

# UNIT 1A

## A Brief History Of Computing

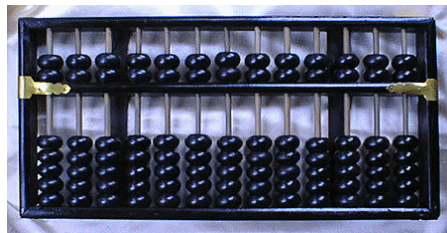
Pre-Electronic Computing (up to the 1800s)

## What is computation?

- Computation (n.) - The act or process of computing
- Computing (n.) - the procedure of calculating; determining something by mathematical or logical methods.
- Computer science (n.) - the branch of engineering science that studies (with the aid of computers) computable processes and structures

Source: [www.thefreedictionary.com](http://www.thefreedictionary.com)

# The Abacus



← Each bead = 5

← Each bead = 1

Chinese abacus

- Earliest archaeological evidence of a Greek abacus used around the 5<sup>th</sup> century BC.
- Other abacus forms: Soroban (Japan), Choreb (Afghanistan), Schoty (or stchoty) (Russia)

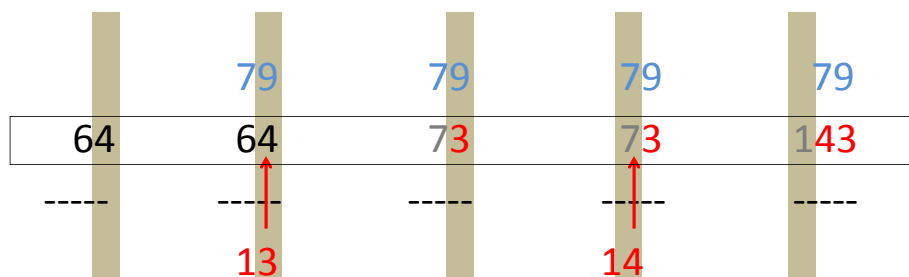
## Adding With An Abacus



The abacus is a memory aid.

Must know addition table, but only up to 9+9.

Let's add 79 into 64:



## Why Use An Abacus?

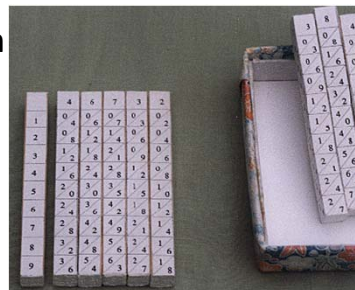
- Appropriate technology: pencil and paper not available in the early ages.
- Can be faster than writing.
- Helps you keep track of large numbers.
- Easy to chain calculations to add a whole series of numbers.
- But... **the human does all the work!**  
(And even more work for multiplication.)

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## John Napier

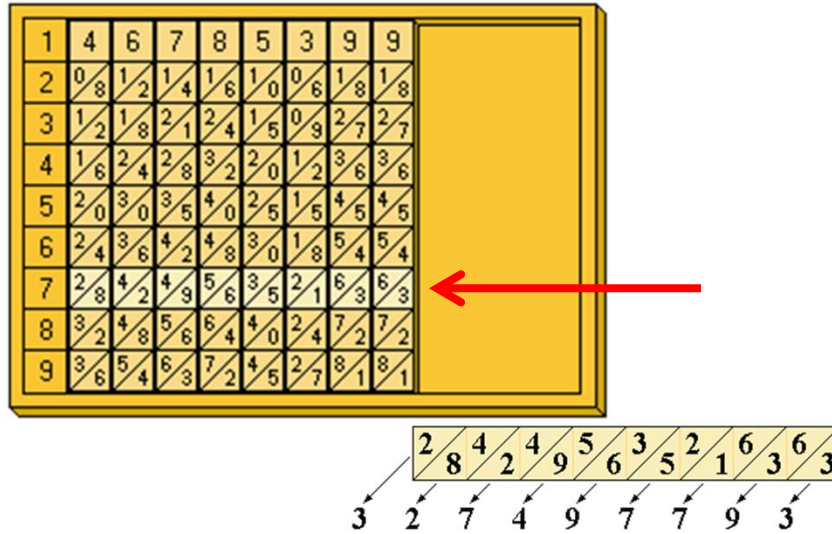
- Scottish mathematician (1550-1617)
- Invented Napier's Bones, used to perform multiplication using only addition.
- Napier's bones were very successful and widely used in Europe until the mid 1960's.
- Napier is also the inventor of logarithms.



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$$7 \times 46785399 = ?$$

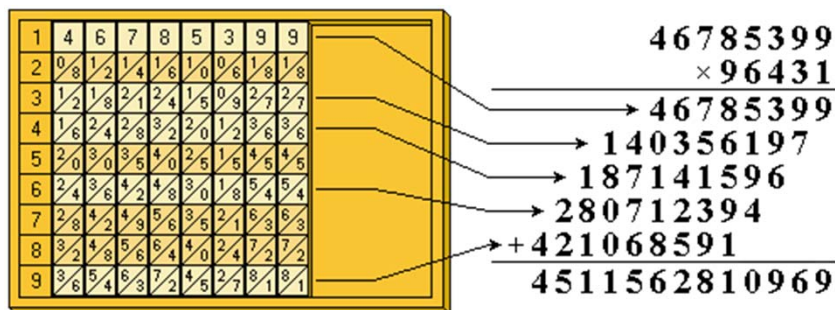


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## Multiplying Multi-Digit Numbers

Do single-digit multiplications, shift, and add.



As with the abacus, humans do most of the work!

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## Slide Rules Multiply by Adding Logs



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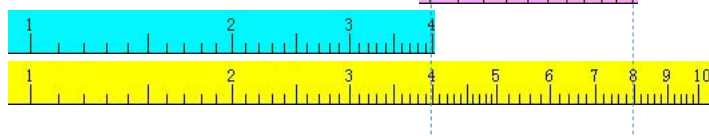
## Fast Multiply By Adding Logs

log scale



$$\log(a \times b) = \log(a) + \log(b)$$

$$4 \times 2 = 8$$



$$\log(4 \times 2) = \log(4) + \log(2)$$

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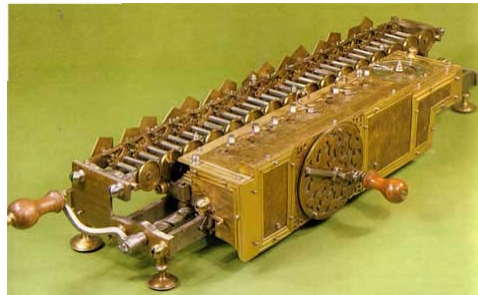
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# Mechanical Arithmetic Machines



Blaise Pascal's  
Pascaline (1643)

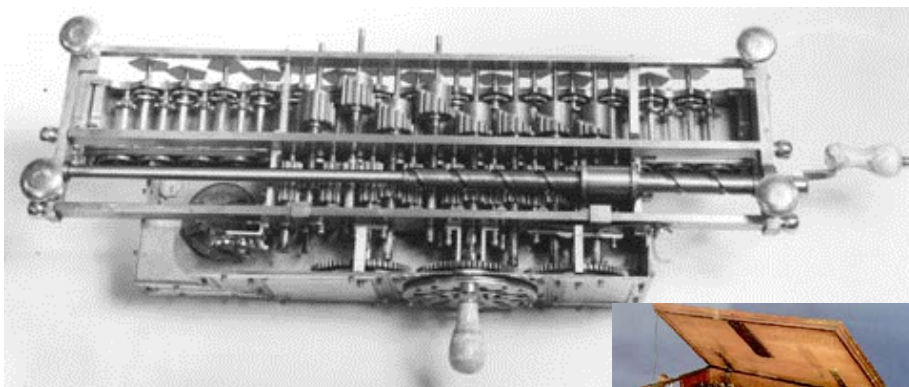
Leibniz' step reckoner  
(designed in 1673,  
completed in 1694)



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## Leibniz Step Reckoner



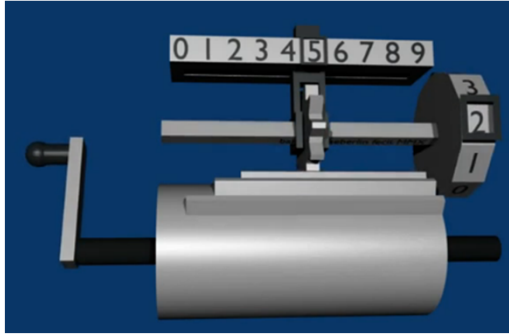
Could add and subtract automatically.  
Could multiply and divide by manually  
shifting the carriage.



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# How Can We Make A Machine Do (Most of) The Work?



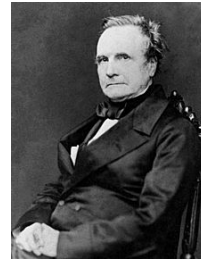
Leibniz' Stepping Drum Video  
 $5 + 2 + 3 = 10$

Key problem:

How to make the carry work reliably in a purely mechanical system?

It's harder than you think!

## Charles Babbage (1791-1871)



- Mathematician, industrialist, philosopher, politician
- Frustrated by the many errors in printed mathematical tables (sines, cosines, logs, etc.) used in navigation and engineering.
- Observed that **many long computations consist of operations that were regularly repeated.**

## Next Lecture

- Continue with history of computing
  - Pre-electronic computers
  - Early electronic computers
- Reading for the week:
  - Explorations in Computing Chapter 1
  - Blown to Bits Chapter 1
  - Computational Thinking by Wing (optional)