Go forth, and Multiply!

Maths Club

Elliott Tjia

Base instincts

- What is a number base?

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- What is our main number base?

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- What is our main number base?
  - Ten (Decimal)
  - Digits used: 0,1,2,3,4,5,6,7,8,9

Base instincts

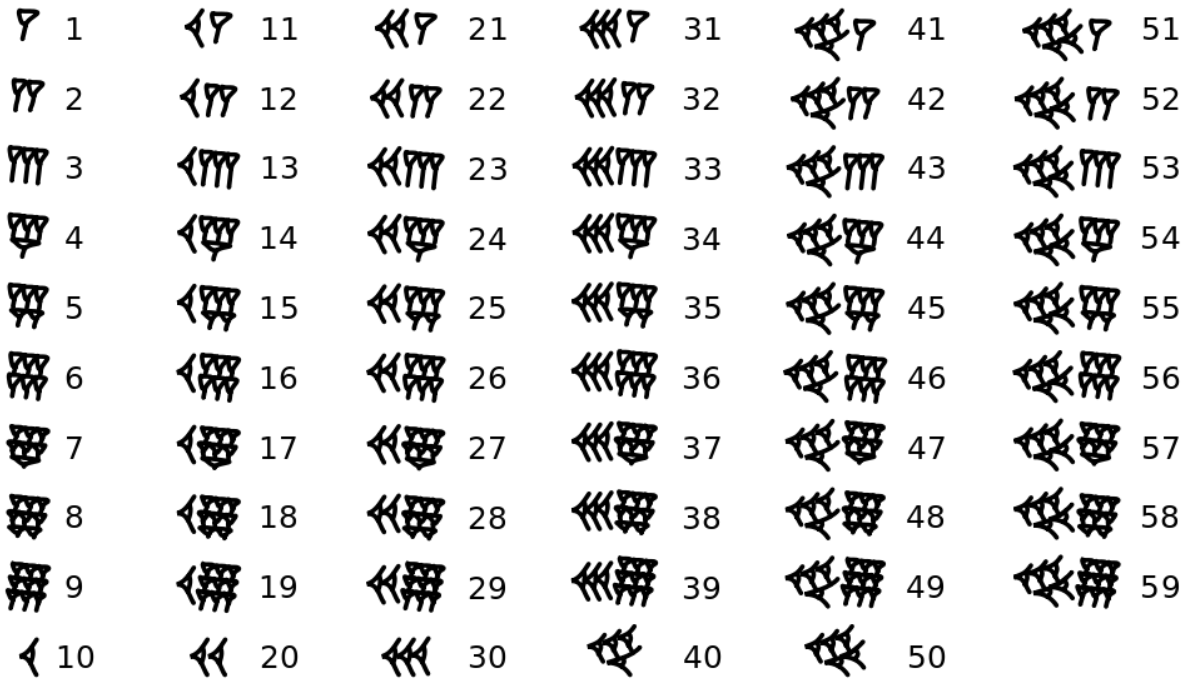
- What is a number base?
- What is our main number base?
  - Ten (Decimal)
  - Digits used: 0,1,2,3,4,5,6,7,8,9
- A number base is just a representation of the same information, and doesn't change the data itself.

One, Two, Many, Many-One,...

- How did people count?

One, Two, Many, Many-One,...

- How did people count?
  - Babylonians, base 60 counting system.
  - Mayans, base 20 - today is 13.0.0.3.4



- Do we use any non-base ten counting?

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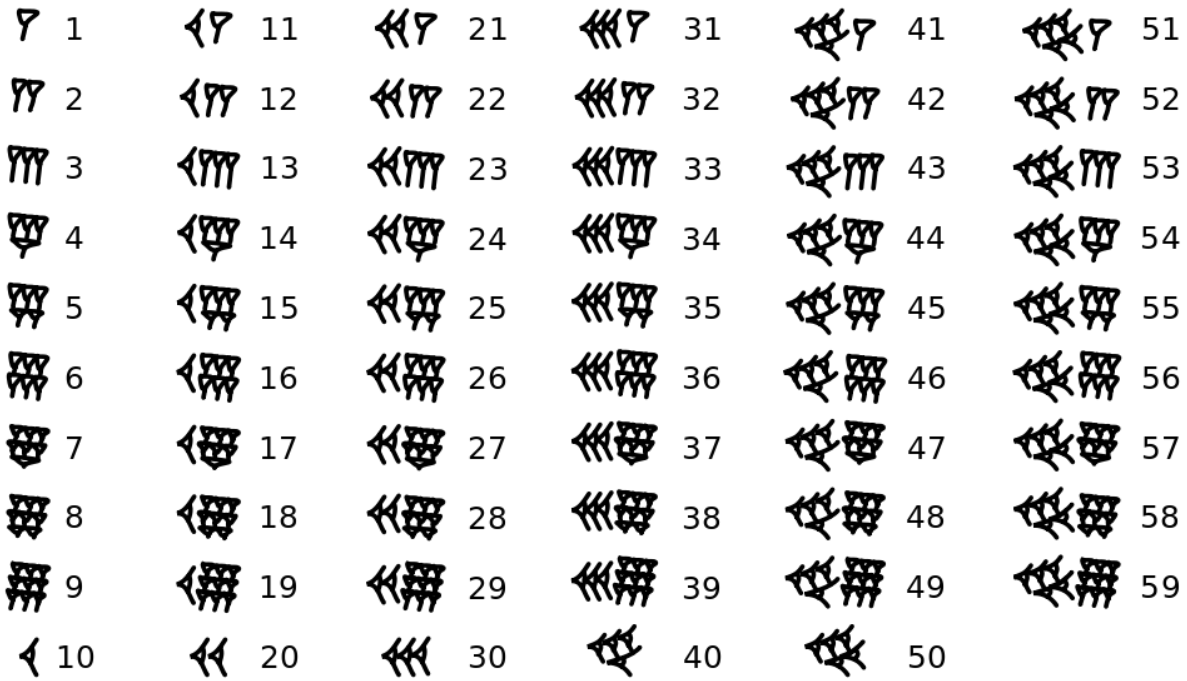


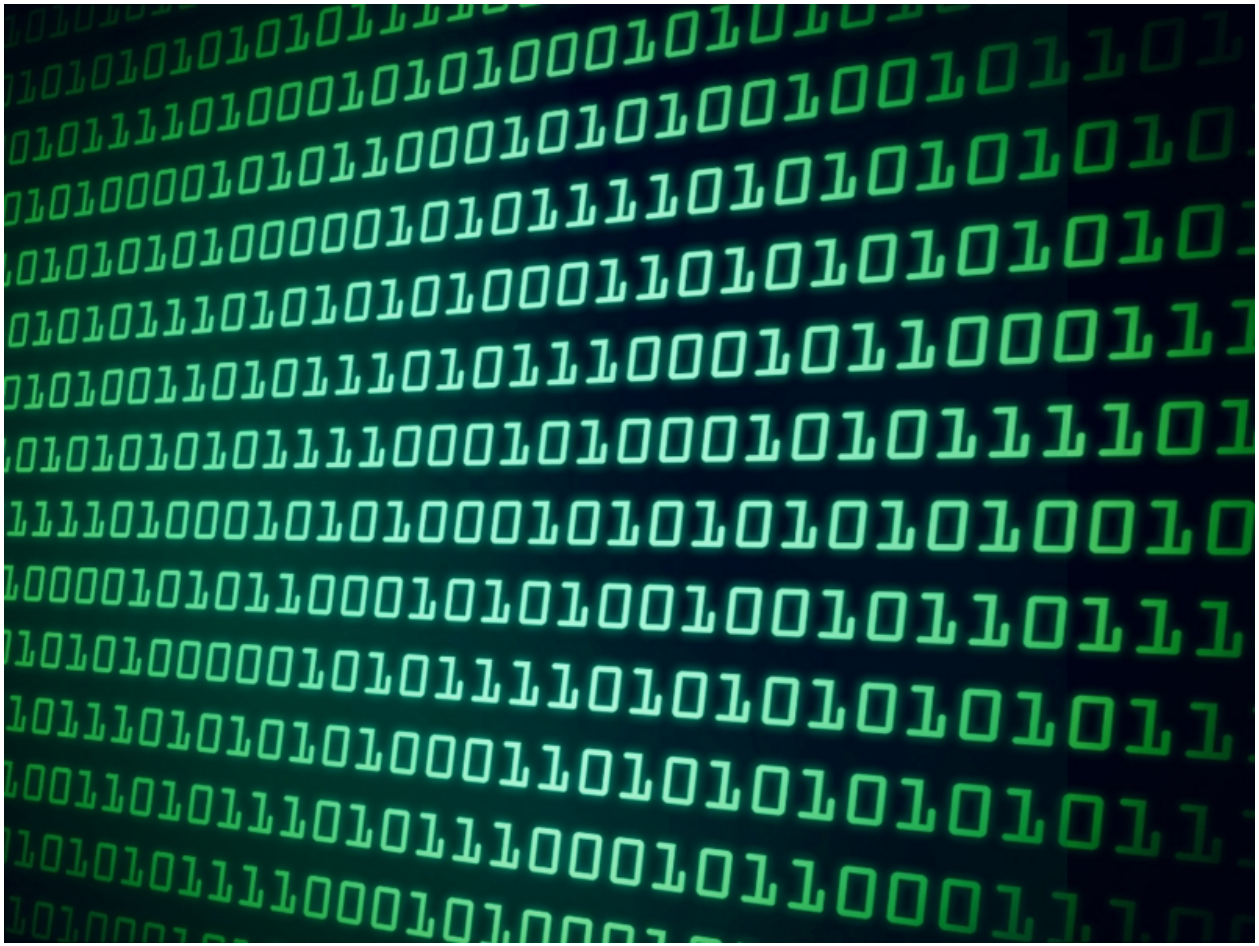
- Do we use any non-base ten counting?
  - Seconds in a minute, minutes in an hour, hours in a day

An On-off relationship with computers

- How to Computers count?

An On-off relationship with computers

- How to Computers count?
- Base 2 (Binary)



All your base are belong to us

- Problem: Every base is base 10

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- Notation for bases 34_5

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- Notation for bases $34_5 = 19_{10}$

All your base are belong to us

- Problem: Every base is base 10
- Notation for bases $34_5 = 19_{10} = 10011_2$

Something doesn't add up

- Addition and subtraction still work in the same fashion
- $33_7 - 12_7 =$

Something doesn't add up

- Addition and subtraction still work in the same fashion
- $33_7 - 12_7 = 21_7$
- $23_5 + 14_5 =$

Something doesn't add up

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- $33_7 - 12_7 = 21_7$
- $23_5 + 14_5 = 42_5$

Something doesn't add up

- Addition and subtraction still work in the same fashion
- $33_7 - 12_7 = 21_7$
- $23_5 + 14_5 = 42_5$
- Question Sheet 1

My base is bigger than your base

- Hexadecimal is base 16
- $10_{10} = ??_{16}$

My base is bigger than your base

- Hexadecimal is base 16
- $10_{10} = ??_{16}$
- Remembering that a base is defined by the number of unique digits used, base 16 can use the following digits: 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F

By the Power of Grayskull

- Conversion between bases is easier if one base is an integer power of the other e.g. $16 = 2^4$

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By the Power of Grayskull

- Conversion between bases is easier if one base is an integer power of the other e.g. $16 = 2^4$
- $3_{16} = 11_2$
- $A_{16} = 1010_2$
- $3A_{16} = 111010_2$

Dem bones

- Classical Algorithm
  - Napier's bones
- Single Digit Additions, Multiplications, Shifts.

Quite a peasant experience

- In base 2, a multiplication by 2 is equivalent to a shift.
  - Peasant Multiplication

Quite a peasant experience

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- Karatsuba Algorithm

Quite a peasant experience

- In base 2, a multiplication by 2 is equivalent to a shift.
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- Karatsuba Algorithm
- Question Sheet 2

Jack Skellington would be proud

- Base 8 is Octal
- Base 10 is Decimal

Jack Skellington would be proud

- Base 8 is Octal
- Base 10 is Decimal
- OCT 31=

Jack Skellington would be proud

- Base 8 is Octal
- Base 10 is Decimal
- OCT 31=DEC 25