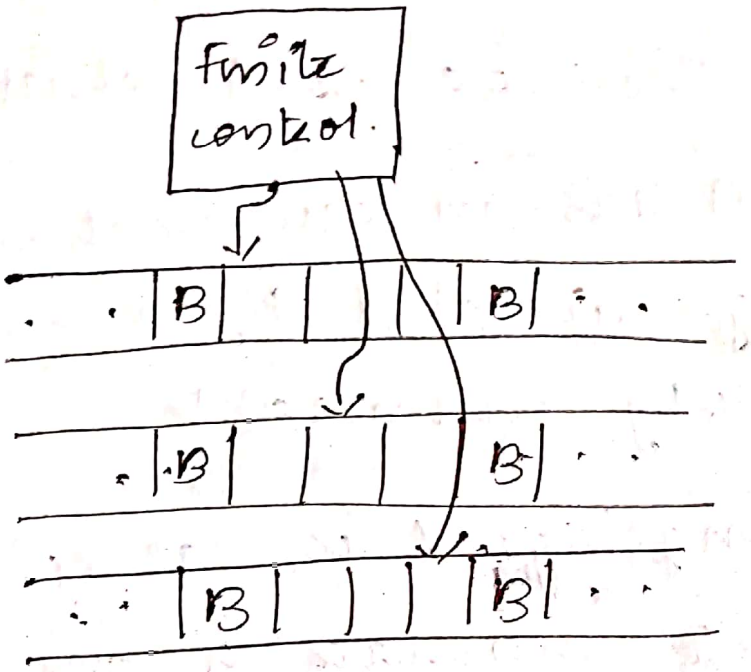
Multitape Turing Machine

A multitape TM has a finite control and some finite no. of tapes. ~~Each tape~~ As in single tape TM, the set of tape symbols include blank, and has a subset called input symbols, of which blank is not a member. The set of states include initial state and some final states.

1. The i/p, a finite sequence of i/p symbols, is placed on first tape.
2. All other cells of all tapes hold blank.
3. The finite control is in initial state.
4. The head of first tape is at the left end of i/p.
5. All other tape heads are at some arbitrary cell.



A move of multitape TM depends on state and symbol scanned by each of tape heads.

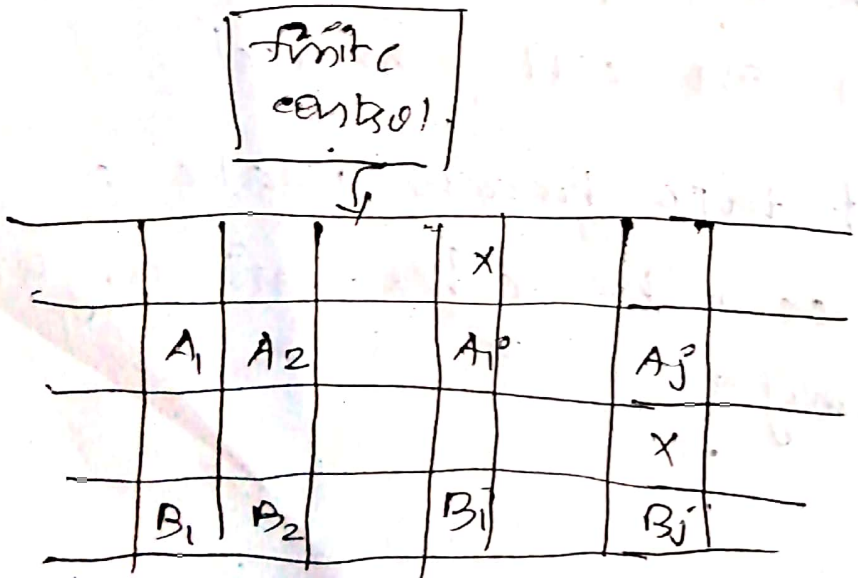
1. The control enters a new state, which could be same as previous states.
2. On each tape, a new tape symbol is written on cell scanned.
3. Each of tape heads make a move, which can be either left, right or stationary.

Equivalence of One-tape and Multitape TM

Every multitape TM has an equivalent single tape TM

* Every language accepted by a multiple TM is recursively enumerable.

Suppose language L is accepted by k-tape TM M. We simulate a one-tape TM N whose tape we think of as having $2k$ tracks. Half these tracks hold tapes of M, and half hold only single marker where the head of each corresponding tape M is currently located.



for a k-tape M it has an equivalent N with k head markers.

After visiting, each head marker and storing each scanned symbol in a component of its finite control, N knows what tape symbols are being scanned by each of M's heads. N now, changes the symbol in each and moves head markers left or right. Finally N changes the state of M as recorded in its own finite control. At this point, N has simulated one move of M.

We select N's accepting states all those states that record M's state as one of accepting states of M. Thus whenever the simulated M accepts, N also accepts, and N does not accept otherwise.