4.

```
median ( A, B, sa, ea, sb, eb)
{
    ma = ⌊(sa + ea)/2⌋ ; // median of A
    mb = ⌊(sb + eb)/2⌋ ; // median of B
    if (A.length == 1 and B.length == 1)
        return (A[0] + B[0])/2 ;
    else if (A.length == 2 and B.length == 2)
        return ( max( A[0], B[0])+
                 min( A[1], B[1]))/2 ;
    else if (A[ma] > B[mb])
        return median ( A, B, sa, ma-1, mb+1,
                        eb)
    else if (A[ma] < B[mb])
        return median(A, B, ma+1, ea, sb, mb-1,
    else
        return A[ma] ; // case : ma = mb
}
```

2. If a node is red, then both of its children are black. From this property we can say $b \geq h/2$

where b = black height of the RB tree
h = height of the RB tree

(a) Now for maximum number of internal nodes the RB tree will be a complete binary tree with alternating black and red level of nodes and we have $b = h/2$

Total number of internal nodes for this kind of tree is $2^h - 1 = 2^{2b} - 1$

(b) For minimum number of internal nodes the RB tree will be a binary tree consisting of all black nodes and we have $b = h$

Total number of internal nodes for this kind of tree is $2^h - 1 = 2^b - 1$

You can refer to https://www.cs.usfca.edu/~galles/visualization/RedBlack.html

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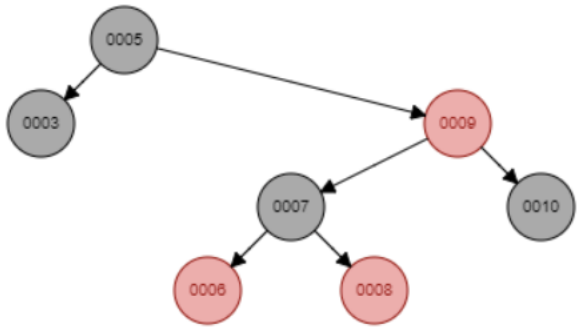
Red/Black Tree

Insert | Delete | Find | Print | Show Null Leaves



Animation Completed

Skip Back | Step Back | Pause | Step Forward | Skip Forward

Animation Speed

w: 1000 h: 500 | Change Canvas Size | Move Controls

Algorithm Visualizations