Computers and Computing

COMP 102, lecture 1

Computers and Computing (COMP-102)

Syllabus - Fall 2014

General Information

Location:	ENGMC 103
Times:	Monday and Wednesday, 13:05-14:25am.
Instructor:	**Prof. Claude Crépeau**, School of Computer Science Email: *crepeau@cs.mcgill.ca* Office: McConnell 110N Office hours: Tuesday 12:00-14:00
Class web page:	http://crypto.cs.mcgill.ca/~crepeau/COMP102/

Course Description

A course for students with no previous knowledge of computer science. The course is intended to provide a survey of selected topics in computer science starting from how computers store data (text, numbers, image, sound, and video), to the inner workings of computers (hardware) and moving on to more advanced topics such as computability, complexity, web design, AI, robotics, cryptography, and social implications of computing. (3 credits; 3 hours per week)

Prerequisite: The course is appropriate for both novice and experienced computer users. It is intended for any student with high-school-level math and science background who has a keen interest in learning how the science of computation is impacting the world in which we live.

Restrictions: Credit will not be given for COMP-102 if it is taken concurrently with, or after, any of COMP-202, COMP-203, COMP-208, or COMP-250. Management students cannot receive credit for COMP-102.

Course Outline

- Introduction to Computer Science. A brief history of computing.(1 week).
- How is information represented in a computer? Bits and bytes, data structures, sounds and images, data compression. (2 weeks)
- How do we tell computers what to do? Basic ideas in algorithms, scripting, sorting and searching. (4 weeks).
- Computer systems. (1 week).
- Networks and networking. (1 week).
- Computability. (1 week)
- Special topics: Cryptography, Artificial intelligence, Robotics, Graphics, Computational biology (topics may vary) (2 weeks)

Reference Materials

1. Required textbook: None.
2. Suggested reading: *The Information: A History, a Theory, a Flood* by James Gleick (Available in most local and online bookstores.)
3. Lecture notes: Available from the course web page as we go.

Class Requirements

The class grade will be based on the following components:

- Individual assignments - 40%
- One in-class written midterm examinations - 20%
- One final exam - 40%

The assignments will include some practical problems, some applications, and some writing. Some formal programming will be required.

Homework Policy

Assignments and projects must be submitted IN CLASS on the day when they are due. Assignments submitted BEFORE the due date (in class or directly to my office) will also be accepted. Late assignments will NOT be accepted (no exception). No make-up exams.

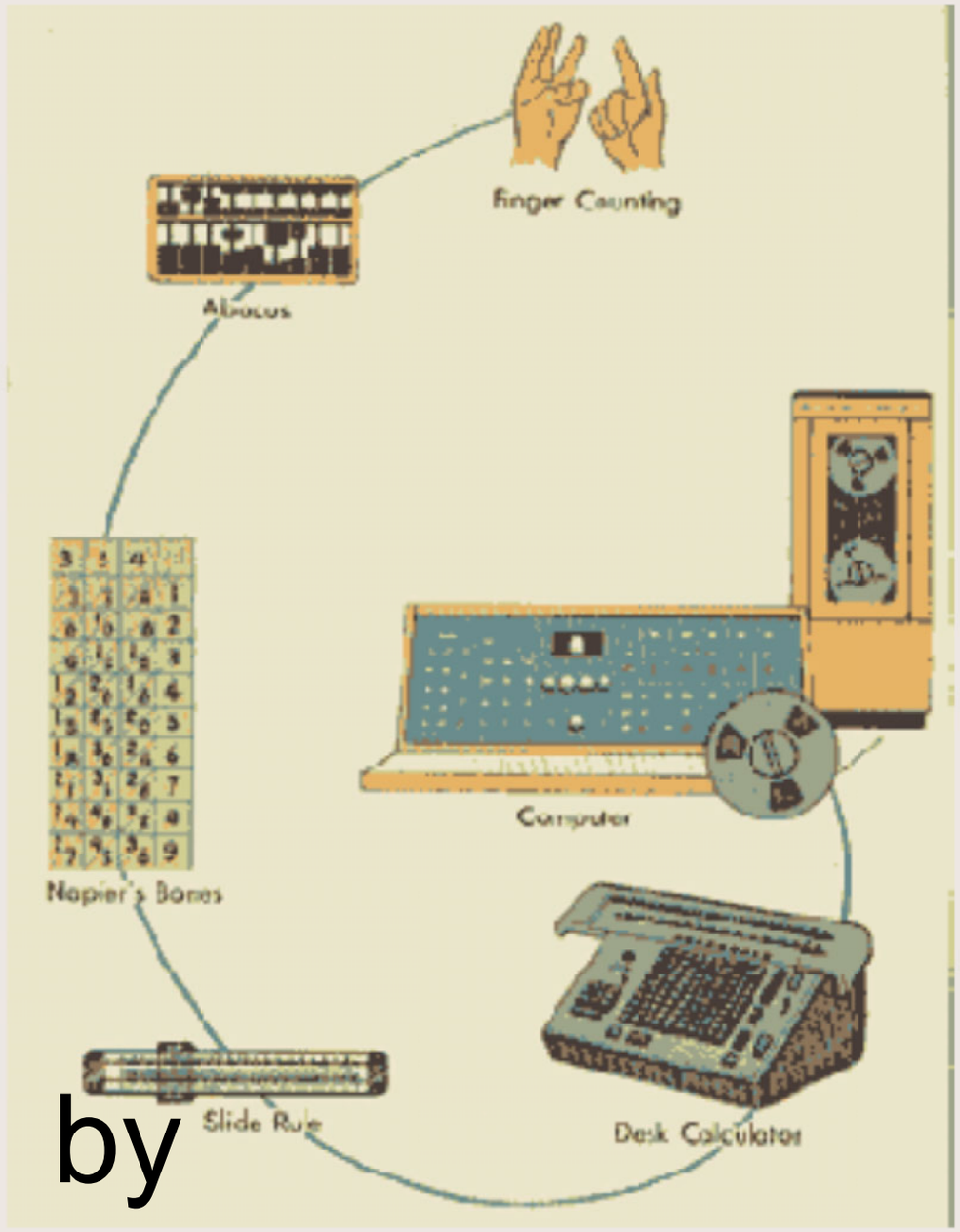
All assignments and exams are INDIVIDUAL.

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr/honest/) for more information).

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

http://www.slideshare.net/BethAdamczyk/highlights-in-computer-history

Highlights in Computer History



by

Beth Adamczyk

COMPUTER

From the Latin word "computare"

to reckon – to sum up

Webster's Dictionary defines "computer" as any programmable electronic device that can store, retrieve, and process data

The Old Oxford English dictionary describes a computer as a **person** employed to make calculations.

Dictionary

compute

com•pute |kəmˈpyoōt|
verb [trans.] (often **be computed**)
calculate or reckon (a figure or amount) *: we can compute the exact increase | depreciation is computed by applying the straight-line method.*
- [intrans.] make a calculation, esp. using a computer *: modern circuitry can compute faster than any chess player.*
- [intrans., with negative] informal seem reasonable; make sense *: the idea of an ethic governing what goes on in cyberspace simply does not compute.*

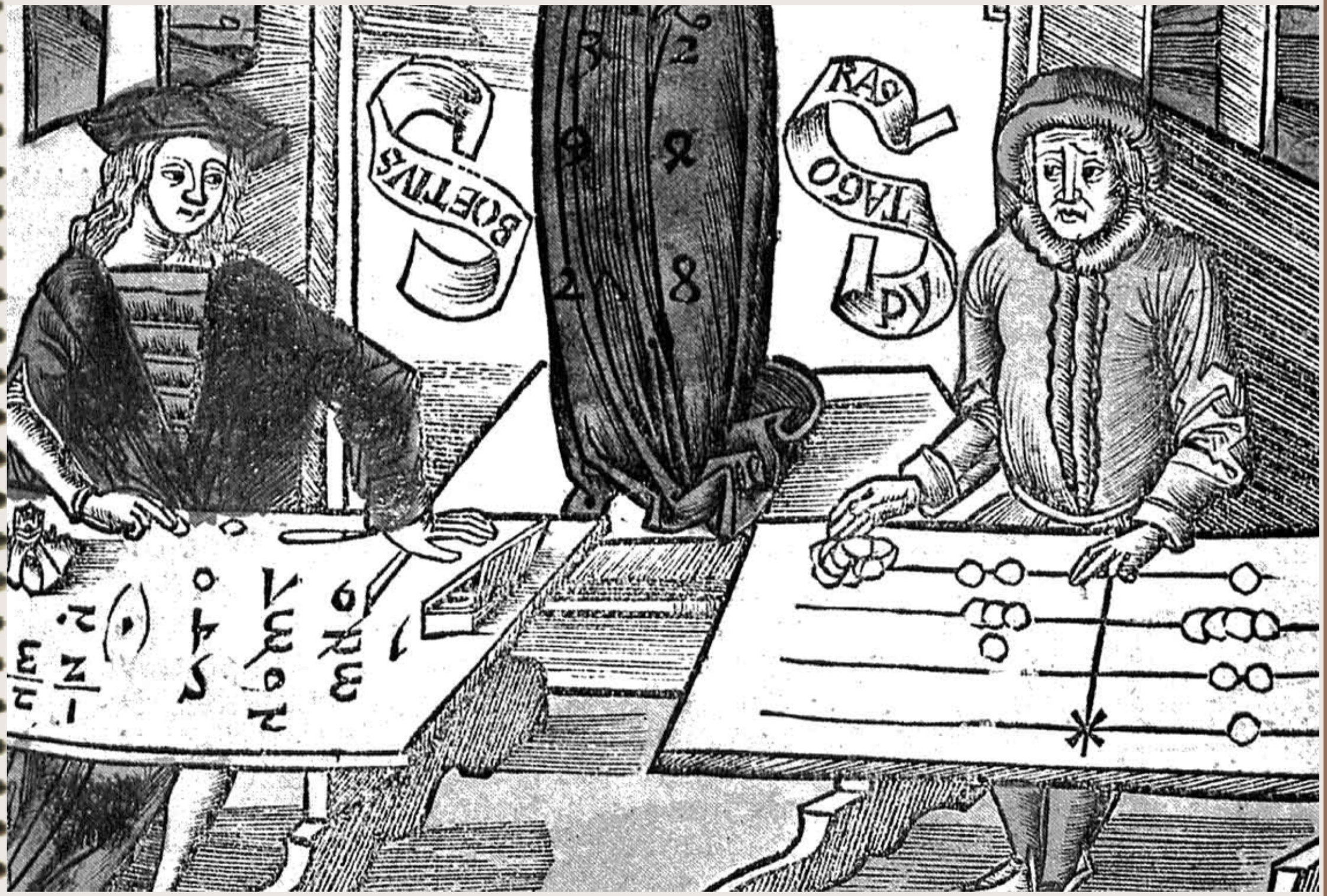
[ORIGIN: from the phrase *does not compute*, once used as an error message in computing.]

DERIVATIVES
com•put•a•bil•i•ty |kəmˌpyoōtəˈbilitē| |kəmˈpjudəˈbɪlədi| |-təˈbɪlɪti| noun
com•put•a•ble |kəmˈpjudəbəl| |-ˈpju:təb(ə)l| |ˈkɒm-| adjective
com•put•a•bly |-blē| |kəmˈpjudəbli| adverb
com•put•ist |-ˈpyoōtist| noun

ORIGIN early 17th cent.: from French ***computer*** or Latin ***computare***, from ***com- 'together' + putare 'to settle (an account).'***

Abacus 3000 BC

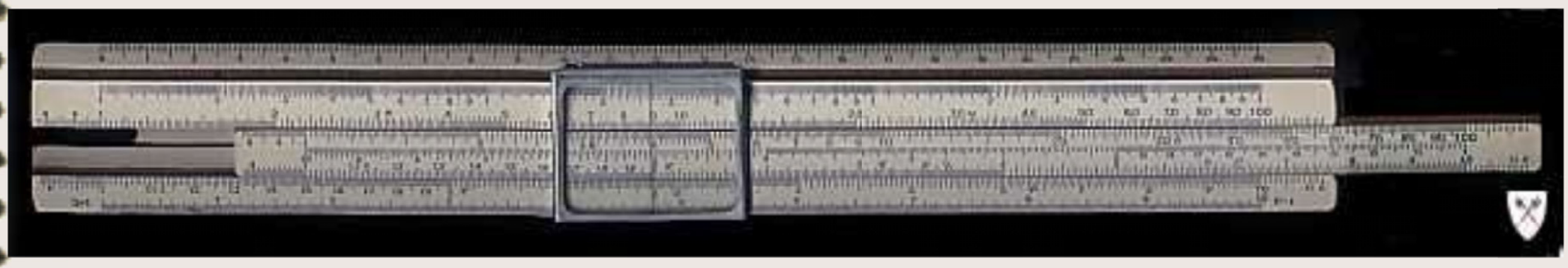
The Abacus, a simple counting aid, was most likely invented in Babylonia.



Fight around 1503 about calculation method

the slide rule 1622

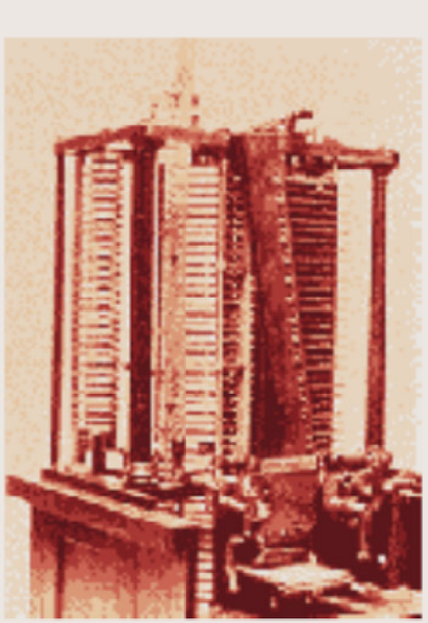
- The **slide rule** is a mechanical precursor of the pocket calculator. It was invented in England by William Oughtred and was very commonly used until the 1970s when it was made obsolete for most purposes by electronic calculators.



1623 - 1833

•1623: **Wilhelm Schickard**, a professor at the University of Tubingen, Germany, builds the first mechanical calculator. It can work with six digits, and carries digits across columns

- 1640: **Blaise Pascal** invents the first commercial calculator, a hand powered adding machine
- 1673: **Gottfried Leibniz** builds a mechanical calculating machine that multiplies, divides, adds and subtracts
- 1780: American **Benjamin Franklin** discovers electricity
- 1801: a Frenchman, **Joseph-Marie Jacquard** builds a loom that weaves by reading punched holes stored on small sheets of hardwood.



•1833: **Charles Babbage** designs the Analytical Machine that follows instructions from punched-cards. It is the first general purpose computer

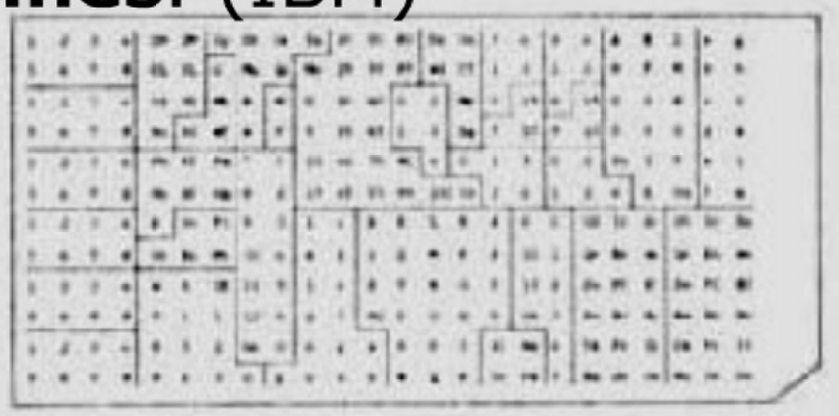
1991

Charles Babbage's
Analytical Machine

The 1890 census is tabulated on punch cards

The 1890 census is tabulated on punch cards similar to the ones Joseph-Marie Jacquard used 90 years earlier to create weaves. Developed by **Herman Hollerith** of MIT, the system uses electric power(non-mechanical). The new high technology of the day consisted of wooden cabinetry, electric dials, and perforated paper cards.

In 1924 Herman Hollerith's Computing-Tabulating-Recording Company changed its name to **International Business Machines**. (IBM)

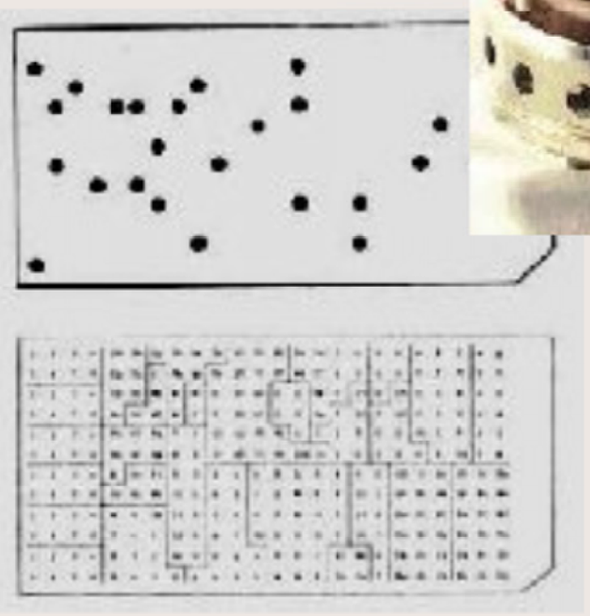


1892 - 1928

- 1892: William Burroughs patent for an improved calculating machine with an added printer was the first practical adding and listing machine.
- 1903: Nikola Tesla, a Yugoslavian who worked for Thomas Edison, patents electrical logic circuits called gates or switches.
- 1927: First public demonstration of television
- 1928: A Russian immigrant, Vladimir Zworykin, invents the cathode ray tube (CRT).

First Generation Computers 1940-1956: Vacuum Tubes

The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions. First generation computers relied on machine language to perform operations, and they could only solve one problem at a time. Input was based on punched cards and paper tape, and output was displayed on printouts.

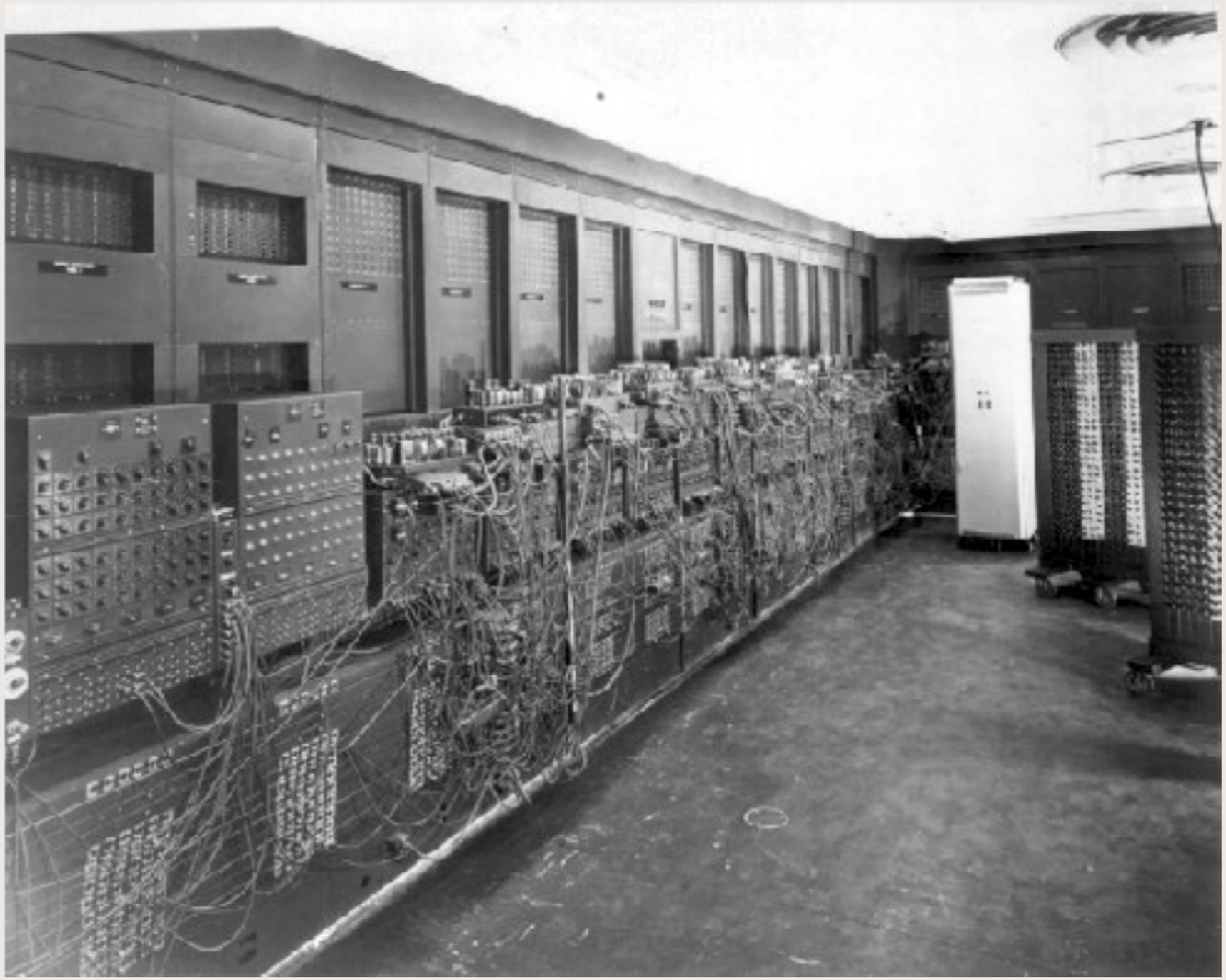


1938 - 1943

- 1938: Hewlett-Packard Co. is founded to make electronic equipment

- 1939: First Radio Shack catalog is published.
- 1940: First color TV broadcast
- 1943 Colossus, a British computer is used for code-breaking.

ENIAC



ENIAC 1946 -1955

ENIAC was a product of World War II. The military needed to develop firing tables for its artillery, so that gunners in the field could quickly look up which settings to use with a particular weapon on a particular target under particular conditions. The equations to determine these figures were so complex; they took days for a human to calculate. Designed by Dr. John W. Mauchly and Dr. J. Presper Eckert, work completed on the Electronic Numerical Integrator And Computer (ENIAC) in 1946 at the University of Pennsylvania Moore School of Electrical Engineering. The price tag was $486,804.22. It could do 5,000 additions and 360 multiplications per second In addition to ballistics, the ENIAC's field of application included weather prediction, atomic-energy calculations, cosmic-ray studies, thermal ignition, random-number studies, wind-tunnel design, and other scientific uses.

ENIAC 1946 -1955

By today's standards for an electronic computer the ENIAC was a grotesque monster. Its thirty separate units, plus power supply and forced-air cooling, weighed over thirty tons. Its 19,000 vacuum tubes, 1,500 relays, and hundreds of thousands of resistors, capacitors, and inductors consumed almost 200 kilowatts of electrical power. As computer technology advanced, the ENIAC became obsolete. During its time, it was the fastest computer in the world, but less expensive machines made it economically uncompetitive. At 11:45 PM on October 2, 1955 -- almost ten years after its dedication, the Electronic Numerical Integrator And Computer was shut down. Today, parts of the machine can be seen on display in various museums throughout the world, including the Smithsonian in Washington D.C., and in the very room where it was first constructed at the Moore School for Electrical Engineering of the University of Pennsylvania. The US patent office recognizes ENIAC as the first computer.

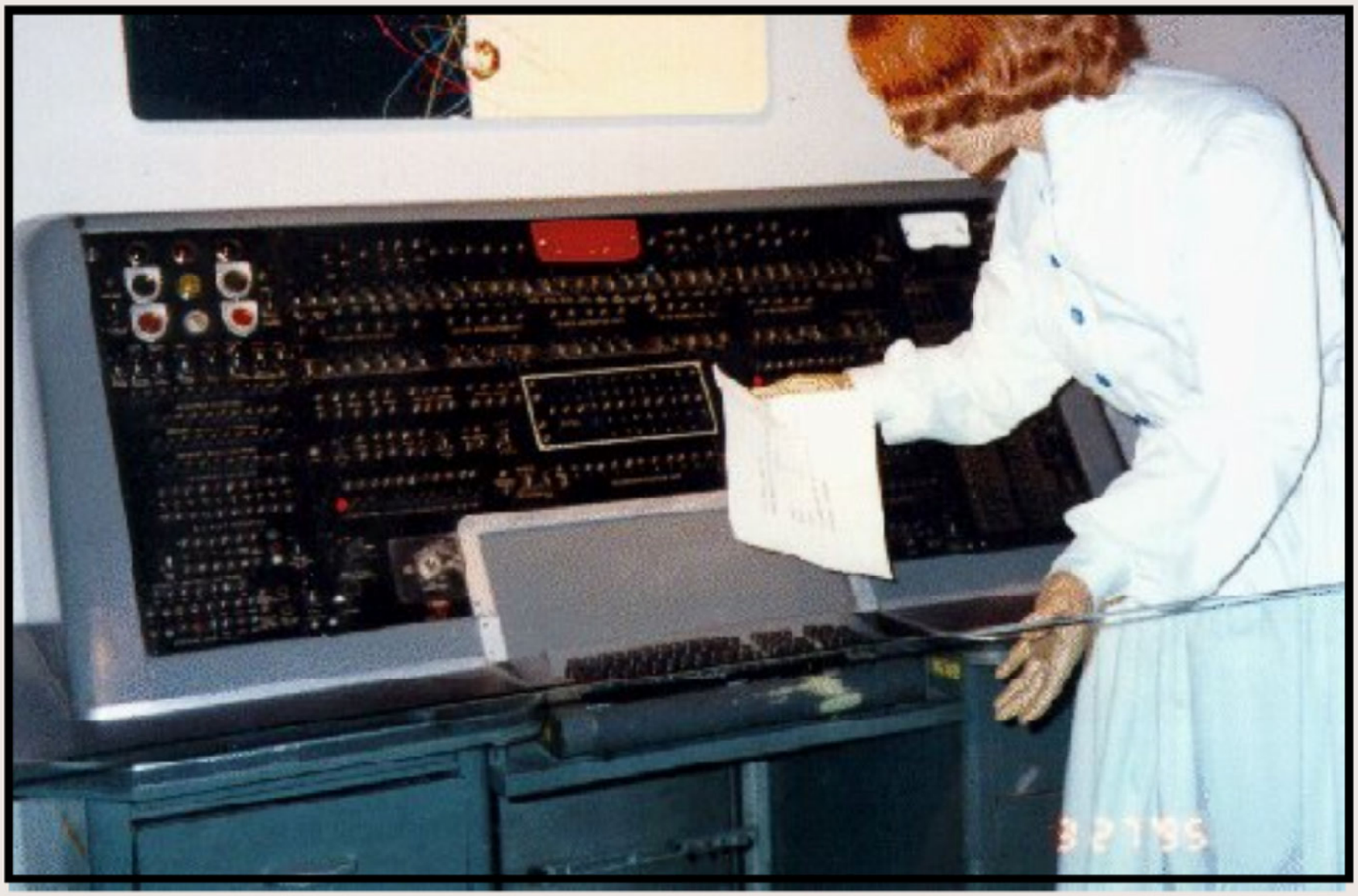
1946 - 1952

•1946: Term **"bit"** for binary digit is used for first time by John Tukey.

•1947: Three scientists at Bell Telephone Laboratories, William Shockley, Walter Brattain, and John Bardeen demonstrate their new invention. The name **transistor** is short for "transfer resis**tor**"

- 1952: IBM introduces the 701 the first commercially successful computer. It is a vacuum tube, or first generation, computer

UNIVAC 1952



UNIVAC 1952

UNIVAC (Universal Automatic Computer) was designed by J. Presper Eckert and John Mauchly, the men behind the first electronic computer, the ENIAC.

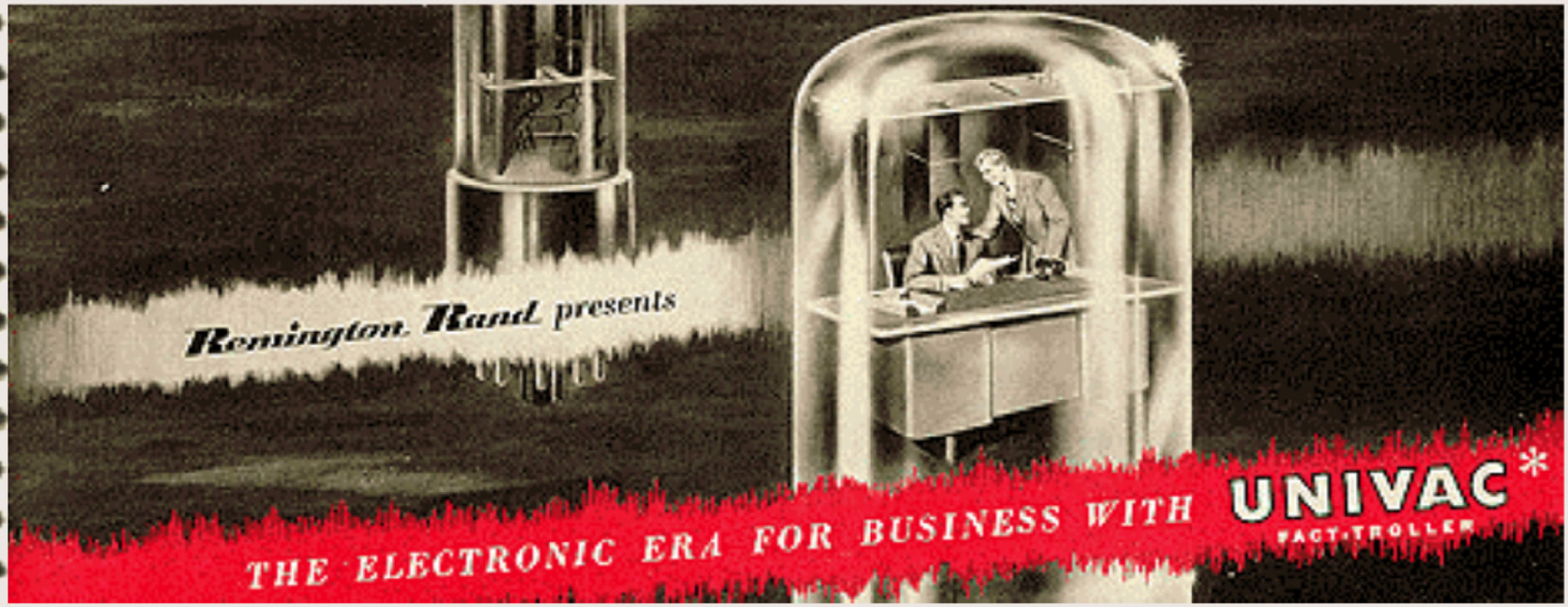
It weighed some 16,000 pounds, used 5,000 vacuum tubes, and could perform about 1,000 calculations per second. It was the first American commercial computer, as well as the first computer designed for business use. The first few sales were to government agencies, the A.C. Nielsen Company, and the Prudential Insurance Company. The first UNIVAC for business applications was installed at the General Electric Appliance Division, to do payroll, in 1954.

UNIVAC 1952

CBS used one of the 46 UNIVAC computers produced to predict the outcome of the 1952 Presidential Election. UNIVAC I predicted an Eisenhower landslide with 7% of the votes, just one hour after the polls closed. CBS did not air the prediction for 3 hours because they did not trust the machine……

The prediction proved to be accurate.

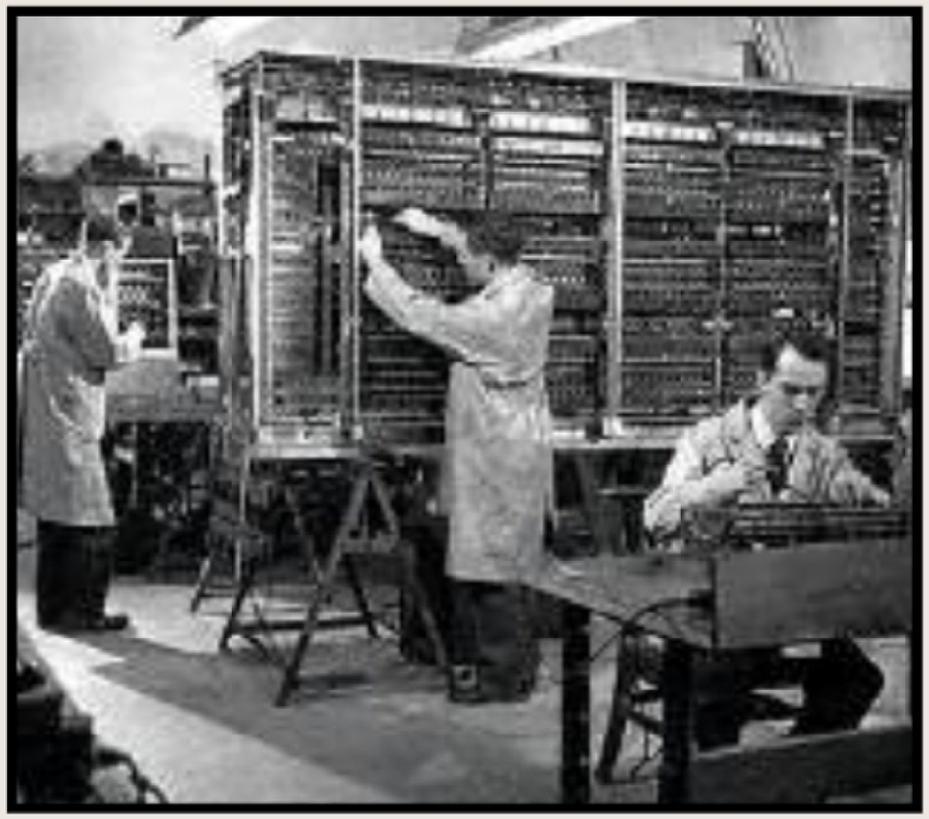
Advertisement for the UNIVAC



1952

AVIDAC 1953

- AVIDAC began operation in January 1953. Referred to as an "electronic brain", it was the first electronic digital computer developed by Argonne, a US Dept of Energy Laboratory. AVIADAC was was used in reactor engineering and theoretical physics research, and was the first of several landmark computers built by Argonne.



Second Generation Computers- 1956-1963: Transistors

Transistors replaced vacuum tubes and ushered in the second generation of computers. The transistor was invented in 1947 but did not see widespread use in computers until the late 50s. The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube. Second-generation computers still relied on punched cards for input and printouts for output.

In 1959 IBM shipped its first transistorized, or second generation, computers –

The IBM 1401

1957 Lejaren Hiller

Lejaren (luh-JARE-en) Hiller has become legendary as the first person to compose music with a computer. The *ILLIAC Suite* was completed in 1957. In 1976, his *Electronic Sonata*, a perfectly orthodox, 45-minute sonata-form movement is made entirely of computer-generated and computer-manipulated sounds.

Hiller founded the Experimental Music Studio at the University of Illinois in the late '50s and served as a Professor of Composition at the State University of N.Y. at Buffalo.

Hiller died Jan 26, 1994 in Buffalo, NY

Third Generation Computers – 1964-1971: Integrated Circuits

In 1961, the development of the integrated circuit by Robert Noyce of Fairchild Semiconductor, was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers. Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time. Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.

1960 - 1971

- 1960: Removable disks first appear
- 1963: Douglas Engelbart invents the mouse pointing device for computers
- 1964: IBM introduces the System 360 first integrated circuit-based, or third generation, computer.

- 1964: John Kemeny and Thomas Kurtz develop the BASIC programming language at Dartmouth College.
  BASIC is an acronym for
  Beginners All-purpose Symbolic Instruction Code

- 1965: First computer science Ph.D. is granted to Richard L. Wexelblat at the University of Pennsylvania.
- 1969: Bell Labs develops its own operating system, UNIX
- 1971: Texas Instruments introduces the first "pocket calculator." It weighs 2.5 pounds
- 1971 - Ray Tomlinson developed the first email application

IBM System 360

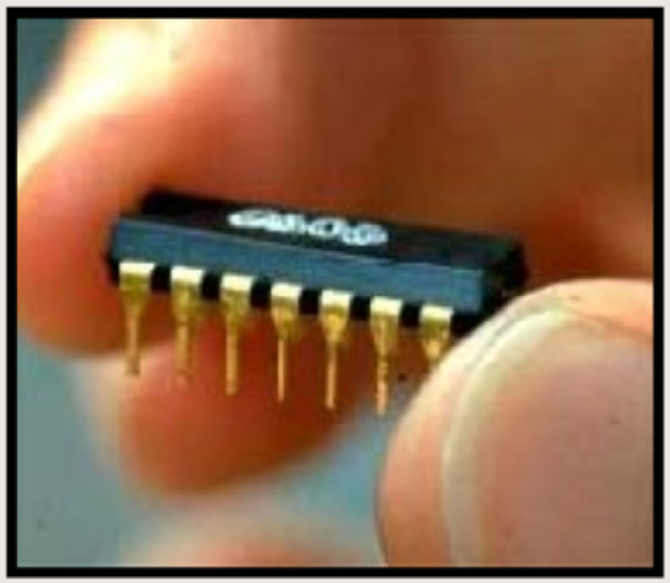
Mini Computer's of the 1960's

•1965: Digital Equipment Corporation (DEC), introduces the first minicomputer the PDP-8

1969: Honeywell releases the H316 "Kitchen Computer", the first home computer, priced at $10,600 in the Neiman Marcus catalog.

Fourth Generation computers – 1971-Present: Microprocessors

- The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004 chip, developed in 1971, located all the components of the computer on a single chip.



1973 - 1980

- 1973: At the Lakeside prep school in Washington state, Bill Gates tells a friend "I'm going to make my first million by the time I'm 25."
- 1975: The Altair is hailed as the first "personal" computer. A 12 year old girl suggests the name "Altair" for the new microcomputer. Altair was the name of where Star Trek's Enterprise was going that night on TV.
- 1975: Microsoft is founded after Bill Gates and Paul Allen who adapt and sell BASIC to MIT for the Altair
- 1977: Apple Computer is founded and introduces the Apple II personal computer
- 1980: Total computers in use in the U.S. exceed one million units

Osborne I – the first "laptop"

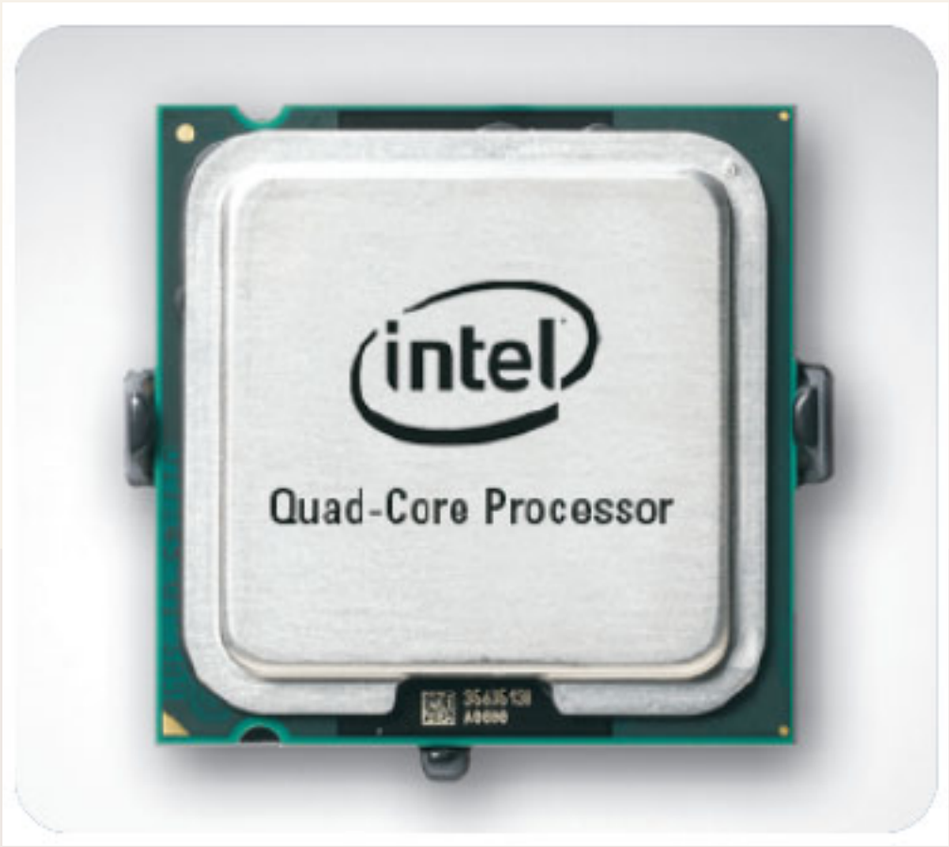
- 1981: Adam Osborne completed the first portable computer, which weighed 24 pounds and cost $1,795. The price made the machine especially attractive, as it included software worth about $1,500. The machine featured a 5-inch display, 64 kilobytes of memory, a modem, and two 5 1/4-inch floppy disk drives.

1983 - 1991

- 1983: Total computers in use in the U.S. exceed ten million units
- 1984: Apple introduces the Macintosh computer
- 1985: Microsoft Windows 1.0 ships
- 1985: Aldus introduces PageMaker for the Macintosh and starts the desktop publishing era.
- 1989: The number of computers in the U.S. exceeds 50 million
- 1991: Notebook PCs are introduced by most PC vendors

1991-today

- Until 2005 single-core processors outnumbered multi-core processors. In the years before there were only multi-core solutions used in individual cases.
- At a frequency ~ 4 GHz the CPU gets too hot and takes lots of electricity. This was the point when multi-core processors became more important. Demand for multi-core increased.



1991-today

- In the second half of 2006 the best processors were dual-core processors.
- Since 2006 the development has gone on, so that the new processors get four or more independent microprocessors.
- Today, single-core processors are not used in new personal computers.

TODAY

CD / DVD
/ Blu-ray

Smart phones

Flat Screens

laptop

MP3 players

U S B connectivity

Electronic Tablets

scanner

TOMORROW ...???