Levels of Abstraction

Computer Organization
Level of Abstraction

- Provides users with concepts/tools to solve problem at that level
- Implementation hides complex details
  - different implementations using different underlying “machines” are possible
Level of Abstraction -- Example

- **Abstract Data Types**
  - stack, queue, priority queue

- **Use for building higher level programs**
  - solution search (e.g. maze, TSP)
  - depth-first, breadth first, branch and bound

- **Implementation**
  - built on base language: C++, Pascal, Ada, etc.

- **Can be used to build high level abstraction**
  - generic solution search
  - event driven simulation language
Levels of Abstraction

Virtual Machine 3

Implementation of VM 3 on VM 2

Virtual Machine 2

Implementation of VM 2 on VM 1

Virtual Machine 1

Implementation of VM 1 on VM 0

Virtual Machine 0
Data Structures example

Base Language, e.g. C++

Data Structures
translation

Event Scheduling Simulation Language
translation

Simulation of Bank
Hardware/Software Interface

simple RISC

4. High Level Language (HLL)  Compiler (translation)
3. Assembly Language  Assembler (translation/mapping to ISA)
2. Operating System (OS)  Partial Interpretation (device drivers, etc)
1. Instruction Set Architecture (ISA)  Hardware
0. Digital Logic  Hardware
-1. Electronics -- transistors, etc
Hardware/Software Interface
more complex architectures

3  Assembler
   Assembler (translation/mapping to ISA)

2  OS
   Partial Interpretation (device drivers, etc)

1  ISA
   Firmware interpreter

1A Microarchitecture

0  Digital Logic
   Hardware

-1  Electronics -- transistors, etc
Java

- Java (HLL)
- Java Compiler
- Java Byte Code (ISA)
- Interpreter and JIT compiler
- Java Virtual Machine (JVM)
- OS
- Machine ISA
Java -- Java Chips

Java (HLL)

Java Compiler

Java Byte Code = ISA

Interpreter and JIT compiler

JVM

(Microarchitecture)

Digital Logic
This Course

High Level Language (HLL)
- Compiler (translation) - COSC 420

Assembly Language
- Assembler (translation/mapping to ISA) - COSC 425

Operating System (OS)
- Partial Interpretation (device drivers, etc) - COSC 301

Instruction Set Architecture (ISA)

Hardware

Digital Logic

Electronics -- transistors, etc