

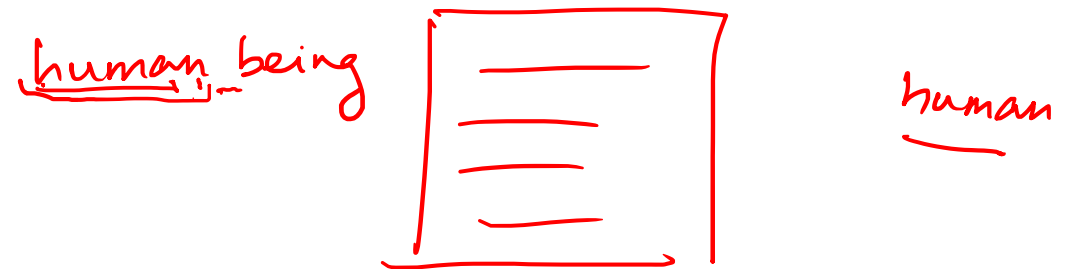
Problem Solving Through Programming in C: Tutorial

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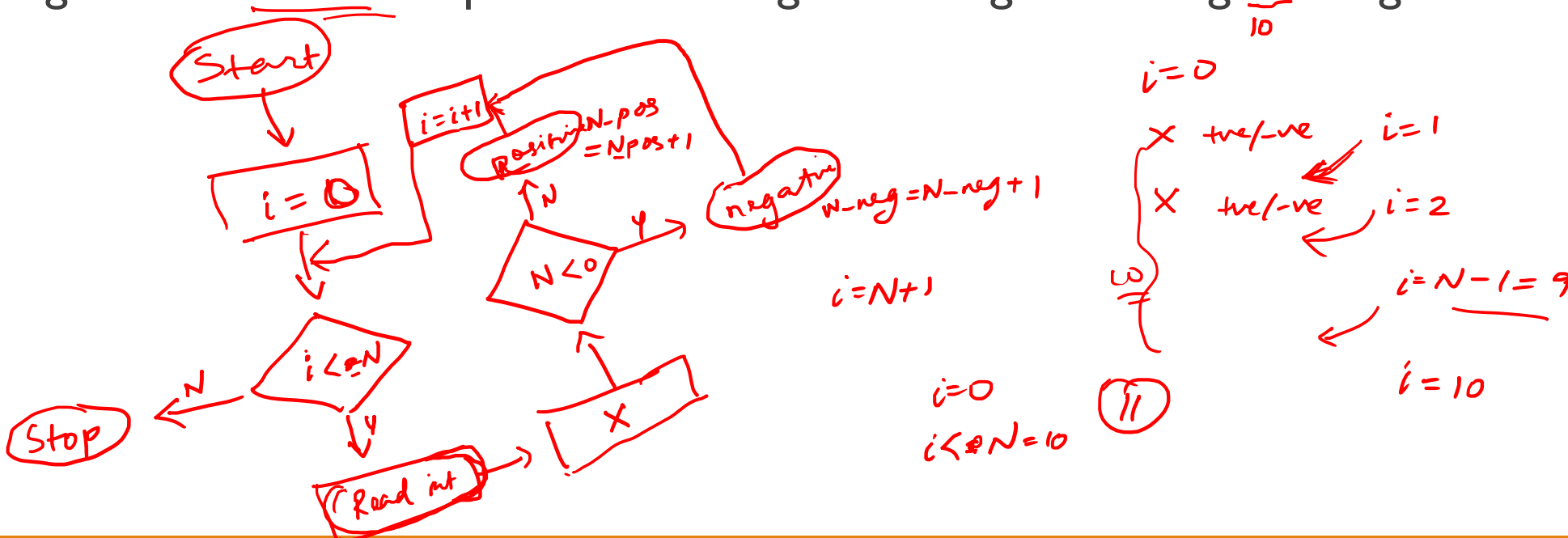
Problem Solving

- Any problem, which can be thought of in logical sequences can be solved using programming.
- “Logical thinking” – the most important part of the programming
- How can you think logically?

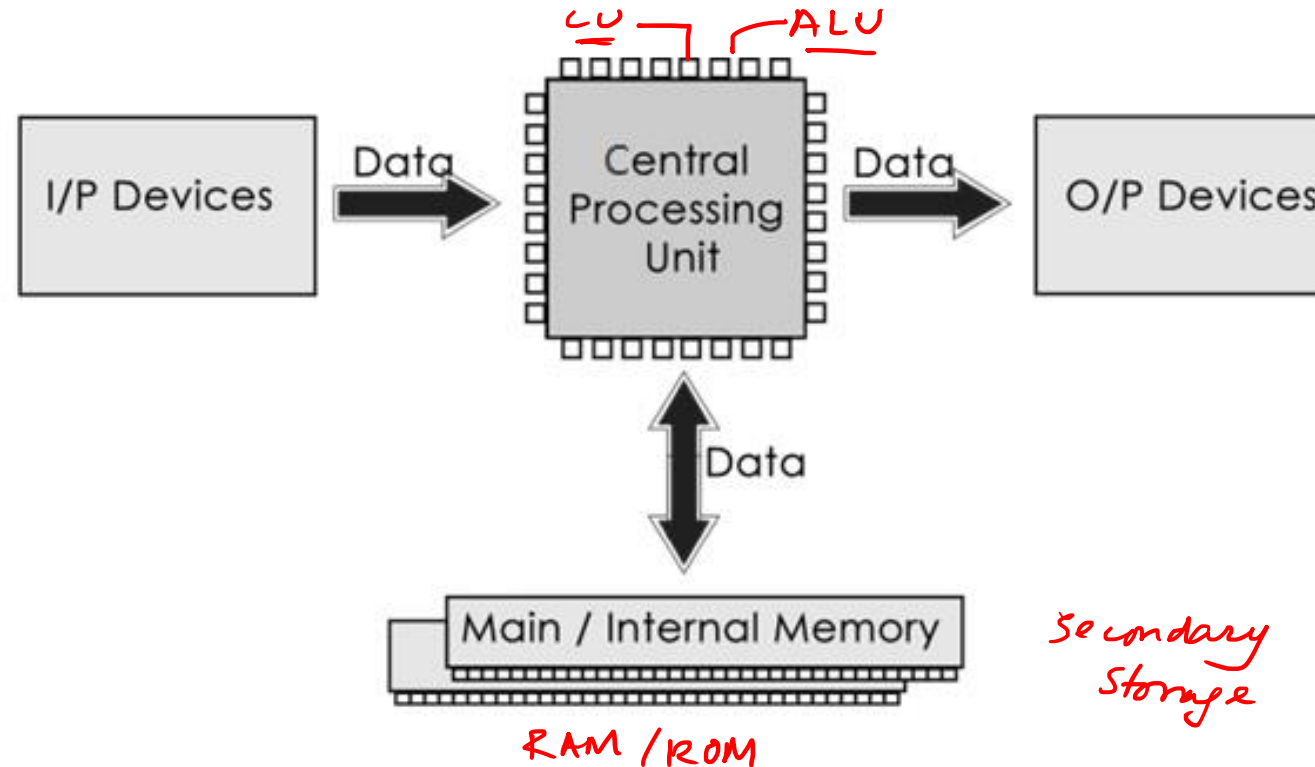


Logical thinking and algorithms

- What is an algorithm? - a set of instructions to solve a problem
 - Different methods of explaining an algorithm: Flow charts, Pseudocode
- e.g. – Find number of positive and negative integers among N integers



Components of a computer



Number Systems

- Binary – Base 2 system – 0 and 1 (*Machine readable*)
- Octadecimal – Base 8 system - 0, 1, 2, 3, 4, 5, 6, 7
- Decimal – Base 10 system - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- Hexadecimal – Base 16 system - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

7|8|9

$$\begin{aligned}
 &9 \times 10^0 \\
 &+ 8 \times 10^1 \\
 &+ 7 \times 10^2 \\
 &=
 \end{aligned}$$

1|0|1

$$\begin{aligned}
 &1 \times 2^0 \\
 &+ 0 \times 2^1 \\
 &+ 1 \times 2^2 \\
 &= 5
 \end{aligned}$$

10 11 12 13 14 15

e.g. – Convert $(1011.101)_2$ to decimal

$$\begin{aligned}
 &1011.101 \\
 &\begin{matrix} 3 & 2 & 1 & 0 & -1 & -2 & -3 \\ 2 & 2 & 2 & 2 & 2 & 2 & 2 \end{matrix} \\
 &1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\
 &+ 1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} \\
 &= 11.625
 \end{aligned}$$

e.g. – Convert $(6A7F)_{16}$ to decimal and binary

$(6A7F)_{16}$

$$\begin{aligned}
 &F \times 16^0 \\
 &+ 7 \times 16^1 \\
 &+ 4 \times 16^2 + 6 \times 16^3 = 27263
 \end{aligned}$$

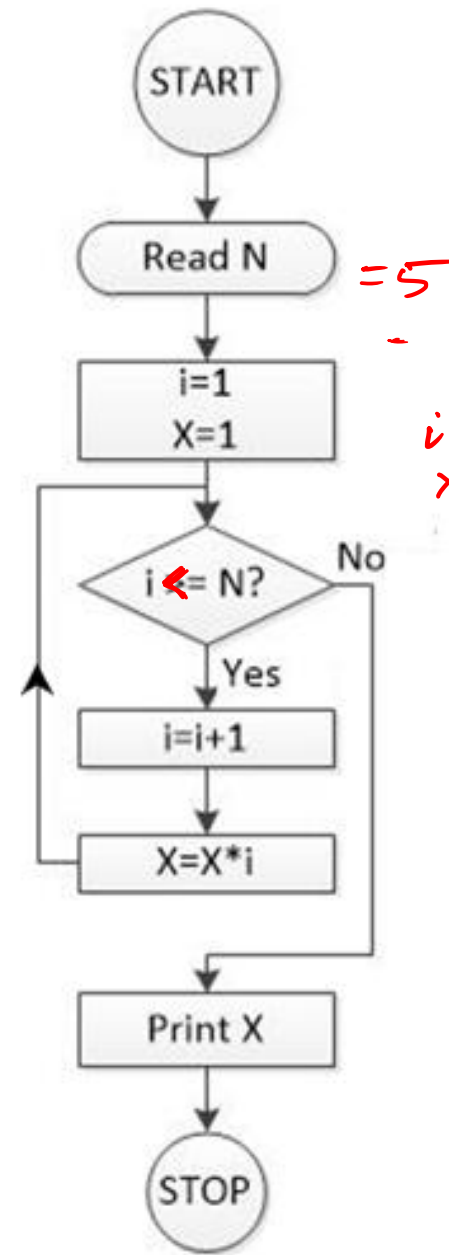
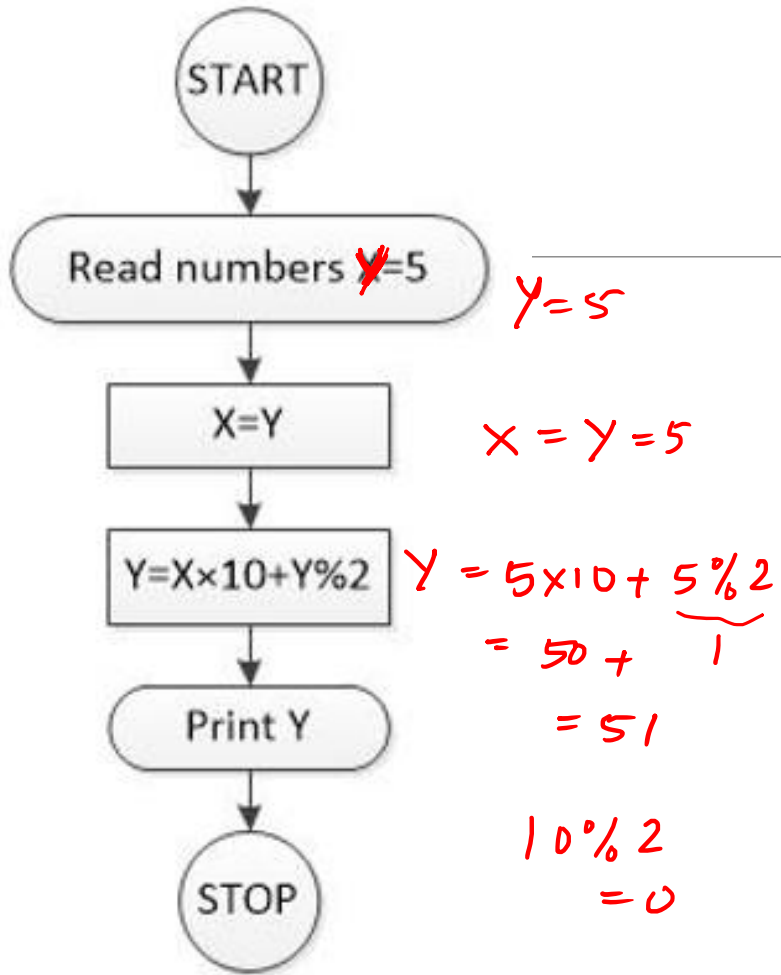
$$\begin{array}{r}
 2 \overline{) 27263} \\
 \underline{2} \\
 07 \\
 \underline{06} \\
 01 \\
 \underline{00} \\
 01
 \end{array}$$

Programming Language

- A method of conveying the instructions to the computer
- 3 levels of languages:
 - Machine level (Compiled/interpreted code) — *binary 0/1*
 - Assembly level —
 - High level (Source code) — *programming*
- Compiler/ Interpreter – converts the source code to machine readable form

C: Memory and Variables

- Memory: Primary, secondary, others (cache, registers, buffers)
- 1 Byte = 8 Bits (Bit is the smallest unit of memory)
- Variables – memory locations in the RAM which is allocated during compilation
- What does $X = Y$ mean?
- What happens when we write $X = Y * Z$?



Q. Draw a flowchart to extract all digits from a natural number.

Handwritten calculations for the loop flowchart:

- $i <= 5$
- $2 \leq 5$
- $5 \leq 5$
- $i = 6$
- $120 \times 6 = 720$
- $6 \leq 5 \times$
- $3 \leq 5$
- $4 \leq 5$
- $i = 4$
- $i = 5$
- $6 \times 4 = 24$
- $24 \times 5 = 120$