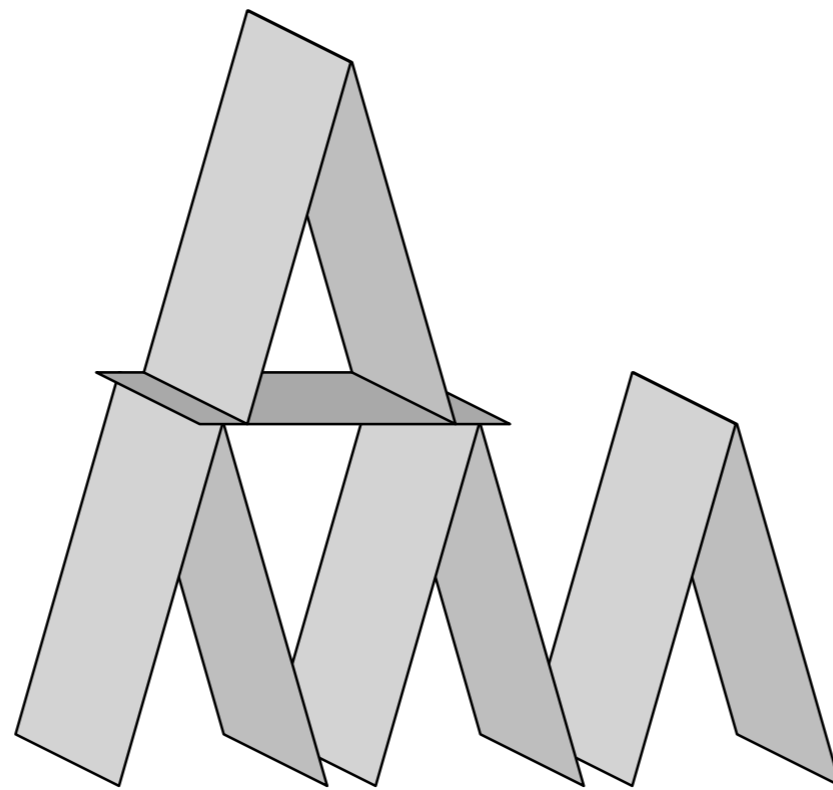




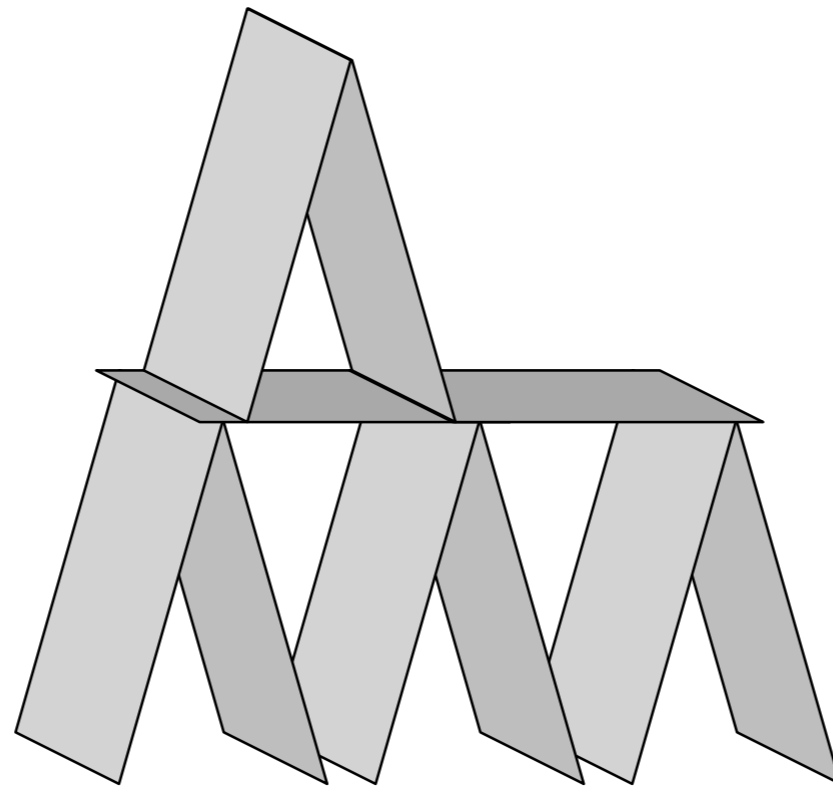
**2 niveaux** 🙌 **3 niveaux**



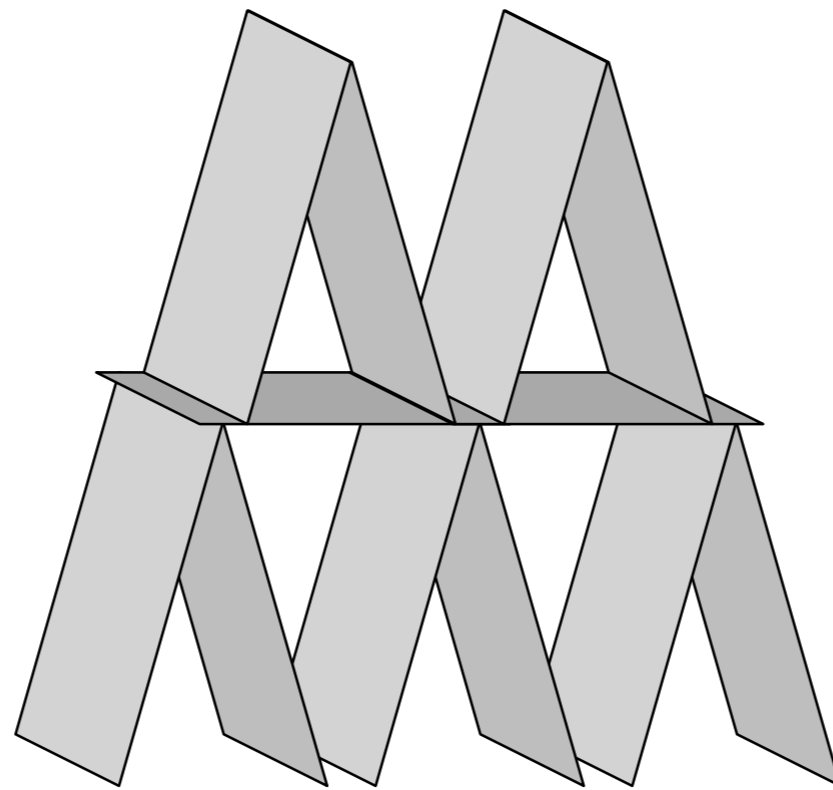
**2 niveaux** 🙌 **3 niveaux**



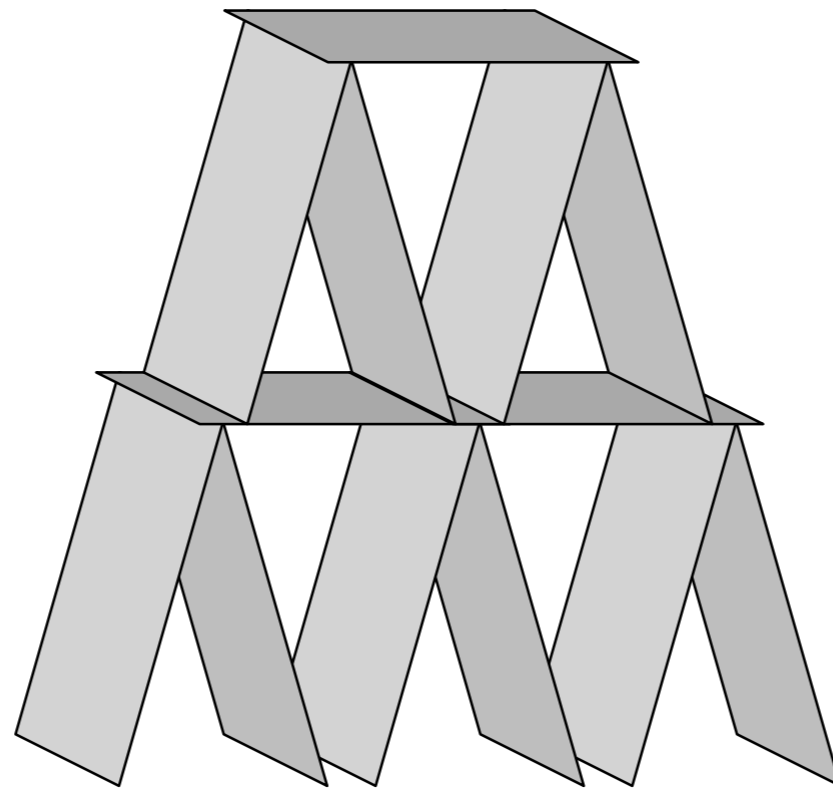
**2 niveaux** 🙌 **3 niveaux**



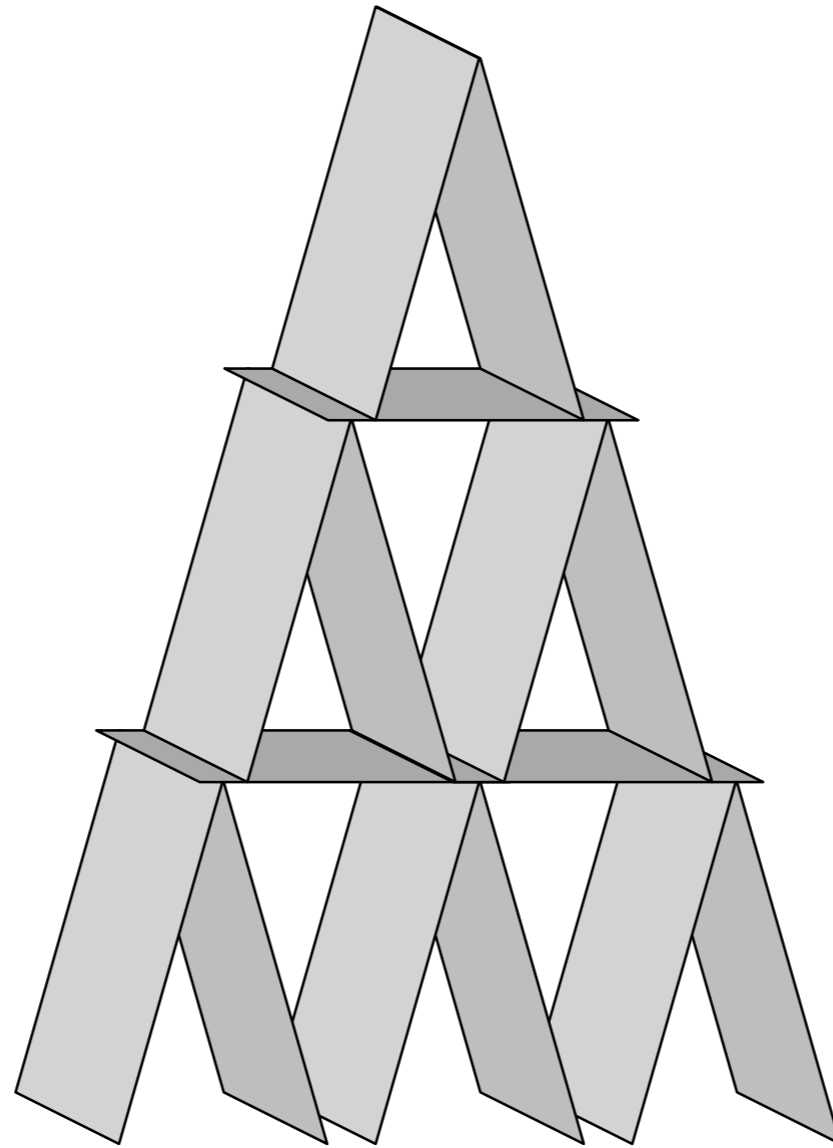
**2 niveaux** 🙌 **3 niveaux**



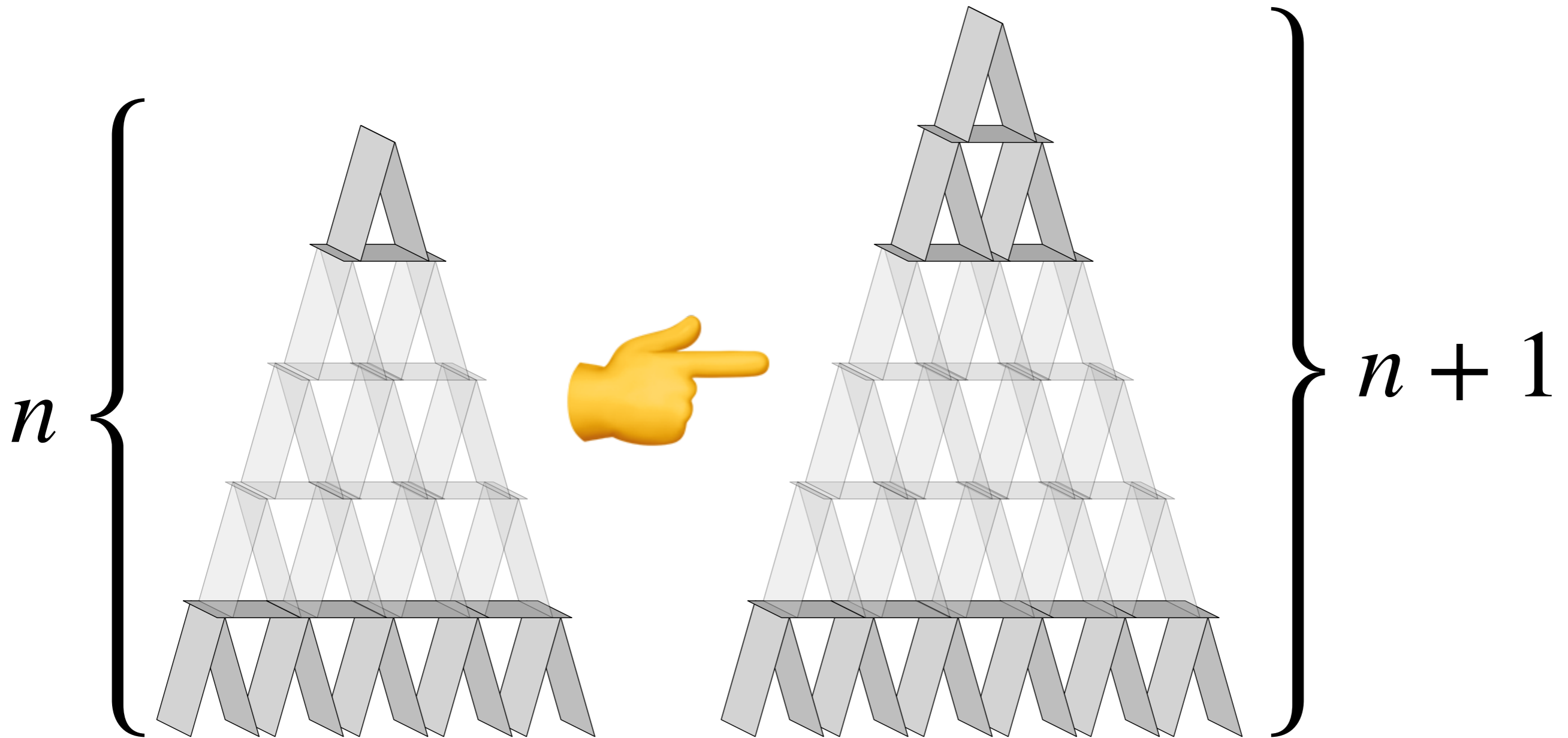
**2 niveaux** 🙌 **3 niveaux**



2 niveaux  3 niveaux



$n$  niveaux 🙌  $n + 1$  niveaux ?



# Exercice 6 du TD1



# Chiffrement de César



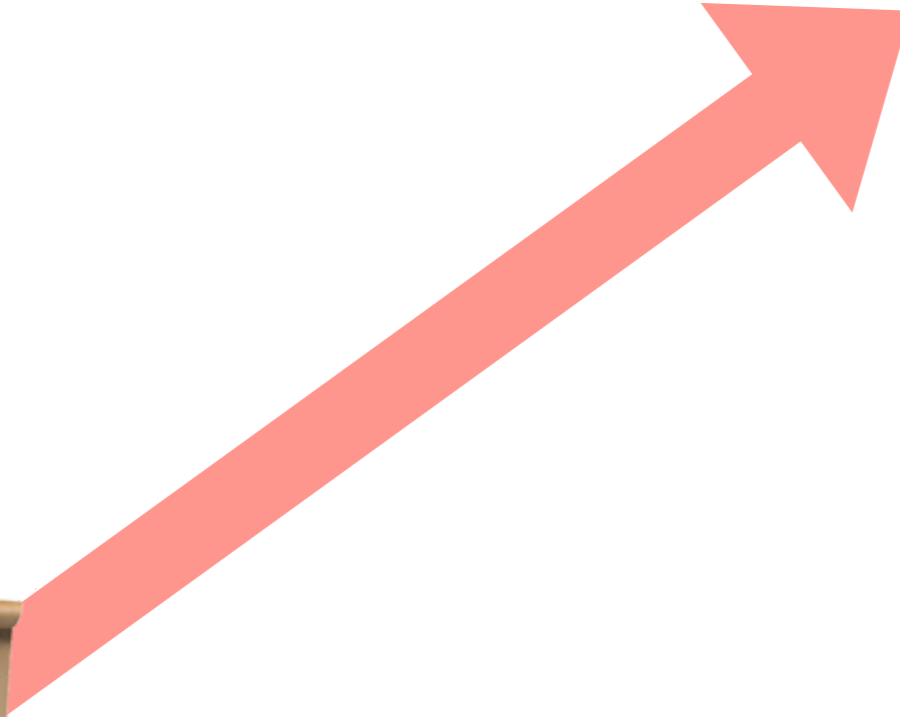




the rebels, the troublemakers,  
the round pegs in the square holes.  
The ones who see things differently.  
They're not fond of rules. And they  
have no respect for the status quo.  
You can quote them, disagree with  
them, glorify or vilify them. About  
the only thing you can't do is ignore  
them. Because they always get



the rebels, the troublemakers,  
the round pegs in the square holes.  
The ones who see things differently.  
They're not fond of rules. And they  
have no respect for the status quo.  
You can quote them, disagree with  
them, glorify or vilify them. About  
the only thing you can't do is ignore  
them. Because they always get



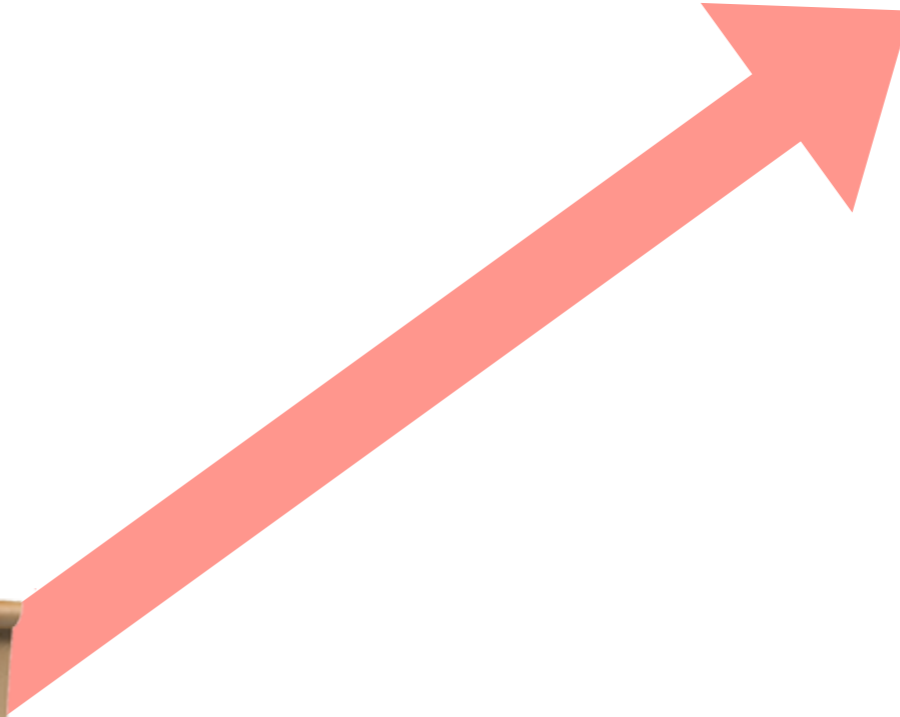


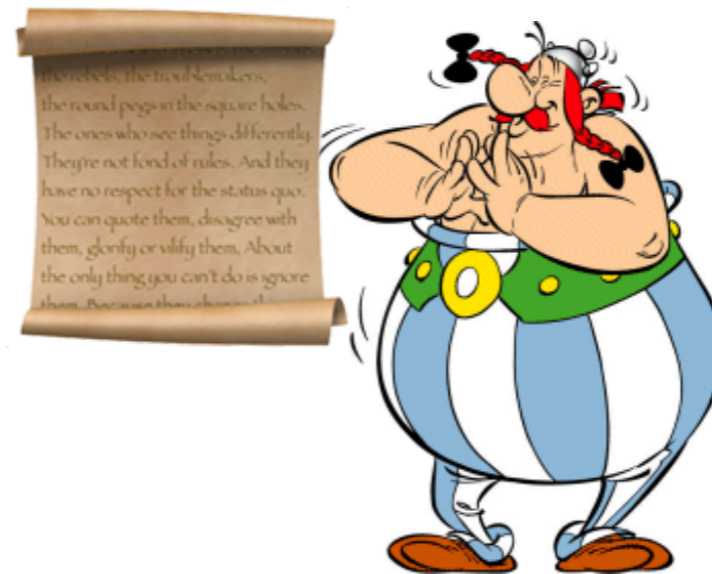
the rebels, the trouble makers,  
the round pegs in the square holes.  
The ones who see things differently.  
They're not fond of rules. And they  
have no respect for the status quo.  
You can quote them, disagree with  
them, glorify or vilify them. About  
the only thing you can't do is ignore  
them. Because they always get





the rebels, the troublemakers,  
the round pegs in the square holes.  
The ones who see things differently.  
They're not fond of rules. And they  
have no respect for the status quo.  
You can quote them, disagree with  
them, glorify or vilify them. About  
the only thing you can't do is ignore  
them. Because they always get

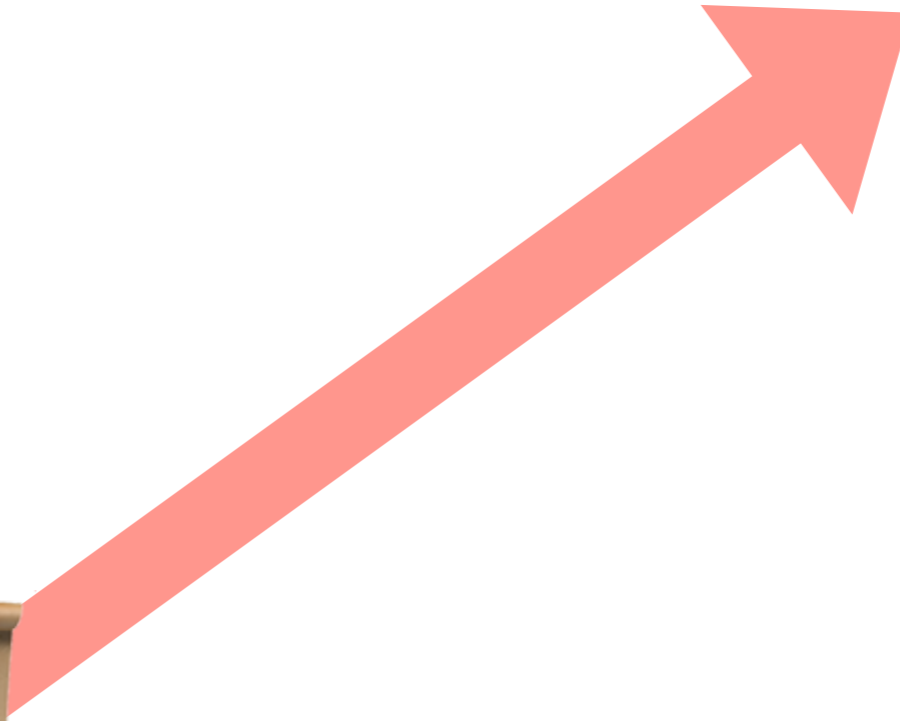


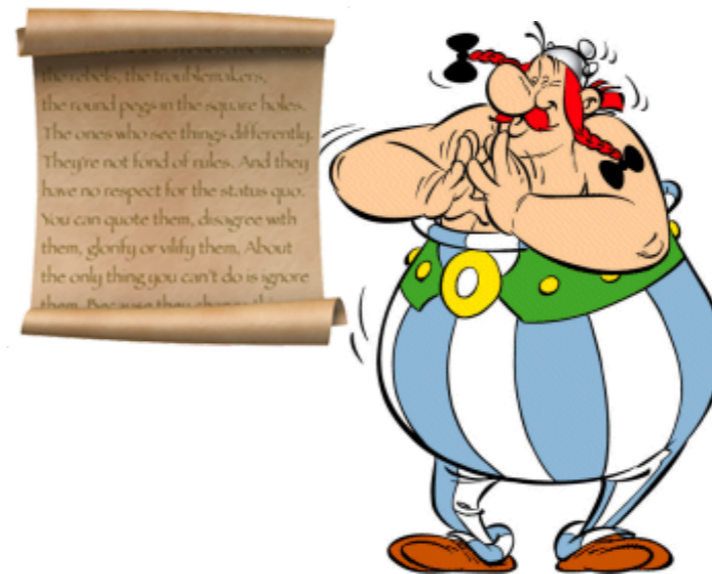






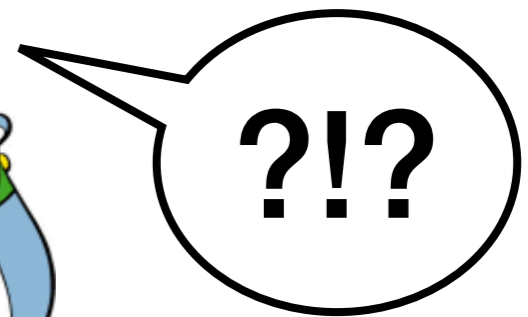
the rebels, the troublemakers,  
the round pegs in the square holes.  
The ones who see things differently.  
They're not fond of rules. And they  
have no respect for the status quo.  
You can quote them, disagree with  
them, glorify or vilify them. About  
the only thing you can't do is ignore  
them. Because they always get







the rebels, the troublemakers,  
the round pegs in the square holes.  
The ones who see things differently.  
They're not fond of rules. And they  
have no respect for the status quo.  
You can quote them, disagree with  
them, glorify or vilify them. About  
the only thing you can't do is ignore  
them. Because they change it.




# Chiffrement de César

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

salut

# Chiffrement de César


a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

 = 5

salut

# Chiffrement de César


a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z

 = 5

salut

# Chiffrement de César


a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e

 = 5

salut

# Chiffrement de César

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e

 = 5

salut  xfqzy



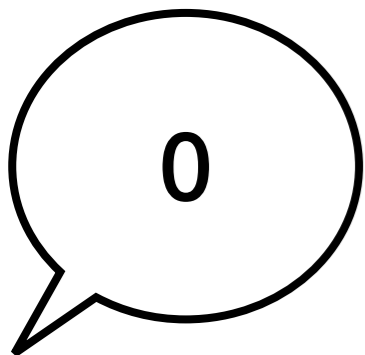
# Exercice 7 du TD1

**On est combien  
dans la salle ?**

# Comptage séquentiel



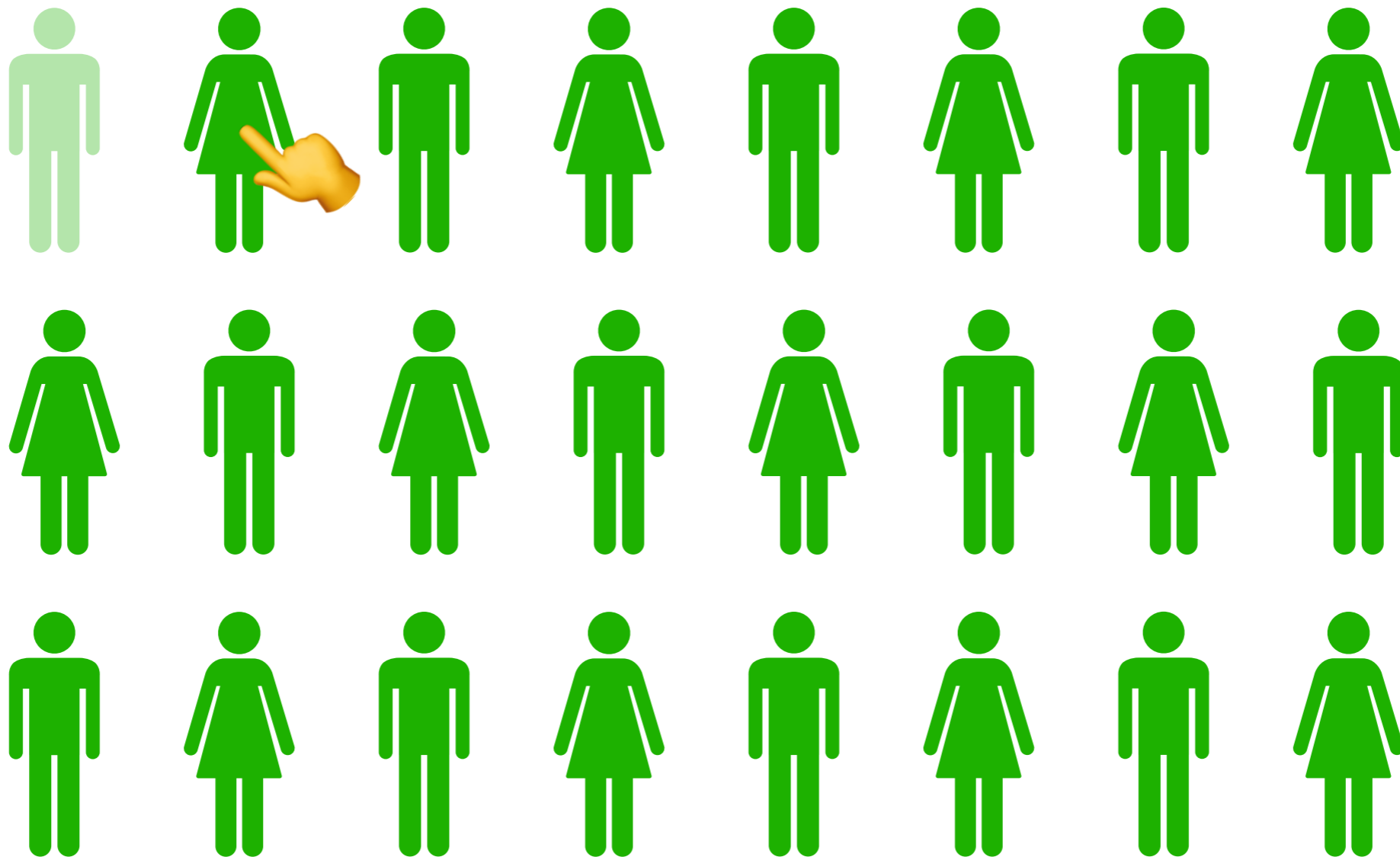
# Comptage séquentiel



# Comptage séquentiel

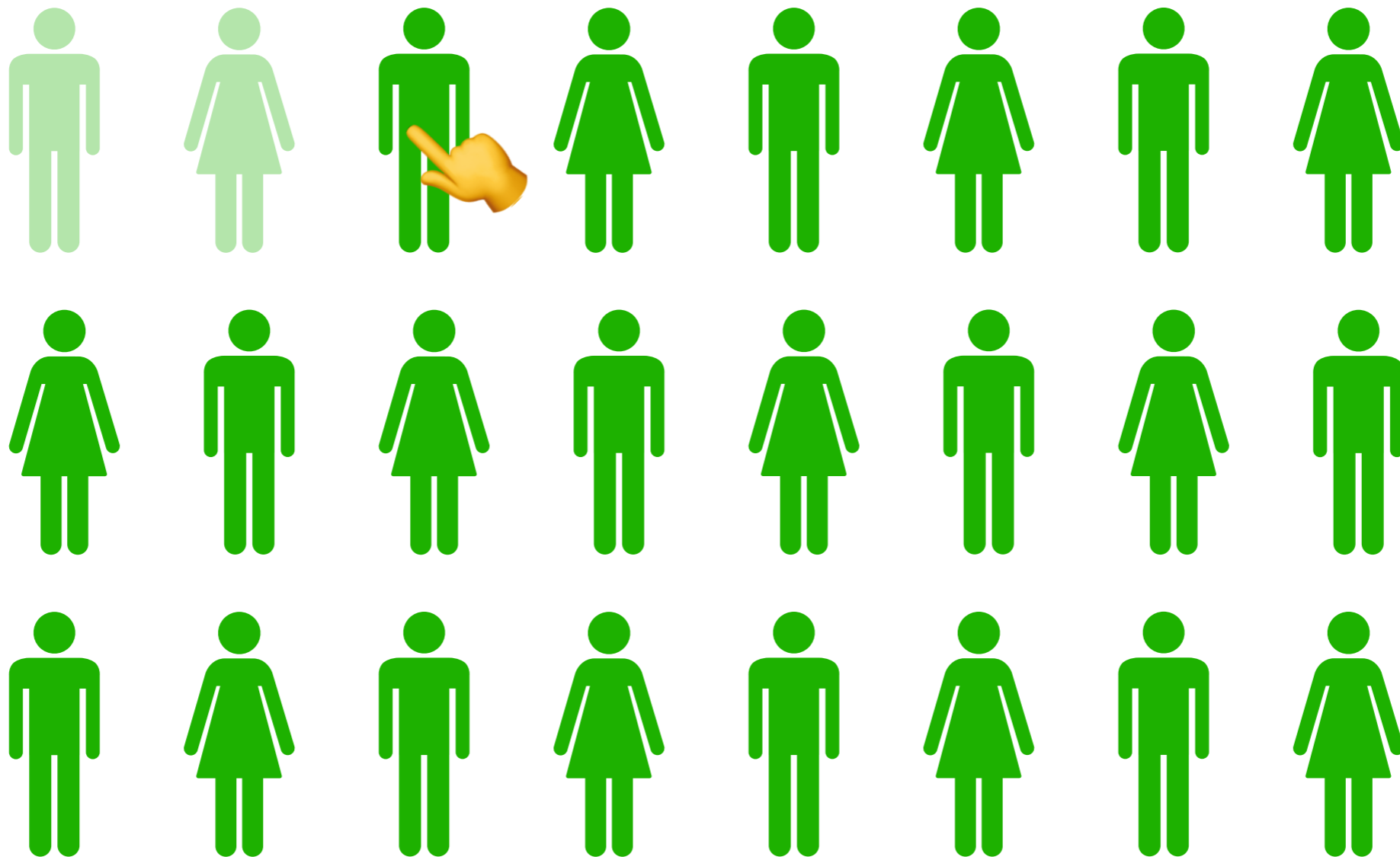


# Comptage séquentiel



2

# Comptage séquentiel



3

# Comptage séquentiel



23



# Comptage séquentiel



24

# Comptage séquentiel



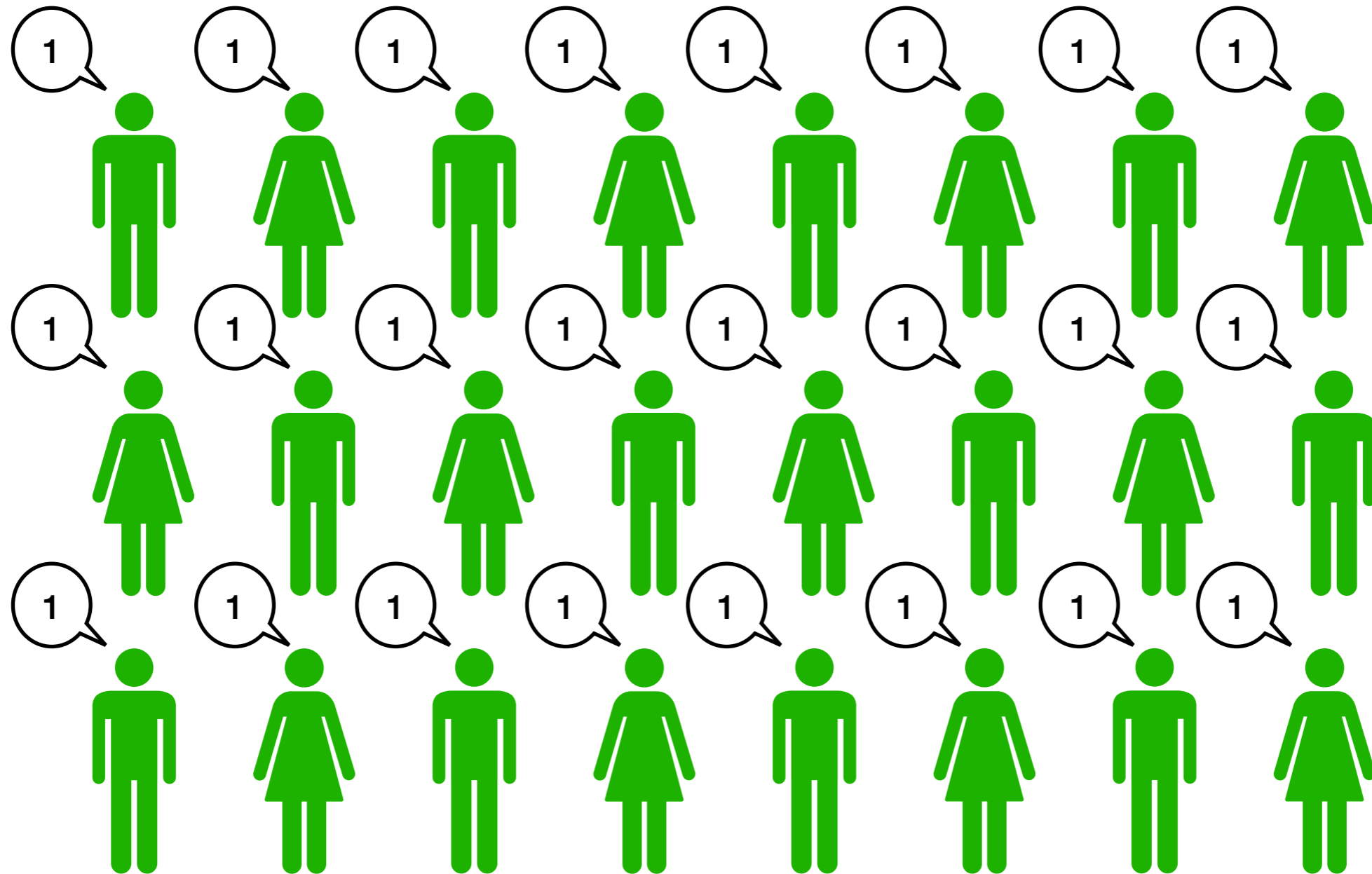
24

**Est-qu'on peut  
compter plus vite ?**

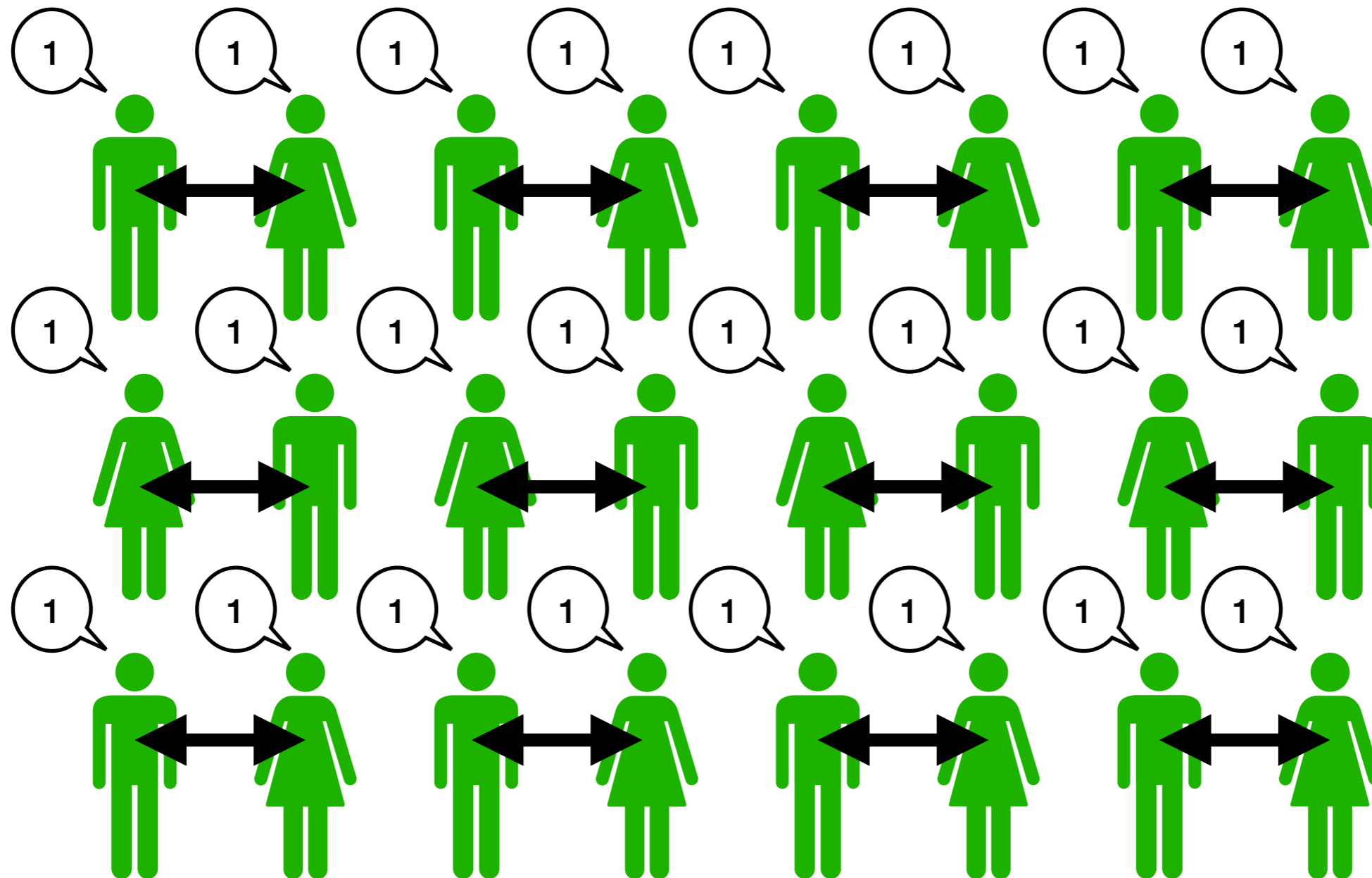
# Comptage distribué



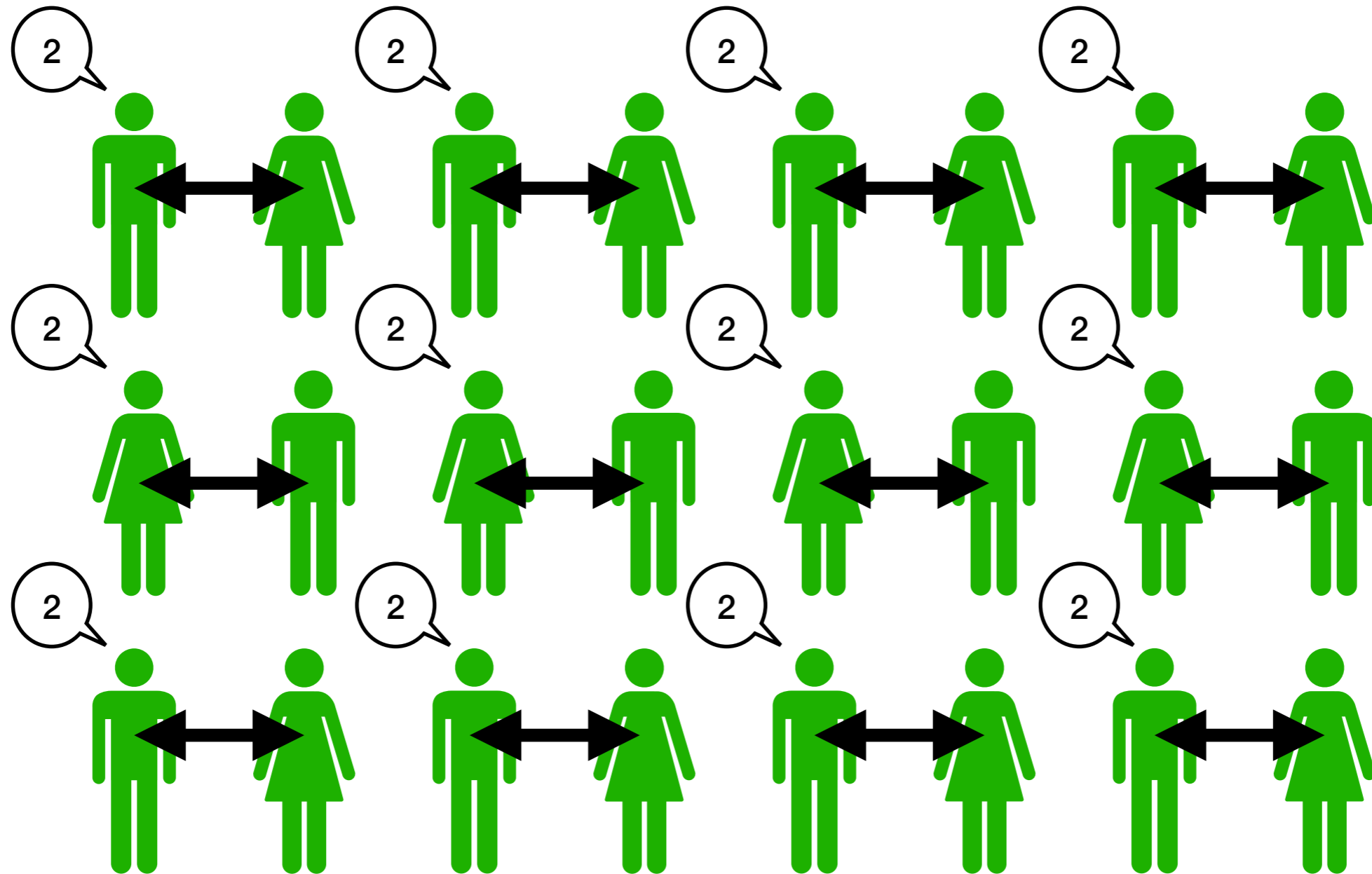
# Comptage distribué



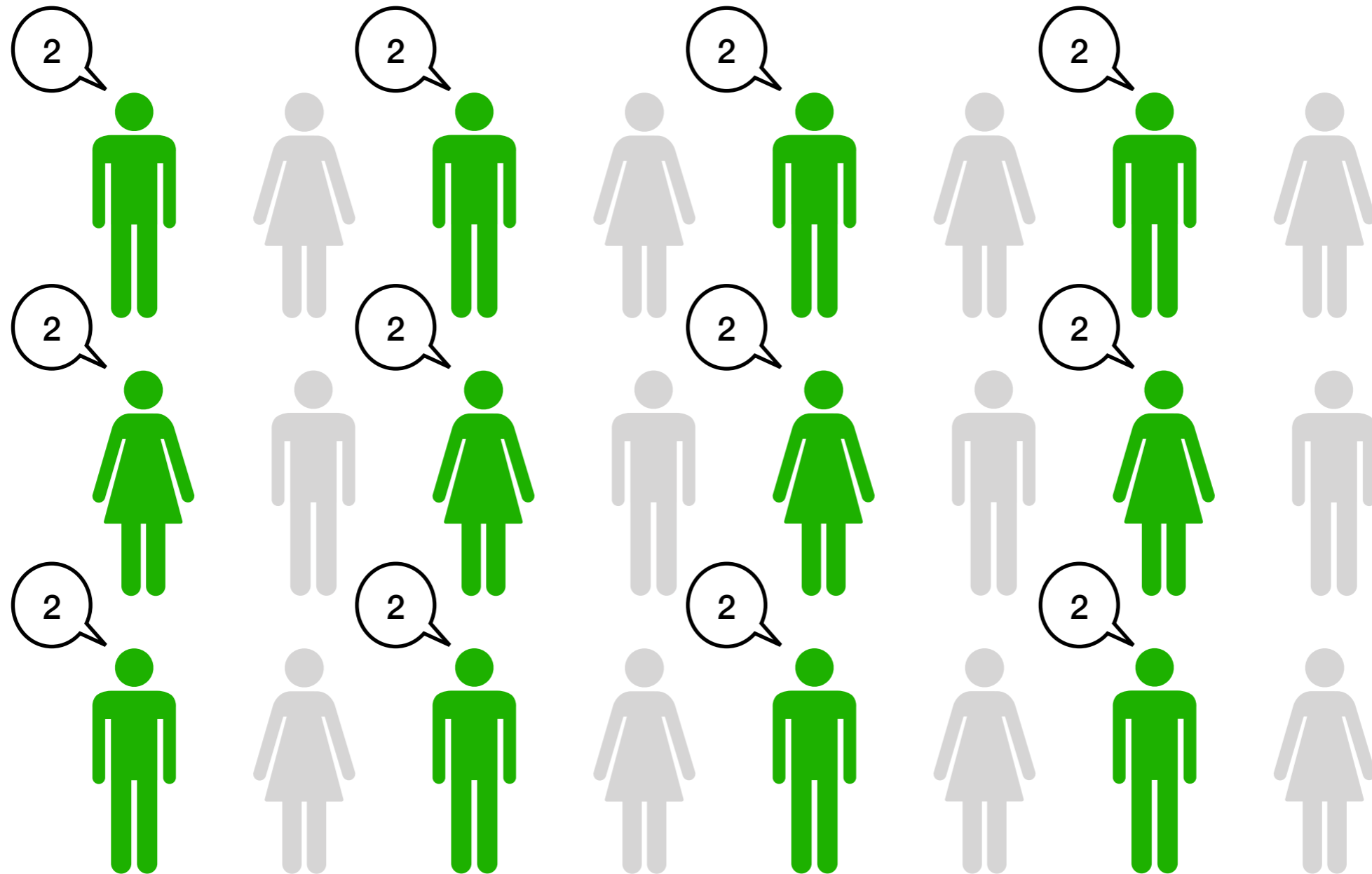
# Comptage distribué



# Comptage distribué

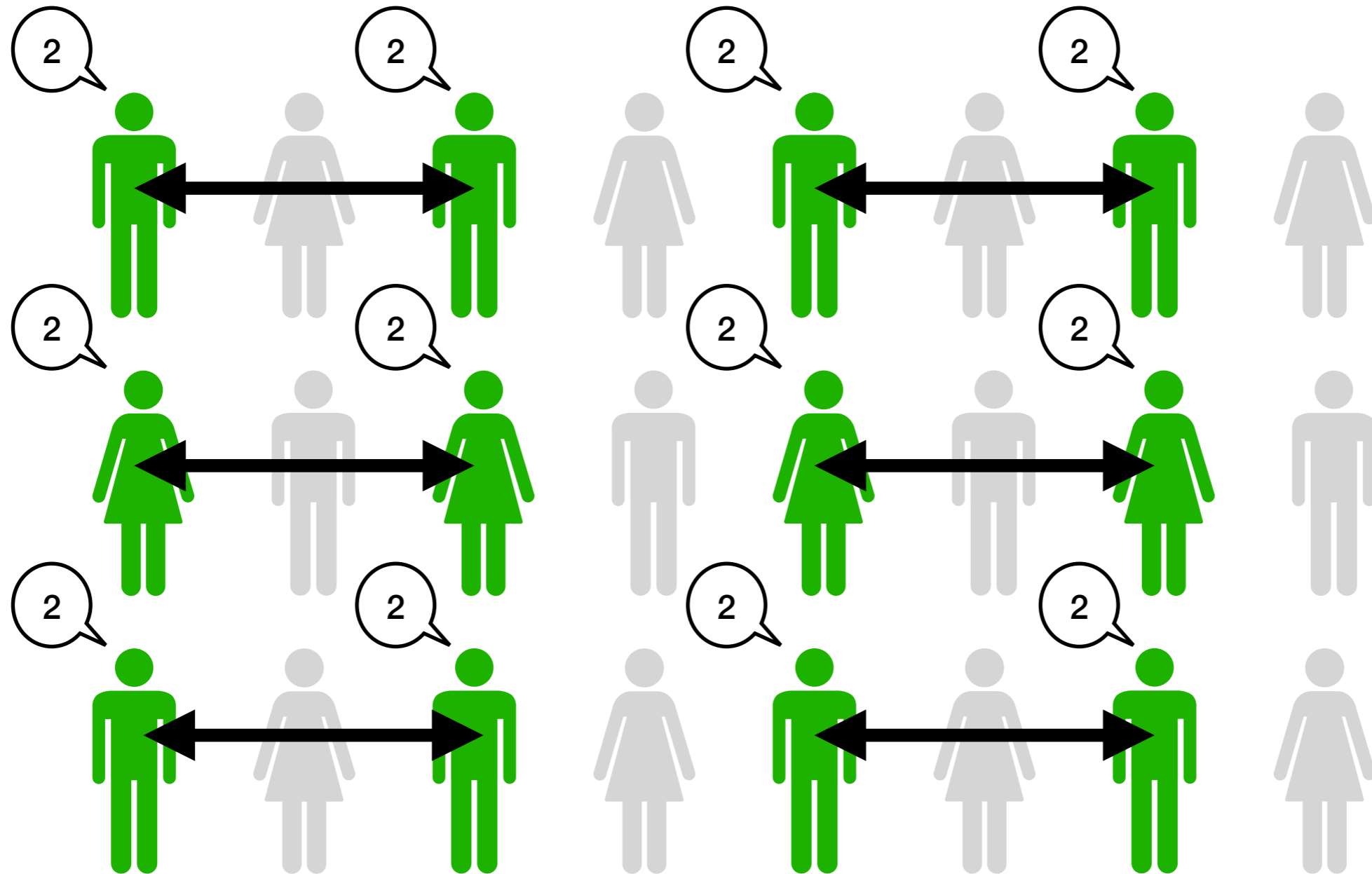


# Comptage distribué

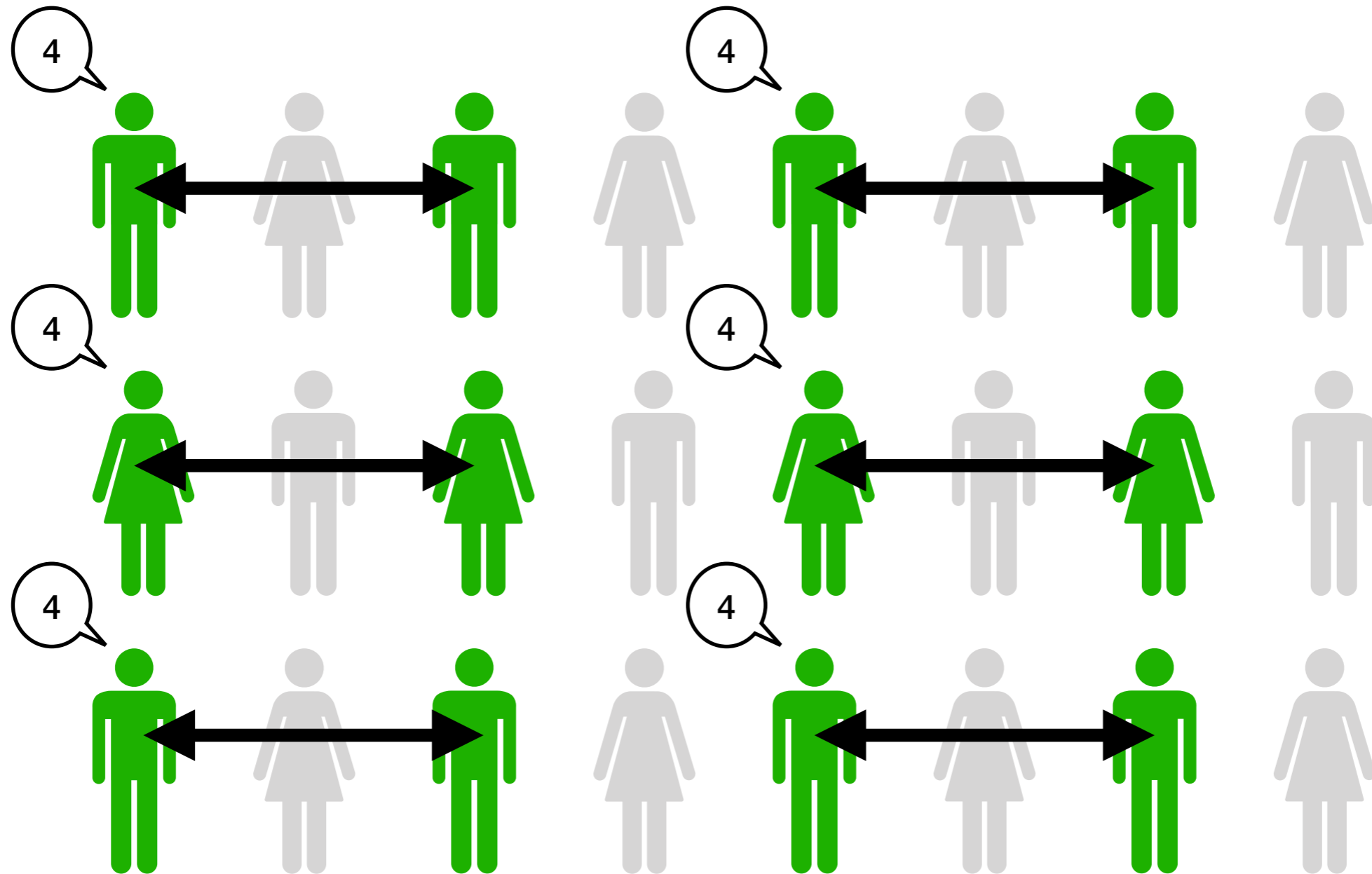




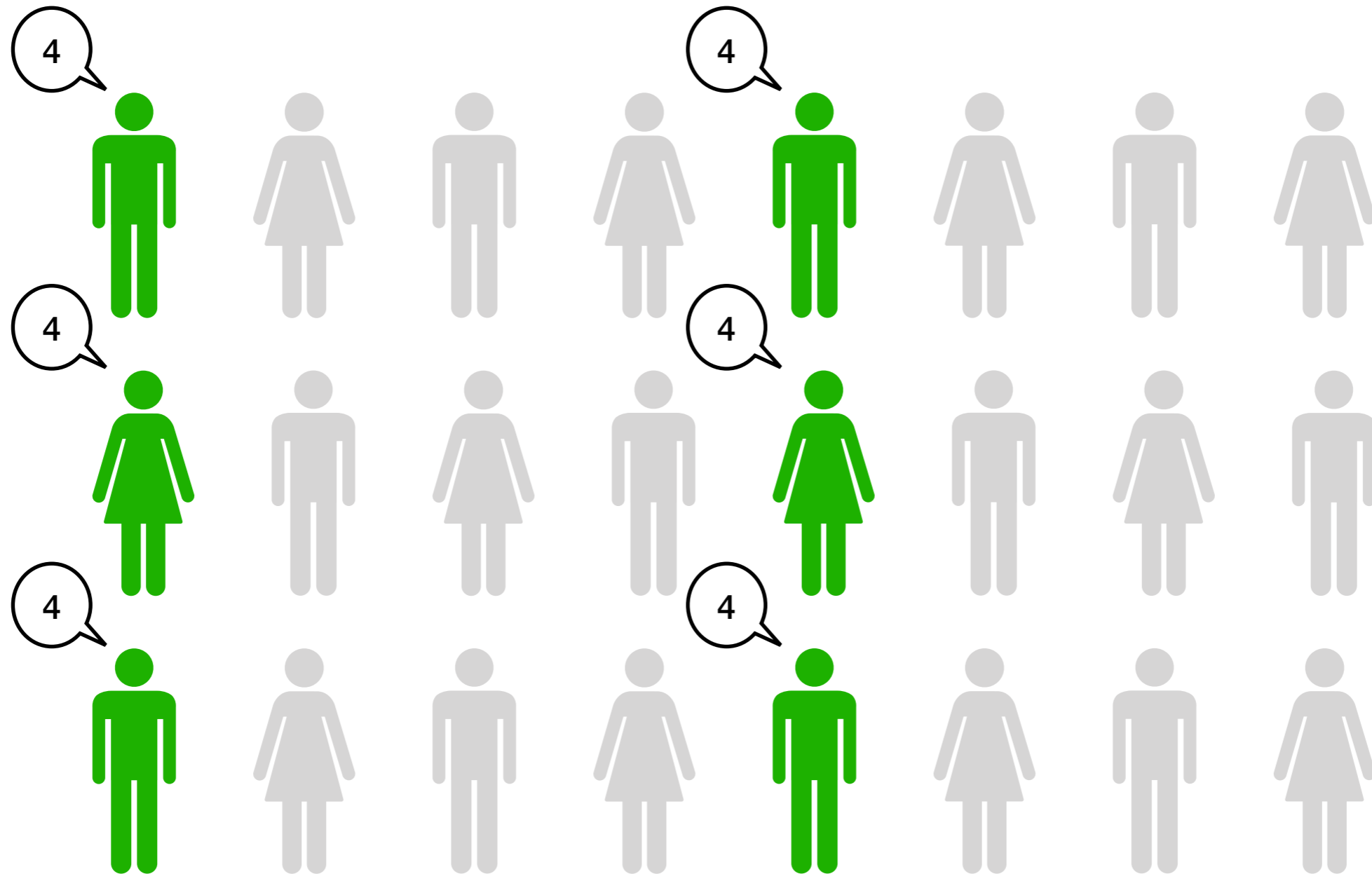
# Comptage distribué



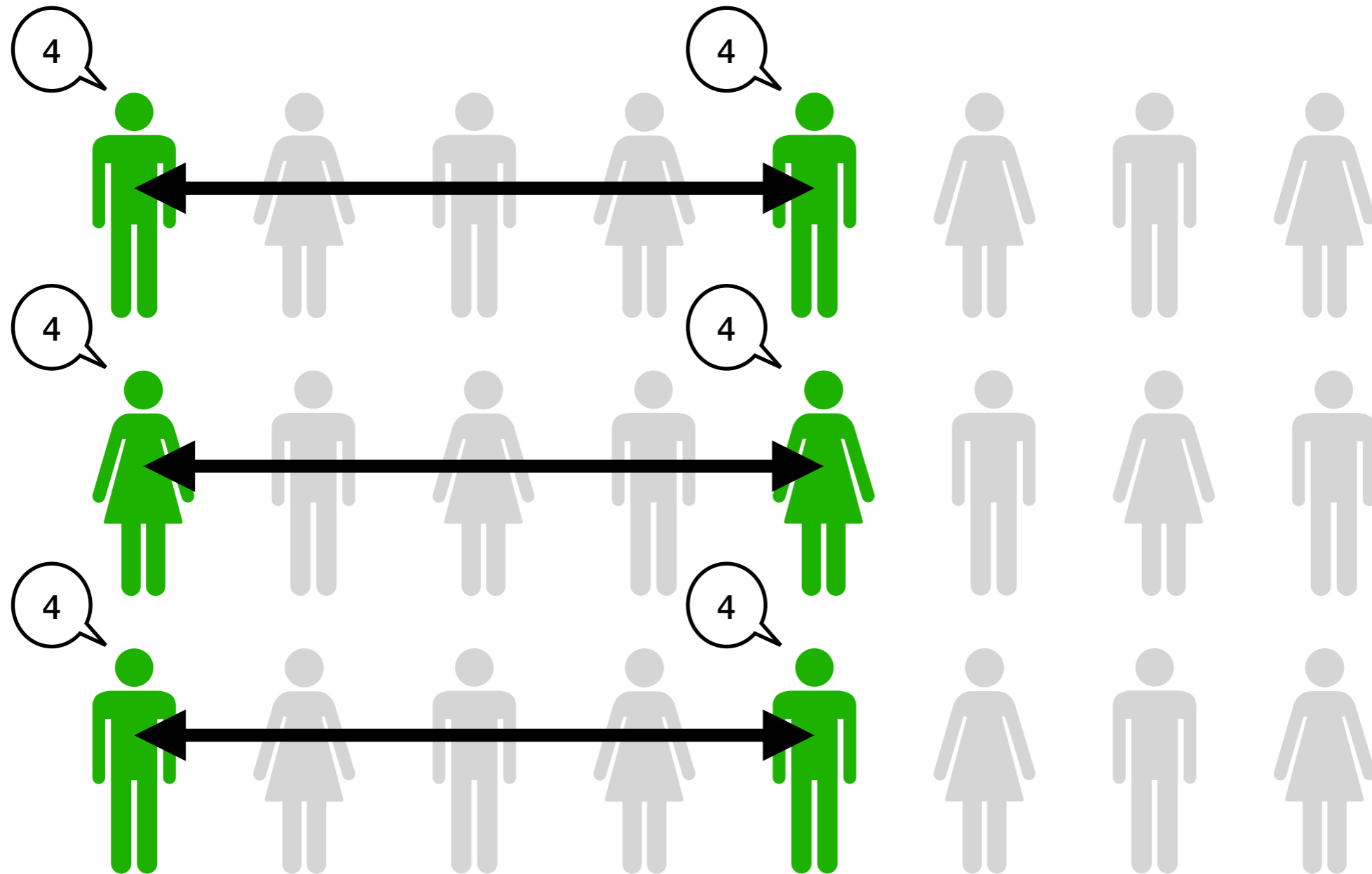
# Comptage distribué



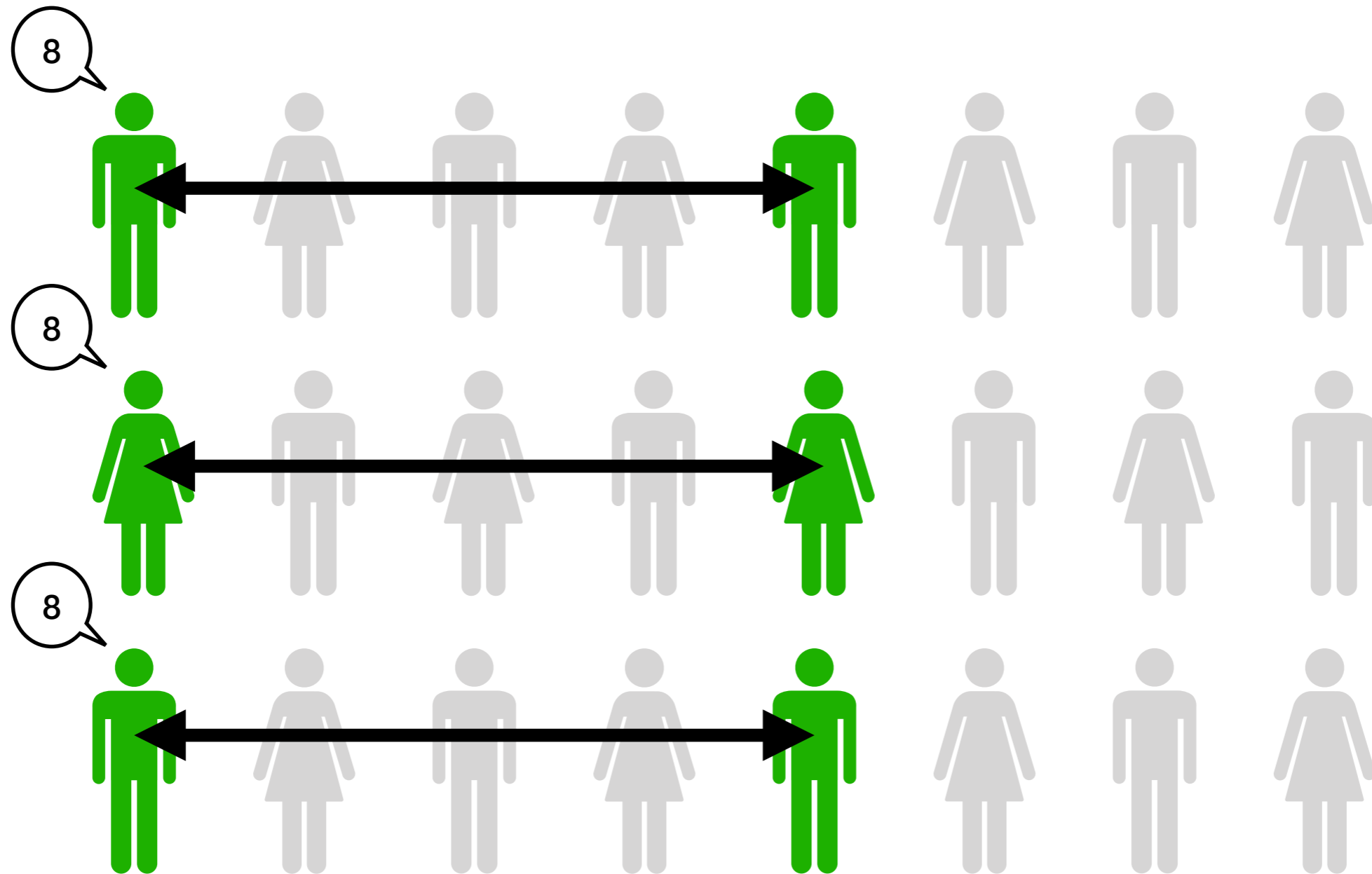
# Comptage distribué



# Comptage distribué



# Comptage distribué





# Comptage distribué



# Comptage distribué





# Comptage distribué



# Comptage distribué



# Comptage distribué



# Comptage distribué



