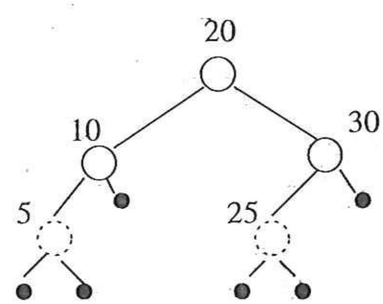
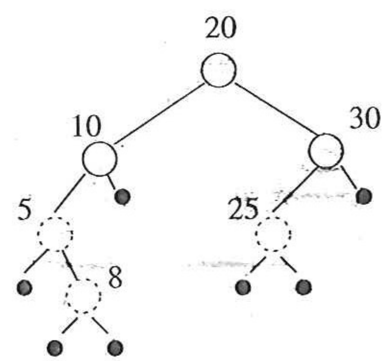
4.
```
median ( A, B, sa, ea, sb, eb)
{
    ma = ⌊(sa + ea)/2⌋ ;  // median of A
    mb = ⌊(sb + eb)/2⌋ ;  // median of B
    if (A.length == 1 and B.length == 1)
          return (A[0] + B[0])/2 ;
    else if (A.length == 2 and B.length == 2 )
          return (max(A[0], B[0])+
                      min(A[1], B[1]))/2 ;
    else if (A[ma] > B[mb])
          return median( A, B, sa, ma-1, mb+1,
    else if (A[ma] < B[mb])                              eb)
          return median(A, B, ma+1, ea, sb, mb-1)
    else  return A[ma] ;   // case: ma = mb
```

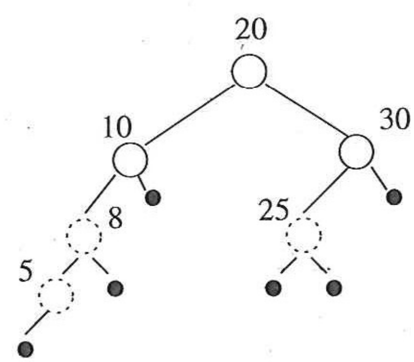
1. Start with the following tree:



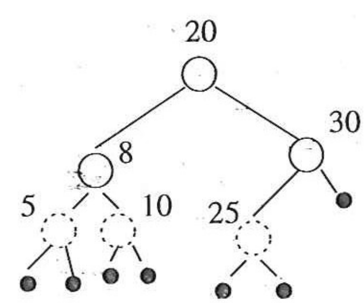
Insert 8. This gives us the following tree.



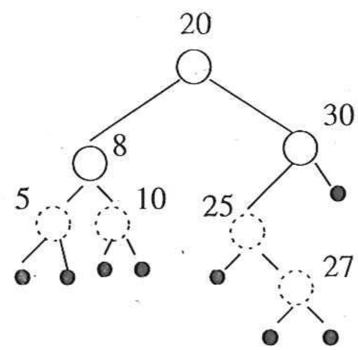
This puts us in case 2 (aunt is black and we have the zig-zag pattern). We first left rotate to get this tree:



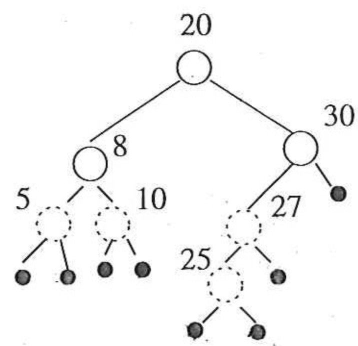
This moves us to case 3 which we fix by doing a right rotate and a recolor:



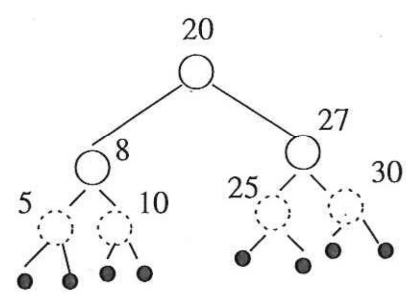
Now we insert 27:



Again we are in case 2. We first left rotate:



Now we right rotate and recolor:



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 $2^h - 1 = 2^b - 1$