Turing machine:

* Finite automation equipped with an infinite tape as its memory
* The tape begins with the input to the machine written on it
* With an infinite number of blank cells
* The machine has a tape head which reads and writes a single cell of memory at a time
* 3 Parts:
  + **Finite state control** that issues commands
  + An **infinite tape** for input and scratch space
  + A **tape head** that can read and write a single tape cell at a time
* Each step:
  + Writes a symbol to the cell which is under the tape head
  + Changes current state if needed
  + The tape head will then move either to the left or the right
* Input/Tape alphabets:
  + The **input alphabet (Σ)**, all input strings are written in the input alphabet
  + A **tape alphabet (Γ)**, **Σ ⊆ Γ** (**Σ** is a subset of **Γ**) the tape alphabet contains all symbols that can be written onto the tape
    - The tape alphabet can contain any number of symbols, with at least one blank symbol (☐). The ☐ is not an element of Σ
  + When the Turing machine begins it will have an infinite tape of blank symbols (☐) with the input written at a location. The tape head is positioned at the start.
  + This means upon reading , replace it with a and move in the given direction of (
* Once the Turing machine has stopped processing an input, it will not be finished with the input
  + It will then need to decide whether to accept or reject the input
  + This could cause the Turing machine to enter a infinite loop which will never accept or reject the input

If the machine does not go into a accepting or rejecting state the machine will run forever never halting

1. The Turing machine can both read and write on the tape
2. The read and write head on the tape can move left or right, up and down the tape to view each cell on the tape
3. The tape can be infinite
4. Each state for accepting and rejecting will take effect immediately

[*https://s3.amazonaws.com/academia.edu.documents/35002661/\_Sipser\_\_2006\_\_Introduction\_to\_the\_Theory\_of\_Computation\_\_Second\_Edition.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1537739429&Signature=vne%2Fl2nbRLtsoDu%2FnNh0pOnlRro%3D&response-content-disposition=inline%3B%20filename%3DINTRODUCTION\_TO\_THE\_THEORY\_OF\_COMPUTATIO.pdf*](https://s3.amazonaws.com/academia.edu.documents/35002661/_Sipser__2006__Introduction_to_the_Theory_of_Computation__Second_Edition.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1537739429&Signature=vne%2Fl2nbRLtsoDu%2FnNh0pOnlRro%3D&response-content-disposition=inline%3B%20filename%3DINTRODUCTION_TO_THE_THEORY_OF_COMPUTATIO.pdf)

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