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To prove the double infinite tape Turing machine *D* is equals to Normal ordinary Turing machine *M*.

In order to show the equivalence between *D* and *M*, it is necessary show the following two things:

• First one is, any language *L* that can be recognized by *M* can be recognized by *D* as well, and

• Second part is, any Language *L'* that can be recognized by *D* can be recognized by *M*.

This can be showed by simulation. That is, simulate *D* to act like *M* and vice-versa.

(i) **Simulating *M* by *D*:**

Step 1: Mark the left hand end of *D*.

Step 2: Prevent *D* from moving its head to the left of the mark.

In this way *D* simulates *M*.

(ii) **Simulating *D* by *M*:**

To simulate the doubly infinite tape TM(Turing machine) *D* by an ordinary TM *M,* simulate it with a 2-tape TM.

As the 2 tape TM was already equivalent is power to an ordinary TM.

Simulation of doubly infinite tape TM ' *D* ' with 2-tape TM ' M_1 ':

The first tape of M_1 is written with input string and the second tape is blank.

Now cut the tape of doubly infinite tape Turing machine *D* into two parts, at the starting cell of the input string.

• One part containing input string and all the blank spaces to its right.

• Second part containing left of the input string appears on the second tape, in reverse order.

In this way *M* simulates *D*.

Thus from (i) and (ii)

D is equivalent to *M* i.e., Turing machine with a doubly infinite tape is equivalent to an ordinary Turing machine.