Released
Sept 1975

ECE401

Perspectives In Electrical and Computer Engineering

Lecture 2

https://www.youtube.com/watch?v=P8ti1hnLiLw

1

Last Time

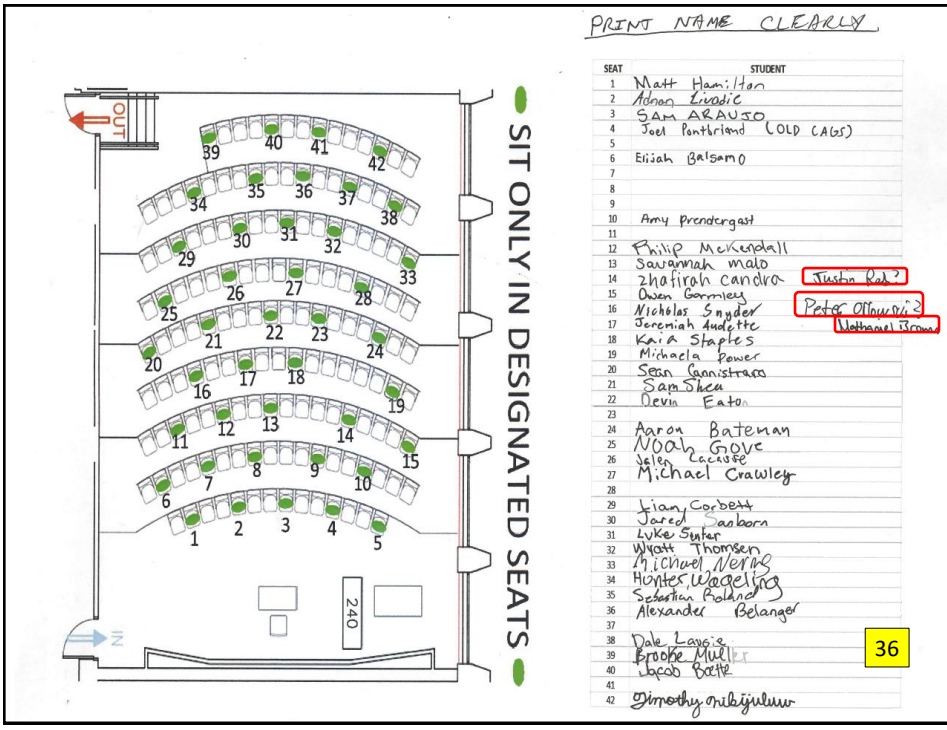
- Introductions
  - Who are Armata Kumari and Chris Foster?
  - Who is Professor Messner?
- Classroom Rules
- Material Delivery Methods
- Syllabus Overview
- A personal story and some tips

2

Today

- Class seating issue
- ECE Engineering Programs at UNH
- Discussion Forum
  - Virtual Introductions
  - What will computers look like in the year 2060?
- A bit on Computer Evolution

3



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Engineering Programs

- What Kind of Electrical and Computer Engineering Programs are available?
  - Electrical Engineering
  - Computer Engineering
  - Software Engineering

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Electrical Engineering

- Electrical Engineering today is made up of two areas typically called:
  - Electrical Engineering
  - Computer Engineering
- An avalanche of technological advances in the area of digital (or if you prefer “Computer”) design over the years has forced the development of two distinct degree programs at many universities

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Two Programs At UNH

EE – Electrical Engineering

CE – Computer Engineering

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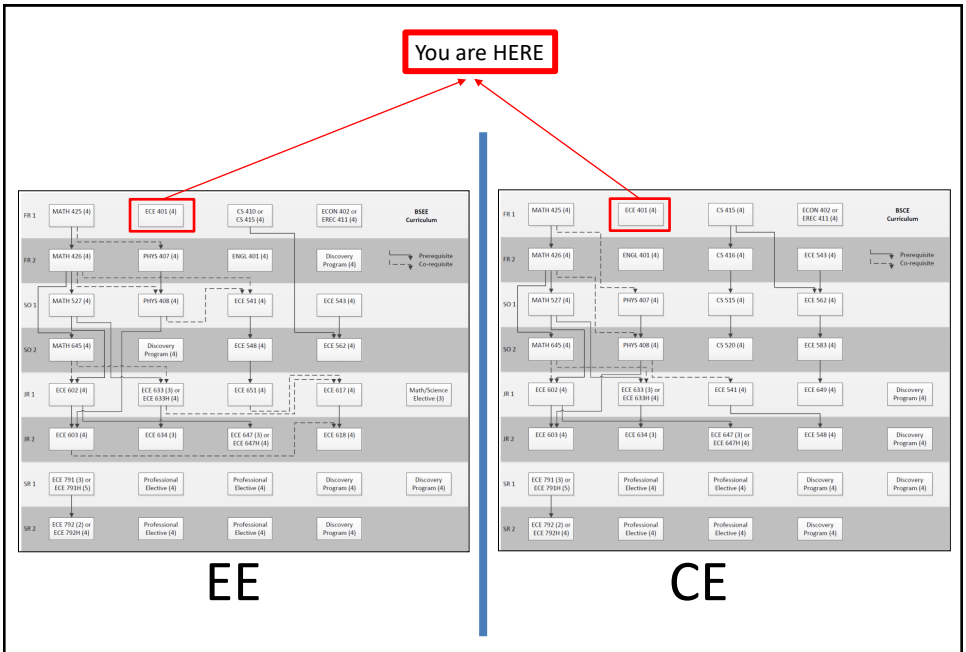

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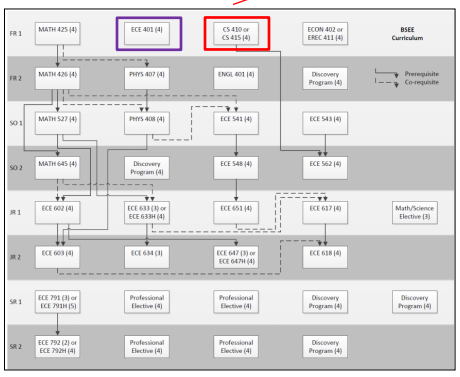
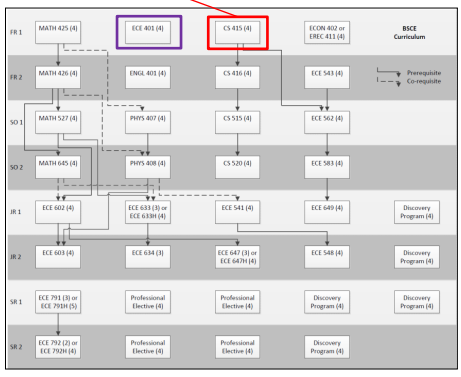
If you are a EE and there is a possibility of you changing from CE you should take CS415 instead of CS410



EE



CE

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ELECTRICAL ENGINEERING

AT UNH

https://ceps.unh.edu/electrical-computer-engineering/program/bs/electrical-engineering-major

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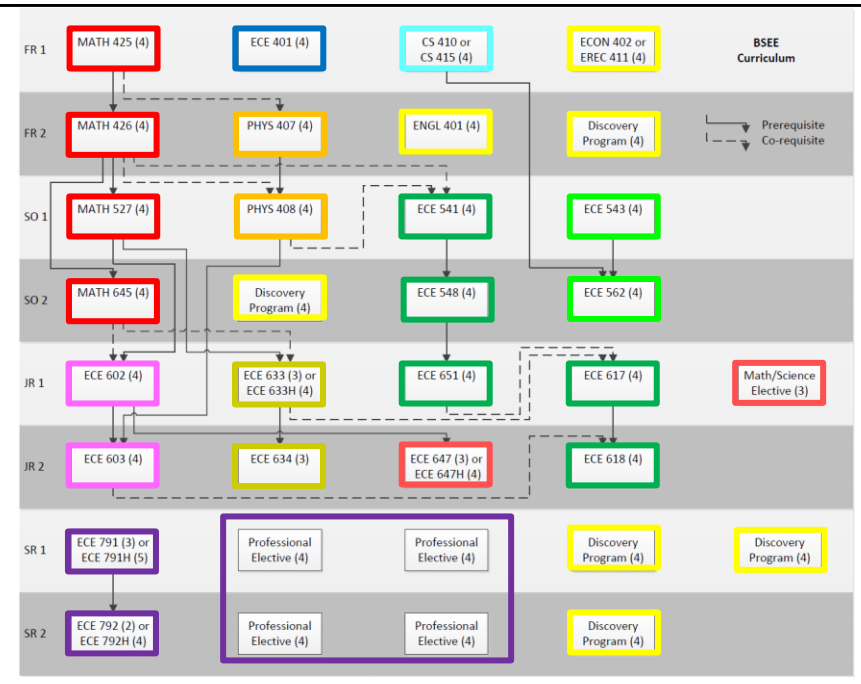

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COMPUTER ENGINEERING

AT UNH

https://ceps.unh.edu/electrical-computer-engineering/program/bs/computer-engineering-major

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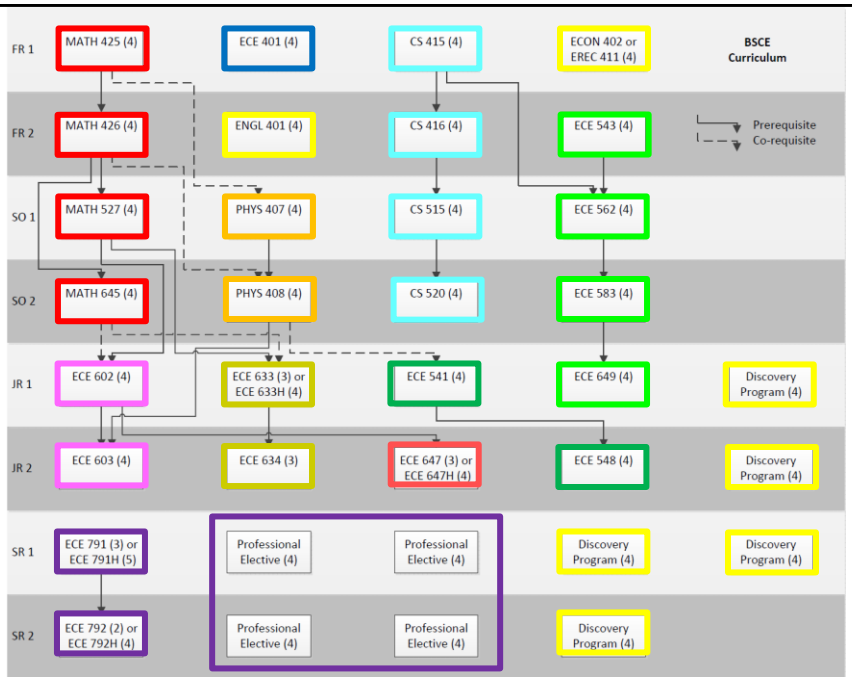

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Engineering at UNH

- Now you know what Electrical Engineering is a UNH (well at least on paper)
  - The rest of this course in designed on the principles of "active learning" (i.e., the thought that students will learn better by doing than by merely sitting in class lectures)
  - This concept is what the ECE Department at UNH is all about. Learning by doing and being subjected to the practical realities of what a laboratory environment brings
  - NOTE
    - Theory does not always hold true in practice due to physical constraints and probabilistic variables

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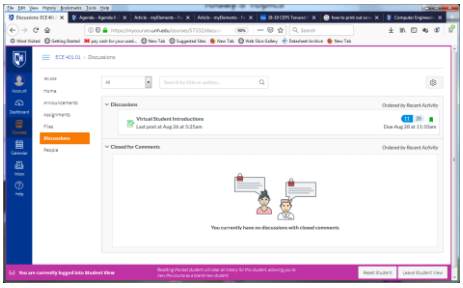
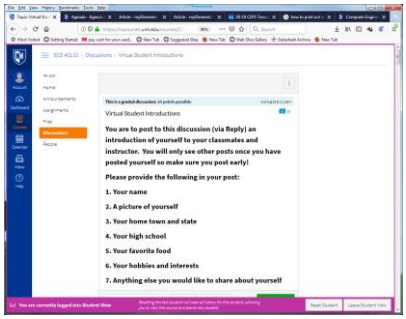
Discussion Forum 1

Virtual Introductions

- As you know I had you post in the discussion section of Canvas some information about yourself





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Discussion Forum 2

Advances in Computer Technology

- You have been exposed to technology your whole life. However, computers have not always been what they are today. They have evolved over time.
- I had no idea as to what I would have on my desk today when I was first subjected to a computer way back in the Fall of 1975 when I was a Freshman at Clarkson College of Technology.
  - At that time, a computer took up a whole room and was behind a glass wall. I have been amazed at what has happened in those brief number of years.

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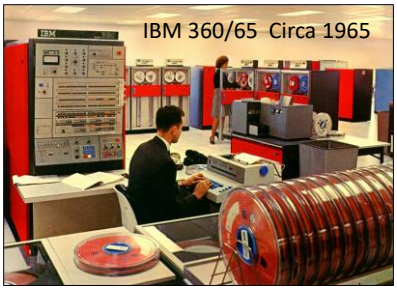
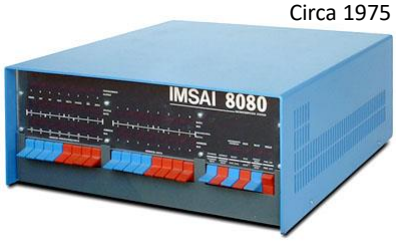
IBM 360/65 Circa 1965



IMSAI 8080
Circa 1975



Apple II
Circa 1977

Commodore 64 Circa 1982

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Discussion Forum 2

Advances in Computer Technology

- What I am asking you to do is perform a bit of research into how computers have evolved and then think "outside the box" and comment on what you feel computers will look like and how they will interface to people in the future
- This exercise is meant to stimulate discussion and debate regarding what might be the “look” of computer technology in 2060
  - You are **required** to make at least one post regarding this discussion and to respond to a minimum of 4 posts from other students in order to interject your thoughts and start a dialog
  - This Forum will be available all semester so that as we move forward you can revisit the discussion and reinforce or modify your view as you learn more about topics investigated in this course

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Discussion Forum 2

Advances in Computer Technology

- Historically one can look and see where things started (from the early days of fingers and toes) to todays' world of electronic computing and the associated software operating systems and applications
- Extrapolation of this historical view to the future requires not only that you following the trends of the past, but that you make use of your ***imagination***
- Engineers and Scientists will drive the next generation of computing!
  - Such advances must be Tempered by Societal Morals and Proper Governmental Controls

A Historical Perspective on Digital Development and the Computer

Historical Development

- Generation Zero: Mechanical Calculating Machines (1642 - 1945)
  - Calculating Clock
    - Wilhelm Schickard (1592 - 1635)

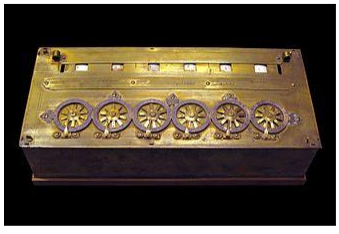
German Professor of Hebrew and Astronomy

Replica of Schickard's Calculating Machine

Historical Development

- Generation Zero: Mechanical Calculating Machines (1642 - 1945)
  - Pascaline
    - Blaise Pascal (1623 - 1662)

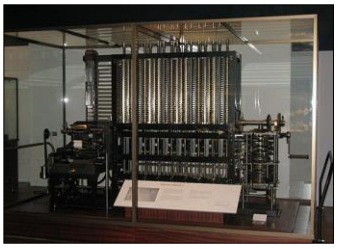
French mathematician, physicist, inventor, and Catholic theologian



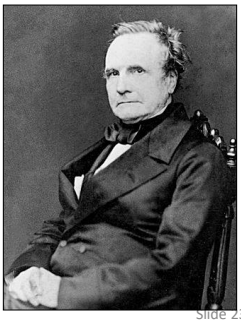
An early Pascaline

Historical Development

- Generation Zero: Mechanical Calculating Machines (1642 - 1945)
  - Difference Engine
    - Charles Babbage (1791 - 1871), also designed but never built the Analytical Engine
    - Babbage originated the concept of a digital programmable computer



English mathematician, philosopher, inventor and mechanical engineer

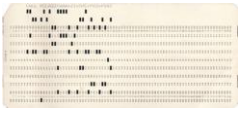


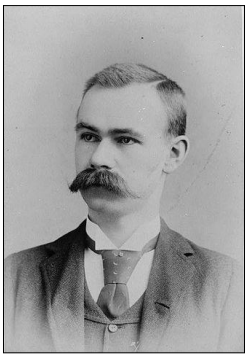
Historical Development

- Generation Zero: Mechanical Calculating Machines (1642 - 1945)
  - Punched card tabulating machines
    - Herman Hollerith (1860 - 1929)

American inventor and Engineer

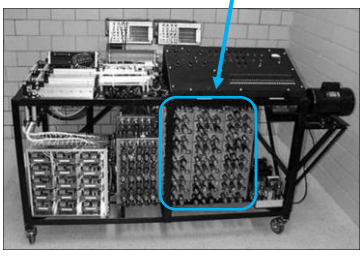
IBM 029 Card Punch Machine





Historical Development

- First Generation Vacuum Tube Computers (1937-1963)
  - Atanasoff Berry Computer (1937 - 1938) solved systems of linear equations
  - John Atanasoff and Clifford Berry of Iowa State University



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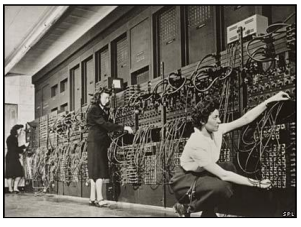
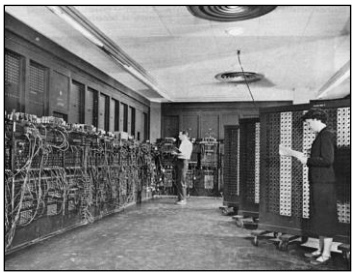
Historical Development

- The First Generation: Vacuum Tube Computers (1945 - 1953)
  - Electronic Numerical Integrator and Computer (ENIAC)
  - John Mauchly and J. Presper Eckert
  - University of Pennsylvania, 1946





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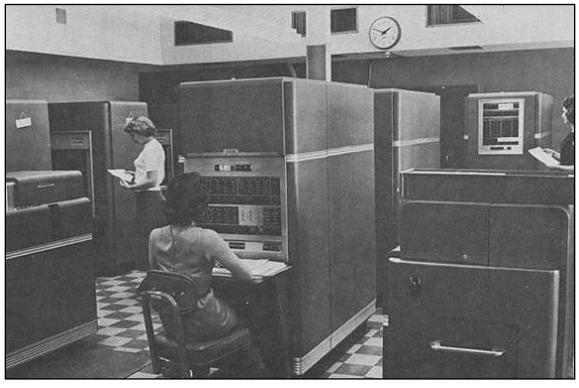
Historical Development

- The First Generation: Vacuum Tube Computers (1945 - 1953)
  - The IBM 650 first mass-produced computer (1955)



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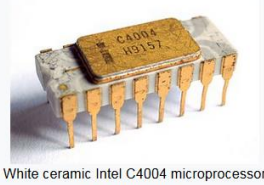
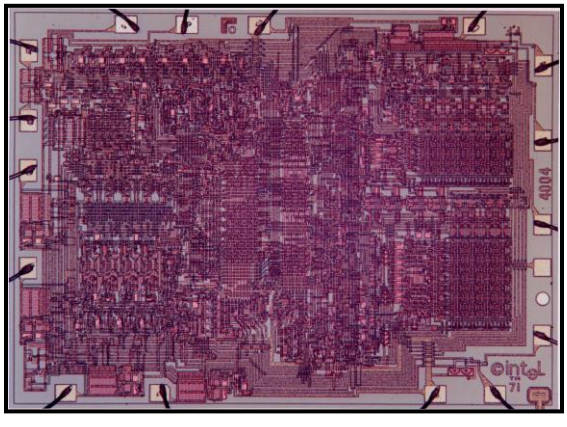
Intel 4004



White ceramic Intel C4004 microprocessor with grey traces

Produced	From late 1971 to 1981
Common manufacturer(s)	Intel
Max. CPU clock rate	740 kHz
Min. feature size	10 µm
Instruction set	4-bit BCD-oriented
Transistors	2300[1]
Data width	4
Address width	12 (multiplexed)
Successor	Intel 4040
Application	Busicom calculator, arithmetic manipulation
Package(s)	16-pin DIP

Intel 4004 Circa 1971
4 – bit microprocessor



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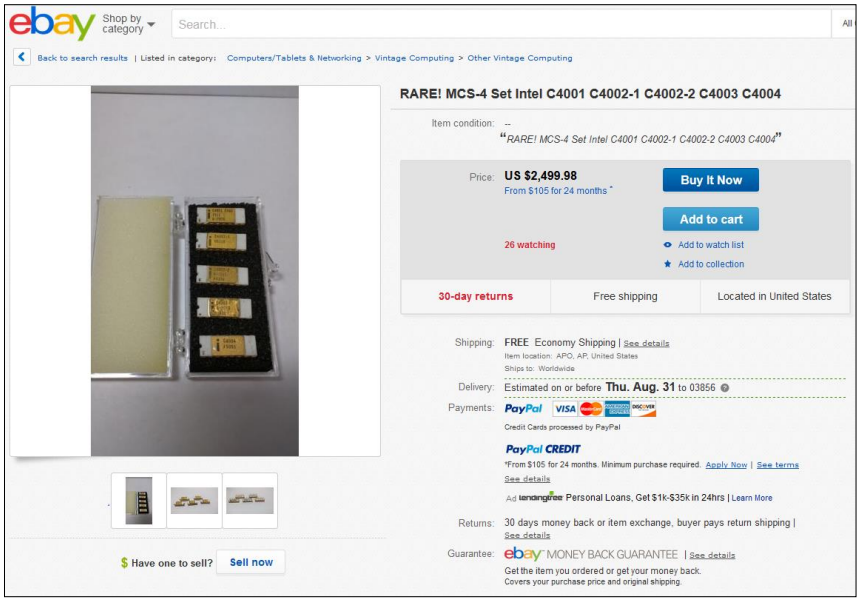

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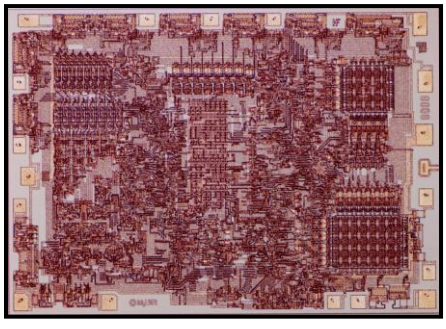
Intel 8008

An Intel 8008

Produced	From mid 1972 to 1983[1]
Common manufacturer(s)	Intel
Max. CPU clock rate	0.2 MHz to 0.8 MHz
Min. feature size	10 µm
Instruction set	8008
Successor	Intel 8080
Application	Computer terminals, calculators, bottling machines, 1970s ASEA industrial robots[2] (IRB 6), simple computers, etc.
Package(s)	18-pin DIP

Intel 8008 Circa 1972
8 bit microprocessor



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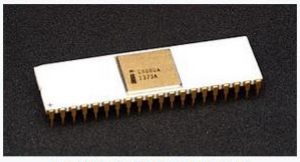
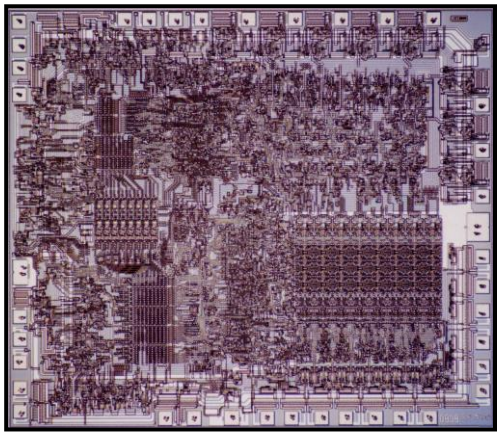
Intel 8080 Circa 1974
8 - bit microprocessor

Intel 8080



An Intel C8080A processor

Produced	April 1974; 44 years ago
Common manufacturer(s)	Intel
Max. CPU clock rate	2 MHz to 3.125 MHz
Min. feature size	6 µm
Instruction set	8080
Predecessor	Intel 8008
Successor	Intel 8085 Intel 8086 Intel 8088
Package(s)	40-pin DIP



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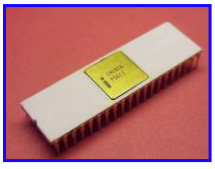
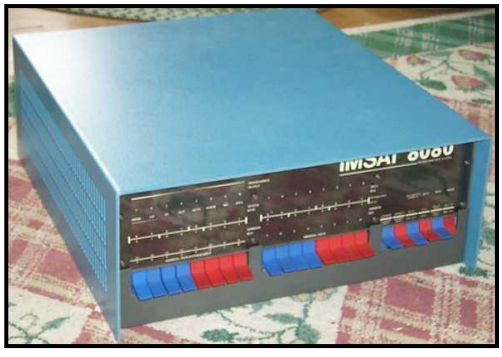
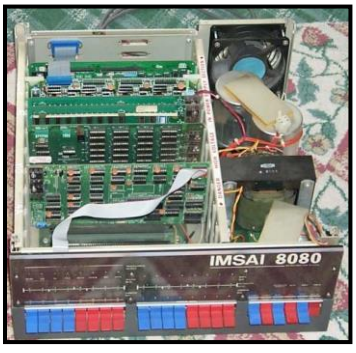


IMSAI 8080
Circa 1975





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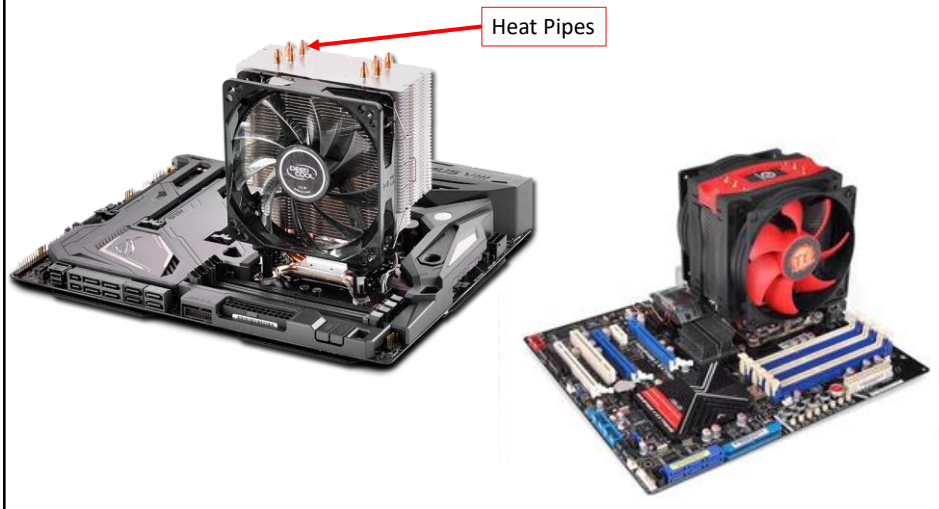
Contemporary Motherboards



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Liquid Cooling

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Early Intel Pentium Processors

Core p	Process	Clock rates	L1 cache	FSB	Socket	Release date
P5	0.8 µm	60–66 MHz	16 KB	60–66 MHz	Socket 4	March 1993
P54C	0.6 µm	75–120 MHz	16 KB	50–66 MHz	Socket 5	October 1994
P54CS	0.35 µm	133–200 MHz	16 KB	60–66 MHz	Socket 7	June 1995
P55C	0.35 µm	120–233 MHz	32 KB	60–66 MHz	Socket 7	January 1997[12]
Tillamook	0.25 µm	166–300 MHz	32 KB	66 MHz	Socket 7	August 1997

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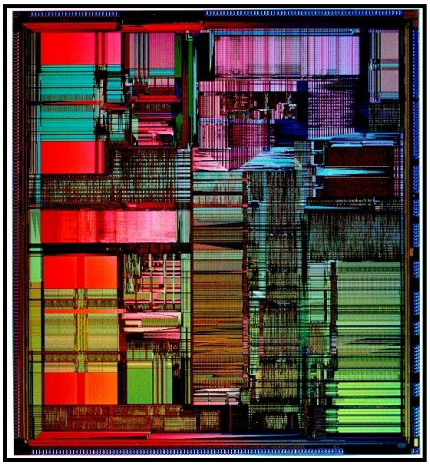
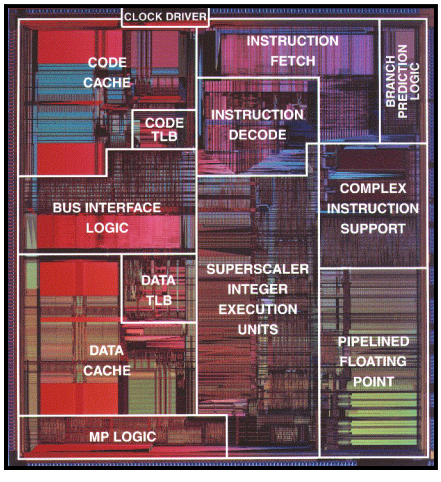
Intel Pentium Circuit Circa 2000





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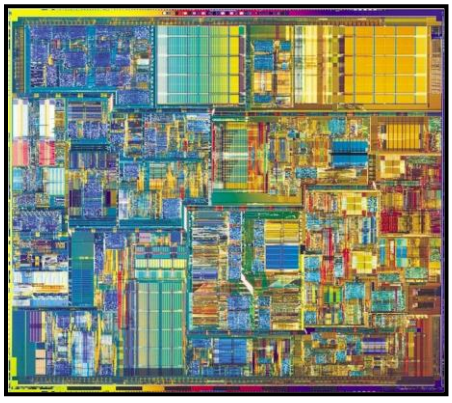
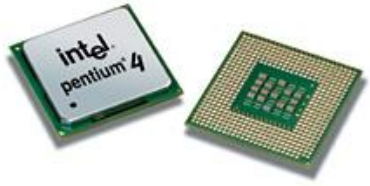
Pentium 4 Processor Circa 2000-2008





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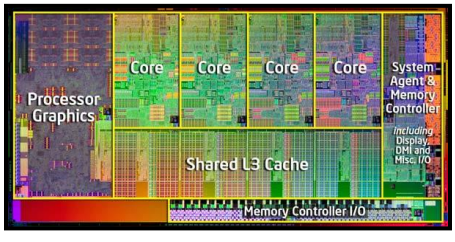
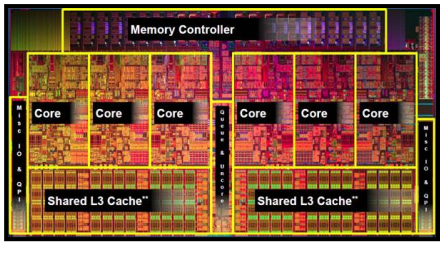
Circa 2011-Present





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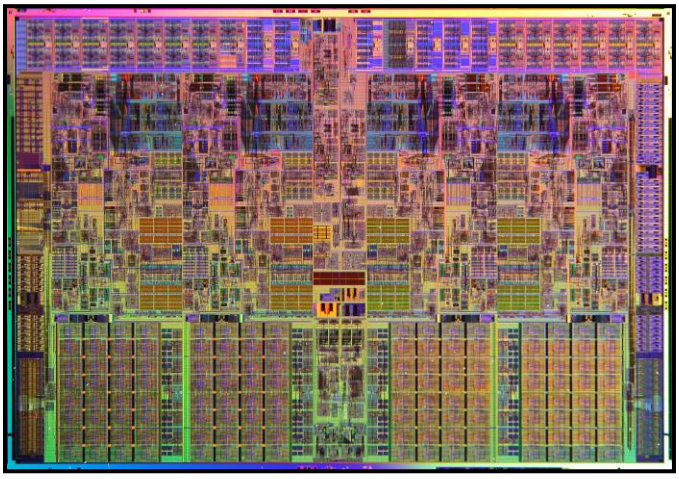
Intel i7 Sandy Bridge die (silicon) Circa 2011



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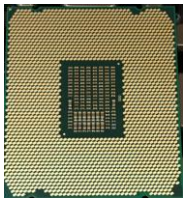
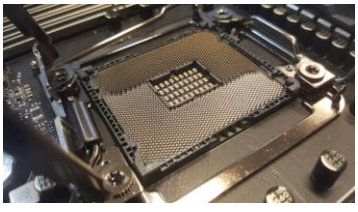
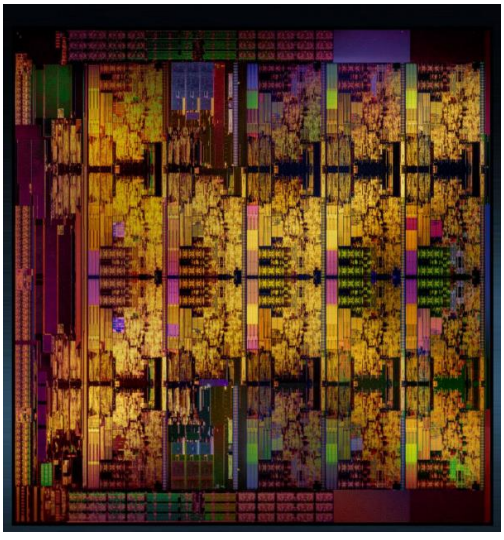




18 core
Core i9 – 7980XE

Skylake-X



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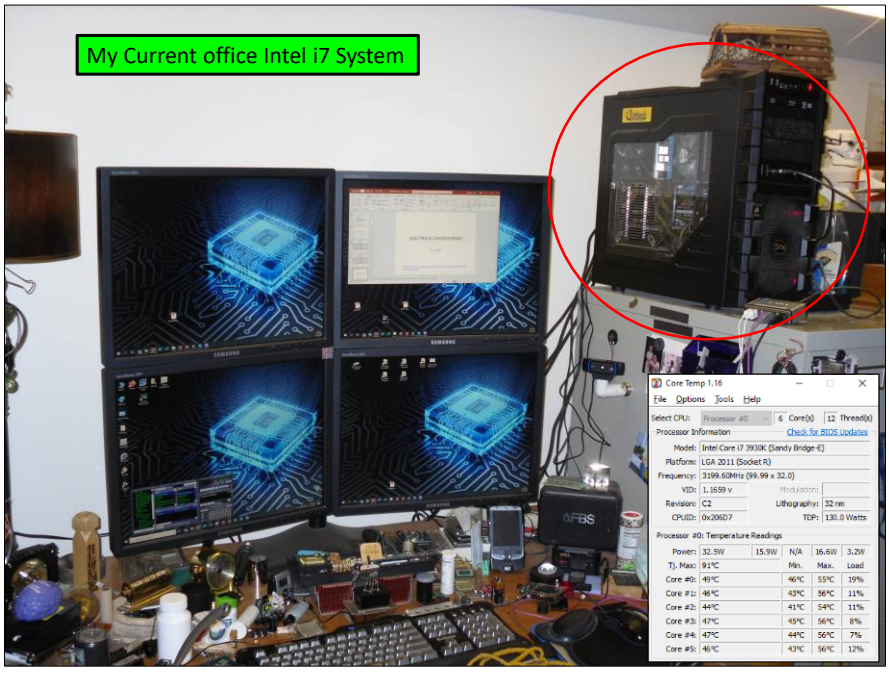

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Some Important Events in Computer History

TIME

B.C. Fingers and toes, abacus
A.D. Stonehenge, quipu
1650 Mechanical two function calculator (Pascal)
1690 Multiplying calculator (Leibnitz)
1800 Loom controlled by punched cards (Jacquard)
1823 Difference Engine (Babbage)
1850 Analytical Engine design (Babbage)
1890 U.S. Census-punched cards (Hollerith)
1900 Printing business calculators (Burroughs)
1920-1960 Unit record equipment (IBM, NCR, etc.)
1939 Electronic computer prototype (Atanasoff)
1943 Collosus vs. Enigma (Turing)
1944 MARK I electromechanical, plug board computer (Aiken)
1946 ENIAC electronic computer (Eckert, Mauchly)
1950's First generation-tubes (eg IBM 701, STRETCH, 650)
1960 Second generation-transitors, compilers (eg IBM 401)
1965 Third generation-IC's, operating system; minicomputers (eg IBM 360, DEC pdp8)
1970 LSI memory (Intel)
1972 Microprocessor (Ted Hoff-Intel 4004) later 8008,8080,8086,80286,80386,etc.
1978 VLSI – Very Large Scale Integration
1979 Programmable Logic Device Appears
1979 Single Chip Digital Signal Processing Chip introduced by Bell Laboratories
1985 ULSI – Ultra Large Scale Integration
1990's Wafer Scale Integration
2000's System on Chip and 3D Integrated Circuits

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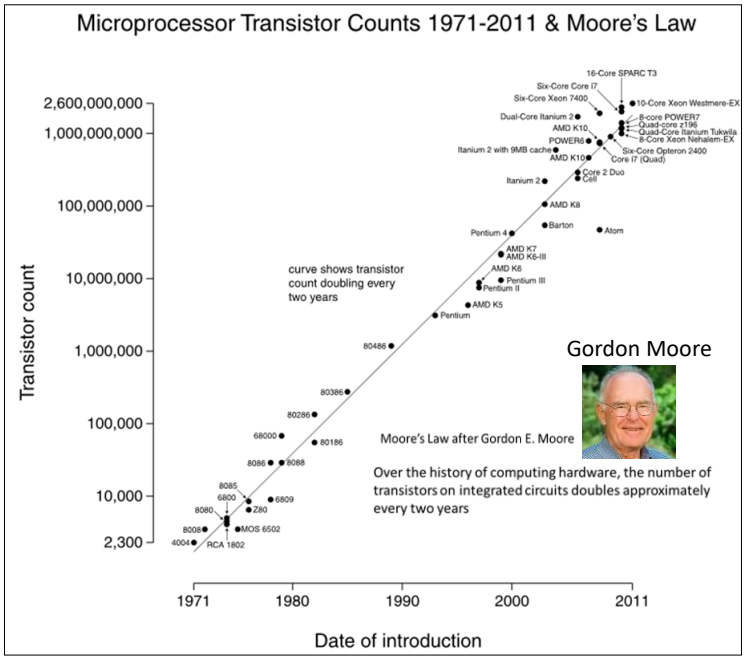

Major Driving Force of Computers is Technology

- Moore's Law
  - Technology for Switching
    - Mechanical Relay ~ 0.01 seconds or 10^{-2}
    - Vacuum Tube ~ 0.00001 seconds or 10^{-5}
    - Transistor ~ 0.000001 seconds or 10^{-6}
    - Integrated Circuit ~ 0.00000001 seconds or 10^{-8}
    - Ultra Large-Scale IC ~ 0.000000001 seconds or 10^{-9}

Future: 3D Integrated Circuits
Molecular Computing
Quantum Computing

END