ITM1010
Computer and Communication Technologies

Course Information

The Instruction Team

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Course Information

- Lectures
  - Tuesday, 10:30am-12:15noon, ICS 204 (no class on Sept. 16)
  - Friday, 8:30am-9:15am, LSB LT5
- Tutorials
  - To be decided today
- Course web page
  - http://www.ee.cuhk.edu.hk/~kppun/itm1010
- Course assessment
  - 20% Assignments
  - 30% Midterm test, to be held on October 10 (Fri), 2003
  - 50% Final Examination

Reference Books

- *Digital Electronics: A Simplified Approach*, 2001 Edition, by Robert D. Thompson, Prentice Hall, 2001.
- *Using Information Technology*, 5th Edition by Brian Williams and Stacey Sawyer, McGraw-Hill, 2003.
- *Telecommunications Essentials*, by Lillian Goleniewski, Addison Wesley, 2002
- *Digital and Analog Communication Systems*, by Leon W. Couch, Prentice Hall, 2001.

What will you learn in this course?

- Part I: Introduction to Computer Technologies
  - Number systems
  - Boolean algebra and combination logic circuits
  - Sequential logic circuits
  - Computer organization
- Part II: Introduction to Communication Technologies
  - Information and signals
  - Bandwidth and modulation
  - Multiplexing and compression
  - Communication systems: fixed link, optical, wireless and satellite

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Lecture #1

Part I: Introduction to Computer Technologies

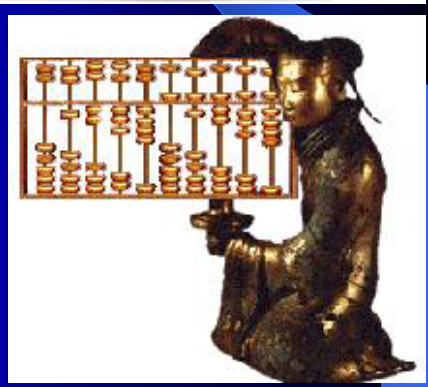
A brief history of computers

Activity

- Form groups of about 4
- Discuss the question “What are the basic functions of computers?”
- One person from each group should list the group’s opinions on chart-paper
- Time allocation ~ 10 minutes

Ancient times

- The abacus, which emerged about 5,000 years ago and is still in use today, may be considered the first computer. The abacus as we know it today, appeared around 1200 in China; in Chinese, it is called 算盘.
- It is manual.



Mans progress is measured by the sophistication of his tools. First, he discovered how to control fire. Eventually he invented the wheel. He built boats and learned to harness the wind.

As soon as commerce developed in early societies, people recognized the need to calculate and to keep track of information. They soon devised simple computing devices and bookkeeping systems to enable them to add, subtract, and record simple transactions.

1600-1945

- Blaise Pascal's Adding Machine (1642)
  - Adopt partly the principle of abacus
  - Worked by a system of gears and dials (mechanical)
  - The principle is still being used today (odometers).
- Leibniz improved the Pascal's machine (1674)
  - It could also multiply.

Blaise Pascal, a French mathematician;

In 1644, Blaise Pascal (1623-1662), the 18-year-old son of a French tax collector, invented what he called a numerical wheel calculator to help his father with his duties. This brass rectangular box, also called a Pascaline, used eight movable dials to add sums up to eight figures long. Pascal's device used a base of ten to accomplish this.

Leibniz is a German mathematician and philosopher.

In 1674, a German mathematician and philosopher, Leibniz (1646-1716), improved the Pascaline by creating a machine that could also multiply. Like its predecessor, Leibniz's mechanical multiplier worked by a system of gears and dials. The centerpiece of the machine was its stepped-drum gear design, which offered an elongated version of the flat gear.

Left picture is Pascal's adding machine.

The principle of Pascal's adding machine is still being used today, such as in the odometers (mile meters in cars).

1960-1945 (Cont')

Arithometer

- It wasn't until 1820 that mechanical calculators gained widespread use.
- Charles Xavier Thomas de Colmar, a Frenchman, invented a machine, called arithometer that could perform the four basic arithmetic functions: add, subtract, multiply and divide.
- The arithometer was widely used until the First World War.

1600-1945 (Cont')

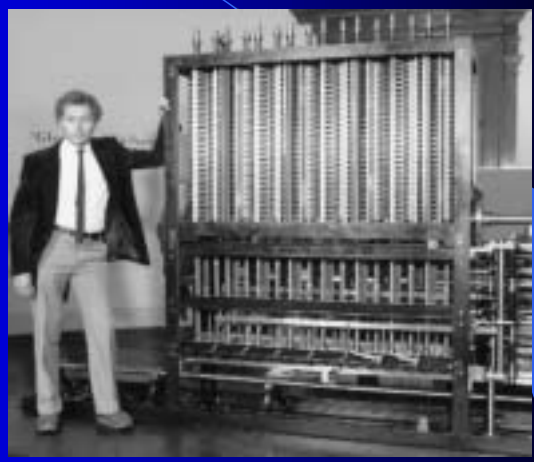
- Analytical Engine
  - Proposed by Babbages in 1822.
  - Perform all mathematical calculations, store values in its memory, perform logical comparisons among values and print results automatically.
  - Steam powered.
  - Never been built because it lacked one thing – electronics.
  - However, it outlined the basic elements of a modern general purpose computer and was a breakthrough concept.

Babbages, an English Mathematician.

When the age of industrialization spread throughout Europe, machines became fixtures in agricultural and production sites. An invention that made profound changes in the history of industrialization was the mechanical loom invented by a Frenchman named Joseph Jacquard. With the use of cards punched with holes, it was possible for the Jacquard loom to weave fabrics in a variety of patterns.

The idea of using punched card to store a predetermined pattern to be woven by the loom clicked in the mind of Charles Babbage, an English mathematician who lived in the nineteenth century. He foresaw a machine that can perform all mathematical calculations, store values in its memory and perform logical comparisons among values. He called it the Analytical Engine. Babbages analytical engine, however, was never built. It lacked one thing-electronics. The technology at that time was not capable of building Babbages dream because electronics was not yet known or even thought of. Electronics was the missing link in Babbages analytical engine.

Analytical Engine



1600 – 1945 (Cont')

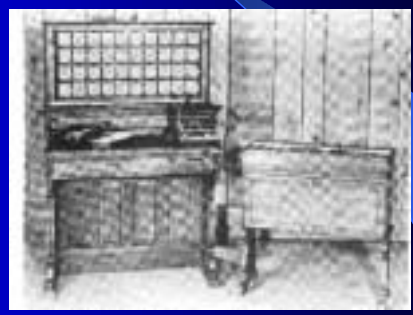
- Hollerith's Tabulating Machine (1889)
  - Hollerith adopted Jacquard punched cards concept to process US census data.
  - He used cards to store census data which he fed into a machine that compiled the results mechanically.
  - It cut by two thirds the computing time.
- The Birth of IBM
  - Hollerith brought his punch card reader into the business world, founding Tabulating Machine Company in 1896, later to become International Business Machines (IBM) in 1924 after a series of mergers.

Hollerit, an American inventor;

Herman Hollerith adopted the punched card concept of Jacquard. Census data were translated into a series of holes is a punched card to represent the digits and the letters of the alphabet. It was then passed through a machine with a series of electrical contacts that were either turned off or on depending on the existence or non-existence of holes in the punched cards. These different combinations of off/on situations were recorded by the machine and represented a way of tabulating the result of the census. The code developed by Hollerith is the code on the computer punched cards or paper tapes of telex machines and it is called the Hollerith code.

Holleriths machine was highly successful. It cut by two thirds the time it took to tabulate the result of the census. It made money for the company that manufactured Holleriths machine. And in 1911, this company merged with its competitor to form International Business Machine (IBM).

Hollerith's Tabulating Machine



Modern computers

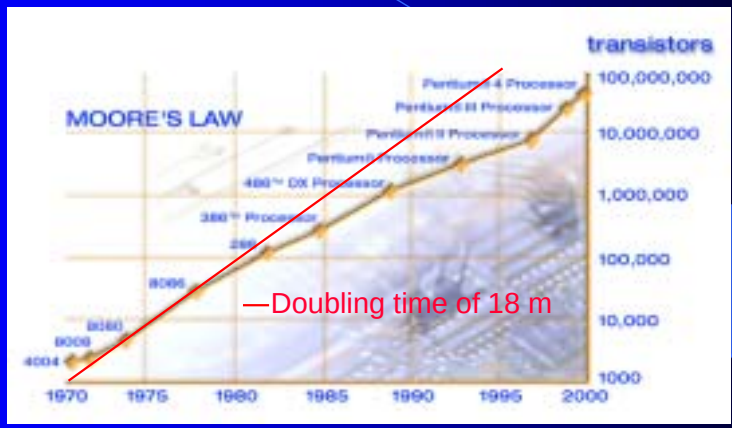
- First Generation (1946-1956)
  - The first modern computer is ENIAC (Electronic Numerical Integrator and Computer) (1946)
  - No moving parts
  - Programmable
  - Had the capability to store problem calculations
  - Built with vacuum tubes (ENIAC has 18,000 VTs)

  - Large size (ENIAC occupied 1,500 square feet of floor space).

Modern Computers (Cont')

- Second Generation (1956-1963)
  - Transistor-based
  - Smaller & Faster
- Third Generation (1964-1971)
  - Integrated Circuits (IC) based
  - Further miniaturized
- Fourth Generation (1971- present)
  - Characterized by Large Scale Integration (LSI), VLSI, ULSI
  - Speed ever increases
- Fifth Generation (Present and beyond)
  - AI, thinking machines, intelligent machines, & superconductors.

MOORE'S LAW



Courtesy of Intel

The number of transistors per silicon chip doubles every 18-24 months.