Stored Program Machines

The von Neumann Architecture

- One of the foundational ideas of modern computing—traditionally attributed to John von Neumann although others can make valid claims to the idea—is that code is stored in the same memory as data. This concept is called the stored programming model.
- The next few slides introduce the Manchester Baby, which was the first stored-program computer. In the rest of today’s class, I will describe the operation of a slightly more powerful machine that I’ve nicknamed Toddler.

The Manchester Baby

Structure of the Toddler Machine

The Toddler Instruction Set

- `LOAD xx` Loads the value from address `xx` into the AC
- `STORE xx` Stores the value from AC into address `xx`
- `ADD xx` Adds the value at address `xx` to the AC
- `SUB xx` Subtracts the value at address `xx` from AC
- `HALT` Halts the machine
- `JUMP xx` Takes the next instruction from address `xx`
- `JUMPZ xx` Jumps to `xx` if the AC is zero
- `JUMPN xx` Jumps to `xx` if the AC is negative
- `INPUT xx` Reads a value into address `xx`
- `OUTPUT xx` Prints the value in address `xx`

Exercise: Multiply Two Numbers

- How would you write a Toddler program to multiply two nonnegative numbers, even though the machine has no multiply instruction?