Component 4: Introduction to Information and Computer Science

Overview of Programming Languages, Including Basic Programming Concepts

Topics In This Unit

- Topic I: The Purpose of Programming Languages
- Topic II: What are the Different Programming Languages, from Machine Code to High-level Structured Programming Languages?
- Topic III: Software Development Life Cycle and Compilation/Interpretation
- Topic IV: Components of a Programming Language.
- Topic V: Objects and Modularity

Topic I
The Purpose of Programming Languages

- Where are Programming Languages used?
  - Application Software
  - Operating System Software

Application Software

- Application software
  - Personal efficiency software: spreadsheet, word processor, presentation software, …
  - Software that has a more specific purpose (Examples: photography, tax preparation, boat design, …)
  - Scientific applications
  - Business software
  - Health care software

Operating System Software

- Operating System Software
  - Independent or machine-based
    - Windows, Mac OS, Linux, UNIX
  - Server-based
    - Windows Server 2008, Linux, UNIX, NetWare, Solaris
  - Mobile-based (Embedded)
    - Windows Mobile, Palm OS, iPhone OS, Blackberry, Symbian OS, Linux

Topic II
What are the different Programming Languages, from Machine Code to High-level Structured Programming Languages?

Categories of Programming Languages

- Machine Language (First Generation)
  - Binary language
- Low-level Language (Second Generation)
  - Assembler
- Procedural Language (Third Generation)
  - COBOL (Grace Hopper, 1959), Fortran (John Backus et al, 1954), Pascal (Niklaus Wirth, 1970) , RPG (IBM, 1960s), …

Categories of Programming Languages

- Scripting Languages, Applets, Servlets, ActiveX Controls
- Object Oriented Language
  - VB.Net (Microsoft, 2002), Java (James Gosling, 1995), C++ (Bjarne Stroustrup, 1979), C# (Anders Hejlsberg, 2000), …
- Data Oriented Language (Fourth Generation)
  - SQL (Edgar F. Codd, 1970)

Why so many different languages?

- Legacy languages tend to stick around
  - COBOL
- Different languages for different purposes
  - JavaScript, VB.Net, SQL, PHP, VBA
- New technology requires new languages
  - JavaScript, Applets, Perl
- New languages to take advantage of new features
  - Ruby on Rails, Ajax, OOP languages (like Java, C++)

Some Languages Specifically Designated for Health Care

- MUMPS (**M**assachusetts General Hospital **U**tility **M**ulti-**P**rogramming **S**ystem, Neil Pappalardo first developed in '60s, standardized in 1977)
- MIIS (Proprietary implementation of MUMPS, 1969)
- MAGIC (MEDITECH Corp – founder N. Pappalardo, 1982)

Topic III
Software Development Life Cycle and Compilation/Interpretation

- Software Development Life Cycle (SDLC)
- The Logic Solution, Software Design/Software Engineering
- The Program Language Solution
- Translation into Machine Code

The Software Development Life Cycle (SDLC)

- Requirements Analysis (specifications)
- Design
- Testing
  - Desk checking design
  - Formal walkthrough of design
  - Program unit test
  - System tests of program in context with other programs
- Implementation
- Maintenance
- Obsolescence

The Logic Solution, Software Design/Software Engineering

- Text-based design tool
  - Pseudocode (no universal standard for pseudocode syntax)
- Graphics-based design tools
  - Flowcharting (Frank Gilbreth, 1921)
  - Warnier/Orr (Jean Dominique Warnier, 1940s/Ken Orr)
  - Nassi/Shneiderman (Isaac Nassi and Ben Shneiderman, 1972)
- Object design tool
  - Unified Modeling Language (UML) (Grady Booch, Ivar Jacobson and James Rumbaugh, 1997)

Example Pseudocode

Problem Statement:

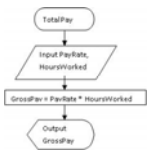
Find the gross pay for an employee given the number of hours worked and the pay rate.

Pseudocode:

```
TotalPay module
    Input PayRate, HoursWorked
    GrossPay = PayRate * HoursWorked
    Output GrossPay
End module
```


Some Graphical Tool Solutions

Flowchart



Warnier/Orr

Nassi-Schneiderman