CS F364
Design & Analysis of Algorithms

ALGORITHMS - COMPLEXITY

Computability

- **Computation Models: Turing Machine Model**
- **Church-Turing Hypothesis**
- **Equivalence of Models : RAM Model**

Computability – Machine Models

- Church-Turing Hypothesis:
  - *Anything computable can be computed by a Turing machine.*
- Turing machine:
  - A *Turing machine* is an abstract machine characterized by:
    - states – in which the machine can be
    - (state) transitions – specifying on which input, will the machine go from one state to another and write some output
    - a (semi-infinite) tape – used for input / output

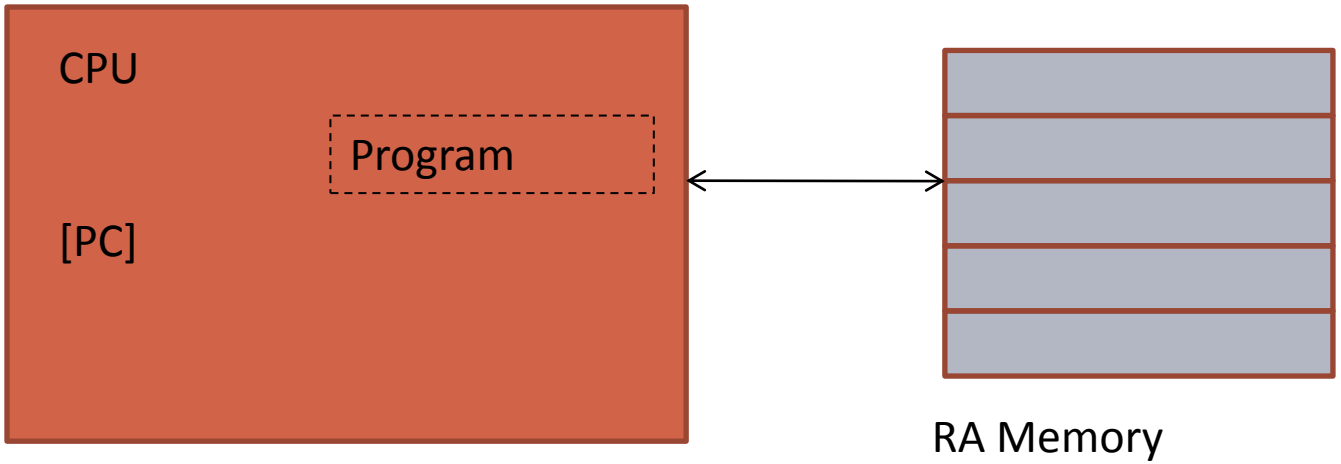
Computability – Machine Models [2]

- Church-Turing Hypothesis
  - Can't be proven – because "what is computable" is not a grounded notion.
  - In practice, if we mean "computable" to be
    - *computable in finite number of steps,*
    - *each of which can be executed*
      - *in a finite amount of time and*
      - *using a finite amount of resources*

    then the hypothesis is reasonable.
  - It can be disproved – if someone comes up with a "superior" machine model.

COMPUTABILITY – MACHINE MODELS [4]

- Random Access Machine (RAM) Model



Equivalent to Turing machine model.
Capability abstraction of common computers / processors

Exercise: *Prove that the RAM model is equivalent is to the TM model.*