Nondeterminism in Turing Machine (Part-2)

Theorem: Every NondeterministicTM has an equivalent Deterministic TM
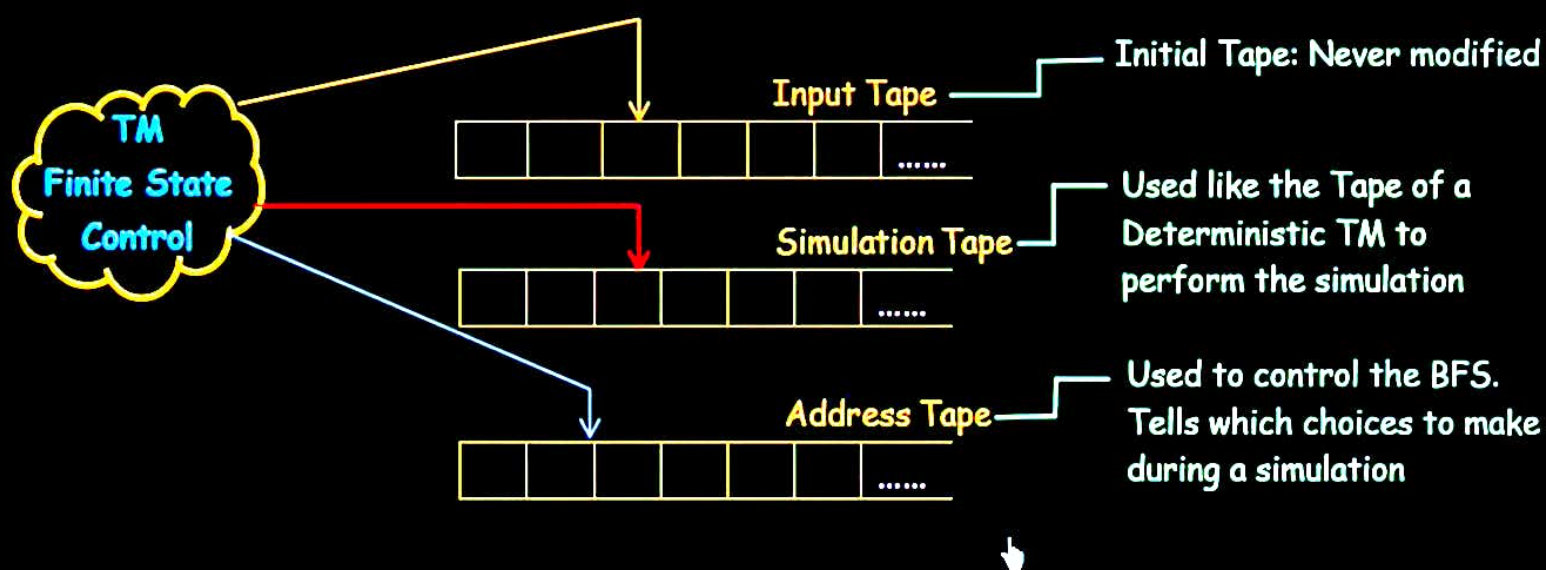
Proof:
- Given a Nondeterministic TM (N) show how to construct an equivalent Deterministic TM (D)
- If N accepts on any branch, the D will Accept
- If N halts on every branch without any ACCEPT, then D will Halt and Reject.

Approach:
- Simulate N
- Simulate all branches of computation
- Search for any way N can Accept

Algorithm:

Initially: TAPE 1 contains the Input
        TAPE 2 and TAPE 3 are empty

- Copy TAPE 1 to TAPE 2
- Run the Simulation
- Use TAPE 2 as "The Tape"
- When choices occur (i.e. when Nondeterministic branch points are encountered) consult TAPE 3
- TAPE 3 contains a Path. Each number tells which choice to make
- Run the Simulation all the way down the branch as far as the address/ path goes (or the computation dies)
- Try the next branch
- Increment the address on TAPE 3
- REPEAT

> If ACCEPT is ever encountered, Halt and Accept
> If all branches Reject or die out, then Halt and Reject