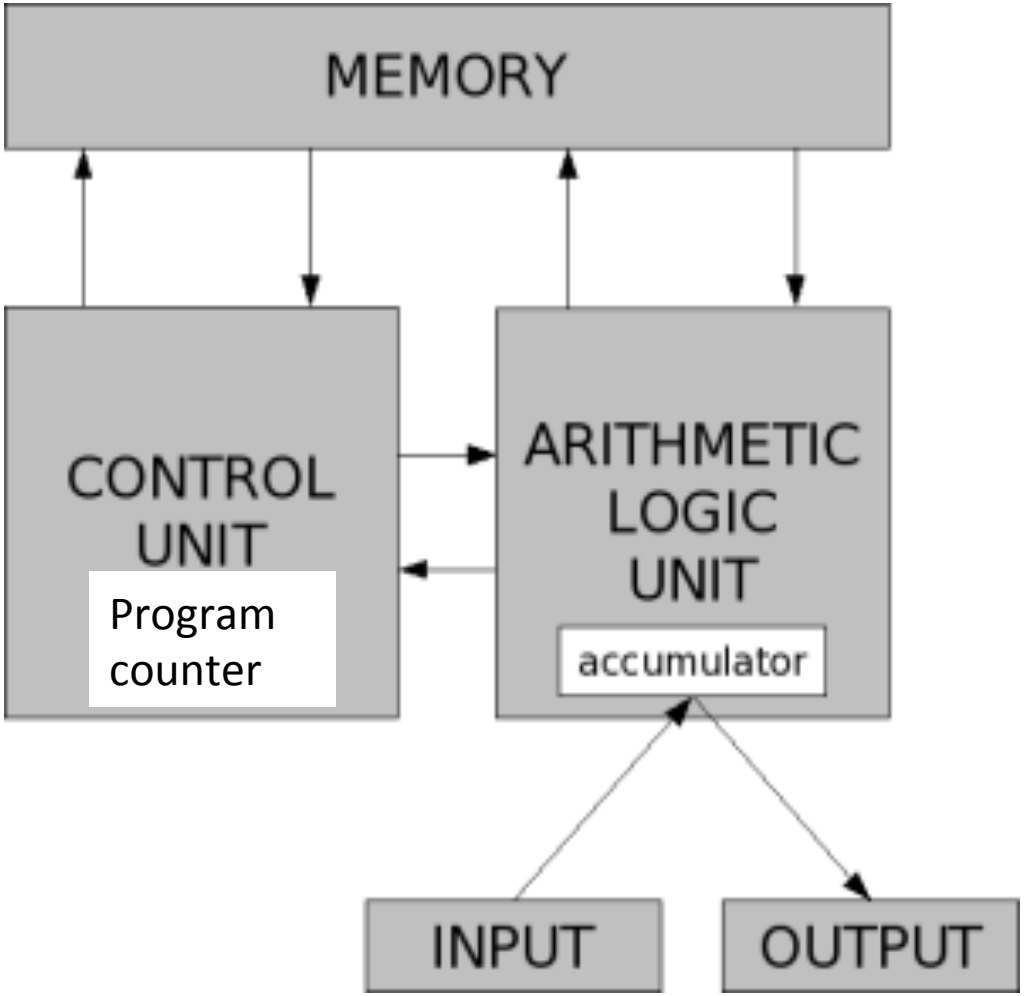
How do we capture a recipe in a mechanical process?

- Build a machine to compute square roots
  - **Fixed Program Computers**
    - Calculator
    - Atanasoff and Berry's (1941) computer for systems of linear equations
    - Alan Turing's (1940's) bombe – decode Enigma codes
- Use a machine that stores and manipulates instructions
  - **Stored Program Computer**

Stored program computer

- Sequence of instructions (program) stored inside computer
  - Built from predefined set of primitive instructions
    - Arithmetic and logic
    - Simple tests
    - Moving data
- Special program (interpreter) executes each instruction in order
  - Use tests to change flow of control through sequence, to stop when done

A basic machine architecture



What are the basic primitives?

- Turing showed that using six primitives, can compute anything
  - **Turing complete**
- Fortunately, modern programming languages have a more convenient set of primitives
- Also have ways to abstract methods to create new “primitives”
- But anything computable in one language is computable in any other programming language