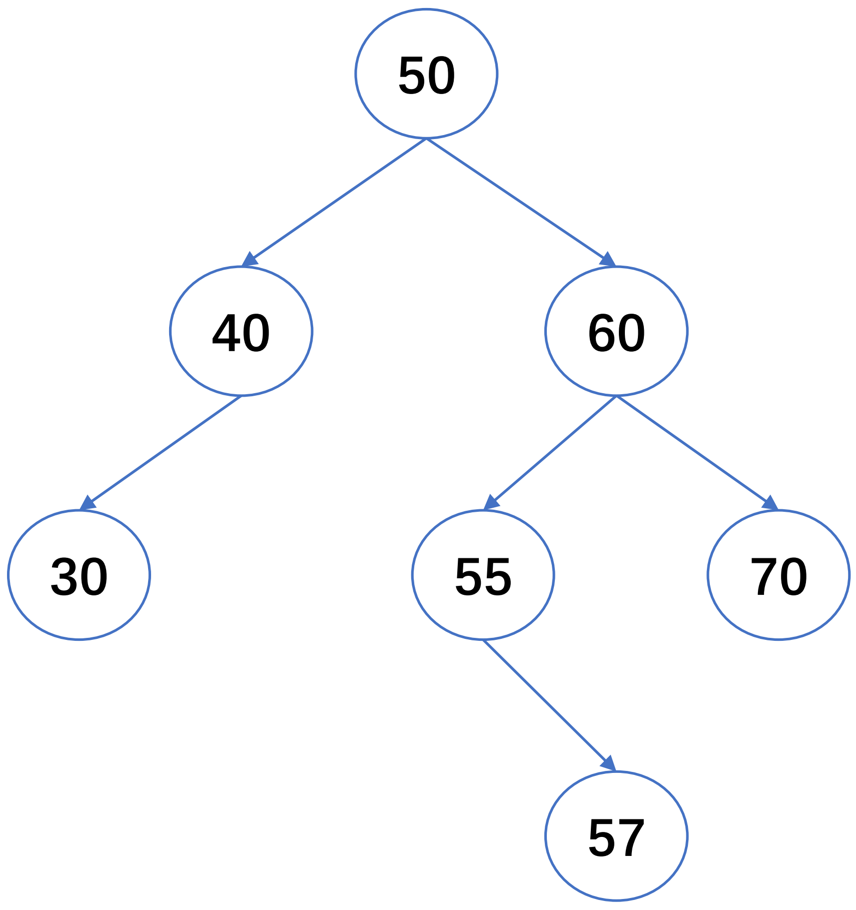
1. If there is a binary search tree, whose node is between 1 and 1000, now we want to search a node whose key is 363. Which of the following is impossible for a search sequence? C

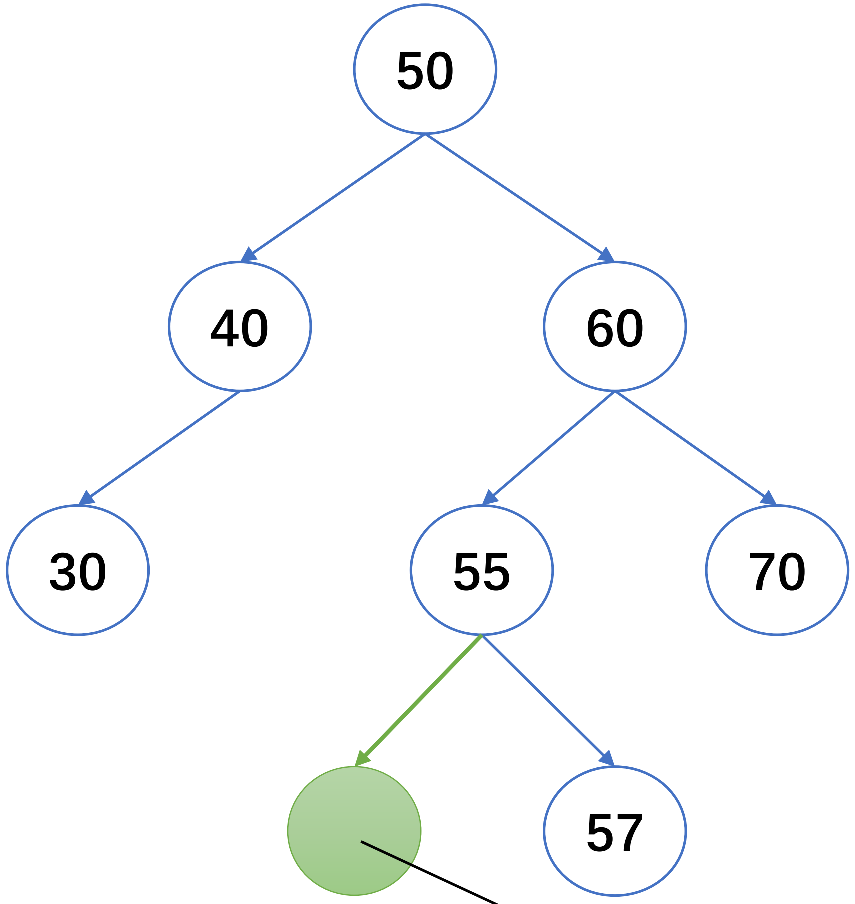
A. 2, 252, 401, 398, 344, 397, 363
B. 924, 220, 911, 244, 898, 258, 362, 363
C. 925, 202, 911, 240, 912, 245, 363
D. 2, 399, 387, 219, 266, 382, 381, 278, 363



For any node i, the nodes in i's left subtree are always less or equal than i, and the nodes in its right subtree are always larger or equal than i.

2. Consider whether the following statement is correct or not:

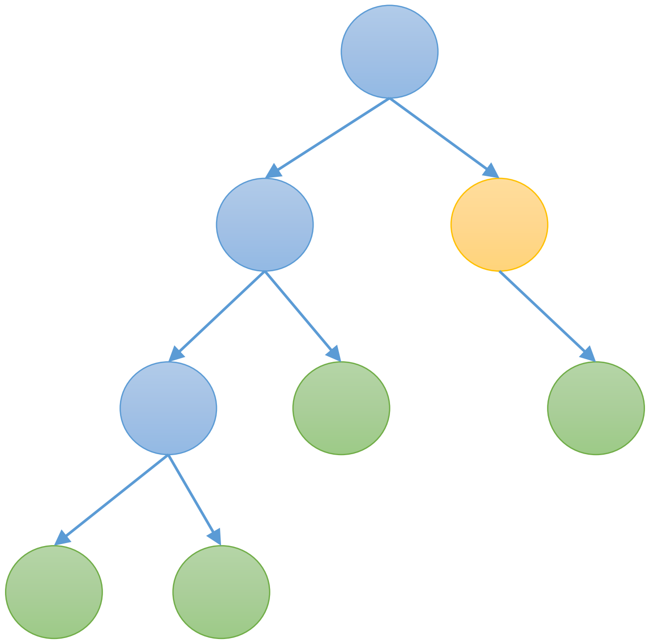
In a binary search tree, if node u has two children, its successor has no left child



correct

The value of this node is between 50 and 55, so it will become the new successor.

3. Prove that in a binary tree, the number of nodes whose degree are 0(leaf node) minus the number of nodes whose degree are 2 is equal to 1.



For example, the blue nodes' degree are 2, the green nodes' degree is 0. And the number of green nodes is 4, the number of blue nodes is 3, so we can get 4-3=1.

Proof: Let n denotes the number of nodes in the whole binary tree, n0 denotes the number of nodes whose degree is 0, n1 denotes the number of nodes whose degree is 1, n2 denotes the number of nodes whose degree is 2.

Since it is a binary tree, we have n=n0+n1+n2 (1)

And every nodes with degree 1 have 1 child and every nodes with degree 2 have two children, so the total number of children in this tree is n'=n1+2*n2.

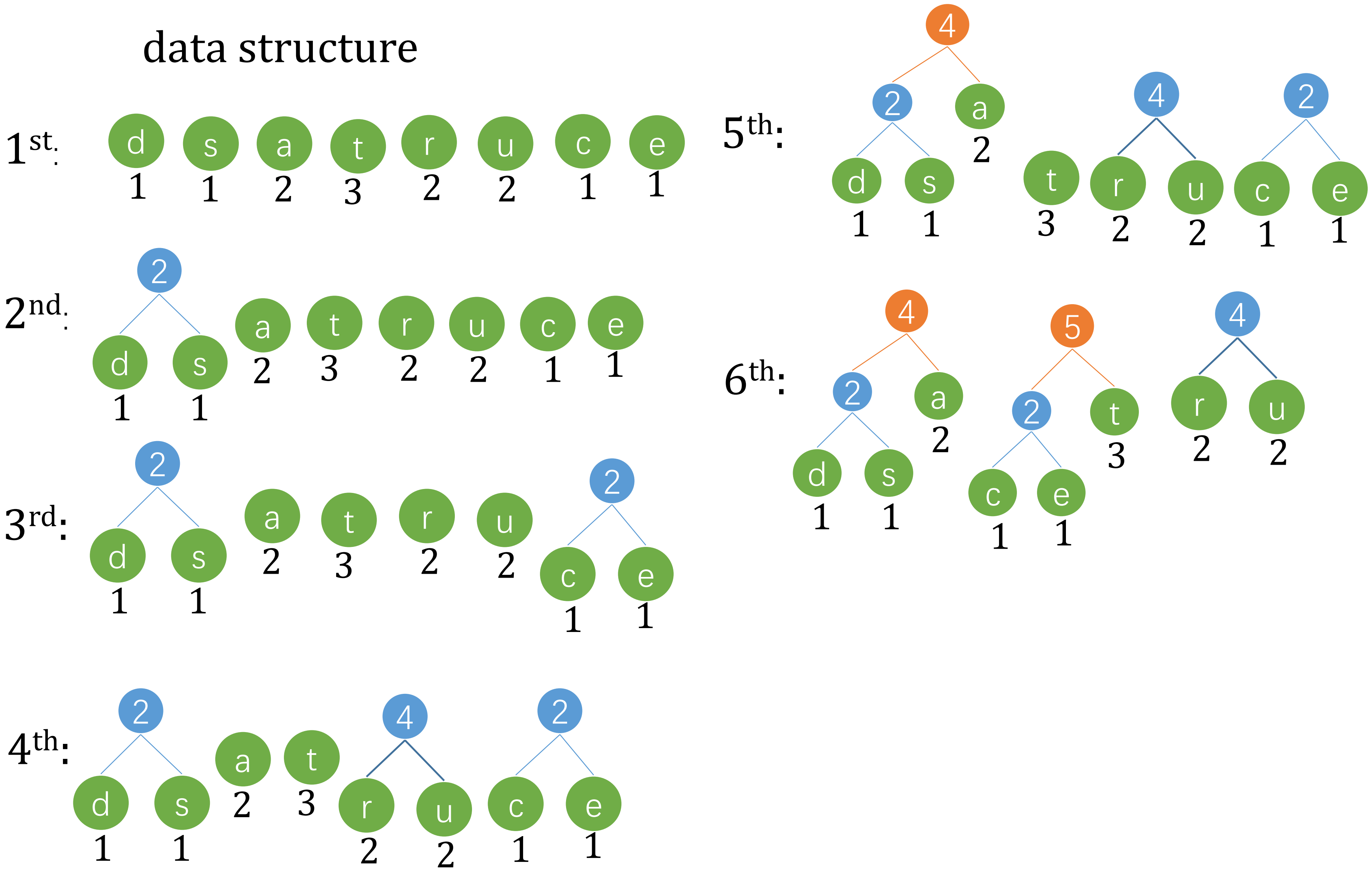
In the binary tree, only the root node is not a child, so we have

n = n'+1 = n1+2*n2+1 (2)

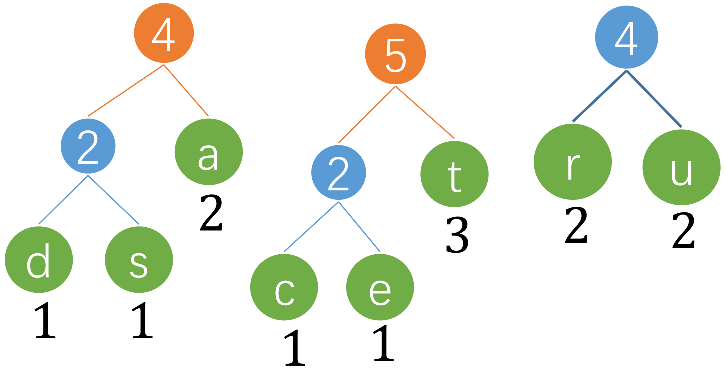
Combining (1) and (2), we can get n0+n1+n2=n1+2*n2+1, therefore, n0-n2=1.

4. Construct the Huffman Code for the following message:

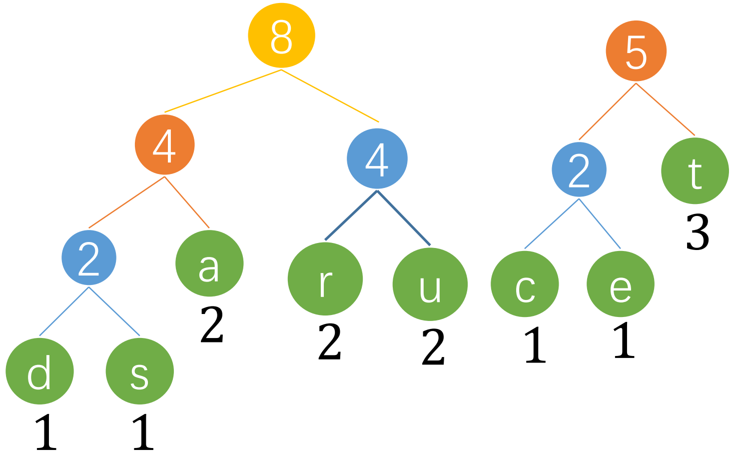
letter	Frequency
d	1
a	2
t	3
s	1
r	2
u	2
c	1
e	1



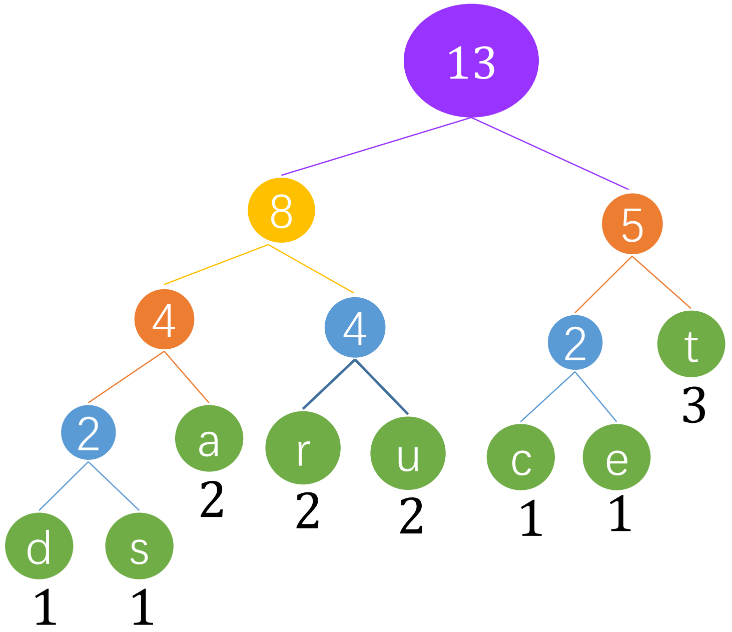
6th:



7th:



8th:



letter	Frequency	Code
d	1	0000
a	2	001
t	3	11
s	1	0001
r	2	010
u	2	011
c	1	100
e	1	101

$$\frac{\sum l_i f_i}{\sum f_i} = \frac{2\times3+(3+3+3)\times2+(3+3+4+4)\times1}{1+2+3+1+2+2+1+1}$$

$$= \frac{38}{13}$$