Algoritmos
Introdução a Computação

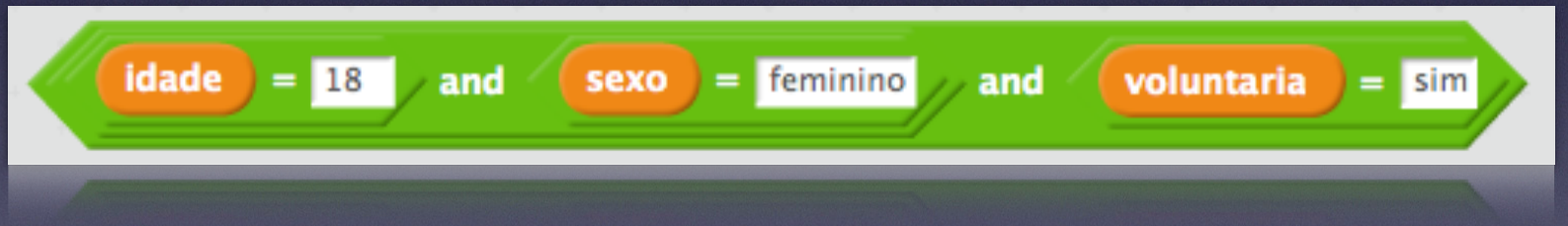
Prof. Hitoshi Nagano, Ph.D.

Aula 5

Algebra Booleana

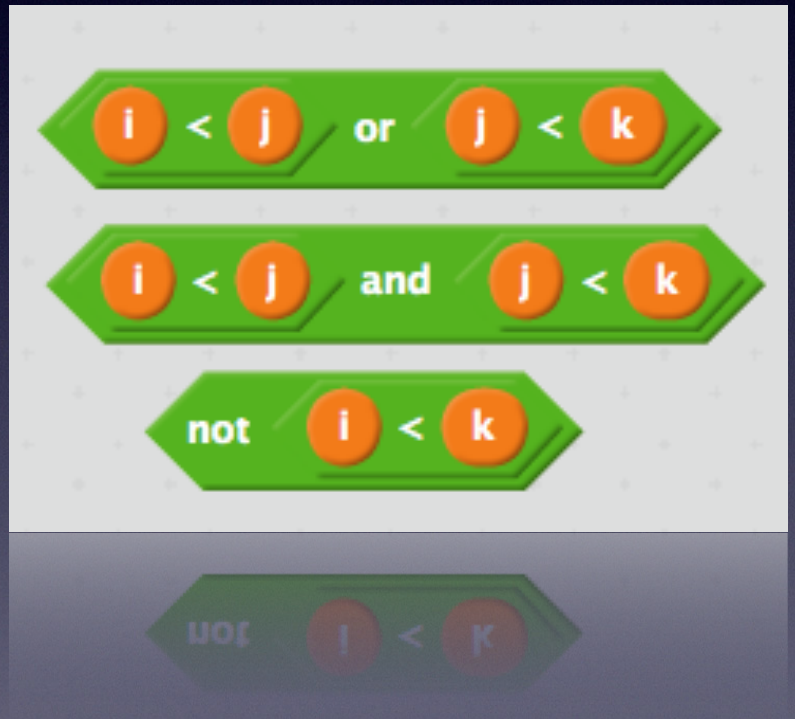
explique...


idade = 18 and sexo = masculino


idade = 18 and sexo = feminino and voluntaria = sim


idade = 18 and sexo = masculino or idade = 18 and sexo = feminino and voluntaria = sim

expressões booleanas

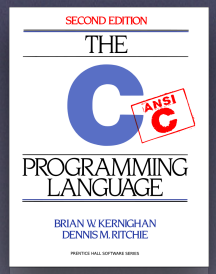



```
((i < j) || (j < k))
((i < j) && (j < k))
      !(i < j)
```

expressões booleanas

Operador AND

condição A	condição B	resultado
0	0	0
0	1	0
1	0	0
1	1	1

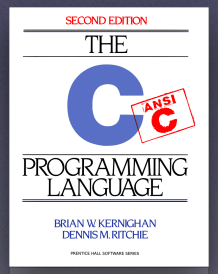



```
((condA) && (condB))
```

expressões booleanas

`Operador OR`

condição A	condição B	resultado
0	0	0
0	1	1
1	0	1
1	1	1

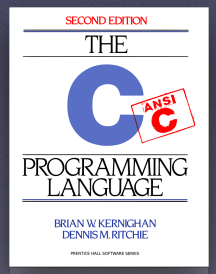



```
((condA) || (condB))
```

expressões booleanas

Operador NOT

condição	resultado
0	1
1	0




```
!(cond)
```

Exercício

- Escrever um programa para imprimir múltiplos de 3 ou 5
- Escrever um programa para imprimir múltiplos de 3 e 5

Loops aninhados
Nested Loops

Exercício a

- Escrever um programa para imprimir “#####” n vezes, um em cada linha.

- Exemplo: n = 2

```
#####
#####
```

- Exemplo: n = 5

```
#####
#####
#####
#####
#####
```

Exercício b

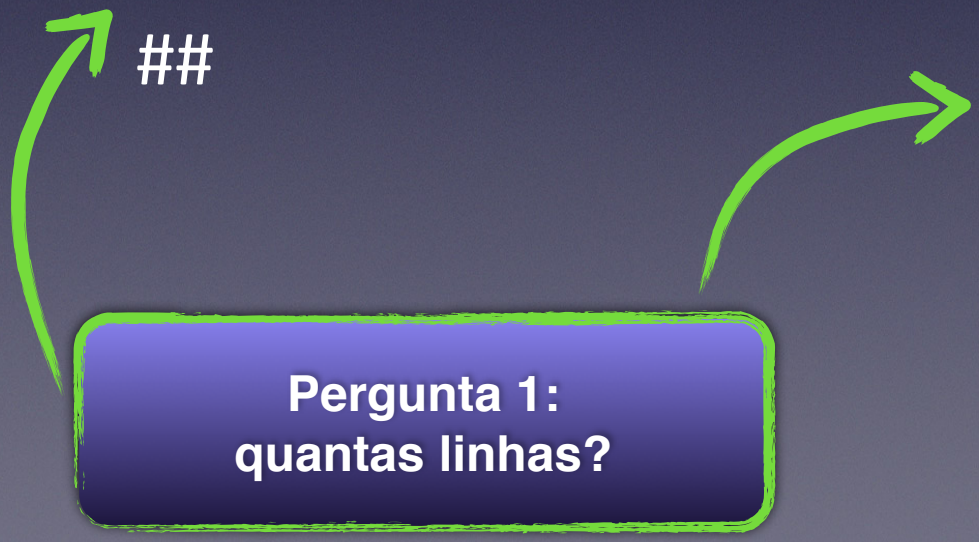
- Escrever um programa para imprimir “#” n vezes numa linha, em n linhas.

- Exemplo: n = 2

```
##
##
```

- Exemplo: n = 5

```
#####
#####
#####
#####
#####
```



Exercício b

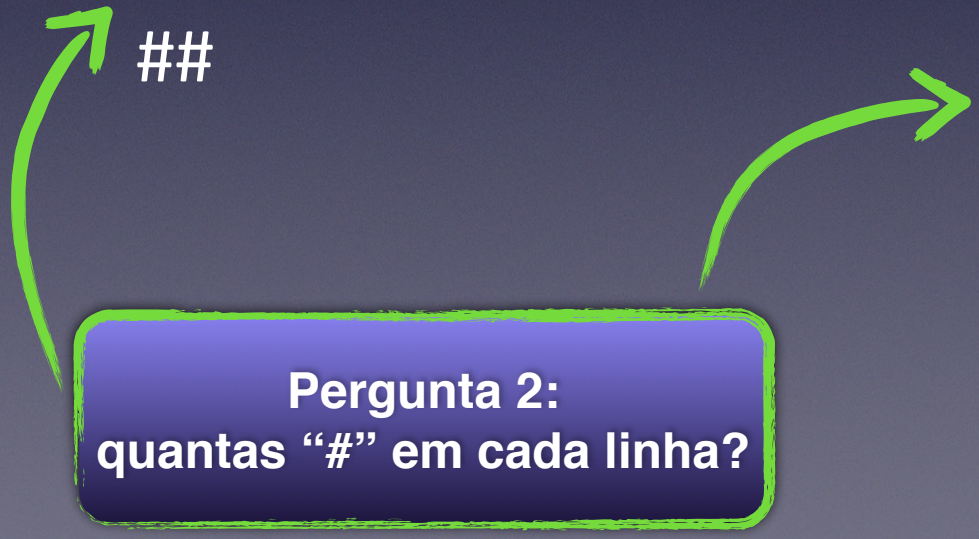
- Escrever um programa para imprimir “#” n vezes numa linha, em n linhas.

- Exemplo: n = 2

```
##
##
```

- Exemplo: n = 5

```
#####
#####
#####
#####
#####
```



Exercício c

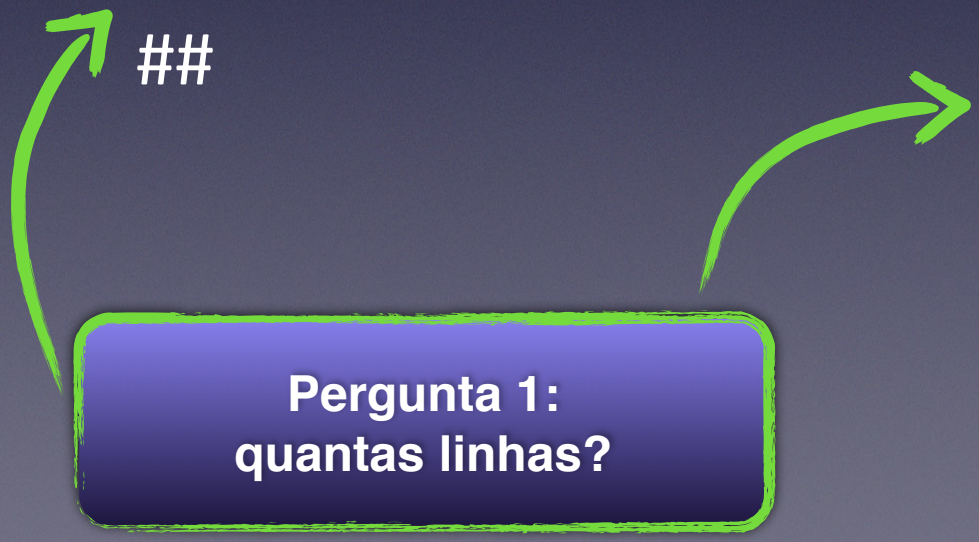
- Escrever um programa para imprimir uma pirâmide.

- Exemplo: n = 2

```
#
##
```

- Exemplo: n = 5

```
#
##
###
####
#####
```



Exercício c

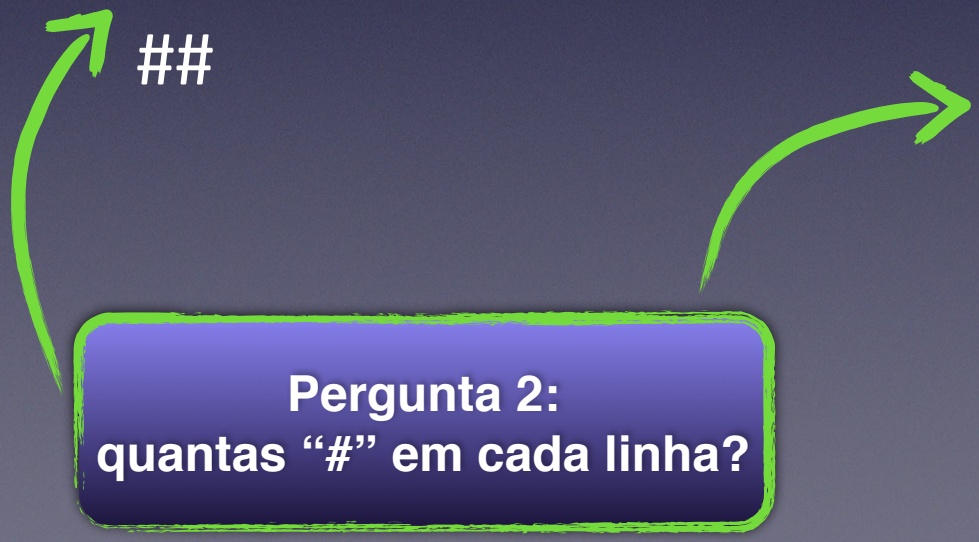
- Escrever um programa para imprimir uma pirâmide.

- Exemplo: n = 2

```
#
##
```

- Exemplo: n = 5

```
#
##
###
####
#####
```



Problemas de imprecisão e transbordamento

Tipos em C

- char 1 byte
- integer 4 bytes
- float 4 bytes
- bool 1 byte
- long 8 bytes
- double 8 bytes

Tipos em C

- char 1 byte
- **integer 4 bytes**
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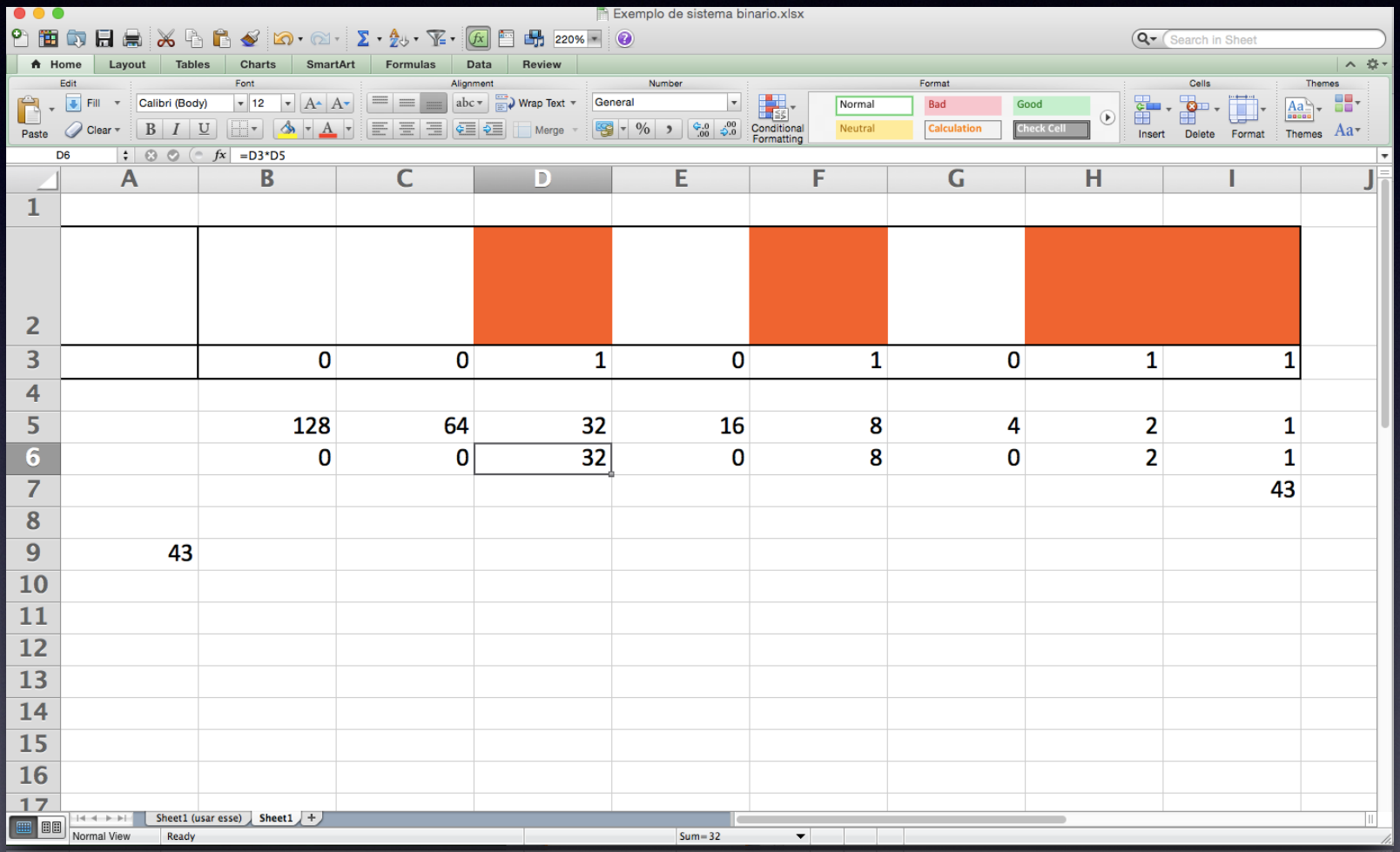


	A	B	C	D	E	F	G	H	I	J
1										
2										
3		0	0	1	0	1	0	1	1	
4										
5		128	64	32	16	8	4	2	1	
6		0	0	32	0	8	0	2	1	
7									43	
8										
9	43									
10										
11										
12										
13										
14										
15										
16										
17										

Pergunta

Quantos números diferentes consigo representar com 4 bytes?

Resposta: 4.294.967.296

unsigned int

inteiros positivos $(0, 2^{32} - 1)$

inteiros positivos e negativos $(-2^{31}, 2^{31} - 1)$

signed int

Genericamente

Quantos números diferentes consigo representar com n bits?

Resposta: 2^n

unsigned int

inteiros positivos $(0, 2^n - 1)$

inteiros positivos e negativos $(-2^{n-1}, 2^{n-1} - 1)$

signed int

Valores limites do Linux/C

(arquivo limits.h)

- 32-bits, podemos representar:
  inteiros positivos (0, 2^{32} - 1)
  inteiros positivos e negativos (-2^{31}, 2^{31} -1)

- Em C no Linux, os limites operacionais de cada tipo encontram-se no arquivo: /usr/include/limits.h.
  Veja, por exemplo, as linhas:

```
/* Minimum and maximum values a `signed int' can hold.  */
#  define INT_MIN       (-INT_MAX - 1)
#  define INT_MAX       2147483647
/* Maximum value an `unsigned int' can hold.  (Minimum is 0.)  */
#  define UINT_MAX      4294967295U
```

Valores limites do Linux/C

(arquivo limits.h)

De fato, no programa:

```
#include<stdio.h>
int main()
{
    unsigned int i = 4294967295;
    printf("%u\n",i);
    i++;
    printf("%u\n",i);
    i++;
    printf("%u\n",i);
}
```

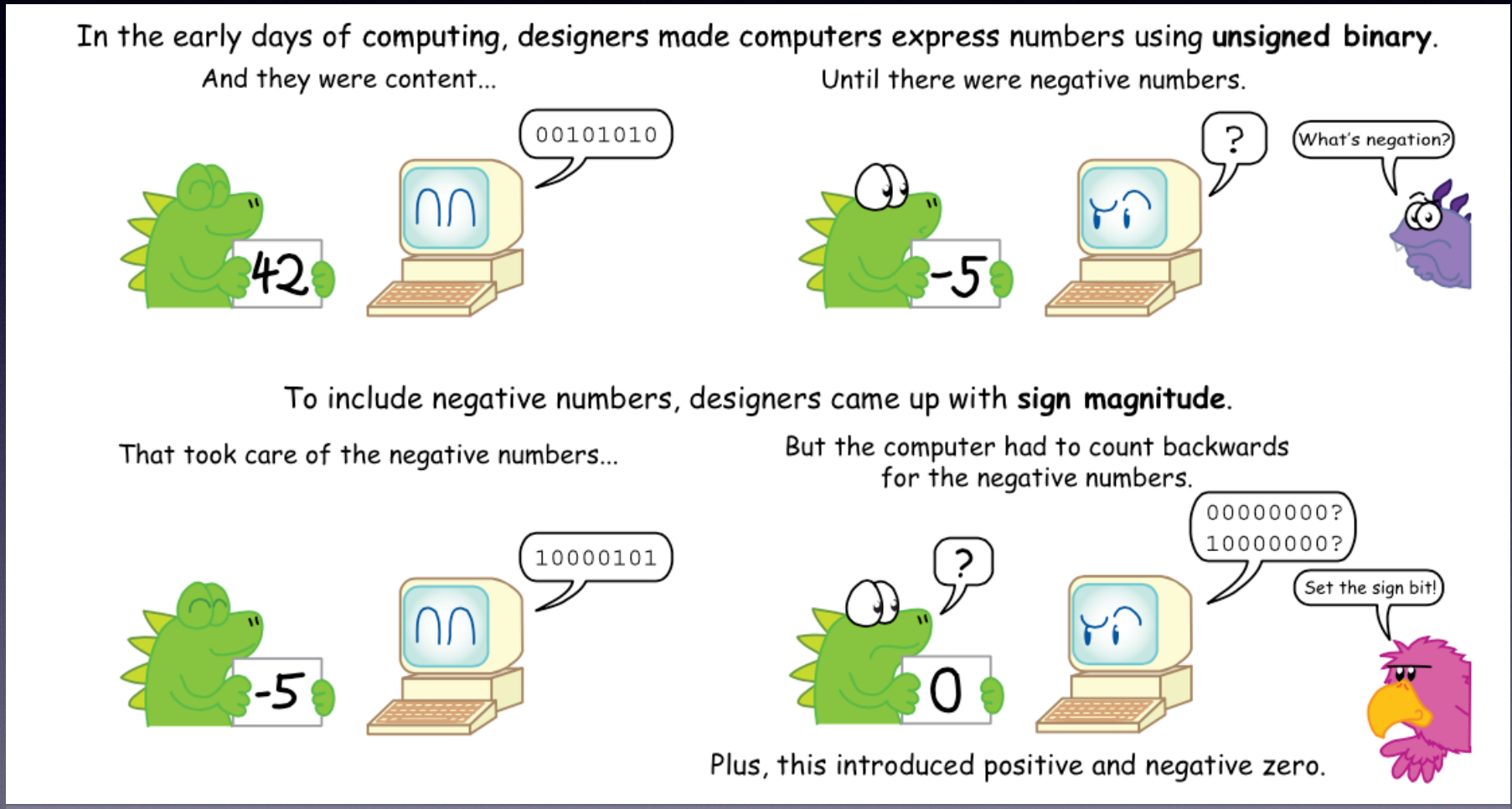
Teremos como resultado:

```
~/Unisantos/prova$ gcc ex10.c -o
ex10
~/Unisantos/prova$ ./ex10
4294967295
0
1
```

maior inteiro que uma variável tipo **int** consegue representar

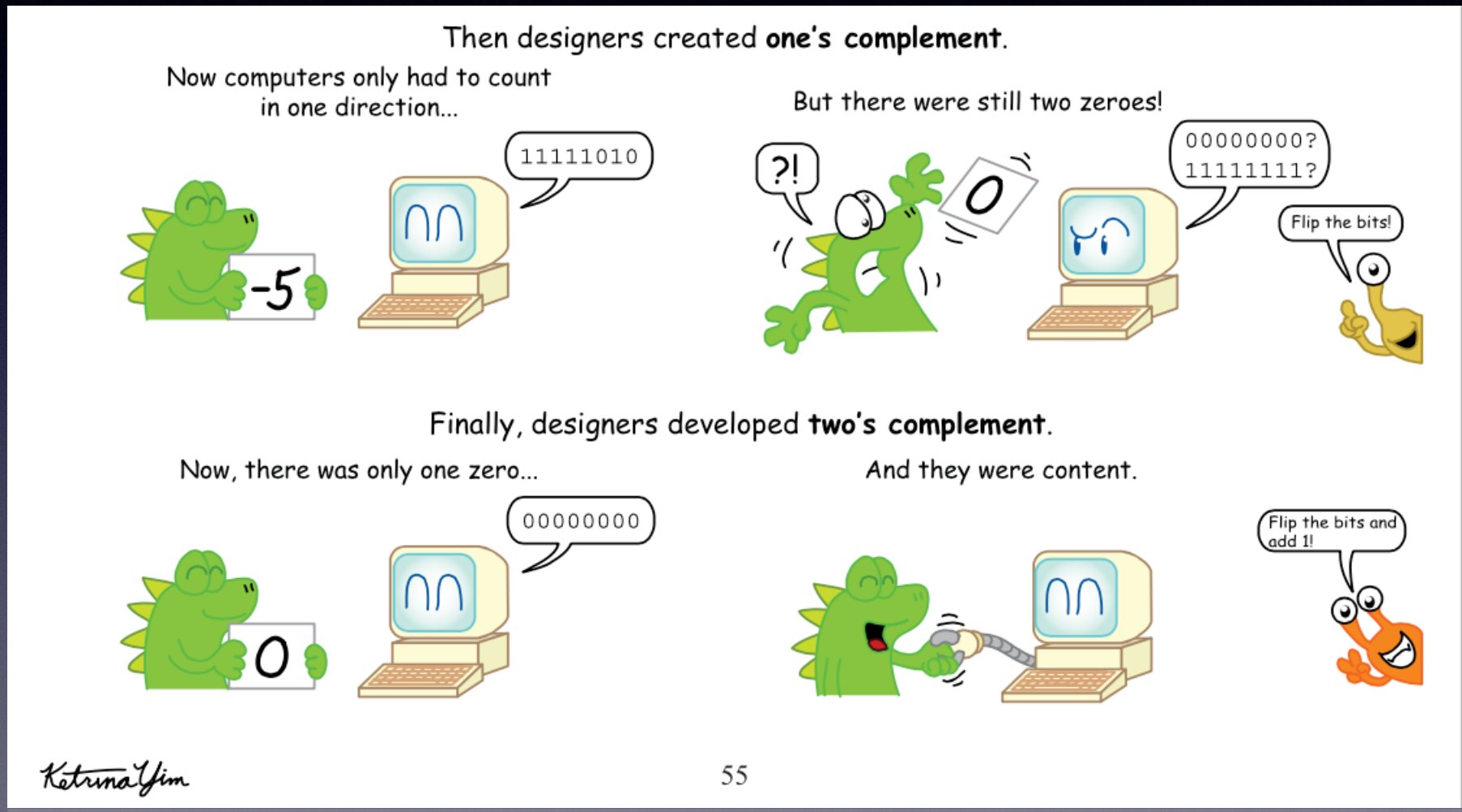
Deveria ser **4.294.967.296** mas esse número não consegue ser representado com 32 bits

Inteiros



Arte: Katrina Yim

Inteiros

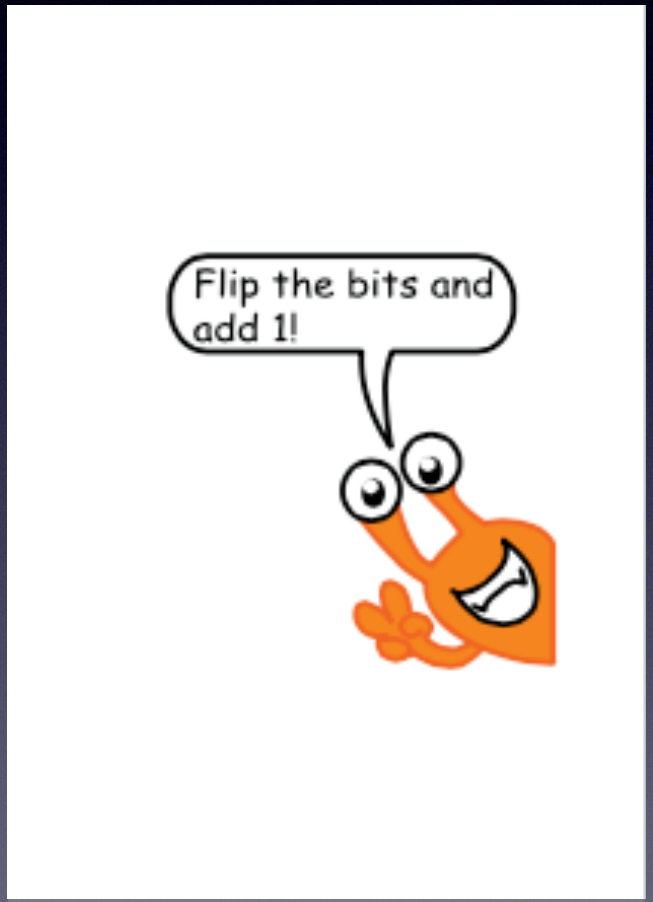


Arte: Katrina Yim

Inteiros

Positivo => Negativo

inverter os bits e somar 1



Arte: Katrina Yim

Exemplo com 4 bits

Decimal	Binário			
-8	1	0	0	0
-7	1	0	0	1
-6	1	0	1	0
-5	1	0	1	1
-4	1	1	0	0
-3	1	1	0	1
-2	1	1	1	0
-1	1	1	1	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1

Pergunta

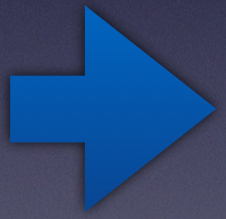
como representar:

1/3
3.1415
1.08 x 109

float

s	e	e	e	e	e	e	e	e	e	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
31	30	…																												…	2	1	0
s	expoente									mantissa																							

e: expoente (8 bits)
m: mantissa (23 bits)
s: sinal (1 bit)



$valor = m.2^e$

imprecisão do float

```
#include<stdio.h>

int main()

{

   float f = 1/10;
   printf("%f\n",f);

}
```

```
#include<stdio.h>

int main()

{

   float f = 1.0/10;
   printf("%.15f\n",f);

}
```

exemplos

```
     0 =                      0 = 0 00000000 00000000000000000000000
    -0 =                     -0 = 1 00000000 00000000000000000000000
 0.125 =                  0.125 = 0 01111100 00000000000000000000000
  0.25 =                   0.25 = 0 01111101 00000000000000000000000
     2 =                      2 = 0 10000000 00000000000000000000000
     4 =                      4 = 0 10000001 00000000000000000000000
 0.375 =                  0.375 = 0 01111101 10000000000000000000000
     3 =                      3  = 0 10000000 10000000000000000000000
     6 =                      6 = 0 10000001 10000000000000000000000
   0.1 =      0.10000000149011612 = 0 01111011 10011001100110011001101
   0.2 =      0.20000000298023224 = 0 01111100 10011001100110011001101
   0.8 =      0.80000001192092896 = 0 01111110 10011001100110011001101
 1e+12 =             999999995904 = 0 10100110 11010001101010010100101
  inf  =                      inf = 0 11111111 00000000000000000000000
 -inf  =                     -inf = 1 11111111 00000000000000000000000
  nan  =                      nan = 0 11111111 10000000000000000000000
```

Problemas

- transbordamento de inteiro
  integer overflow
- imprecisão do ponto flutuante
  floating point imprecision

Tipos em C

- char 1 byte
- **integer 4 bytes** → **long 8 bytes**
- **float 4 bytes** → **double 8 bytes**
- bool 1 byte

Imprecisão e suas consequencias

- Arianne 5 e Patriot https://www.youtube.com/watch?v=EMVBLg2MrLs

Paradoxo Simpson

Carla	Luiz
R$100/R$500	**R$200/R$800**
R$600/R$800	**R$400/R$500**

Carla	Luiz
R$100/R$500	**R$200/R$800**
20%	**25%**
75%	**80%**
R$600/R$800	**R$400/R$500**

Carla		Luiz
R$100/R$500		**R$200/R$800**
20%	**<**	**25%**
75%	**<**	**80%**
R$600/R$800		**R$400/R$500**

QUEM POUPA MAIS ???

Carla

Luiz

Carla

Luiz

Carla

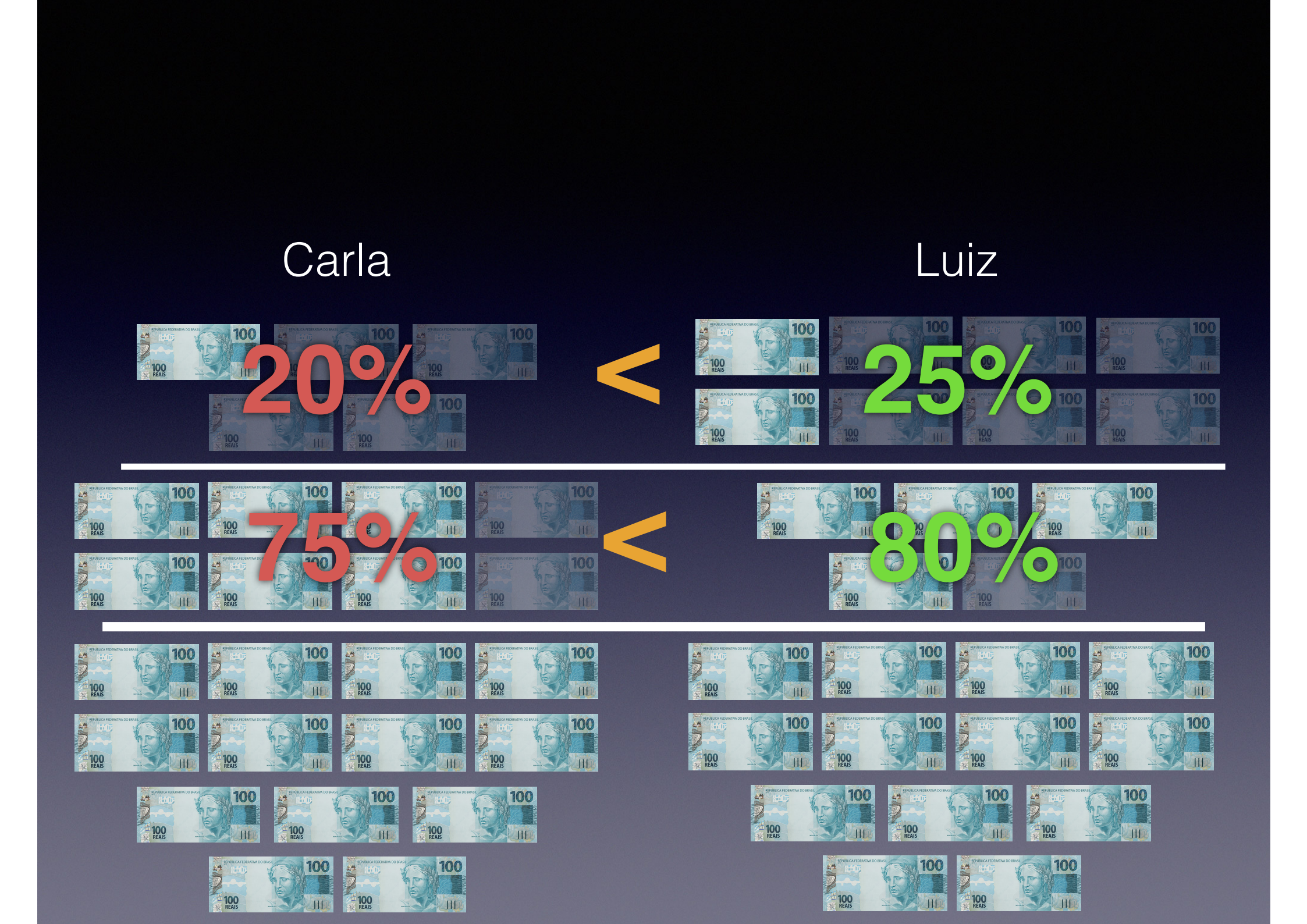
Luiz

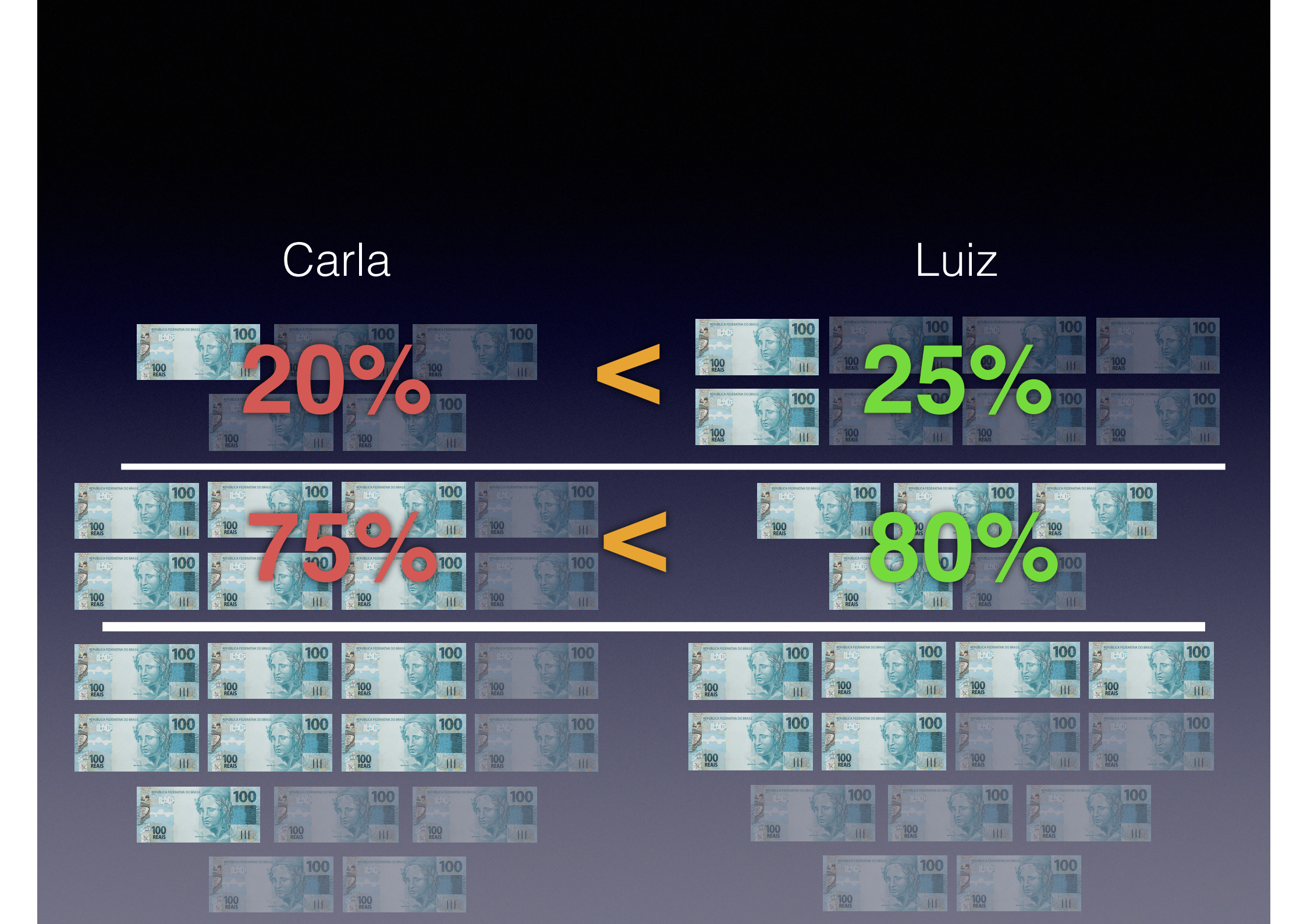
Carla

Luiz

<

<


Carla
Luiz
20%
<
25%
75%
<
80%


Carla
Luiz
20%
<
25%
75%
<
80%

Paradoxo de Simpson

Carla		Luiz
20%	<	25%
75%	<	80%
700/1300	>	600/1300
53,8%		46,2%