LLRBs
What is it?

- Basically a better representation of B-frees
- Is a ane-to-ore correpondance with another B-tree
- In a $B$-tree, if thee is a rive with two values, then in an LLEB, there is a left red ink to push dom the smaller value

[7
LLRB Papertios
(1) No mote bus two reed links प?
(2) Every path from coot to leaf his same number of black call lints (LCRB 1-1 correspond to B-trees, each path from coot to leaf in $B$-tree has same number of black links ).
(3) Max passible LLRB height $=2 \mathrm{H}+1$, where $H$ is hight of corresponding $B$-tree
(4) BST Properties: every node left of node less than node; evens node on right of greater than note.

Insertion (LLRB)
Insertion always adds a node with a red link to the bottom of the tree.
(1) Add into tree as a leaf rode (same procedive w BST) w/ red link
(2)

- If thee is a right leaning wild with red link, we have left leaning violation. - Rotate left parent nude of wild

- If there are tho consecutive red links of a hide $x$, there is a inaracet 4 -mode volution -rote right peat wise of $x$

- If there are nodes with two red-linted children, there is a 4 -nide violation. - Color flip all lints of the poet of the two rece-linted diidden


