Program Development

• Problem: convert ideas into executing program (binary image in memory)
• Program Development Process: tools to provide people-friendly way to do it.

• Tool chain:

1. **Programming Language**

– **Syntax**: symbols + grammar for constructing statements (C=A+B)
– **Semantics**: what is meant by statements → what happens upon execution (add A plus B and store the result in C)
– **Assembly Language**: simplest readable language. One-to-one mapping to machine instructions.

2. Assembler: Program to **convert** assembly language to object format
• Object Code: program in machine format (i.e. binary)
• May contain unresolved references (variables or functions)
3. Linker: program to **combine** object files into a single executable file
– All references resolved

4. Loader: program to **load** executable files **into memory**. May initialize registers (e.g. IP) and starts it going.
5. Debugger: program that **loads** and **controls** execution of the program
· start/stop execution, view and modify state variables

• **Source Code**

– Program written in assembly or high-level language
• **Object Code**

– Output of assembler or compiler

– Executable program in binary format (machine instructions)

– Unsolved external references (Linker: solves these references and creates executable file)

• **Executable Code**

– The complete executable program in binary format.