

System Software and Software Development

Part I: System Software

Functions of an Operating System



- start up the computer
- administer security
- control a network
- access the Web
- monitor performance and provide housekeeping services
- schedule jobs and configure devices
- manage memory
- manage programs
- provide user interface

Where is the Operating System located?



operating system resides on ROM in handhelds



operating system resides on hard disk in most cases

Booting

■ Booting is a process of starting or restarting a

cold boot

Process of turning on a computer after it has been powered off completely

warm boot

Process of restarting a computer that is already powered on

What messages display on the screen when you boot up?

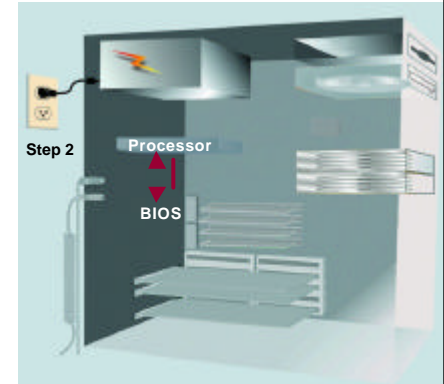
Annotations on the left side of the screenshot:

- BIOS version and copyright notice → ROM BIOS Version 2.10 A05
Copyright BIOS Tech Inc. 2003
All rights reserved
- total amount of memory → 0065536 KB
- devices detected and tested → Keyboard.....Detected
Mouse.....Detected
Hard Disk Installed WCW AC41600H
Floppy A: Installed
- Windows message → Starting Windows
- sound card and CD-ROM drivers loaded → SoundUTIL TSR Version 1.20
Copyright SoundCard Technology 2002-03
IDE CD-ROM Device Driver Version V2.33 (4/20/03)
Copyright Gaijin Electric Co.
1 drive(s) selected

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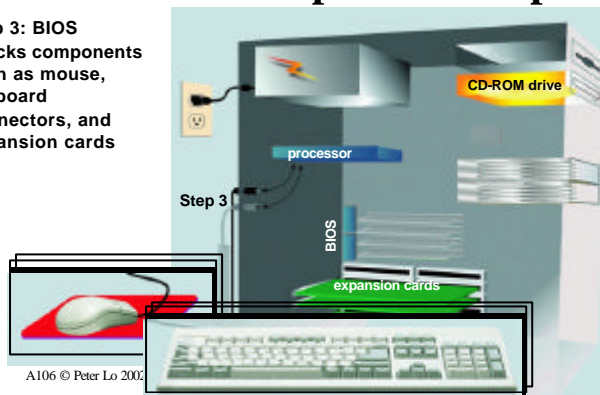
How does a computer boot up?

- 1: Power supply sends signal to components in system unit
- 2: The processor accesses BIOS to start computer



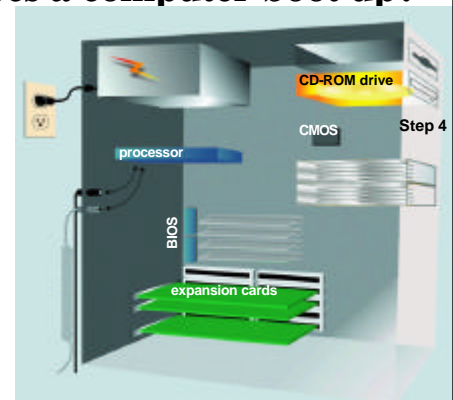
How does a computer boot up?

- Step 3: BIOS checks components such as mouse, keyboard connectors, and expansion cards



How does a computer boot up?

- Step 4: Results of POST are compared to data in the CMOS chip

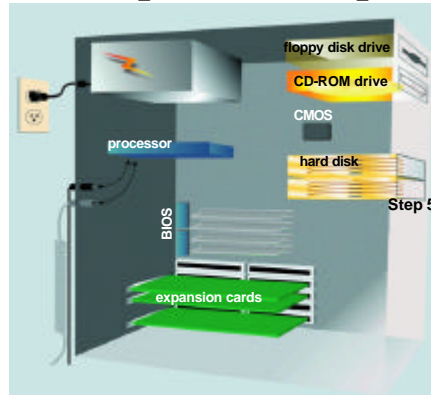


How does a computer boot up?

Step 5: BIOS looks for system files in drive A (floppy disk drive) and then drive C (hard disk)



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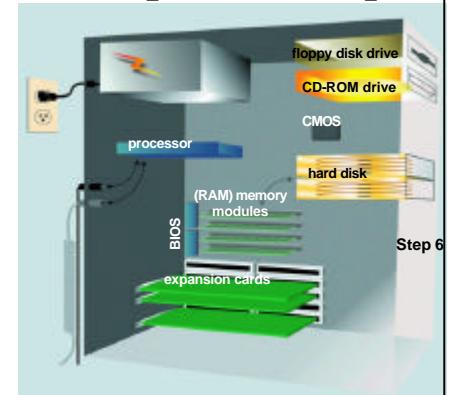


How does a computer boot up?

Step 6: Boot program loads kernel of operating system into RAM from boot drive

Operating system in memory takes control of computer

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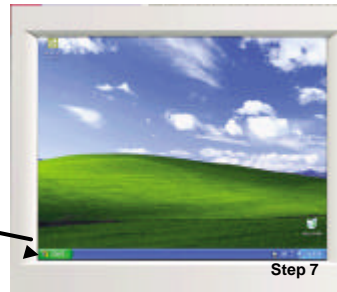


How does a computer boot up?

Step 7: Operating system loads configuration information and displays desktop on screen

Operating system executes programs in Startup folder

click Start to display list of applications you can run

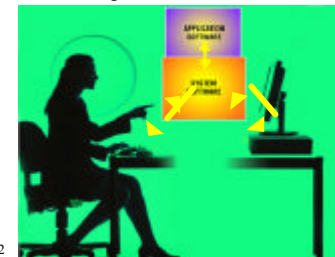


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System Software

- Programs that control the operations of the computer
- Serves as the interface between the user, the application software, and the computer's hardware

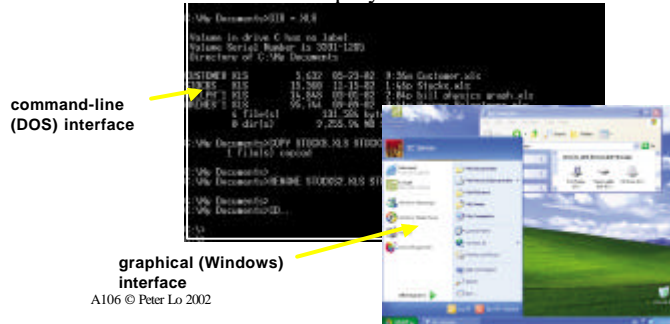


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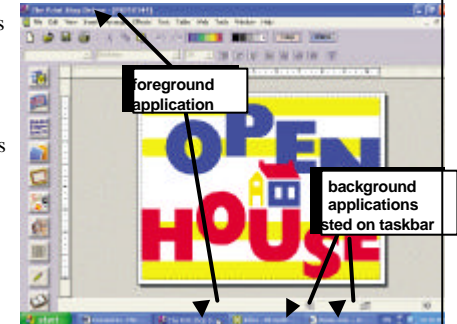
User Interface

- Controls how you enter data and instructions and how information displays on screen



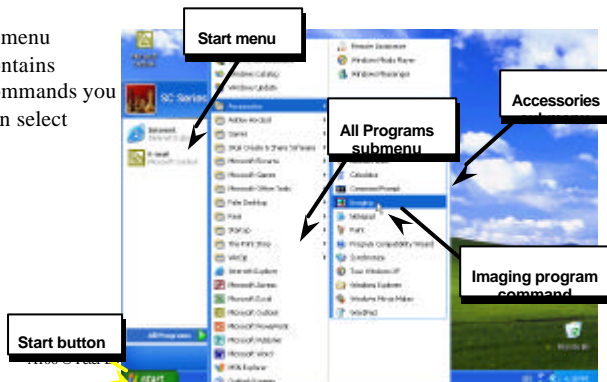
Multitasking

- Allows single user to work on two or more applications that reside in memory at same time
- ⊕ Foreground contains active application - the one you currently are using
- ⊕ Background contains inactive programs that are running but are not in use



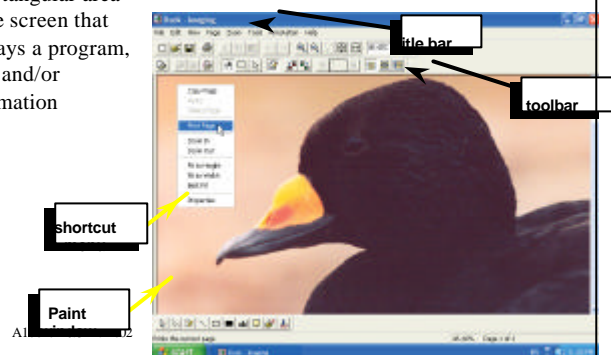
What is a menu?

- A menu contains commands you can select



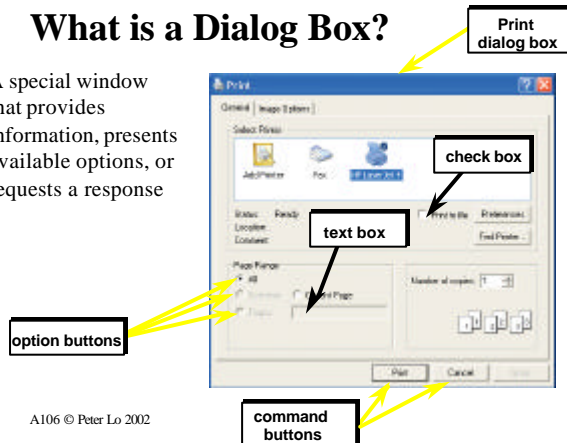
What is an application window?

- A rectangular area of the screen that displays a program, data, and/or information



What is a Dialog Box?

- A special window that provides information, presents available options, or requests a response



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What are other program management features of OS?

multiuser

Operating system enables two or more users to run a program simultaneously

multiprocessing

Operating system can support two or more processors running programs at same time

fault-tolerant computer

Continues to operate even if one of its components fails
Computer has duplicate components such as processors, memory, and disk drives

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Memory Management

- Optimizes the use of random access memory (RAM)

allocates, or assigns, data and instructions to area of memory while they are being processed

monitors contents of memory

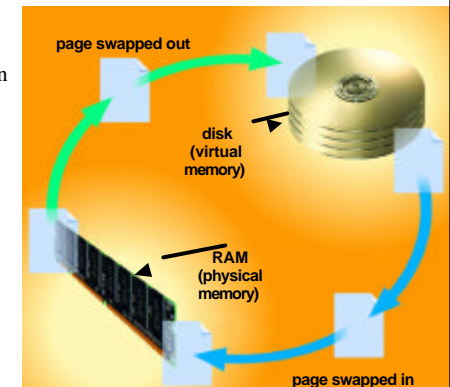
clears items from memory when processor no longer requires them

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Virtual Memory (VM) Management

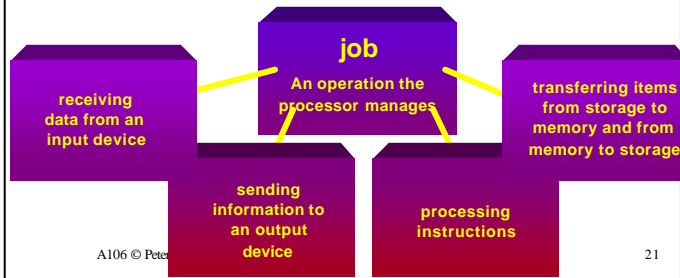
- Operating system allocates portion of hard disk to function like RAM
- Paging
- Thrashing



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How does an OS schedule jobs?

- Adjusts schedule based on job's priority

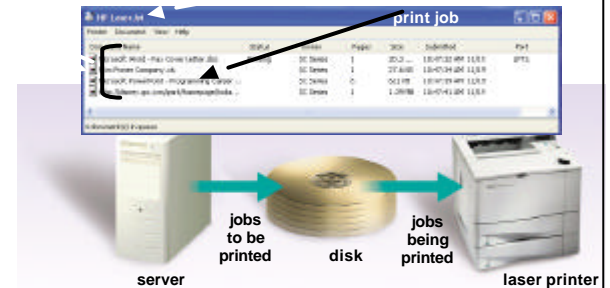


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Spooling

- Print jobs sent to buffer instead of directly to printer, where print jobs wait their turn



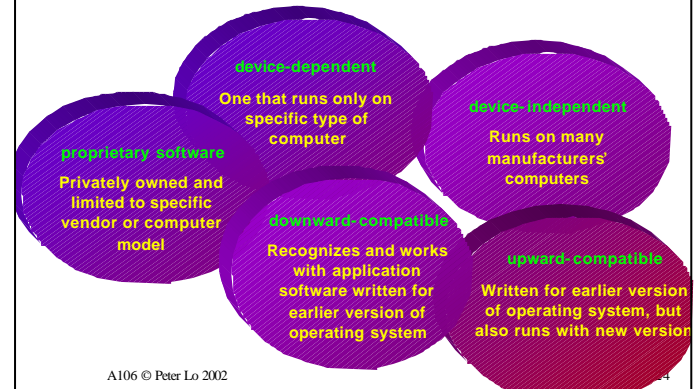
What are features of a network operating system?

- Server is computer that controls access to network and provides centralized storage area
- Other computers on network are called clients



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Characteristics of OS



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Types of Operating Systems

Stand-alone	<ul style="list-style-type: none"> • DOS • Windows 3.x • Windows 95 • Windows NT Workstation • Windows 98 • Windows 2000 Professional • Windows Millennium Edition • Windows XP Home Edition • Windows XP Professional Edition • Mac OS X • OS/2 Warp Client • UNIX • Linux
Network	<ul style="list-style-type: none"> • NetWare • Windows NT Server • Windows 2000 Server • Windows .NET Server • OS/2 Warp Server for eBusiness • UNIX • Linux • Solaris
Embedded	<ul style="list-style-type: none"> • Windows CE • Palm OS 2002 • Palm OS

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DOS (Disk Operating System)

- Refers to several single user operating systems developed in the early 1980s for personal computers

```

C:\My Documents>DIR *.xls
Volume in drive C has no label
Volume Serial Number is 3301-1285
Directory of C:\My Documents

01/06/02  5:53 PM  85-03-02  9:36a  Customer.xls
01/06/02  11:32 AM  11-12-02  1:45a  Steady.xls
01/06/02  11:45 AM  00-00-00  3:04a  Bill (copy) arab.xls
01/06/02  05:34 PM  00-00-00  3:44a  Raines Volunteer.xls
               <-----
               4 file(s)
               131,485 bytes
               0 dir(s)
               9,256,34 # of files

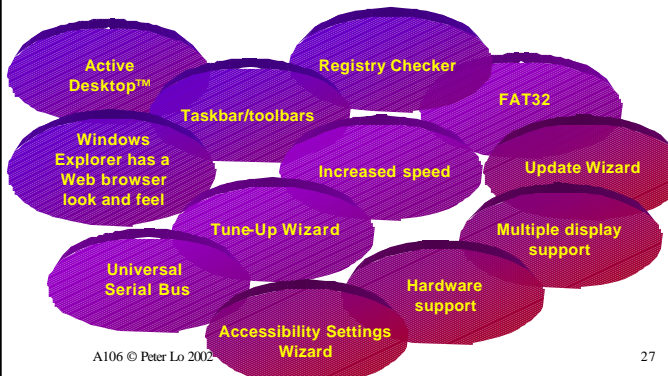
C:\My Documents>COPY *ST0008.XLS *ST0008.XLS
1 file(s) copied

C:\My Documents>
C:\My Documents>RENOME *ST0008.XLS *ST0008.XLS
C:\My Documents>
C:\My Documents>
C:\My Documents>
  
```

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Commands entered by user

Features of most Windows OS



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Mac OS

- Multitasking operating system available only for computers manufactured by Apple
- Apple's Macintosh operating system was first commercially successful GUI



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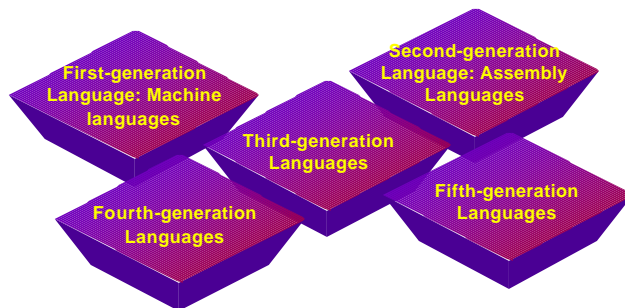
What is a utility program

- System software that performs a specific task
- Examples include:
 - ◆ File viewer
 - ◆ File compression
 - ◆ Diagnostic utility
 - ◆ Uninstaller
 - ◆ Disk scanner
 - ◆ Disk defragmenter
 - ◆ Backup utility
 - ◆ Screen saver

System Software and Software Development

Part II: Programming Language

Categories of Programming Languages



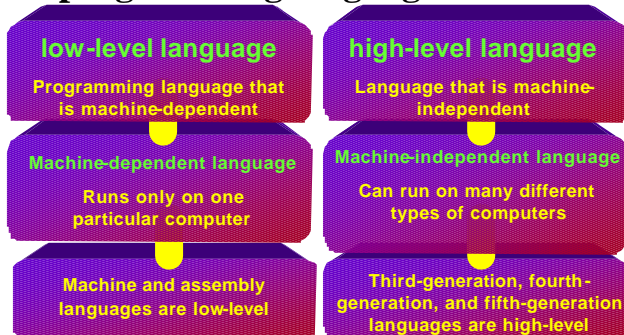
Computer Program

- Computer program is a set of instructions that directs computer to perform tasks.

programming language

Set of words, symbols, and codes that enables a programmer to communicate instructions to a computer

What are low-level and high-level programming languages?

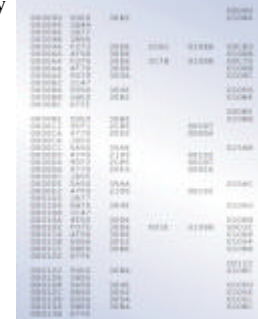


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First-generation Language

- Machine Language is the language that only computer understands directly

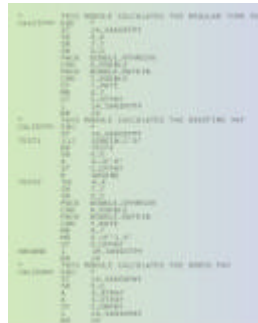


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Second-generation Language

- Assembly language is the instructions made up of symbolic instruction codes



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Third-generation Language (3GL)

- Third-generation Language uses a series of English-like words to write instructions
- Procedural language**: requires program instructions to tell computer what to accomplish and how to do it.

```
* COMPUTE REGULAR TIME PAY
MULTIPLY REGULAR-TIME-HOURS BY HOURLY-PAY-RATE
GIVING REGULAR-TIME-PAY.

* COMPUTE OVERTIME PAY
IF OVERTIME-HOURS > 0
  COMPUTE OVERTIME-PAY = OVERTIME-HOURS * 1.5 * HOURLY-PAY-RATE
ELSE
  MOVE 0 TO OVERTIME-PAY.

* COMPUTE GROSS PAY
ADD REGULAR-TIME-PAY TO OVERTIME-PAY
GIVING GROSS-PAY.

* PRINT GROSS PAY
MOVE GROSS-PAY TO GROSS-PAY-OUT.
WRITE REPORT-LINE-OUT FROM DETAIL-LINE
AFTER ADVANCING 2 LINES.
```

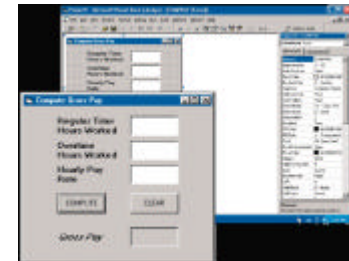
Fourth-generation Language (4GL)

- Syntax is closer to human language than that of a 3GL
- SQL and report generator are examples
- Nonprocedural language: Programmer specifies only what the program should accomplish; it does not explain how

```
SELECT LAST_NAME, FIRST_NAME, GROSS_PAY
FROM EMPLOYEE
WHERE (OVERTIME_HOURS > 0)
ORDER BY LAST_NAME;
LAST_NAME  FIRST_NAME  GROSS_PAY
Antique    Martin      780.00
Charitas   Leslie      715.00
Gullman    Anita       847.50
```

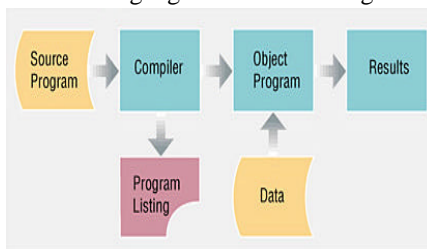
Fifth-generation Language (5GL)

- Provides visual or graphical interface for creating source code
- Visual Basic.NET is an example



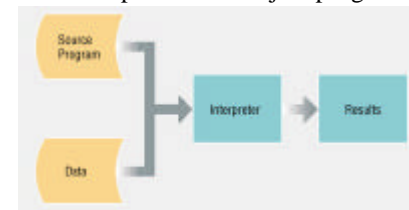
What is a Compiler?

- Program that converts entire source program into machine language before executing it



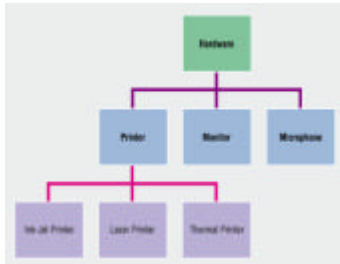
What is an Interpreter?

- Program that translates and executes one program code statement at a time
- Does not produce an object program



Object-Oriented (OO) Approach

- Programmer can package data and program (or procedure) into a single unit, called an object
- Class is larger category of objects



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Object-Oriented Programming (OOP) Language

- Language that uses the OO approach
- OOP is event-driven
 - ◆ Checks for and responds to set of events
- C++ is complete object-oriented language



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Most widely used programming languages

- Structured and Modular Language
 - ◆ Ada, Visual Basic, Pascal
- Object-Oriented (OO) Language
 - ◆ Smalltalk, C, C++, Java, JavaScript (ECMAScript)

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BASIC

- Designed for use as a simple, interactive problem-solving language
- **Beginner's All-purpose Symbolic Instruction Code**

```
REM COMPUTE REGULAR TIME PAY
Regular.Time.Pay = Regular.Time.Hours * Hourly.Pay.Rate

REM COMPUTE OVERTIME PAY
If Overtime.Hours > 0 THEN
  Overtime.Pay = Overtime.Hours * 1.5 * Hourly.Pay.Rate
ELSE
  Overtime.Pay = 0
END IF

REM COMPUTE GROSS PAY
Gross.Pay = Regular.Time.Pay + Overtime.Pay

REM PRINT GROSS PAY
PRINT USING "The gross pay is $#0,##0#.##": Gross.Pay
```

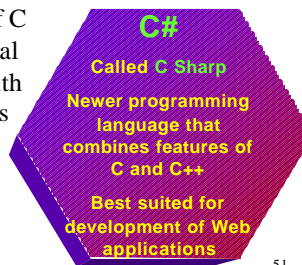
Visual Basic

- Windows-based application that assists programmers in developing event-driven Windows-based applications

```
Private Sub Compute_Click()
    Rem Compute Regular Time Pay
    RegularTimePay = txtRegularTimeHours.Text * txtHourlyPayRate.Text
    Rem Compute Overtime Pay
    If txtOvertimeHours.Text > 0 Then
        OvertimePay = txtOvertimeHours.Text * 1.5 * txtHourlyPayRate.Text
    Else
        OvertimePay = 0
    End If
    Rem Compute and Display Gross Pay
    GrossPay = RegularTimePay + OvertimePay
    lblGrossPay.Caption = Format(GrossPay, "currency")
End Sub
```

C++

- Object-oriented programming language
- Includes all elements of C language, plus additional features for working with object-oriented concepts



COBOL

- Procedural language with English-like statements that make it easy to read, write, and maintain
- Common Business-Oriented Language
- 70 billion lines of code exist

```
* COMPUTE REGULAR TIME PAY
MULTIPLY REGULAR-TIME-HOURS BY HOURLY-PAY-RATE
STRING REGULAR-TIME-PAY.

* COMPUTE OVERTIME PAY
IF OVERTIME-HOURS > 0
    COMPUTE OVERTIME-PAY = OVERTIME-HOURS * 1.5 * HOURLY-PAY-RATE
ELSE
    MOVE 0 TO OVERTIME-PAY.

* COMPUTE GROSS PAY
ADD REGULAR-TIME-PAY TO OVERTIME-PAY
STRING GROSS-PAY.

* PRINT GROSS PAY
MOVE GROSS-PAY TO GROSS-PAY-OUT
WRITE REPORT-LINE-001 FROM DETAIL-LINE
WITH ADVANCING 3 LINES.
```

RPG

- Easy-to-write nonprocedural language used primarily in small businesses
- Report Program Generator

```
C* COMPUTE REGULAR TIME PAY
C.         RTMS      MULT RATE          RTPAY   22
C*
C* COMPUTE OVERTIME PAY
C.         OTHMS     OTRP 0
C.         RATE     MULT 1.5          OTRPAY   22
C.         OTHMS     MULT OTHMS       OTHPAY   22
C.         OTRP      OTRP
C.         OTHPAY    OTHPAY   22
C.
C* COMPUTE GROSS PAY
C.         OTHPAY    ADD OTHPAY        GPAY     22
C.
C.         PRINT GROSS PAY          CACTODETAIL
C.
C* OUTPUT SPECIFICATIONS
DEPRINT 1          DETAIL          22 'GROSS PAY IS '
0              22          38
```

Factors should be considered in selecting a programming language



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Reference

- Computers in Your Future (Ch. 3)
- Introduction to Computing (Ch. 6)
- Discovering Computers World 2003 (Ch. 8)

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