Charles Babbage (1791-1871)

- o Creator of the Analytical Engine - the first general-purpose digital computer (1833)

The Analytical Engine

- o A programmable, mechanical, digital machine
- o Could carryout any calculation
- o Could make decisions based upon the results of the previous calculation
- o Components: input; memory; processor; output

Ada, Countess of Lovelace(1815-52)

- o Babbage: the father of computing

- Ada: the mother?

- o Wrote a program for computing the Bernoulli's sequence on the Analytical Engine - world's 1st computer program
- o Ada: A programming language specifically designed by the US Dept of Defense for developing military applications was named Ada to honor her contributions towards computing

A lesson that we all can learn from Babbage's Life

Charles Babbage had huge difficulties raising money to fund his research

- o As a last resort, he designed a clever mathematical scheme along with Ada, the Countess of Lovelace
- o It was designed to increase their odds while gambling. They bet money on horse races to raise enough money to support their research experiments
- o Guess what happened at the end? The lost every penny that they had.

   1. Fast

   2. Bored

3. Storage

Here is a fact:

In 1997 Deep Blue, a supercomputer designed by IBM, beat Gary Kasparov, the World Chess Champion
That computer was exceptionally fast, did not get tired or bored. It just kept on **analyzing** the situation and kept on **searching** until it found the perfect move from its list of possible moves …

The "Turing test"

A test proposed to determine if a computer has the ability to think. In 1950, Alan Turing (Turing, 1950) proposed a method for determining if machines can think. This method is known as The Turing Test.

Vacuum Tube – 1904

A vacuum tube is just that: a glass tube surrounding a vacuum (an area from which all gases has been removed). A British scientist named John A. Fleming made a vacuum tube known today as a diode. Then the diode was known as a "valve,"

ABC – 1939

The Atanasoff-Berry Computer was the world's first electronic digital computer. It was built by John Vincent Atanasoff and Clifford Berry at Iowa State University during 1937-42.

Harvard Mark 1 – 1943

Howard Aiken and Grace Hopper designed the MARK series of computers at Harvard University. clicking metal parts, 55 feet long and 8 feet high. The 5-ton device contained almost 760,000 separate pieces. Used by the US Navy for gunnery and ballistic calculations, the Mark I was in operation until 1959.

ENIAC – 1946

ENIAC (**E**lectrical **N**umerical **I**ntegrator **A**nd **C**alculator). The U.S. military sponsored their researchIt took the team about one year to design the ENIAC and 18 months and 500,000 tax dollars to build it. The ENIAC contained 17,468 vacuum tubes, along with 70,000 resistors and 10,000 capacitors.

Transistor

The first transistor was invented at Bell Laboratories on December 16, 1947 by William Shockley. Compared to vacuum tubes, it offered:

- smaller size
- better reliability
- lower power consumption
- lower cost

Floppy Disk – 1950:

Invented at the Imperial University in Tokyo by Yoshiro Nakamats.

UNIVAC 1 – 1951

The first commercially successful electronic computer, UNIVAC I, was also the first general purpose computer - designed to handle both numeric and textual information. It was designed by J. Presper Eckert and John Mauchly.

Compiler – 1952

Grace Murray Hopper an employee of Remington-Rand worked on the NUIVAC. She took up the concept of reusable software in her 1952 paper entitled "The Education of a Computer" and developed the first software that could translate symbols of higher computer languages into machine language. (Compiler)

ARPANET – 1969

ARPA was assigned to research how to utilize their investment in computers via Command and Control Research (CCR). Dr. J.C.R. Licklider was chosen to head this effort. Developed for the US DoD Advanced Research Projects Agency

Intel 4004 – 1971

The 4004 was the world's first universal microprocessor.

Altair 8800 – 1975

Developers Edward Roberts, William Yates and Jim Bybee spent 1973-1974 to develop the MITS (Micro Instruments Telemetry Systems) Altair 8800. The price was $375, contained 256 bytes of memory (not 256k),but had no keyboard, no display, and no auxiliary storage device.

Cray 1 – 1976

The Cray 1 was the world's first "supercomputer," a machine that leapfrogged existing technology when it was introduced in 1971.

IBM PC – 1981

On August 12, 1981, IBM released their new computer, re-named the IBM PC. The "PC" stood for "personal computer" making IBM responsible for popularizing the term "PC".

The first IBM PC ran on a 4.77 MHz Intel 8088 microprocessor. The price tag started at $1,565, which would be nearly $4,000 today.

Apple Macintosh – 1984

Apple introduced the Macintosh to the nation on January 22, 1984. The original Macintosh had 128 kilobytes of RAM, although this first model was simply called "Macintosh" until the 512K model came out in September 1984. The Macintosh retailed for $2495.

World Wide Web -1989

WWW quickly gained great popularity among Internet users.

What is World Wide Web?

- A huge resource of information
- Logically unified: Any one from any where can access the information using a very simple scheme consisting of links & URLs
- Physically distributed: The information is stored on Internet-connected computers that are spread all over the globe

Browser

A browser is an application program that provides a way to look at and interact with all the information on the World Wide Web.

URL

URL (Uniform Resource Locator, previously Universal Resource Locator) – pronounced YU-AHR-EHL or, in some quarters, UHRL - is the address of a file (resource) accessible on the Internet.

How many Web pages are there?

- In 1999 there were 800 million Web pages (15 terra (1012) bytes of text)
- In year 2002, the number is supposed to be 8 billion
- If you spend a minute reviewing each of these pages, it will take more than 15,000 years to go through them all

What is secret behind the explosive growth of the Web?

- Anarchy – any page is allowed to link to any other
- There are no controls over who puts what on the Web

Everyone can put whatever they want to put on the Web – and they do!

The most popular Web sites?

- AOL – Most popular ISP's Web site
- Microsoft – Most popular software developer's Web site
- Yahoo – Most popular multi-service Web site
- Amazon – most popular shop on the Web
- CNN – most popular news Web site
- Google – most useful search engine

What is a Web Site?

A Web site is a related collection of World Wide Web (WWW) files that includes a beginning file called a home page.

What is a Web Search Engine?

- Search engines continuously scan the Web and compile a list of all the Web pages that they find

Internet & Web

- The "Internet" and the "Web" are not the same
- In fact, the "Web" is a service that runs over the "Internet". In addition to the Web, there are many other services that run over the Interne.
- Internet is like the network of roads in a city, whereas Web is a service like the Bus Service that run over those roads. Just like other services can use the roads (e.g. wagons),

Info is available on Web

Information about almost every thing known to mankind and then some!

The info is in the form of:

– Text

– Graphics

– Animation

– Video

– Sound

The Semantic Web

- What unique feature distinguishes the Web of today with the Semantic Web of tomorrow?

- Whereas, today's Web's content is designed for humans to read; the Semantic Web's content will be designed for computers to understand meaningfully
- However, the Semantic Web is not a replacement but an extension of the present Web, in which information is given well defined meaning
- Some progress is already being made for adding "Semantic Content" on to the Web, but a lot more will happen in the next 5 years

Computer Types

Computer types according to capability are

- Supercomputers
- Mainframes
- Servers
- Desktops
- Portables

Supercomputers

- State-of-the-art machines designed to perform calculations as fast as the current technology allows
- Used to solve extremely complex and large-scale problems: weather prediction, simulation of atomic explosions; aircraft design; movie animation
- Cost tens of millions of dollars

The Champion: ASCI White

- Most powerful computer as of February 2002
- Capable of 12.3 trillion calculations/sec
    - 74,000 times faster than Cray 1 (1976)
    - 1,000 times faster than Deep Blue (1997)
- Designed for complex 3-D simulations required for testing nuclear weapons
- Powered by 8192 microprocessors
- 6 TB of memory; 160 TB of storage capacity

Mainframe Computers

- Also called "Enterprise Servers"
- Designed for performing multiple, intensive tasks for multiple users simultaneously
- Used by large businesses (e.g. banks, e-commerce sites), military, and industrial organizations
- Designed for very-high reliability
- Cost in millions of dollars

Servers/Minicomputers

- The name minicomputers used to define the class of computers that lies between personal computers and mainframes
- Generally are more reliable than desktops, but not as solid as the mainframes
- Costs in hundreds of thousands of dollars

Desktop Computers

- Also called microcomputers
- Low-end desktops are called PC's and high-end ones "Workstations"
- PC's are used for running productivity applications, Web surfing, messaging
- Workstations cost a few thousand dollars; PC around a $1000

Mobile Computers

Laptops, palmtops, and wearable computers are very capable computers but are light-weight and consume very little power

Laptops

- also called notebook computers
- generally weigh around 2kg
- use special low-power processors
- typically have 256MB memory,
- 40GB of storage
- can work for more than 2 hours on battery.
- Their usage is similar to that of PCs
  They cost in the range of $1500-2500

Palmtops,

- also known as PDA's - Personal Digital Assistants
  Weigh less than a pound
- have very low-power processors
- KB's of memory
- MB's of storage capacity
- Can run for many hours on AA batteries
- Used as an electronic version of a pocket diary
- Also for Web surfing and e-mail or even as mobile phones
- Palmtops cost $200-600

Wearables

- are small in size
- carried in a pocket
- worn on the arm, waist
- or head or elsewhere on the body
- Capability similar to PDA's
- but more expensive
- They are always ON, and always accessible. That is, the user can always enter and execute commands, even while walking around or doing other activities
- Each soldier of the future will be fitted with one

Ranking w.r.t. installed number

- PC's
- PDA's

- Workstations
- Servers
- Wearables (will take the top spot in future)
- Mainframes
- Supercomputers

Essential Hardware Components

At the highest level, two things are required for computing

Hardware: The physical equipment in a computing environment such as the computer and its peripheral devices (printers, speakers, etc.)

Software: The set of instructions that operates various parts of the hardware. Also termed as "computer program

All computers have the following essential hardware components:

Input

The devices used to give the computer data or commands are called Input devices. Includes keyboard, mouse, scanner, etc

Processor

A processor is the logic circuitry that responds to and processes the basic instructions that drive a computer.

Memory

Memory is the electronic holding place for instructions and data that your computer's microprocessor can reach quickly.

Storage

Computer storage is the holding of data in an electromagnetic form for access by a computer processor.

Output

The devices to which the computer writes data are called Output devices

Input Devices

Mouse

A mouse is a small device that a computer user pushes across a desk surface in order to point to a place on a display screen and to select one or more actions to take from that position. **Keyboard**

On most computers, a keyboard is the primary text input device. A keyboard on a computer is almost identical to a keyboard on a typewriter.

Joystick

In computers, a joystick is a cursor control device used in computer games.

Digital Camera

A digital camera records and stores photographic images in digital form that can be fed to a computer as the impressions are recorded or stored in the camera for later loading into a computer or printer. Currently, Kodak, Canon, and several other companies make digital cameras.

Microphone

A device that converts sound waves into audio signals. These could be used for sound recording as well as voice chatting through internet.

Scanner

A scanner is a device that captures images from photographic prints, posters, magazine pages, and similar sources for computer editing and display.

What is a Port?

On computer and telecommunication devices, a *port* (noun) is generally a specific place for being physically connected to some other device, usually with a socket and plug of some kind.

Many Types of Ports

1. Parallel
2. Serial
3. SCSI
4. USB
5. Firewire

Parallel

An interface on a computer that supports transmission of multiple bits at the same time; almost exclusively used for connecting a printer.

Serial

It is a general-purpose personal computer communications port in which 1 bit of information is transferred at a time.

SCSI

A port that's faster than the serial and parallel ports but slower and harder to configure than the newer USB port. Also know as the Small Computer System Interface.

USB

USB (Universal Serial Bus) is a plug-and-play hardware interface for peripherals such as the keyboard, mouse, joystick, scanner, printer and modem.

Firewire

FireWire is simply a really fast port that lets you connect computer peripherals and consumer electronics to your computer without the need to restart.

Processor

- Pentium
- Celeron
- Athlon
- PowerPC
- StrongARM (PDA)
- Crusoe (Laptops)
- SPARC (Workstations)

Memory/Storage

RAM

RAM (random access memory) is the place in a computer where the operating system,

Punch cards

A card on which data can be recorded in the form of punched holes

ROM

ROM is "built-in" computer memory containing data that normally can only be read, not written to. **Hard disk**

Hard disk is a computer storage device which saves and retrieves the data when required. **Floppy disk**

A diskette is a random access, removable data storage medium that can be used with personal computers.

Tape

In computers, tape is an external storage medium, usually both readable and writable, can store data in the form of electromagnetic charges that can be read and also erased.

CD

A compact disc [sometimes spelled *disk*] (CD) is a small, portable, round medium for electronically recording, storing, and playing back audio, video, text, and other information in digital form.

DVD

DVD (digital versatile disc) is an optical disc technology that is expected to rapidly replace the CD-ROM disc (as well as the audio compact disc) over the next few years. The digital versatile disc (DVD) holds 4.7 gigabyte of information on one of its two sides, or enough for a 133-minute movie.

Classifying Memory/Storage

- Electronic (RAM, ROM)
- Magnetic (HD, FD, Tape), optical (CD, DVD)
- Volatile (RAM), non-volatile (HD)
- Direct access (RAM, HD), serial access (Tape)
- Read/write (HD, RAM), read-only (CD)

Output Devices

- Printer
- Plotter
- Speakers
- Monitor

Modem is output as well as input device at the same time.

PC Parts

- Monitor
- Keyboard
- Mouse
- Speaker/headphone
- Microphone
- CPU
- Front buttons
- Backside ports, fan, slots, cables

Inside CPU

- Power supply/fan & connectors
- Motherboard
- Bus
- Edge connectors
- Ports
- Video card
- Modem
- Network card
- Sound card
- ROM
- RAM
- Slots
- DIMM's

The Processor Module

- The slot on the motherboard
- The housing
- Fan
- Heat sink
- Pins (256?), Transistors (10 million?)

HTML Page

HTML

Hyper Text Markup Language

<HTML>

<HEAD>

<TITLE>Altaf Khan's Home Page</TITLE>

</HEAD>

<BODY>

<H1>Altaf Khan</H1>

<P><B>Adjunct Lecturer in Computer Science</B>

<A HREF="http://www.vu.edu.pk/">Virtual University</A>

Building 1, 3rd Floor, Aiwan-e-Iqbal, Lahore

+92 42 555 1212

<A HREF="mailto:altaf@vu.edu.pk">altaf@vu.edu.pk</A>
</P>

<P>I teach the <A HREF="http://www.vu.edu.pk/cs101/">Introduction to Computing</A> course. </P>

</BODY>

</HTML>

Microprocessor

A microprocessor (abbreviated as **µP** or **uP**) is a computer processor on a microchip. It's sometimes called a *logic chip*. A microprocessor is designed to perform arithmetic and logic operations that make use of small number-holding areas called *registers*.

Integrated circuit

- Commonly known as an IC or a chip
- A tiny piece of Silicon that has several electronic parts on it

Components of integrated are

- Devices
- Transistors
- Diodes
- Resistors
- Capacitors
- Wires

And are made of the following materials

- Silicon - semiconductor
- Copper - conductor
- Silicon Dioxide - insulator

A Microprocessor System

- Microprocessors are powerful pieces of hardware, but not much useful on their own
- A microcomputer is 1 example of a microprocessor system

Micro Controller

- Micro-controllers are another type of microprocessor systems
- They are generally not that powerful, cost a few dollars a piece, and are found embedded in video games, VCRs, microwave ovens, printers, autos, etc.

The Main Memory Bottleneck

- Modern super-fast microprocessors can process a huge amount of data in a short duration
- They require quick access to data to maximize their performance

On-Chip Cache Memory

That small amount of memory located on the same chip as the microprocessor is called On-Chip Cache Memory

Bus Interface Unit

The bus interface unit is the part of the processor that interfaces with the rest of the PC.

Instruction Decoder

The *instruction decoder* of a processor is a combinatorial circuit sometimes in the form of a read-only memory,

A **decoder** is a device which is the reverse, undoing the encoding so that the original information can be retrieved.

Microprocessor Building Blocks

Arithmetic & Logic Unit (ALU)

An arithmetic and logical unit **(ALU)** also known as **"Integer Unit"** is one of the core components of all central processing units.

Floating-Point Unit (FPU)

A floating point unit (FPU) is a part of a CPU specially designed to carry out operations on floating point numbers.

Registers

A register is a device for storing data. It is a small amount of very fast computer memory used to speed the execution of computer programs by providing quick access to commonly used values.

Data registers are used to store integer numbers.

Address registers hold memory addresses and are used to access memory.

General Purpose registers can store both data and addresses.

Floating Point registers are used to store floating point numbers.

Constant registers hold read-only values (e.g zero or one).

Vector registers hold data for Single Instruction Multiple Data (SIMD) instructions.

Special Purpose registers which store internal CPU data like the stack pointer or processor status words.

Control Unit

A control unit is the part of a CPU or other device that directs its operation. The outputs of the unit control the activity of the rest of the device. A control unit can be thought of as a finite state machine. It is called the brain of computer microprcessor.

Instruction Set

The set of machine instructions that a microprocessor recognizes and can execute – the only language microprocessor knows

The 1st microprocessor : Intel 4004

- Introduced 1971
- 2250 transistors
- 108 kHz, 60,000 ops/sec
- 16 pins
- 10-micron process
- Cost: less than $100

Currently Popular Intel Pentium 4 (2.2GHz)

- Introduced December 2001
- 55 million transistors
- 32-bit word size
- 2 ALU's, each working at 4.4GHz
- 128-bit FPU
- 0.13 micron process
- Targeted use: PC's and low-end workstations
- Cost: around $600

Moore's Law

- In 1965, one of the founders of Intel – Gordon Moore – predicted that the number of transistor on an IC (and therefore the capability of microprocessors) will double every year. Later he modified it to 18-months

Enhancing the capability of a microprocessor

The computing capability of a microprocessor can be enhanced in many different ways:

- By increasing the clock frequency
- By increasing the word-width
- Improving the architecture

Binary

(Base 2) number system

Decimal

(Base 10) number system

Binary (Base 2) number system consists of just two digits 0,1

Decimal (Base 10) number system consists of ten symbols or digits 0,1,2,3,4,5,6,7,8,9

Other popular number systems

Octal
base = 8
8 symbols (0,1,2,3,4,5,6,7)

Hexadecimal
base = 16
16 symbols (0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F)

Why Binary?

- Because this system is natural for digital computers

Bit stands for **B**inary Dig**it**

Byte = 8 Bits

Decimal to Binary conversion

Check

$1001011 = 1 \times 2^0 + 1 \times 2^1 + 0 \times 2^2 + 1 \times 2^3 + 0 \times 2^4 + 0 \times 2^5 + 1 \times 2^6$

$= 1 + 2 + 0 + 8 + 0 + 0 + 64$

$= 75$

Boolean Logic Operations

We define the following logic operations or functions among the Boolean variables

Name	Example	Symbolically
NOT	$y = NOT(x)$	x'
AND	$z = x \, AND \, y$	$x \cdot y$
OR	$z = x \, OR \, y$	$x + y$

XOR	$z = x$ XOR y	x Ă y

Truth Table of Logic Function
A truth table defines the output of a logic function for all possible inputs

Truth Table for the NOT Operation
(y true whenever x is false)

X	$y = x´$
0	
1	

Truth Table for the NOT Operation

X	$y = x´$
0	1
1	0

Truth Table for the AND Operation
(z true when both x & y true

X	y	$z = x \cdot y$
0	0	
0	1	
1	0	
1	1	

Truth Table for the AND Operation

X	y	$z = x \cdot y$
0	0	0
0	1	0
1	0	0
1	1	1

Truth Table for the OR Operation
(z true when x or y or both true)

x	y	z = x + y
0	0	
0	1	
1	0	
1	1	

Truth Table for the OR Operation

x	y	z = x + y
0	0	0
0	1	1
1	0	1
1	1	1

Truth Table for the XOR Operation
(z true when x or y true, but not both)

X	y	z = x ⊕ y
0	0	
0	1	
1	0	
1	1	

Truth Table for the XOR Operation

X	y	z = x Å y
0	0	0
0	1	1
1	0	1
1	1	0

General Structure of HTML tags

Single tag

<tagName>
Example:

Single Tags with Attributes

<tagName attributes>
Example: <HR width="50%">

Paired Tags

<tagName> … </tagName>
Example: <H1> … </H1>

Paired Tags with Attributes

<tagName attributes> … </tagName>
Example: <H1 align="center"> … </H1>

Code for the List and Table

<UL>
<LI>SimCity</LI>
<LI>Quake</LI>
<LI>Bridge</LI>
</UL>

<TABLE border = "1" >
<TR>
<TH>Indoor</TH>

```
<TH>Outdoor</TH>
</TR>
<TR>
<TD>Squash</TD>
<TD>Cricket</TD>
</TR>
</TABLE>
```

Lists

HTML code	Browser Display

`<UL>`
 	
 `<LI>SimCity</LI>`
 	
 `<LI>Quake</LI>`
 	
 `<LI>Bridge</LI>`
 	
 `</UL>`
	• SimCity
	 • Quake
	 • Bridge

`<UL>` Un-ordered List   `<LI>` Line items

The default "bullet" for these lists is a "disc"

That, however, can be changed to a "circle" or a "square" with the help of the type attribute

HTML code	Browser Display

`<UL type="circle">`
 	
 `<LI>SimCity</LI>`
 	
 `<LI>Quake</LI>`
 	
 `<LI>Bridge</LI>`
 	
 `</UL>`
	• SimCity
	 • Quake
	 • Bridge

HTML code	Browser Display

`<UL type="square">`
 	
`<LI>SimCity</LI>`
 	
`<LI>Quake</LI>`
 	
`<LI>Bridge</LI>`
 	
`</UL>`
	• SimCity
	• Quake
	• Bridge

Q: What happens if I start a new list without closing the original one?

HTML code	Browser Display

`<UL>`
`<LI>SimCity</LI>`
`<LI>Quake II</LI>`
 	
`<UL>`
`<LI>SimCity 3000</LI>`
`<LI>Quake III</LI>`
`</UL>`
 	
`<LI>Bridge</LI>`
`</UL>`
	• SimCity
	• Quake II
	    ○ SimCity 3000
	    ○ Quake III
	• Bridge

Such structures, i.e., those in which another starts before the first list is finished, are called **Nested Lists**

Types of Lists

In addition to un-ordered lists, HTML supports two other types

- Ordered Lists
- Definition List

Ordered List

Ordered List	Browser Display

`<OL>`
`<LI>SimCity</LI>`
`<LI>Quake</LI>`
`<LI>Bridge</LI>`
`</OL>`
	1. SimCity
	
	2. Quake

Ordered List	Browser Display

`<OL type = "a">`
`<LI>SimCity</LI>`
`<LI>Quake</LI>`
`<LI>Bridge</LI>`
`</OL>`
	1. SimCity
	
	2. Quake
	3. Bridge

Ordered List Types

Type	Result
"A"	A, B, C, …
"a"	a, b, c, …
"I"	I, II, III, IV, …
"i"	i, ii, iii, iv, …
"1"	1, 2, 3, …

Q: How would one start an ordered list with something other than 1

Ordered List	Browser Display

`<OL start = 25>`
`<LI>SimCity</LI>`
`<LI>Quake</LI>`
`<LI>Bridge</LI>`
`</OL>`
	25. SimCity
	26. Quake
	27. Bridge

Definition List

Definition List	Browser Display

`<DL>`
`<DT>SimCity</DT>`
`<DD>A great simulation game in which one build cities`
	SimCity
	
	A great simulation game

</DD> <DT>Quake</DT> <DD> One of the best of the shoot- em-up genre </DD> </DL>	in which one build cities Quake One of the best of the shoot-em-up genre

<DL>	Definition List
<DT>	Term
<DD>	Definition

Ordered lists as well as definition lists can be nested just like the un-ordered lists
Can any type of list be nested into any other type?

- Lists are one way of presenting data in a an ordered or formal fashion
- Tables provide another - more customizable - way of displaying ordered information on Web pages

Tables

HTML code	Browser Display
<TABLE border = "1" > <TR> <TH>Indoor</TH> <TH>Outdoor</TH> </TR> <TR> <TD>Squash</TD> <TD>Cricket</TD> </TR> </TABLE>	**Indoor Outdoor** SquashCricket

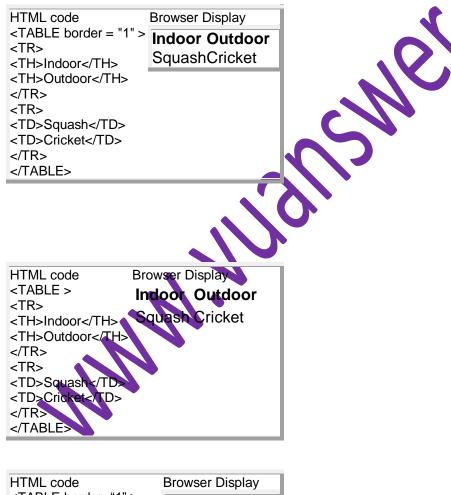|	
<TABLE>	Table (made up of rows)
<TR>	Row (made up of data cells)
<TH>	Heading Data Cell (Can contain paragraphs, images, lists, forms, tables)

<TD>	Data Cell (Can contain paragraphs, images, lists, forms, tables)

<TABLE> Attributes

- **BORDER**
  Determines the thickness of the table border
  Example: <TABLE BORDER = "2">
- **CELLPADING**
  Determines the distance between the border of a cell and the contents of the cell
  Example: <TABLE CELLPADDING = "3">
- **CELLSPACING**
  Determines the empty spacing between the borders of two adjacent cells
  Example: <TABLE CELLSPACING = "1">

HTML code	Browser Display
<TABLE border = "1" > <TR> <TH>Indoor</TH> <TH>Outdoor</TH> </TR> <TR> <TD>Squash</TD> <TD>Cricket</TD> </TR> </TABLE>	**Indoor Outdoor** SquashCricket

HTML code	Browser Display
<TABLE > <TR> <TH>Indoor</TH> <TH>Outdoor</TH> </TR> <TR> <TD>Squash</TD> <TD>Cricket</TD> </TR> </TABLE>	**Indoor Outdoor** Squash Cricket

HTML code	Browser Display
<TABLE border="1" > <TR> <TH colspan="2"> Indoor Outdoor </TH> </TR>	**Indoor Outdoor** Squash Cricket

```
<TR>
<TD>Squash</TD>
<TD>Cricket</TD>
</TR>
</TABLE>
```

HTML code	Browser Display

`<TABLE border = "1" >`
`<CAPTION>`
`My favorite sports`
`</CAPTION>`
`<TR>`
`<TD>Squash</TD>`
`<TD>Cricket</TD>`
`</TR>`
`</TABLE>`
	My favorite sports
	
	Squash Cricket
	
	Squash Cricket

Computer Software

- The HW needs SW to be useful; the SW needs HW to be useful
- When the user needs something done by the computer, he/she gives instructions in the form of SW to computer HW

Machine Language

- Machine language, though readily understood by microprocessors, is very difficult to write in for human programmers

Language Translators

- Human programmers write programs in a language that is easy to understand for them

Software Development

- The SW development process involves many steps, and coding, that is typing the instructions in a high-level language is only a small part of that process – taking-up only around 15% of the effort

Two Major Types of Software

- **System SW**
  Programs that generally perform the background tasks in a computer. These programs, many times, talk directly to the HW

- **Application SW**
  Programs that generally interact with the user to perform work that is useful to the user. These programs generally talk to the HW through the assistance of system SW

System Software

Operating Systems

- It interacts directly with the computer HW
- Other SW normally does not directly interact with the HW, but through the OS

    Examples:
     Windows , Mac , OS , Linux , Unix , Solaris , DOS , CP/M , VMS

Firmware

- Firmware consists of startup and a few low-level I/O routines that assist the computer in finding out and executing the rest of the OS
- On IBM-compatible PC's, it is called BIOS

Utilities

- Computer programs that perform a particular function related to computer system management and maintenance

    Examples:

1- Anti-virus SW
    2- Data compression SW
    3- Disk optimization SW
    4- Disk backup SW

Language Translator

1- Compiler translates the program written in a HLL in one go.
2- nterpreter translates the HLL program one statement at time.

Device Drivers

- A computer program that facilitates the communication between the computer and a peripheral device (e.g. printer, mouse, etc.)

Application Software

Application SW are programs that interact directly with the user for the performance of a certain type of work

- **Scientific/engineering/graphics SW**
  Mathematica; AutoCad; Corel Draw
- **Business SW**
  The billing system for the mobile phone company
- **Productivity SW**
  Word processors; Spreadsheets
- **Entertainment SW**
  Games
- **Educational SW**
  Electronic encyclopedias; The VU Web site

Another way of classifying Software

- Shrink-Wrapped SW
    -You can just go to a shop and buy it
- Custom-built SW
    -You cannot just go to a shop and buy it; you have to find someone who can develop it for you

Who Owns Software?

- Generally, although a piece of SW that is being used by millions, it is not owned by any of them! Instead, it is owned by the maker of the SW

Three Main Types of Software Licenses

1. **Proprietary** – Most software on a Windows PC or a Macintosh belongs to this category
2. **Freeware** – Most software on a Linux PC belongs to that category
3. **Shareware** – the category which lies between the above two categories

Proprietary SW License

- The user needs to pay the maker of the SW for buying a license that allows the user to use the SW

Types of Proprietary Licenses

- Single-user license
- Multi-user license
- Concurrent-user license
- Site license

Freeware SW License

Allows the user free use of the SW

Open-Source SW License

- Some authors give away the machine code only, which is extremely difficult to modify, if at all!

Shareware SW License

- Allows the user free use of the SW, but with a request that the user pay the author a small amount (US$10-50) if the user is satisfied with the SW

Trialware

- The SW is usable for a short period only

Interactive Forms (1)

- Without forms, a Web site is "read-only" – it just provides information to the user

Interactive Forms (2)

- Can be simple or very complex
- Are always placed between the <BODY> and </BODY> tags of a Web page

Interactive Forms (3)

- Text fields
- Check boxes
- Buttons

Server-Side Scripts

- Are programs that reside on Web servers
- Receive info that a user enters in a form
- Process that info and take appropriate action

  Examples:

  CGI scripts on Unix servers

  ASP scripts on Windows servers

Application Software

Application software are programs that interact directly with the user

They generally do not talk directly to the hardware

Classification According to the Mode

Interactive-mode

The user runs the program on the computer and keeps on interacting with the computer while the program runs

Example: Word processor

Batch-mode

The user starts the program and the computer processes the provided data and produces results without any further intervention of from the user

Example: Payroll

Classification According to Application Area

Scientific/engineering/graphics

Business

Productivity

Entertainment

Educational

Scientific SW

Simulation of natural systems

Mathematical computation packages

MathCAD

Engineering SW

Computer-aided design (CAD)

AutoCAD

Telecommunication system SW

Graphics & Animation SW (1)

Two types:

1. Vector graphics

Treats everything that is drawn as an object

These objects can later be easily moved, stretched, duplicated, deleted, etc

Are resolution independent

Relatively small file size

Example: MS Visio, Corel Draw, Flash

Graphics & Animation SW (2)

2. Bit-mapped or raster graphics

Treats everything that is drawn as a bit-map

Example: MS Paint, Adobe Photoshop

Business Applications

Most of the SW being developed today belongs to this category

SW that is required to run most any sort of biz:

Payroll

General ledger

Order entry

Accounts receivable & accounts payable

Inventory control

E-Commerce Software

Reliability

Security

Ability to handle 1000's of transactions, simultaneously

ERP (Enterprise Resource Planning) SW

Very large scale, complex & expensive SW

Example: SAP, Oracle, PeopleSoft, Baan

DSS (Decision Support Systems) SW

Sometimes also called "expert systems"

Many times are based on a branch of computer science called "artificial intelligence"

Productivity SW

Most popular category in terms of licenses sold

Word Processing   -- Spreadsheets

Presentations   -- Databases

Word Processors

Probably the most popular productivity app

Style sheets

Spelling & grammar checking

Web Page Development SW

Web pages can be developed using a simple plain-text editor like the "notepad", but more efficient, easy-to-use HTML editors can make the process quicker

Spreadsheet SW (1)

Electronic replacement for ledgers Is used for automating engineering, scientific, but in majority of cases, business calculationsm.

Spreadsheet SW (2)

Consist of cells arranged in rows and columns

Presentation Development SW

Used to prepare multimedia material for lectures & presentations to display key points, graphics, animation, or video with the help of multimedia projectors

Small-Scale Databases SW (1)

Easy to use applications designed for efficient storage and fast and easy retrieval of data

Small-Scale Databases SW (2)

Before the advent of the currently popular "relational" database model, the data basing function was performed using what is called the "**flat-file**" model

A database consists of a file or a set of files. Information in these is stored in the form of records, and the records are further subdivided into fields

Productivity SW Suites

A set of stand-alone productivity applications designed to work easily with each other

Examples: MS Office, Corel WordPerfect Office

Document-Centered Computing (DCC)

The increasing cooperation among the apps included in productivity suites has given rise to a new computing model called DCC

Entertainment SW

Simple, intuitive, many times social UI's

Music & Video Players

Music players (WinAmp)

Video/Music players (Real player, Windows Media player, QuickTime player)

Music Generation & Movie Editing SW

A PC can be made the hub of a music making studio with help of appropriate HW & SW

Inexpensive, easy-to-use video editing SW has recently become available for the iMac

Games

Educational (especially for toddlers)

Sports

Educational SW

Electronic Encyclopedias

Great resource of useful information presented in a very interesting format

On-Line Learning

With time, the VU Web site will become more and more focused on interactive online learning

Interactive CD's

Same as on-line learning, but through a CD instead of a Web site

Attributes of Good Application Software

Easy to install, un-install

User Interface

Configurable

Has a tutorial and a complete help manual

Word Processing

The art and science of converting written information into a form that looks pleasing when printed

Word Processor

- The tool used to perform word processing
- Today, the term "word processor" generally means the SW used on a computer to perform the task of word processing

Uses of Word Processors

- Write a letter
- Address labels
- Research paper or report
- Advertisement
- Newsletter
- Magazines
- Book
- And thousands of other tasks

Desktop Publishing (DTP)

- A combination of word processing and graphic design. Used to develop elegant documents

DTP: Requirements

- High-end PC with a large-screen monitor
- Laser printer
- Scanner
- DTP SW
- Examples:

- Adobe PageMaker
- QuarkXPress
- Corel Ventura
- MS Publisher

Client Side Script

New Concept: Client-Side Scripts

- Small programs that are a part of the Web page and run on the user's (client's) computer
- They interact with the user to collect info or to accomplish other tasks
- Once it has been collected, they may help pass the collected info on to a server-side script

Advantages of Client-Side Scripting

- Reduced server load as it does not have to send messages to the user's browser about missing or incorrect data

Disadvantages

- Client-side scripts do not work with all browsers
- Some user intentionally turn scripting off on their browsers

JavaScript

Why JavaScript?

JavaScript can be used (along with HTML) to develop interactive content for the Web

What is JavaScript?

- A programming language specifically designed to work with Web browsers
- It is designed to be used for developing small programs – called scripts –

Definition of Algorithm

Sequence of steps that can be taken to solve a given problem is called Algorithm.

Examples:

Addition

Conversion from decimal to binary

The process of boiling an egg

The process of mailing a letter

Sorting

Searching

Origin of the Term "Algorithm"

The name derives from the title of a Latin book: Algoritmi de numero Indorum

That book was a translation of an Arabic book: Al-Khwarizmi Concerning the Hindu Art of Reckoning

That book was written by the famous 9-th century Muslim mathematician, Muhammad ibn Musa al-Khwarizmi

Al-Khwarzmi

Al-Khwarizmi lived in Baghdad, where he worked at the Dar al-Hikma

Dar al-Hikma acquired and translated books on science and philosophy, particularly those in Greek, as well as publishing original research

The word Algebra has its origins in the title of another Latin book which was a translation of yet another book written by Al-Khwarzmi:

Kitab al-Mukhtasar fi Hisab al-Jabr wa'l-Muqabala

Greedy Algorithm

An algorithm that always takes the best immediate, or local solution while finding an answer

Greedy algorithms may find the overall or globally optimal solution for some optimization problems

Deterministic Algorithm

An algorithm whose behavior can be completely predicted from the inputs

That is, each time a certain set of input is presented, the algorithm gives the same results as any other time the set of input is presented.

Randomized Algorithm

Any algorithm whose behavior is not only determined by the input, but also values produced by a random number generator

Heuristic

A procedure that usually, but not always, works or that gives nearly the right answer

The Brute Force Strategy

A strategy in which all possible combinations are examined and the best among them is selected

A Selection of Algorithmic Application Areas

Search

Sort

Cryptography

Parallel

Numeric

Graphical

Quantum computing

Combinatory

Syntax & Semantics

Flowchart

A graphical representation of a process (e.g. an algorithm), in which graphic objects are used to indicate the steps & decisions that are taken as the process moves along from start to finish

Algorithm Building Blocks

- Sequences
- Conditionals
- Loops

Strategy for Sorting

Repeat the following steps while the list is un-sorted:

Start with the first object in the list

Swap it with the one next to it if they are in the wrong order

Repeat the same with the next to the first object

Keep on repeating until you reach the last object in the list

Q: Is this the only possible algorithm for sorting a list?

A: Certainly not! In fact this one (called the "Bubble sort") is probably the worst (reasonable) algorithm for sorting a list – it is just too slow

Some of things that JavaScript cannot do!

- The following file ops. on the client computer:
  -- Read   -- Modify

-- Rename   -- Delete
-- Create

- Create graphics (although, it does have the ability to format pages through HTML - including the placement of graphics)

Some of the things that JavaScript can do!

- Control the appearance of the browser
- Control the content and appearance of the document displayed in the browser
- Store & modify a limited amount of data about the user in the form of client-side "cookies"

Client-Side JavaScript

Although a version of JavaScript exists that can be used to write server-side scripts, our focus in this course will only be on client-side scripting

Case Sensitivity

- HTML is not case sensitive. The following mean the same to the browser:
  <HTML> -- <html>
  <Html> -- <htMl>
- JavaScript is case sensitive. Only the first of the following will result in the desired function – the rest will generate an error or some other undesirable event:
  onMouseClick -- OnMouseClick
  onmouseclick -- ONMOUSECLICK

JavaScript is Object-Based

- Everything that JavaScript manipulates, it treats as an object – e.g. a window or a button

Not Object-Oriented!

- JavaScript is not a true object-oriented language like C++ or Java
- It is so because it lacks two key features:
  -- A formal inheritance mechanism
  -- Strong typing

Types of Objects

- JavaScript objects
  -- Objects that are part of JavaScript
  -- Examples: window, document
- Browser objects
  -- Objects that contain info not about the contents of the display, but the browser itself
  -- Examples: history, navigator
- User-defined object

Event Handlers

- "Events" are actions that occur as a result of user's interaction with the browser
- We use "event handlers" [e.g. onMouseOver(), onClick()] to design Web pages that can react to those events

1. Batch Programs

2. Event-Driven Programs

Batch Programs
These are typically started from a shell (or automatically via a scheduler) and tend to follow a pattern of:
Initialize internal data
Read input data
Process that data
Print or store results

Event-Driven Programs
Examples: GUIs, microwave, camera
The system sends events to the program and the program responds to these as they arrive.

Programming Language

A vocabulary and set of grammatical rules for instructing a computer to perform specific tasks
All programs consists of:

Sequence of instructions
Conditionals
Loops

These may contain:
Data
Input/output (print, etc)
Operations (add, divide, etc)
Examples of Prog. Languages

Types of Prog. Languages

High level Programming Languages
Low Level Programming Languages

High-level programming languages, while simple compared to human languages, are more complex than the languages the uP actually understands,
Assembly languages are similar to machine languages, but are easier to program in as they allow a programmer to substitute names for numbers

Machine languages consist of numbers

Interpreters: immediate response, but execute code slowly.

Compilers: Takes longer to compile, but super-fast execution.

Programming SW Development

SW Design Methodology ?

The set of (often flexible) rules and guidelines a team of developers follow to construct reasonably complex SW systems

- Object Oriented Design
- Structured Design

Object-Oriented Languages

Programming languages specifically designed to make it easy to implement object-oriented designs

Examples: Smalltalk, C++, Java

Variables

Variables give us the ability to manipulate data through reference instead of actual value.

Variables are names assigned to values.

Identifiers

Identifiers are names used by JavaScript to refer to variables (as well as objects, properties, methods, and functions!). An identifier must begin with an alphabetical character (a-z or A-Z) or the underscore "_" character.