CSC101
Introduction to ICT

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Lecture - 2

Introducing Computers

Introduction to Computer Science

What is computer science?

"Everything that happens after you ask a question from Google until you get a result."

Lance Fortnow

- It is a discipline that seeks to build a scientific foundation for computer design and information processing using computers

- Computer science is the study of
  - What can be accomplished using computers, and
  - How to construct software to do these things

Ref: http://blogs.msdn.com/b/alfredth/archive/2011/03/10/what-is-computer-science-all-about.aspx

Introduction to Computer Science

Why study computers?

- A computer is a profoundly important technological device
- Broadly impactful, Occasionally disruptive

- Computers have had impacts on the way we live, the way we think, and the way we do business
- But we are perhaps only 1/3 to 1/2 of the way through the process of absorbing the impact of computing in our lives

- Computers will have a substantial influence on any area of study you choose at CUI
- So, understanding computers is important

Introduction to Computer Science

- Computers have become an integral part of our lives

- Pervasive computing, also known as ubiquitous computing is a concept where computing is made to appear anytime and everywhere
- It is a growing trend of embedding computational capability (generally in the form of microprocessors) into everyday objects to make them effectively communicate and perform useful tasks

- Internet of Things, or IoT, is a system of interrelated computing devices (objects, people or mechanical machines) with unique identifiers (UIDs)
- These devices have the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction

The Computer Defined

- *What is a computer?*

The Computer Defined

- What is a computer?
- A computer can be defined as a programmable electronic machine that accepts input (data), processes it and gives out results (information)
- It allows the user to store all sorts of data and then 'process' that data, or carry out actions with the data, such as calculating numbers or organizing words
- "A computer is a machine for manipulating data according to a list of instructions known as a program"
  Wikipedia

The Computer Defined

- Modern computers are digital
  - Two digits combine to make data
- Older computers were analog
  - A range of values made data

- Computers have had more impact on our society than any other invention
  - Changed work and leisure activities
  - Used by all demographic groups

- Computers are important because
  - Provide information to users
  - Information is critical to our society
  - Managing information is difficult

Types of Computers

- Computers for individuals
- Computers for organizations
- Computers in society

Computers for Individuals

Desktop computers

- The most common type of computer
- Sits on the desk or floor
- Performs a variety of tasks
- Best for individual use

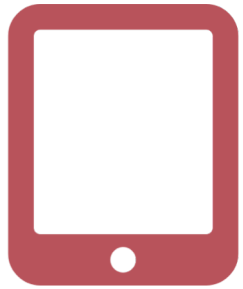
Laptop computers

- Small portable computers also called notebook computers
- Weighs between 3 and 8 pounds
- About 8 ½ by 13 inches
- Typically as powerful as a desktop

Computers for Individuals

Tablet computers

- Newest development in portable computers
- Input is through a pen (or hand), touch screen
- Run specialized versions of office products



Smart phones

- Hybrid of cell phone and PDA
- A cell phone that offers more advanced computing ability
- Web surfing, e-mail access, GPS and many other Apps
- Allow users to store information, take pictures, install programs

Computers for Individuals

Wearable computers

- Also known as body-borne computers are the latest trend in computing
- Essentially, common computer applications (e-mail, multimedia, calendar, scheduler) are integrated into watches, cell phones, visors and even clothing

Computers for Organizations

Network servers

- Centralized computer, all other devices connect to it
- Provides access to network resources
- Multiple servers are called server farms
- Often simply a powerful desktop

Workstations

- Specialized computers
- Optimized for science or graphics
- More powerful than a desktop
- Mostly seen in offices or attached to a network

Computers for Organizations

Supercomputers

- The most powerful computers made
- Handle large and complex calculations
- Process trillions of operations per second
- Found in research organizations

Mainframes

- Used in large organizations
- They are of size of a large cabinet
- Handle thousands of users simultaneously
- Users access through a terminal

Computers in Society

- Examples of some of the computers available in society

- Education
- Finance
- Government
- Healthcare
- Science
- Publishing
- Travel
- Industry

Advantages of Computers

- Automatic
- Speed
- Reliability
- Diligence
- Consistency
- Versatility
- Storage
- Communication
- No feelings

Disadvantages of Computers

- No I.Q
- Violation of privacy
- Impact on labor force
- Health Risks
- Impact on environment

The Origin of Computers

- Where did the computers come from?
- Why did computers emerge in the 1940s?
- How did computers differ from the previous technologies for computation?

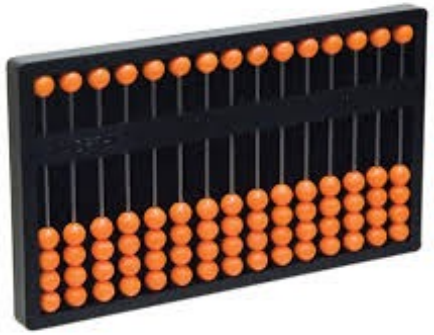
- Threads in the story
  - Charles Babbage / Ada Lovelace: Difference Engine, Analytical Engine
  - Tabulating machines, card-based calculators
  - ENIAC to EDVAC to UNIVAC and the birth of the commercial computing industry

Ref: https://www.livescience.com/20718-computer-history.html

Ref: https://thumbnails-visually.netdna-ssl.com/the-evolution-of-computers_5391efe5bc5a2_w1500.jpg

The Origin of Computers

- Computers are nothing more but Calculating Machines
- It took over generations for early man to build mechanical devices for counting large numbers
- The first calculating device called ABACUS was developed by the Egyptian and Chinese people

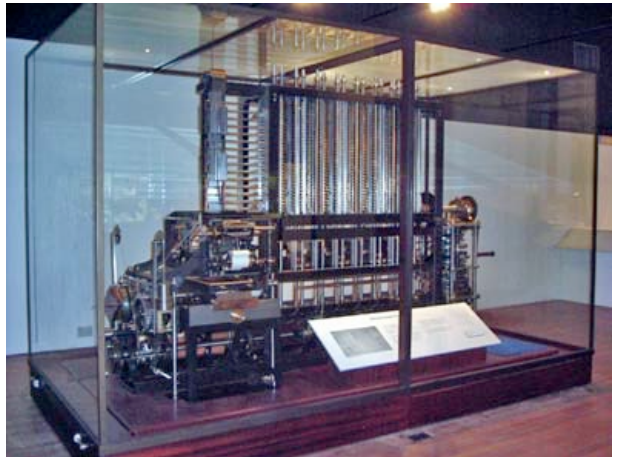


- The word ABACUS means calculating board
- It consisted of sticks in horizontal positions on which were inserted sets of pebbles
- It has a number of horizontal bars each having ten beads
- Horizontal bars represent units, tens, hundreds, etc.

The Origin of Computers

Charles Babbage (1791–1871), British

- Motivated by the desire to reduce drudgery of calculation, and to improve its accuracy
- Was born in the steam age, when electronics was in its infancy
- As a consequence, thought to create a mechanical, steam-powered computing machine
- First machine was the Difference Engine, a mechanical calculator
- Second machine was the Analytical Engine, a programmable calculation device



Read more here: https://en.wikipedia.org/wiki/Charles_Babbage

The Origin of Computers

Ada Lovelace (1815 – 1852)

- A mathematical genius, worked with Babbage on Analytical Engine
- Documented the Analytical Engine, but more importantly programmed Analytical Engine
- Though never realized, Ada developed a strong mental model of how it works, and then developed programs, also in her head, that ran on the machine
- Generally credited as being the world's first computer programmer

Read more here: https://en.wikipedia.org/wiki/Ada_Lovelace

Generations of Computers

- The evolution of computer started from the 16th century and resulted in the form that we see today
- The present day computer, however, has also undergone rapid change during the last fifty-sixty years
- This period, during which the evolution of computer took place, can be divided into five distinct phases known as Generations of Computers
- Each phase is distinguished from others on the basis of the type of switching circuits used
- Each generation is characterized by major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper and more powerful, efficient and reliable devices

Read more here: https://www.webopedia.com/DidYouKnow/Hardware_Software/FiveGenerations.asp

Generations of Computers

FIRST GENERATION (1940-1956)

- The first computers used vacuum tubes for circuitry and magnetic drums for memory and were often enormous, taking up entire rooms
- They were too expensive to operate
- They required a great deal of electricity and generated a lot of heat
- They relied on machine language to perform operations and could solve one problem at a time
- Input was based on punched cards and paper tape and output was displayed printouts
- Some of the computers of the first generation were ENIAC (Electronic Numerical Integrator and Calculator) and EDVAC (Electronic Discrete Variable Automatic Computer)

Generations of Computers

SECOND GENERATION (1956-1963)

- Around 1955, vacuum tubes were replaced with transistors in the second generation computers
- Transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy efficient and more reliable
- It is in the second generation that the concept of Central Processing Unit (CPU), memory, programming language and input and output units were developed
- They used assembly languages and early versions of high-level languages like COBOL and FORTAN
- Some of the computers of the second generation were IBM 1620, IBM 1401 and CDC 3600

Generations of Computers

THIRD GENERATION (1964-1971)

- The development of the integrated circuit was the hallmark of the third generation of computers
- Transistors were miniaturized and placed on silicon chips called Integrated Circuits (ICs) which drastically increased the speed and efficiency of computers
- A single IC has many transistors, registers and capacitors built on a single thin slice of silicon
- Instead of punched cards and printouts, user interacted with computers through keyboards and monitors, and run different applications at one time on them
- They became accessible to mass audience because they were smaller and cheaper than their predecessors
- Some of the computers developed during this period were IBM-360, ICL-1900, IBM-370, and VAX-750
- Higher level language such as BASIC was developed during this period

Generations of Computers

FORTH GENERATION (1971-Present)

- The present day computers that you see today are the fourth generation computers that started around 1970s
- It uses Large Scale Integrated Circuits (LSIC) built on a single silicon chip called microprocessors
- The microprocessor brought the forth generation of computers, as thousands of integrated circuits were built onto a single silicon chip
- The Intel 4004 chip, developed 1971, located all the components of the computer, from CPU and memory to input/output controls, on a single chip
- In 1981 IBM introduced its first computer for home users, 1984 Apple introduced the Macintosh
- Microprocessors moved from desktop computers and into many areas of life as more and more everyday products began to use microprocessor
- This generation also brought the concept of GUIs, the mouse and handheld devices

Generations of Computers

FIFTH GENERATION (Present and Beyond)

- Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today
- The use of parallel processing, quantum computation and molecular and nanotechnology will radically change the face of computers in years to come
- The goal of modern computers is to develop devices that respond to natural language input and are capable of learning and self-organization

Evolution of Computers

ENIAC - Electronic Numerical Integrator and Calculator

- Development began during WWII, but was completed in 1946
- ENIAC could be programmed, Not a stored program computer
- Complex sequences of instructions, could include loops, branches, and subroutines
- Taking a problem and mapping it onto the machine was complex, often took weeks
- Once a potential mapping was put onto paper, the process of getting the program into the ENIAC took days of manipulating cables and switches

Read more here: https://en.wikipedia.org/wiki/ENIAC

Youtube video: https://www.youtube.com/watch?v=k4oGi_dNaPc

Evolution of Computers

EDVAC – Electronic Discrete Variable Automatic Computer

- A follow-on to ENIAC – Key idea was to create a stored program computer
- An important feature of this device was that operating instructions and function tables would be stored in exactly the same sort of memory device as that used for numbers
- This notion of stored-program computing has been central to every computer that has come since

UNIVAC 1 – Universal Automatic Computer

- First commercial computer, launched the commercial computer industry
- It used about 5,000 vacuum tubes, weighed 16,686 pounds and consumed 125 kW
- It could perform about 1,905 operations per second running on a 2.25 MHz clock and occupied more than 35.5 m^2 (382 ft^2) of floor space

Read more here: https://en.wikipedia.org/wiki/EDVAC and https://en.wikipedia.org/wiki/UNIVAC_1

Youtube video: https://www.youtube.com/watch?v=ZU-IVshCAss

Evolution of Computers

Microprocessors

- First microprocessor is Intel 4004 (1971, 4-bit)
- First computer based on microprocessor is Intel SIM4-01
- First microprocessor used in a "PC" is 8008 (1972, 8-bit)
- First PC based on 8008 is Micral (1973)
- First IBM PC was available in 1981 (8088, 4.77MHz, 16-bit, x86 architecture)
- First Pentium processor introduced by Intel in 1993 (200 MHz), Pentium-II (1997, 500 MHz), Pentium-III (1999, 900 MHz), Pentium 4 (2000, 2.26 GHz), all are based on x86 architecture and 32-bit
- First 64-bit processor is Intel Itanium (2001, 800 MHz)
- Then came the Core i3, i5, i7, i9, and high-end Xeon series processors (2010 onwards, microarchitecture)

Read more here: https://www.tomshardware.com/picturestory/710-history-of-intel-cpus.html and https://en.wikipedia.org/wiki/List_of_Intel_microprocessors

Evolution of Computers

Microprocessor VS Microcontroller VS Microcomputer

- Microprocessor
  - is a single integrated circuit that has ability to perform all the functions of central processing unit in a single microchip
- Microcontroller
  - is a highly integrated chip that has all the necessary components present in a single microchip
- Microcomputer
  - is simply a personal computer with all the circuitry at one place, but not in single chip

Evolution of Computers

Computer History Museum

- Located in Mountain View, perhaps the best computer history museum in the world
- Exhibit first 2000 years of computing

Ref: https://www.computerhistory.org

THANK YOU