

Component 4: Introduction to Information and Computer Science

Unit 5: Overview of Programming Languages, Including Basic Programming Concepts Lecture 1

This material was developed by Oregon Health & Science University, funded by the Department of Health and Human
Services, Office of the National Coordinator for Health Information Technology under Award Number 1U49CE000015.

Unit 5 Objectives

- a) Define the purpose of programming languages.
- b) Define the different types of programming languages.
- c) Explain the continuum of programming languages from machine code and assembly languages through scripting languages and high level structured programming languages.
- d) Explain the compiling and interpreting process for computer programs.
- e) Use the following components of programming languages to build a simple program: variables, loops and conditional statements.
- f) Introduce additional programming concepts such as objects and modularity.

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

2

Programming Languages

- Specify commands for a computer to perform
 - Syntax
 - Keywords
 - Punctuation
- Create programs
- Pre-date computers
 - Jacquard looms
 - Player pianos

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

3

Software

All software that runs on a computer
is a program

Written using a programming language
Many different languages available

Software can be small programs
or large, complex ones

Operating system
Word processing program
Simple utility

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

4

Software Development

- Process by which applications are created
- Multiple step and iterative
 - Planning/exploratory phase
 - Analysis/requirements gathering
 - Design
 - Implementation
 - Deployment and maintenance

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

5

Programming Development

- Problem statement
- Determine algorithm
- Code/implement algorithm
- Test and debug
- Deploy

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

6

Algorithms

- Set of steps that defines how a task is performed
- The computer program implements an algorithm
- Algorithm development occurred long before computers!

Algorithm Example #1

- Making a peanut butter and jelly sandwich
 - Get the ingredients & tools
 - Spread peanut butter on one slice
 - Spread jelly on other slice
 - Place two slices together



Algorithm Example #2

Making a peanut butter and jelly sandwich

- Get the ingredients & tools
 - Two slices of bread
 - Peanut Butter
 - Jelly
 - Knife
- Spread peanut butter on one slice
 - Dip knife into peanut butter
 - Remove knife, collecting peanut butter
 - Place knife peanut butter side down on bread
 - Swirl knife to spread peanut butter
- Spread jelly on other slice
- Place two slices together



Algorithm Uses

- Describes problem solution without the programming syntax
 - Pseudocode
 - Flow charts
- Plan solution BEFORE programming
- Can determine/prove
 - Correctness
 - Time
 - Storage

Component 4/Unit 5-1 Health IT Workforce Curriculum
Version 2.0/Spring 2011 10

Coding

- Programs/programming statements are also called code
- Writing programs is called coding
- Choices for programming languages:
 - Functionality of program
 - Where it's going to run
 - What's available

Component 4/Unit 5-1 Health IT Workforce Curriculum
Version 2.0/Spring 2011 11

Categories of Programming Languages

First Generation
Machine code (1s and 0s)

Second Generation
Assembly language
Words describe commands

Third Generation
FORTRAN, BASIC, C, Java
Adds symbols to commands

Fourth Generation
SQL
Powerful, complex commands

Fifth Generation
Prolog, visual programming

}

}

}

}

Low Level Languages

High Level Languages

Component 4/Unit 5-1 Health IT Workforce Curriculum
Version 2.0/Spring 2011 12

Machine Code

- Each computer has an instruction set
 - Set of tasks computer can do
 - Unique sequence of 0s and 1s
- Applications are groups of instructions
- Programmers used to program in 0s and 1s
 - Switches
 - Punched cards

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

13

Assembly Language

- Use words to represent instructions
- Translate assembly code into machine code
- Unique to each computer, just as machine code is specific to each computer

```
.MODEL Small
.STACK 100h
.DATA
    db msg 'Hello,
    world!$'
.CODE
start:
    mov ah, 09h
    lea dx, msg ; or mov
    dx, offset msg
    int 21h
    mov ax, 4C00h
    int 21h
end start
```

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

14

Third Generation Languages

- The next generation of languages added operations
 - No longer unique to computer
 - Programs more portable
- Modern programming languages are third generation
 - FORTRAN, COBOL, C, C++, C#, Java, VB.Net

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

15

Programming Paradigms

- Procedural
 - BASIC, COBOL, FORTRAN, C
- Functional
 - LISP, Scheme
- Object Oriented
 - C++, C#, Java, Ruby
- Others

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

16

Scripting Languages

- Languages that control other applications
 - Batch control—shell scripts
 - Web browsers—javascript
 - Text processing—Perl
- Some have evolved for general application development
 - Perl, Python

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

17

Some Languages Specifically Designated for Health Care

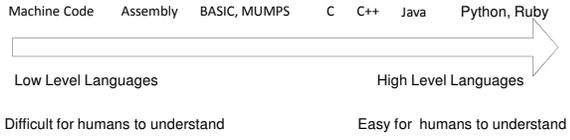
- **MUMPS** (Massachusetts General Hospital Utility Multi-Programming System, Neil Pappalardo first developed in '60s, standardized in 1977)
- **MIIS** (Proprietary implementation of MUMPS, 1969)
- **MAGIC** (MEDITECH Corp – founder N. Pappalardo, 1982)

Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

18

Programming Language Continuum



Component 4/Unit 5-1

Health IT Workforce Curriculum
Version 2.0/Spring 2011

19
