UNIT 1A
A Brief History Of Computing

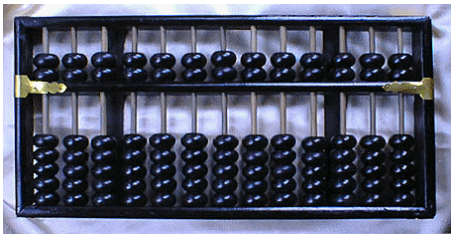
Pre-Electronic Computing (up to the 1800s)

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

The Abacus

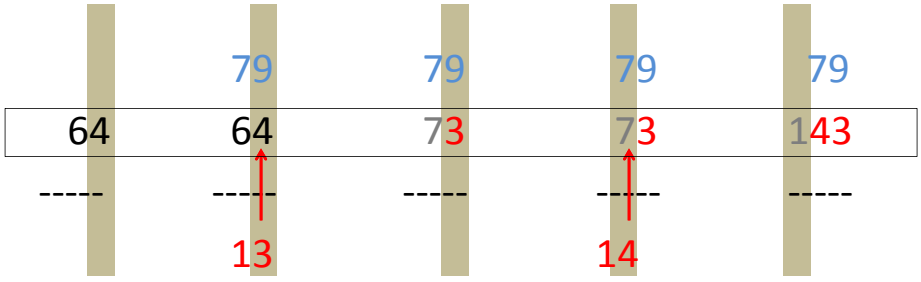


Chinese abacus

- Earliest archaeological evidence of a Greek abacus used around the 5th 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:

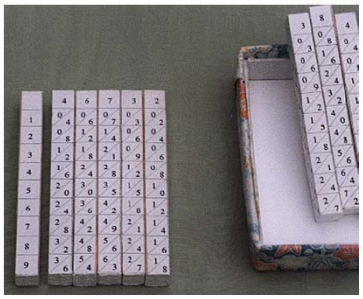


Why Use An Abacus?

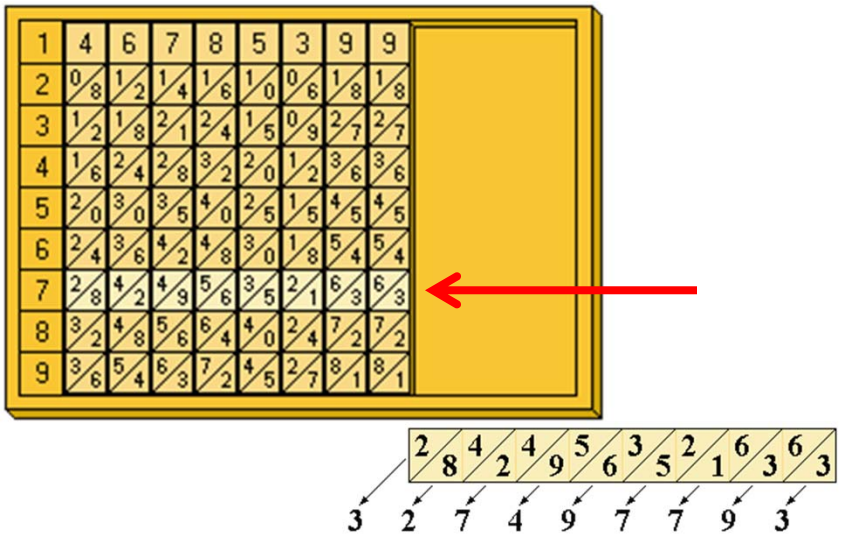
- Appropriate technology: pencil and paper not available in the early ages.
- Can be faster than writing.
- Helps you keep track of large numbers.
- Easy to chain calculations to add a whole series of numbers.
- But… **the human does all the work!**
  (And even more work for multiplication.)

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.

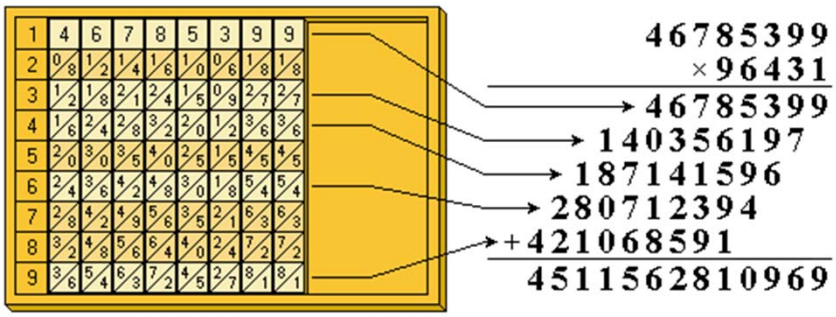


7 x 46785399 = ?



Multiplying Multi-Digit Numbers

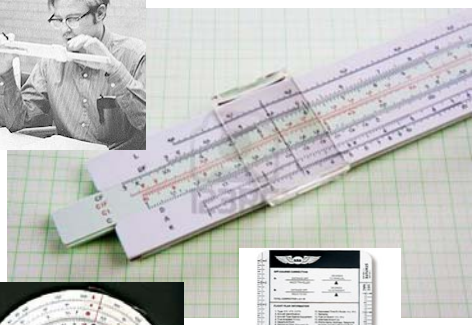
Do single-digit multiplications, shift, and add.



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

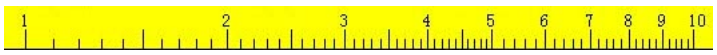
Slide Rules Multiply by Adding Logs





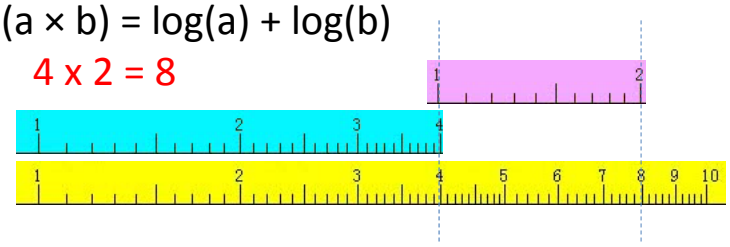

Fast Multiply By Adding Logs

log scale



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

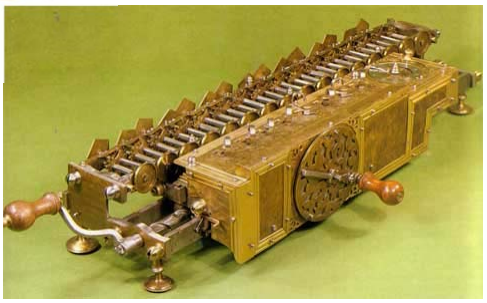
$4 \times 2 = 8$



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

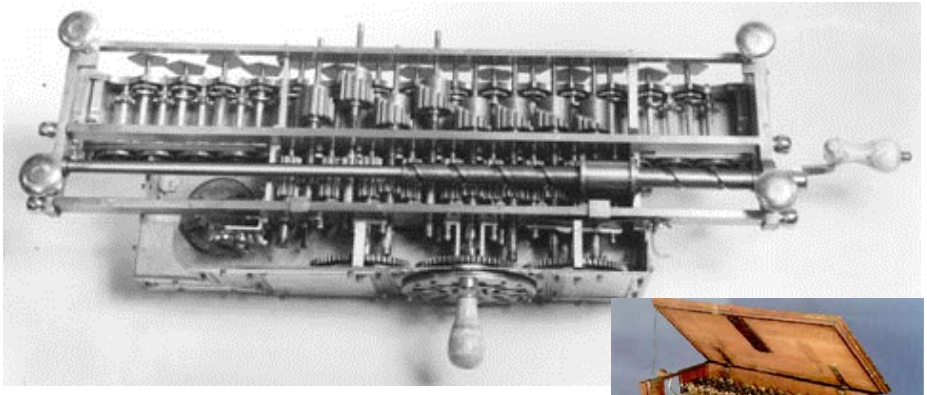
Mechanical Arithmetic Machines

Blaise Pascal's
Pascaline (1643)



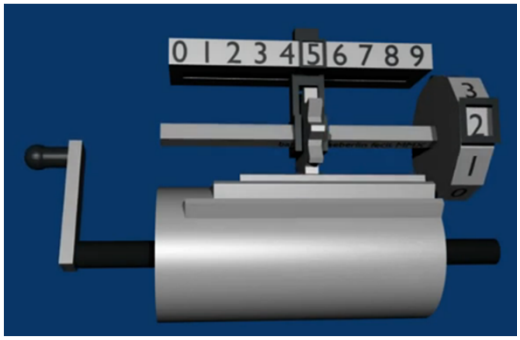
Leibniz' step reckoner
(designed in 1673,
completed in 1694)

Leibniz Step Reckoner



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

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



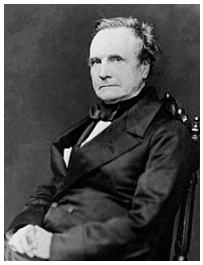
Leibniz' Stepping Drum Video
5 + 2 + 3 = 10

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)

Remember to Do

- Sign up on Piazza. The link is on the course Web site under the RESOURCES link.