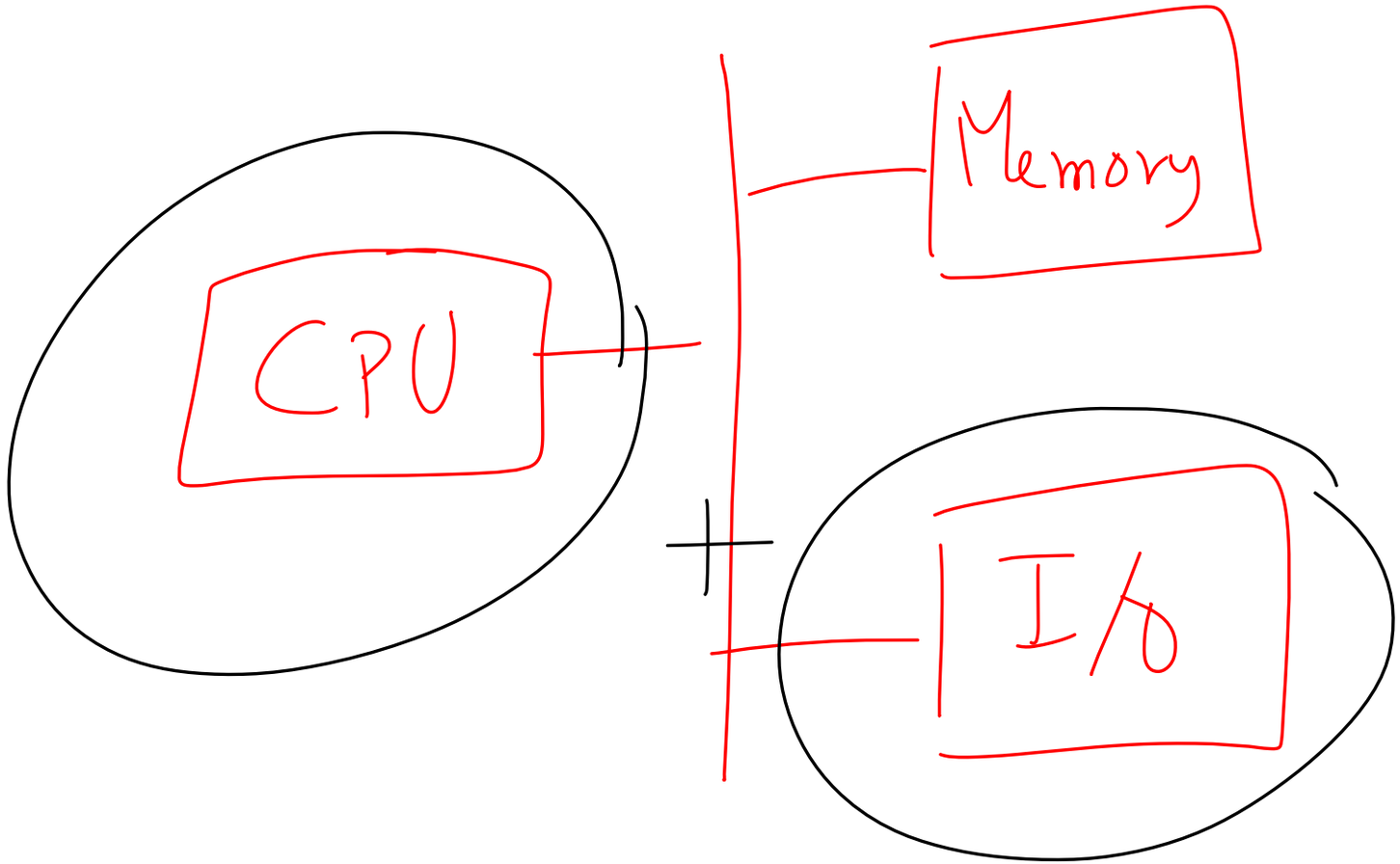
CS340 (Theory of Computation)

What is the power of computers?

What can they compute?

What can they not compute?

What is a computer?



Course Logistics

Assignment : 25%

Midsem : 25%

Endsem : 50%

Grading :

80%+ ⇒ A

20%+ ⇒ D+

Textbook

by Dexter Kozen : Automata and Computability

by Michael Sipser : Introduction to the Theory of Computation

Formalism

A computer computes functions:

$$f : D \longrightarrow R$$

domain?

range?

Domain / Range

Taken as a sequence of bits

$$D : \{0,1\}^*$$

$$R : \{0,1\}^*$$

Representing sequences of bits

Alphabet: a set of symbols

- represented as Σ

Examples: $\Sigma = \{0, 1\}$

$\Sigma = \{a, b, c, \ldots, y, z\}$

$\Sigma = \{0, 1, 2, \ldots, 9\}$

Strings: A finite sequence of symbols from an alphabet

Denoted as Σ^*

$$\Sigma^* = \{ a_1 a_2 a_3 \cdots a_m \mid a_i \in \Sigma \}$$

Examples:

$\{0,1\}^*$: set of all binary strings

$\{0,1,2,\ldots,9\}^*$: set of all non-negative numbers

$\{a,b,\ldots,y,z\}^*$: set of all words using English alphabet

Let F be the class of functions computed by a computer

For any function $f : \Sigma^* \to \Sigma^*$,

define $A_f = \{(x, y) \mid f(x) = y\}$.