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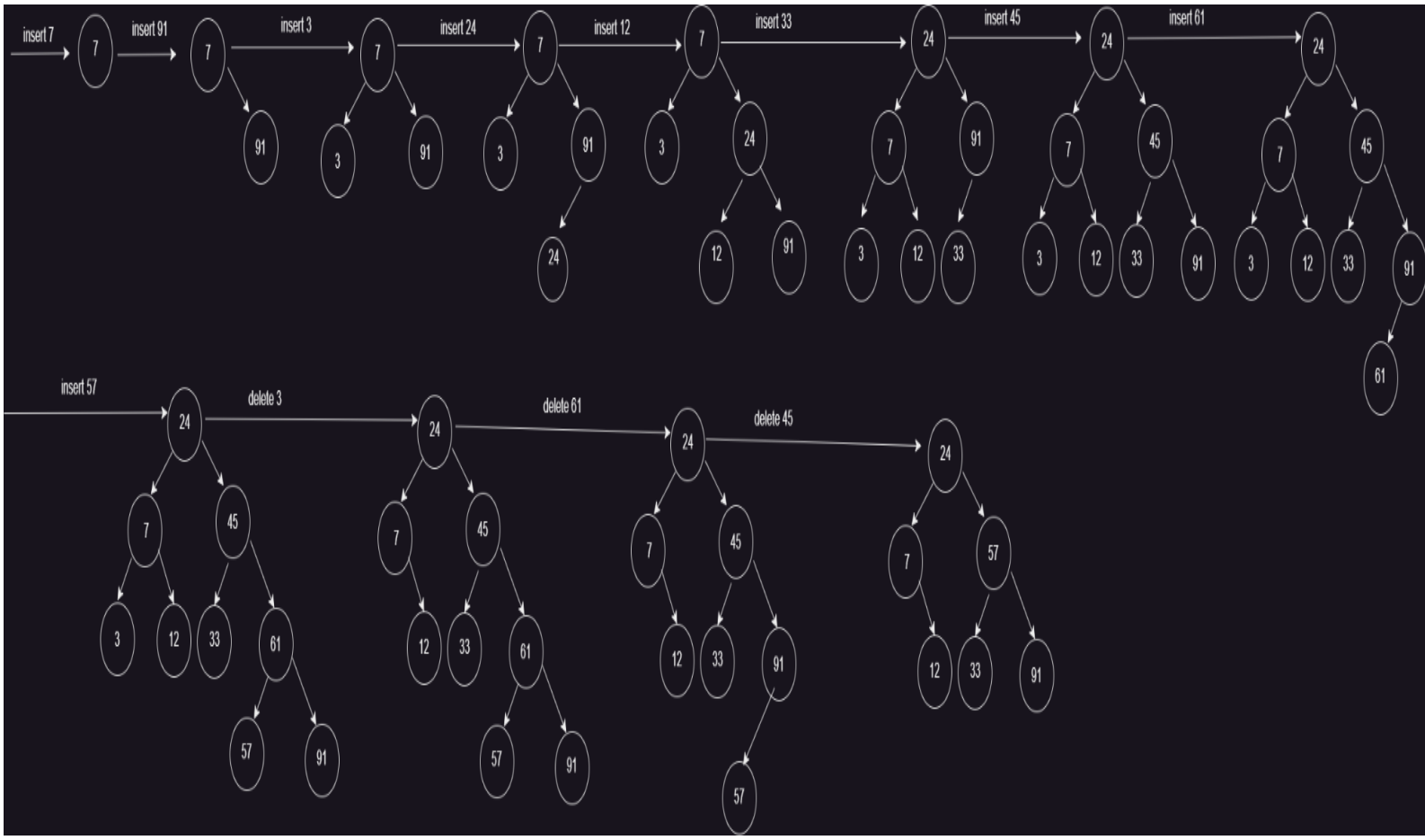
CS202
HOMEWORK 4 - Balanced search trees and Hashing

QUESTION 1

a) AVL trees

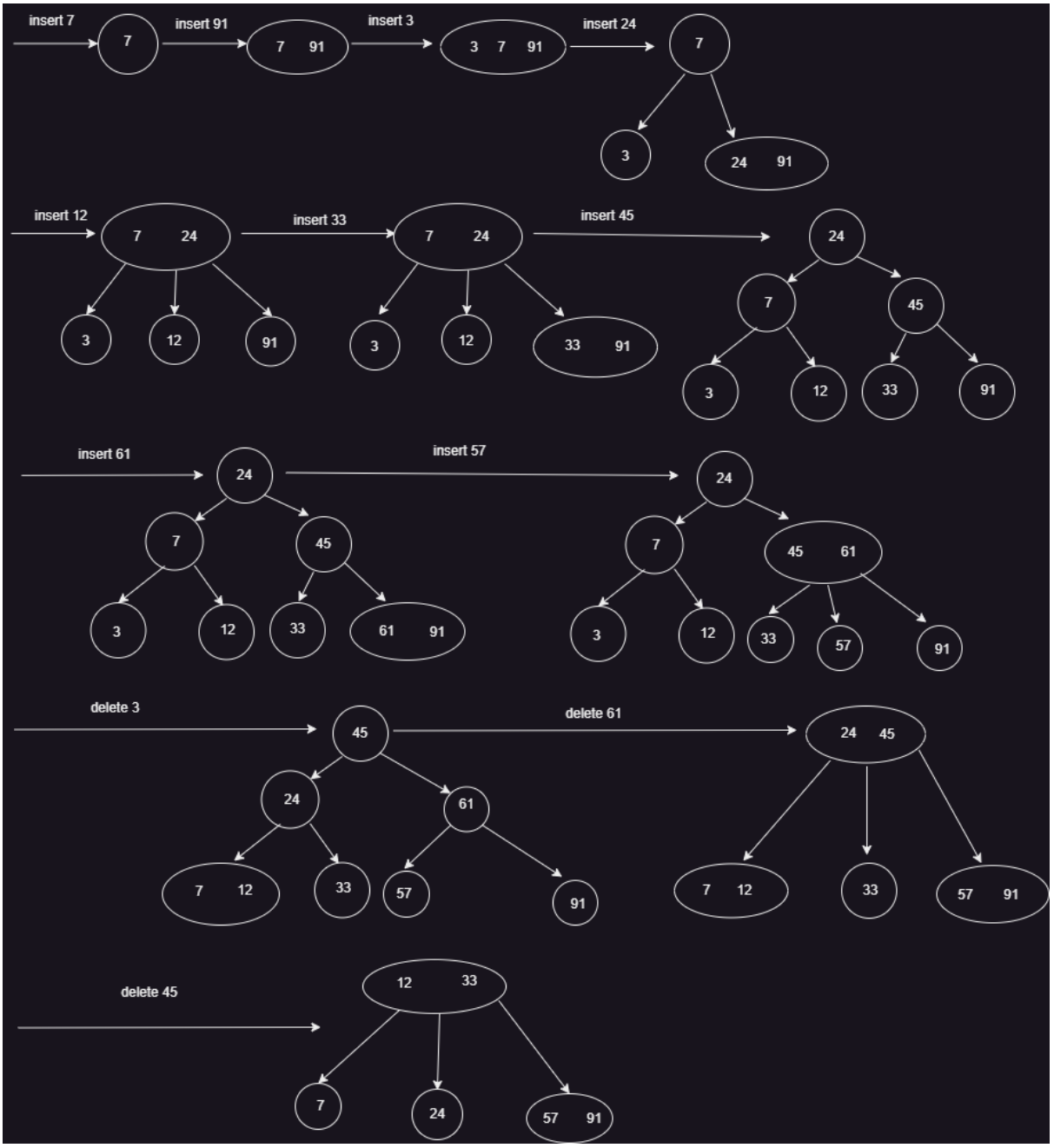


Deletion 3 → Since 3 is the leaf node, it is simply deleted and checking inorder successor is not necessary.

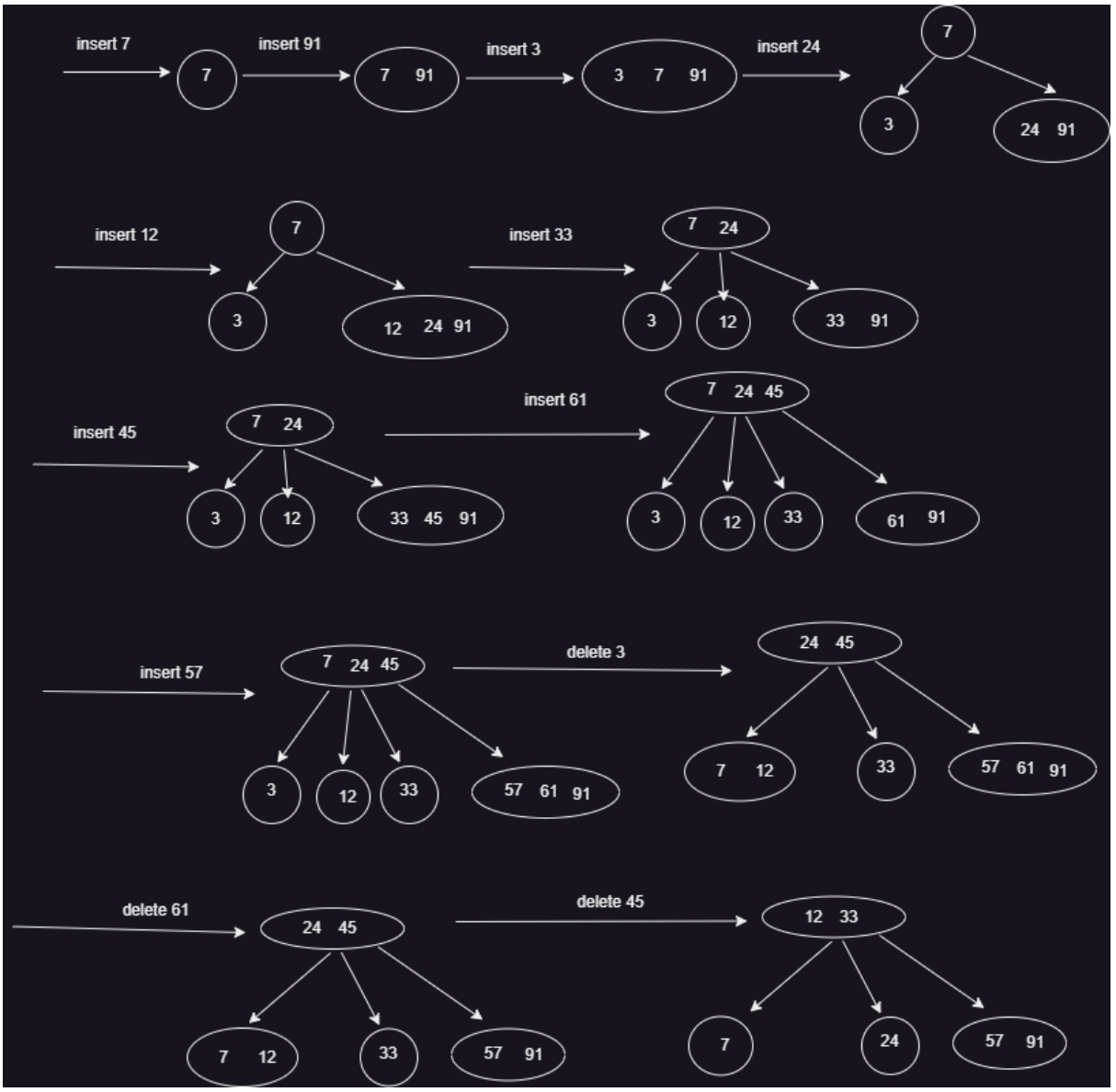
Deletion 61 → Since 61 has two children, inorder successor of 61 should be checked. Inorder successor means the smallest node in the right subtree of the internal node(node with two children). Thus, inorder successor of 61 is 91. 91 should be substituted for 61.

Deletion 45 → Since 45 has two children again inorder successor should be checked. Inorder successor of 45 is 57. 57 should be substituted for 45.

b) 2-3 trees


insert 7
7
insert 91
7 91
insert 3
3 7 91
insert 24
7
3
24 91
insert 12
7 24
3
12
91
insert 33
7 24
3
12
33 91
insert 45
24
7
45
3
12
33
91
insert 61
24
7
45
3
12
33
61 91
insert 57
24
7
45 61
3
12
33
57
91
delete 3
45
24
61
7 12
33
57
91
delete 61
24 45
7 12
33
57 91
delete 45
12 33
7
24
57 91

c) 2-3-4 trees


insert 7
7
insert 91
7 91
insert 3
3 7 91
insert 24
7
3
24 91
insert 12
7
3
12 24 91
insert 33
7 24
3
12
33 91
insert 45
7 24
3
12
33 45 91
insert 61
7 24 45
3
12
33
61 91
insert 57
7 24 45
3
12
33
57 61 91
delete 3
24 45
7 12
33
57 61 91
delete 61
24 45
7 12
33
57 91
delete 45
12 33
7
24
57 91