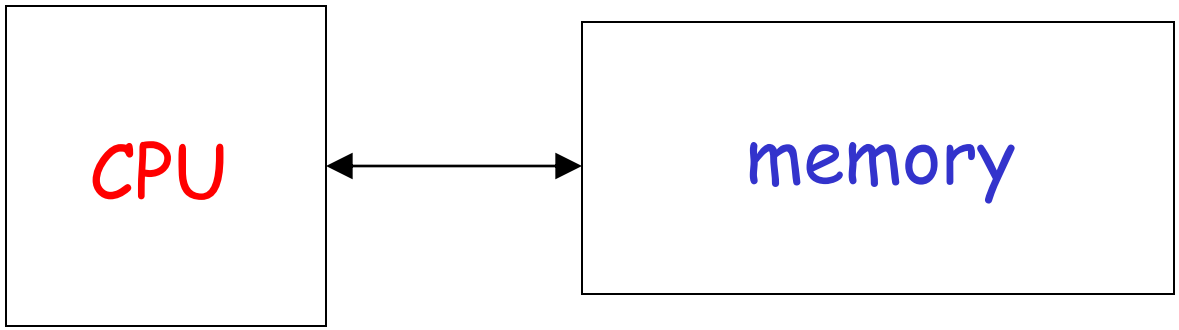
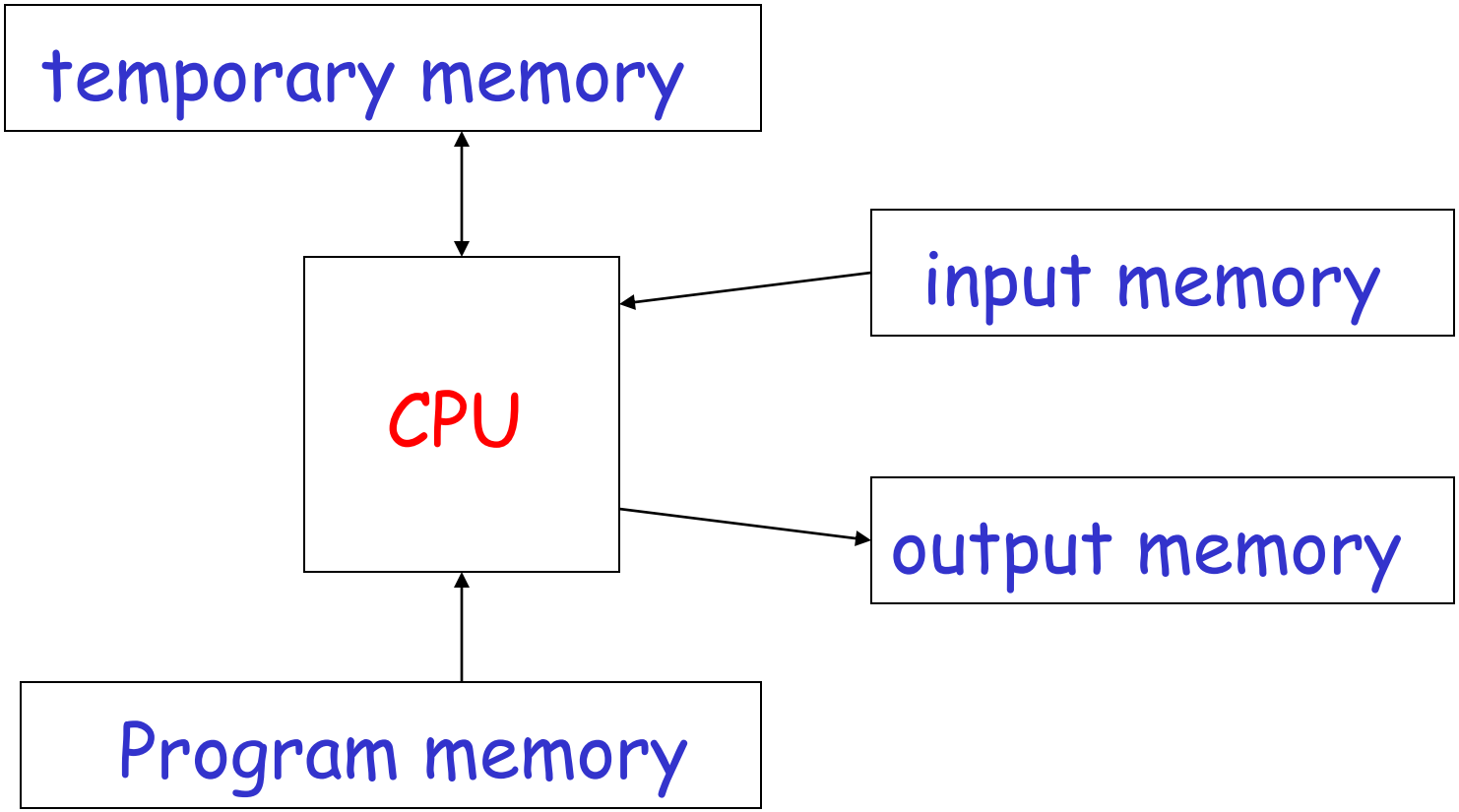
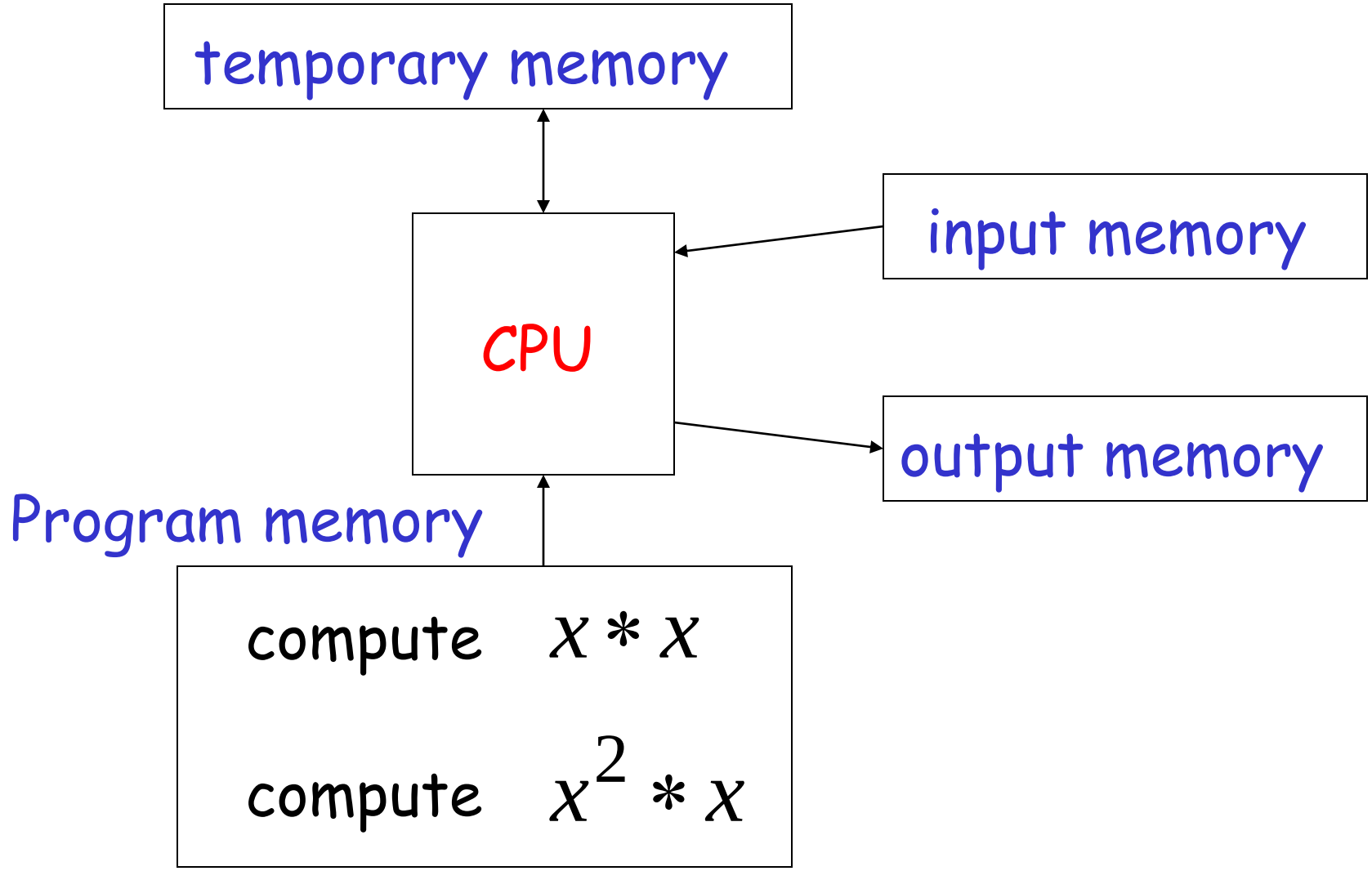
“Theory of Computation”

Computation

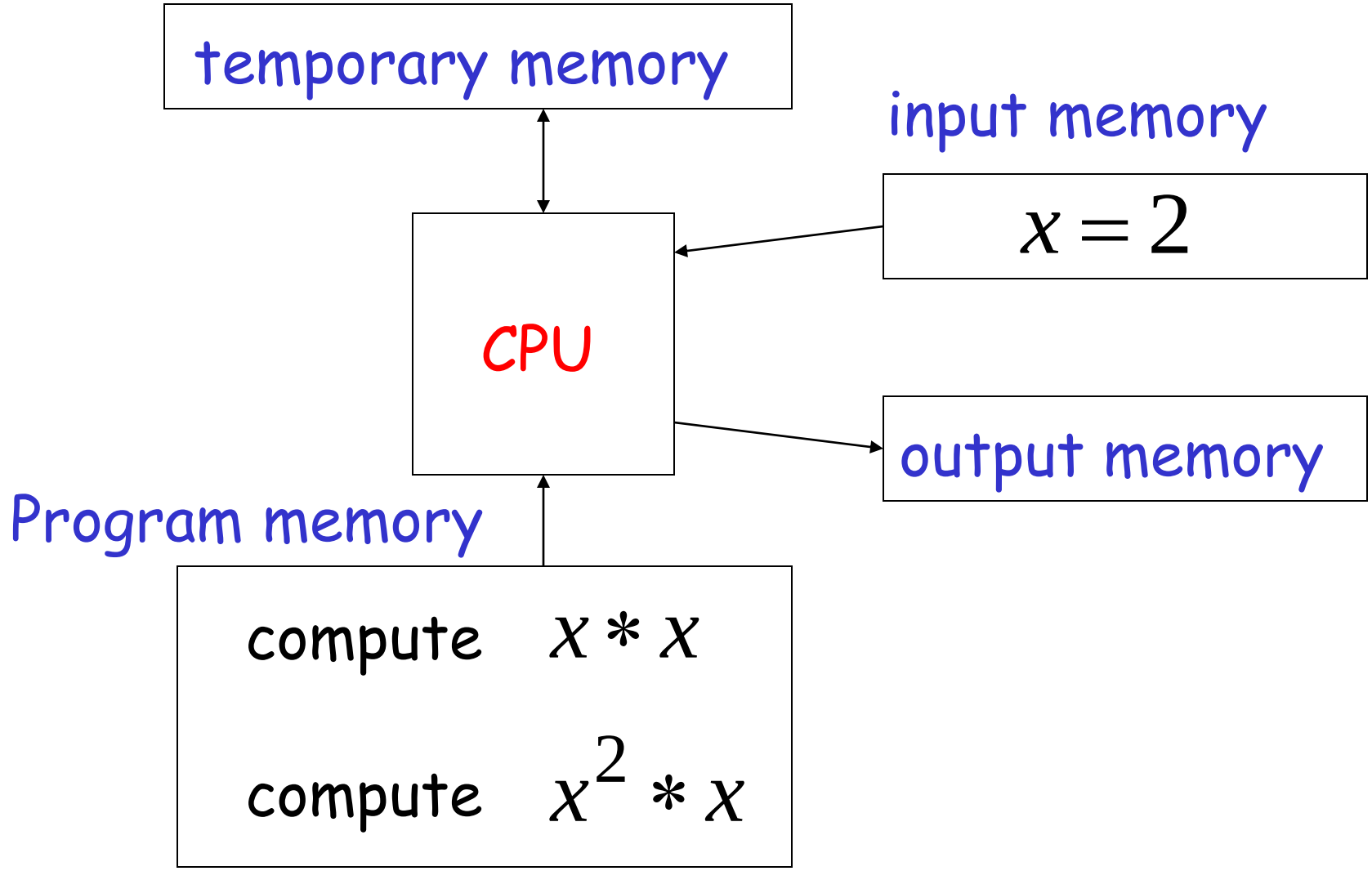



temporary memory
CPU
input memory
output memory
Program memory

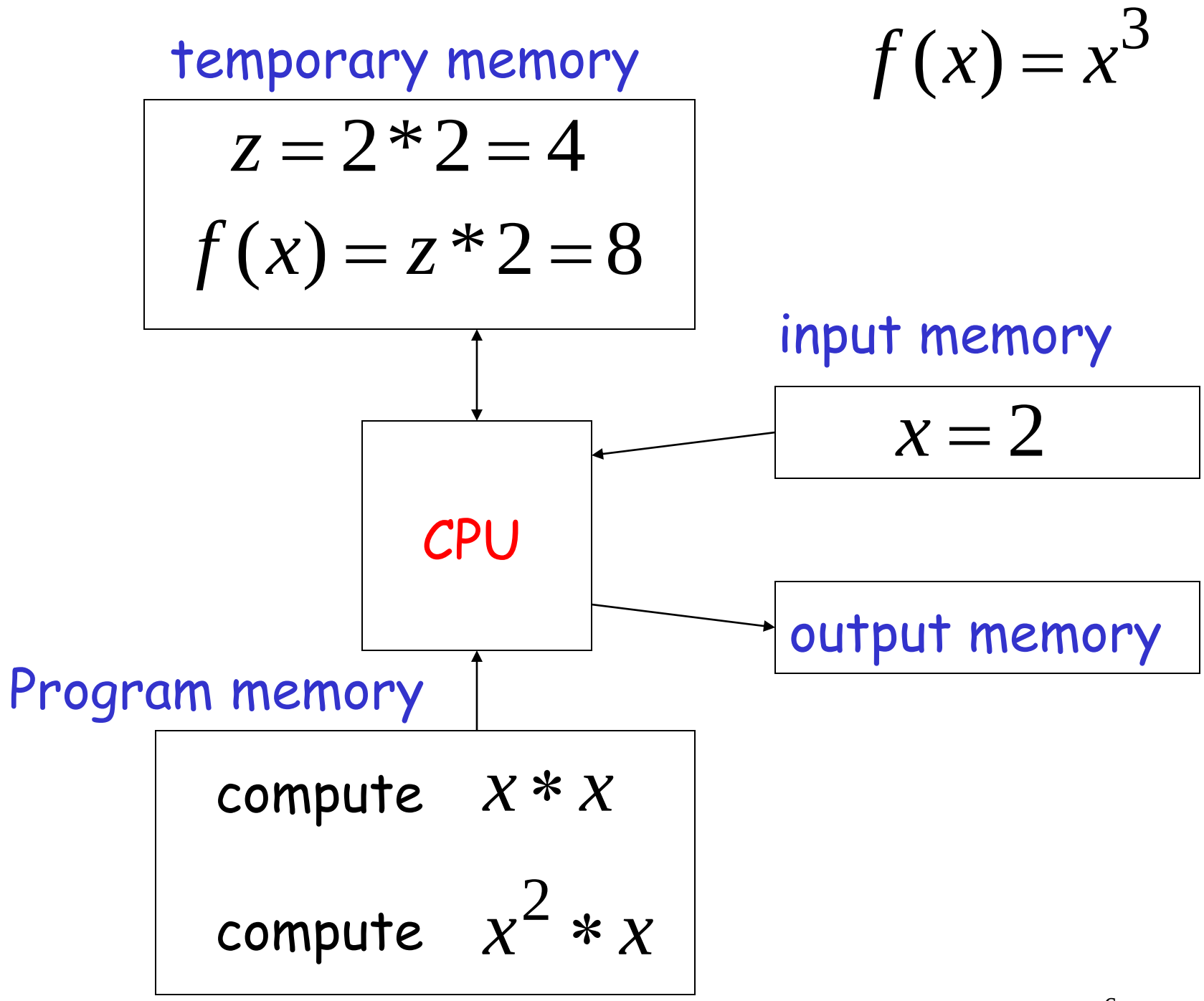
Example: $f(x) = x^3$



$$f(x) = x^3$$


temporary memory
input memory
$x = 2$
CPU
output memory
Program memory
compute $x * x$
compute $x^2 * x$

$f(x) = x^3$


temporary memory
$z = 2*2 = 4$
$f(x) = z*2 = 8$
input memory
$x = 2$
CPU
output memory
Program memory
compute $x * x$
compute $x^2 * x$

$f(x) = x^3$

temporary memory

$z = 2 * 2 = 4$

$f(x) = z * 2 = 8$

input memory

$x = 2$

CPU

$f(x) = 8$

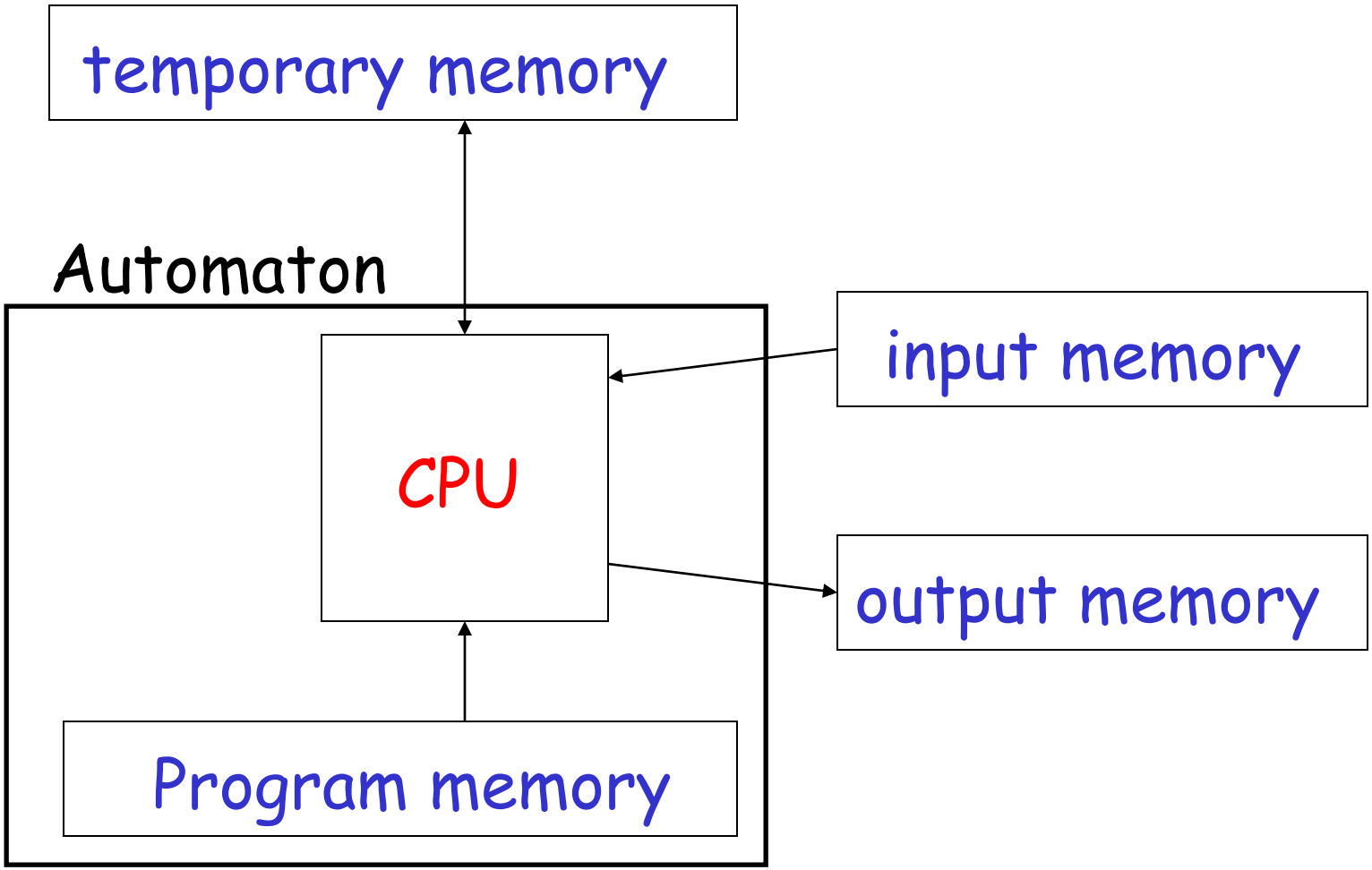
output memory

Program memory

compute $x * x$

compute $x^2 * x$

Automaton

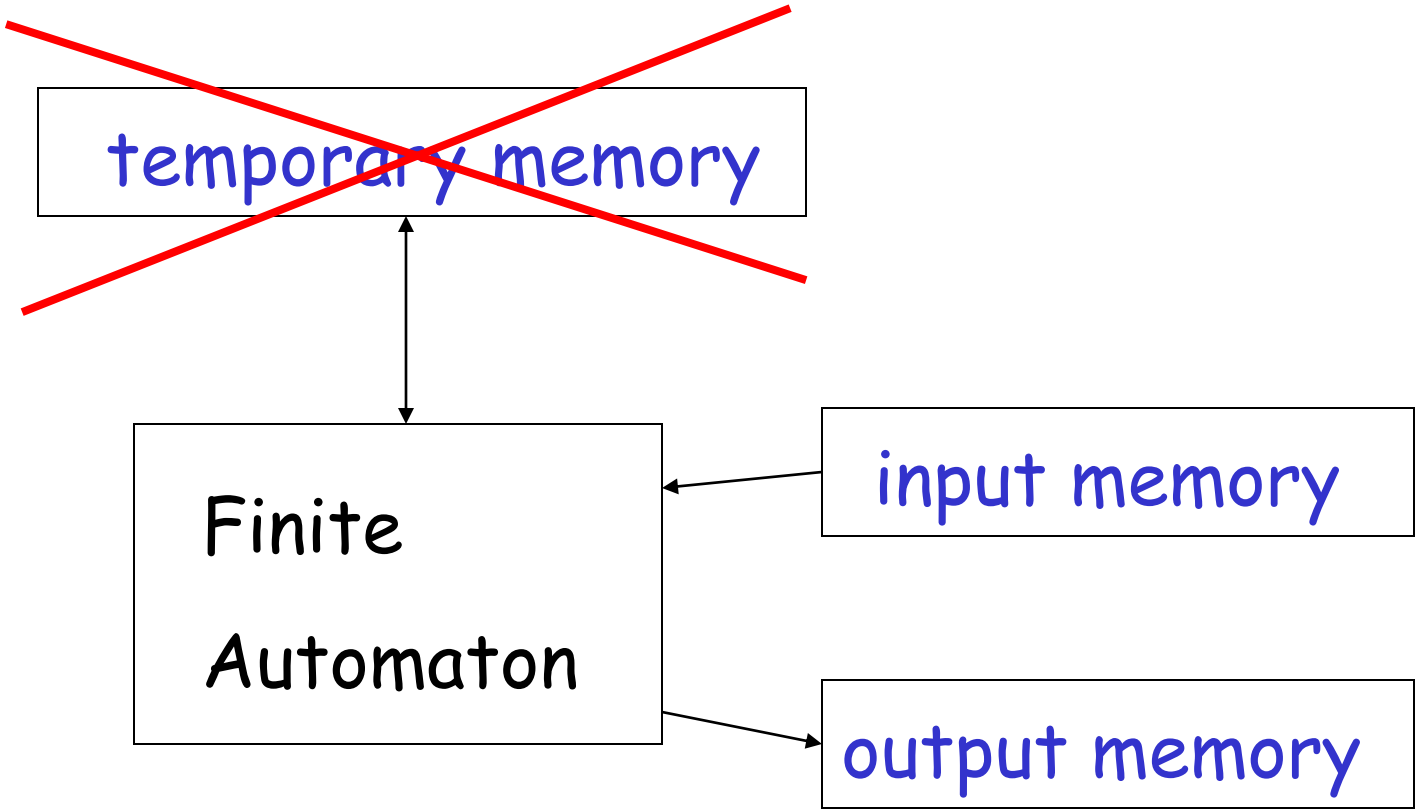

temporary memory
Automaton
input memory
CPU
output memory
Program memory

Different Kinds of Automata

Automata are distinguished by the temporary memory

- **Finite Automata:** no temporary memory
- **Pushdown Automata:** stack
- **Turing Machines:** random access memory

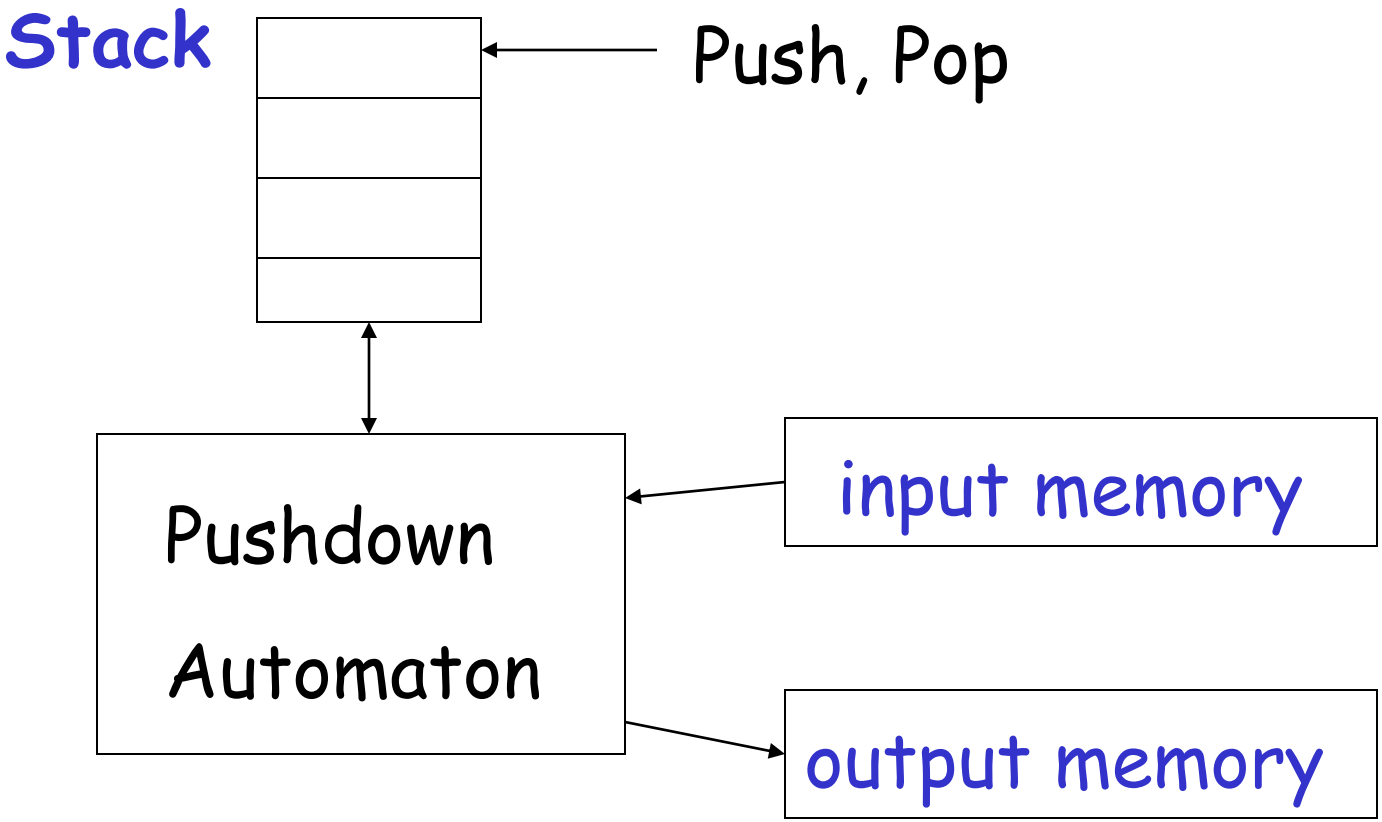
Finite Automaton



Example: Vending Machines

(small computing power)

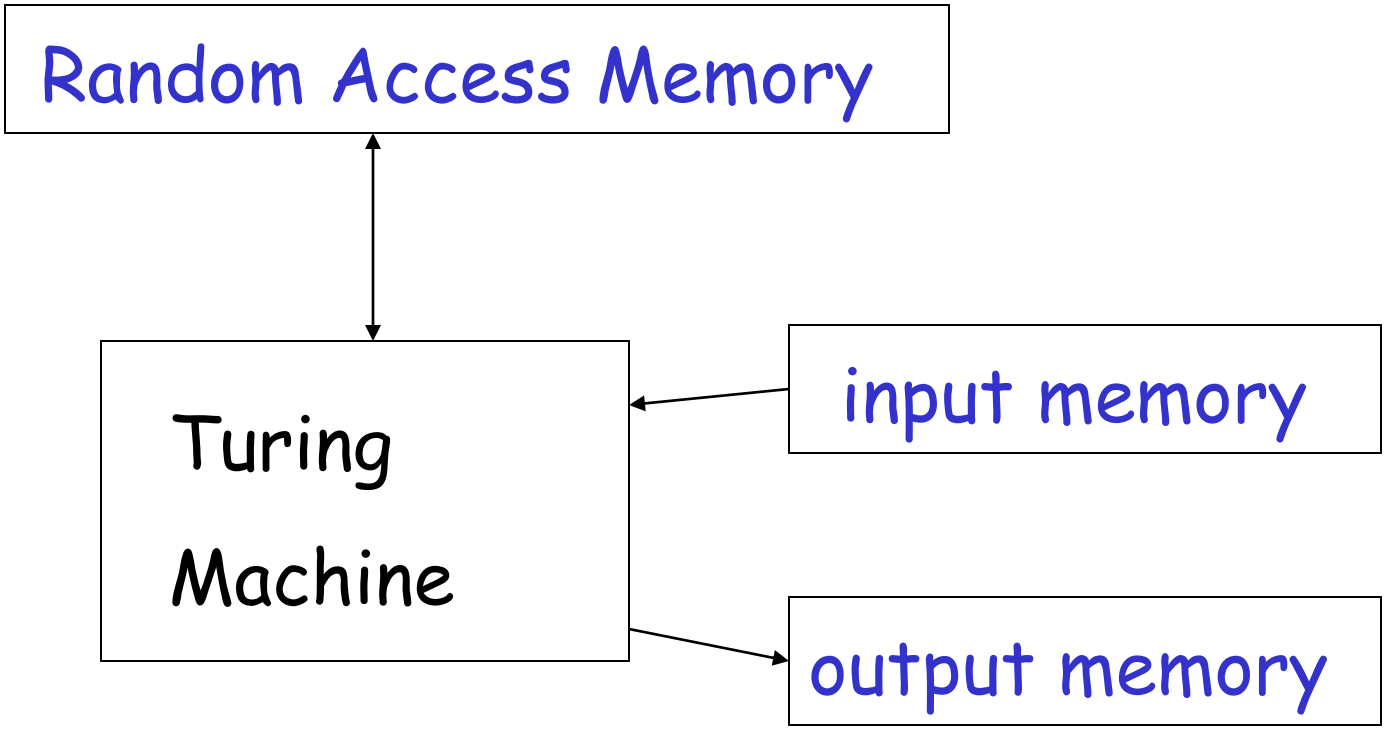
Pushdown Automaton



Example: Compilers for Programming Languages

(medium computing power)

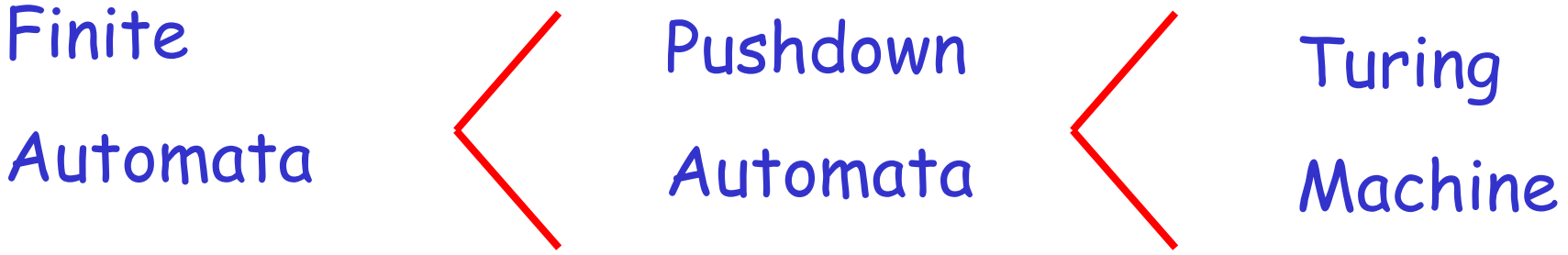
Turing Machine



Examples: Any Algorithm

(highest computing power)

Power of Automata



Less power → More power

Solve more computational problems