FACULTY OF SCIENCE

ACADEMY OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

MODULE	CSC03A3/CSC3A10 COMPUTER SCIENCE 3A
CAMPUS	AUCKLAND PARK CAMPUS (APK)
ASSESSMENT	AVL TREE EXAMPLES **MEMO**

DATE: 2023-05-10 **SESSION:** Practice

ASSESOR(S): PROF D.T. VAN DER HAAR
PROF H. VADAPALLI

DURATION: 36 MINUTES **MARKS:** 30

Please read the following instructions carefully:

1. Answer **all** the questions
2. Write *cleanly* and *legibly*.
3. You may use a non-programmable calculator to answer the questions.
4. This paper consists of 13 pages.

QUESTION 1

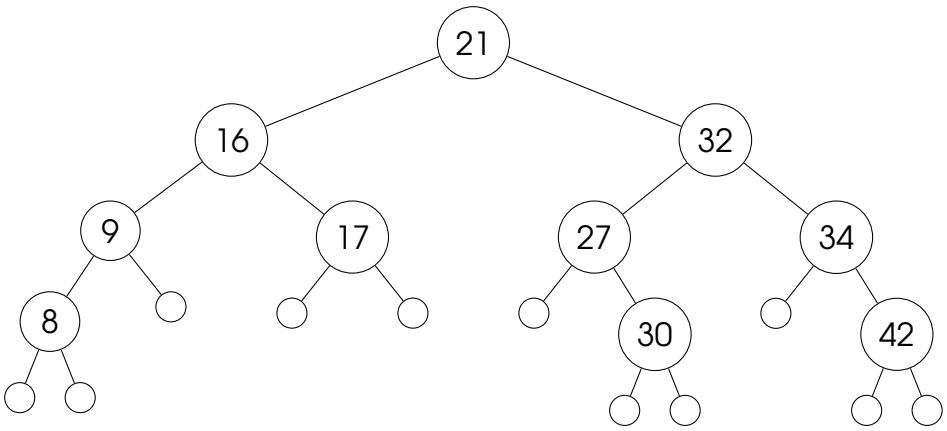
(a) Consider the following AVL tree provided below. Draw the AVL tree state after each of the following operations. If the tree is rebalanced draw the state before and after it being balanced. Removal operations should follow from the tree that resulted from the insertion operations. (15)

1. Insert nodes that contain the following keys: (inserted one-by-one, in the given order)

   17, 29, 14, 26, 24

2. Delete nodes that contain the following keys: (removed one-by-one, in the given order)

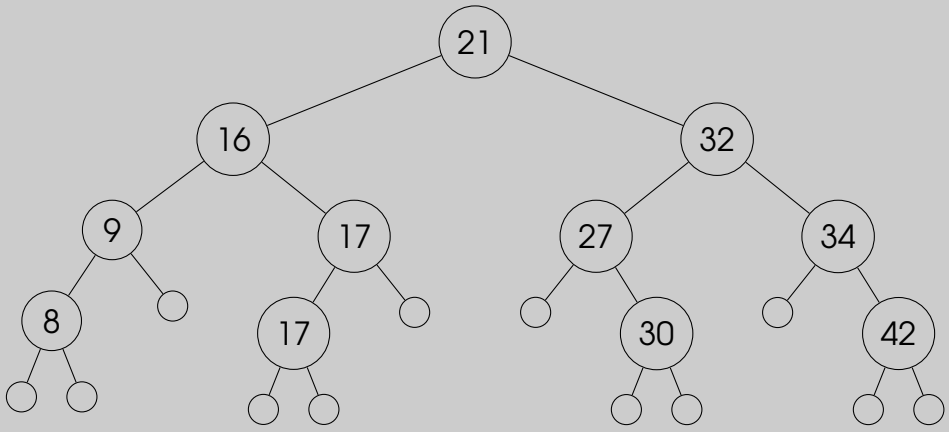
   17, 32, 14, 24



Solution:

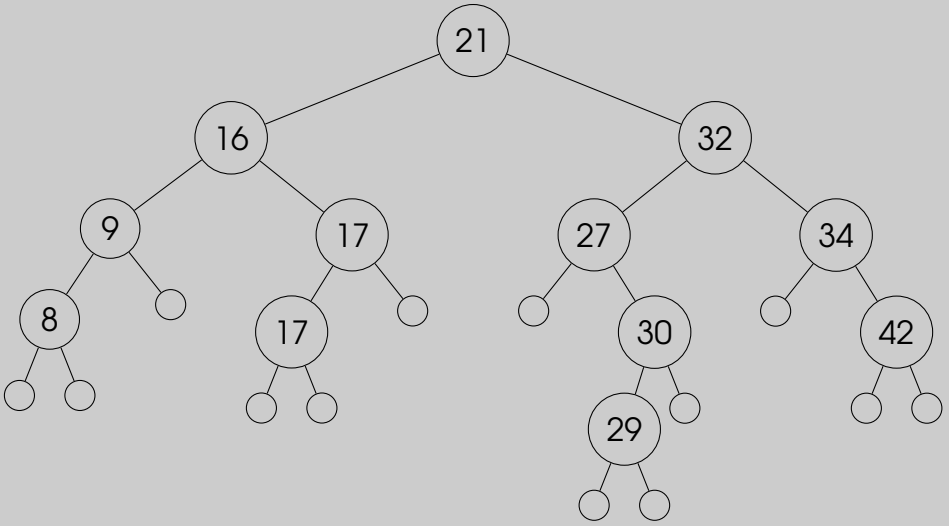
Insert 17

(1 mark):

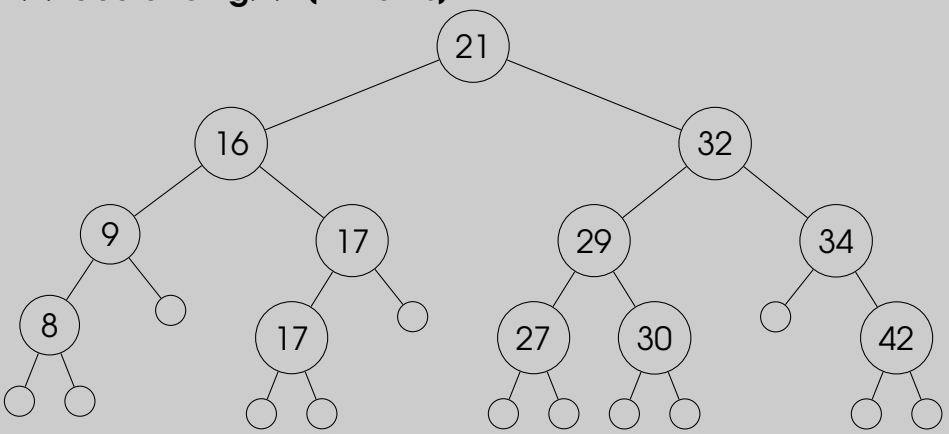


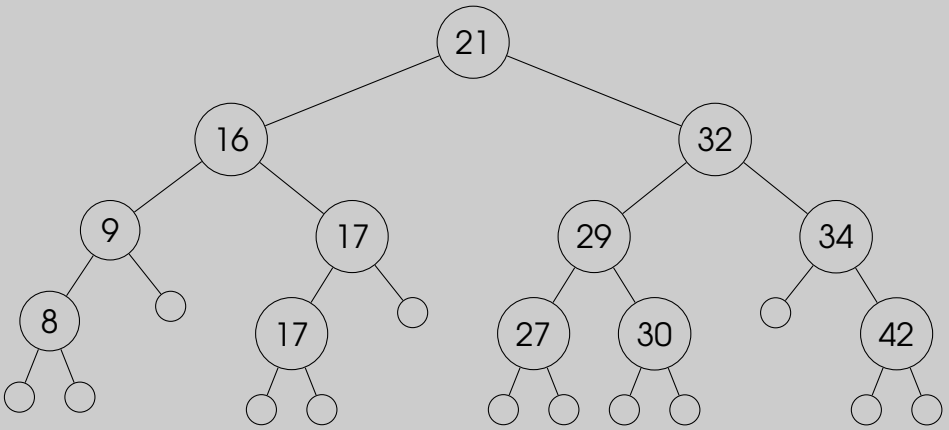
Insert 29

(1 mark):



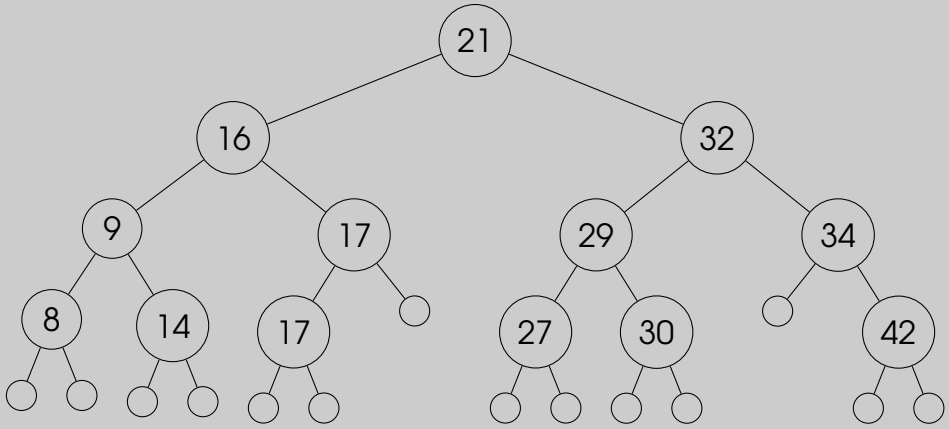
<<**Rebalancing**>> **(2 marks):**





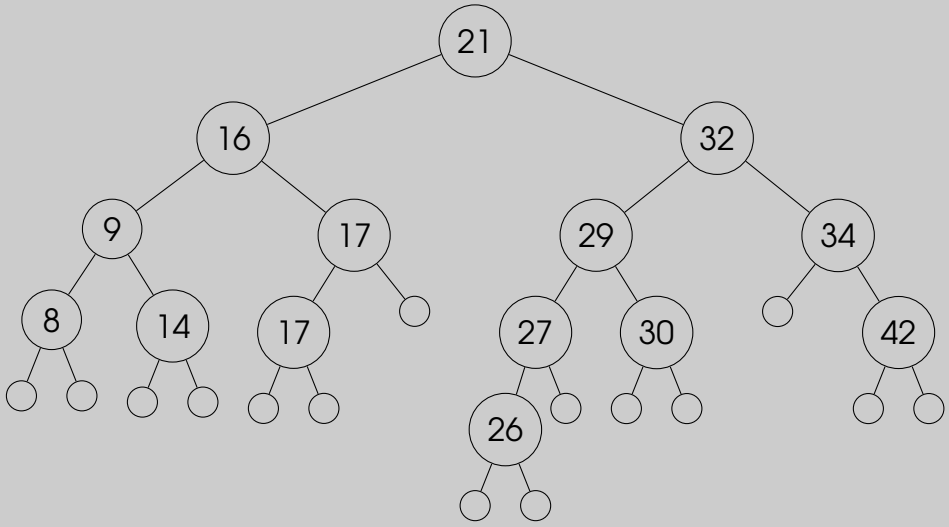
Insert 14

(1 mark):



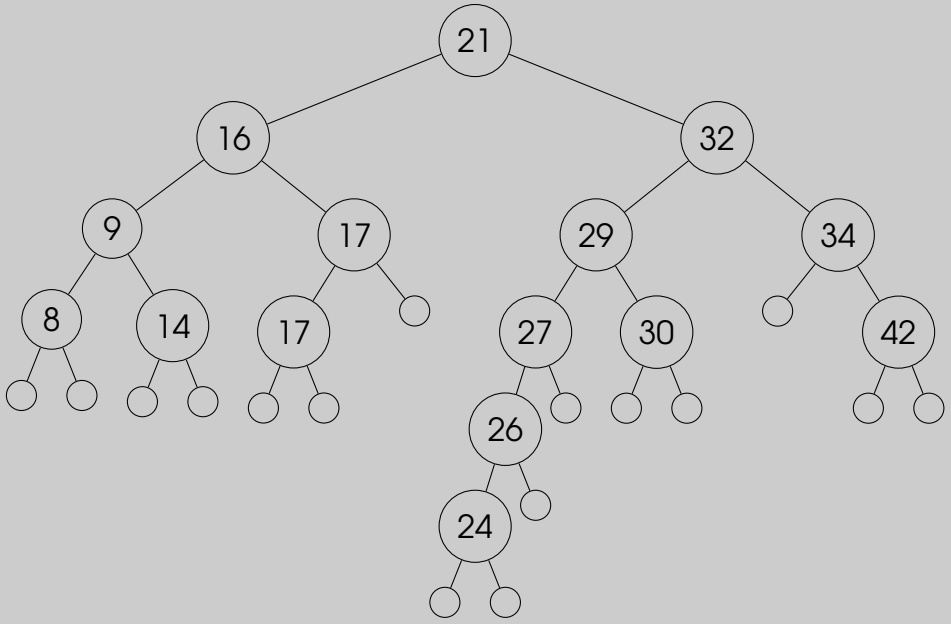
Insert 26

(1 mark):

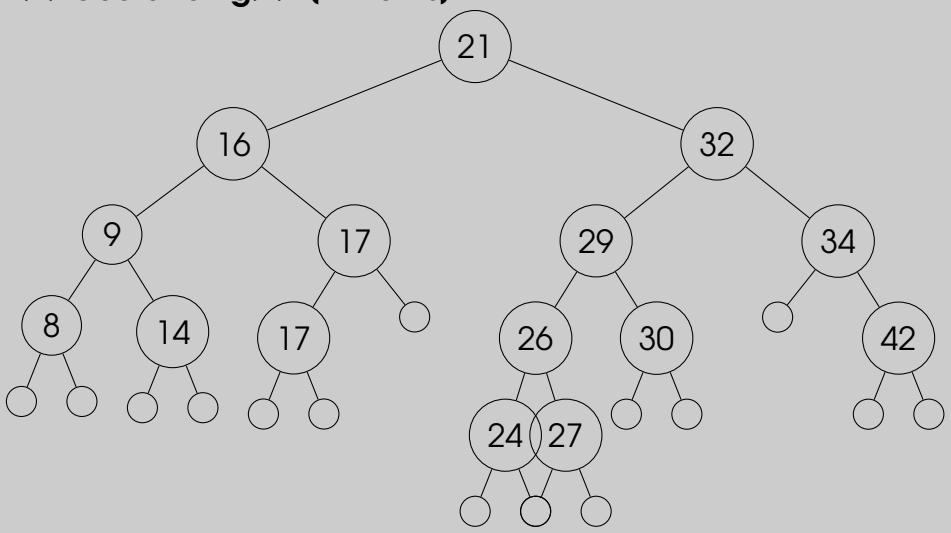


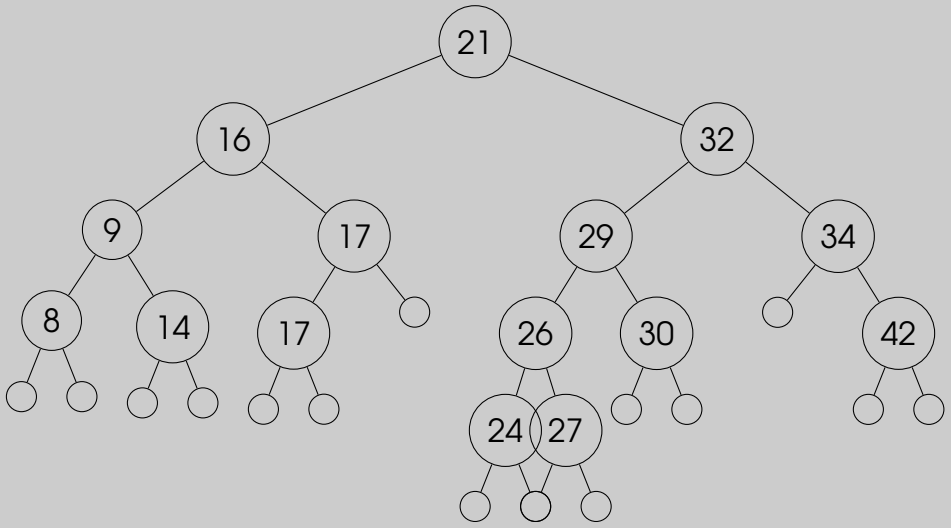
Insert 24

(1 mark):



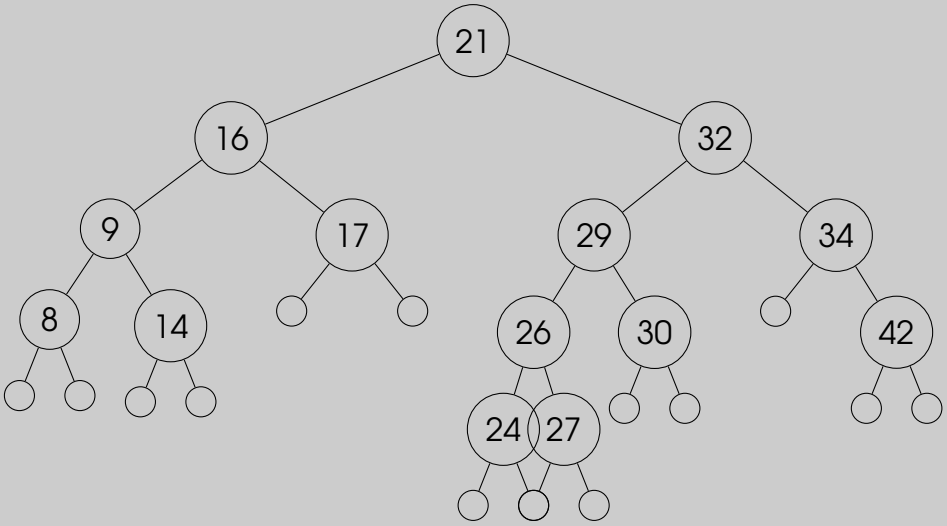
<<**Rebalancing**>> **(2 marks):**





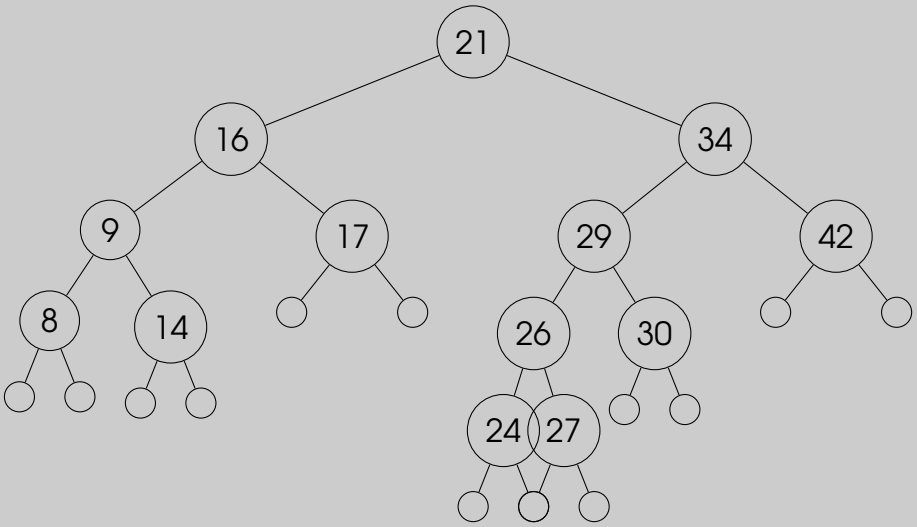
Remove 17

(1 mark):

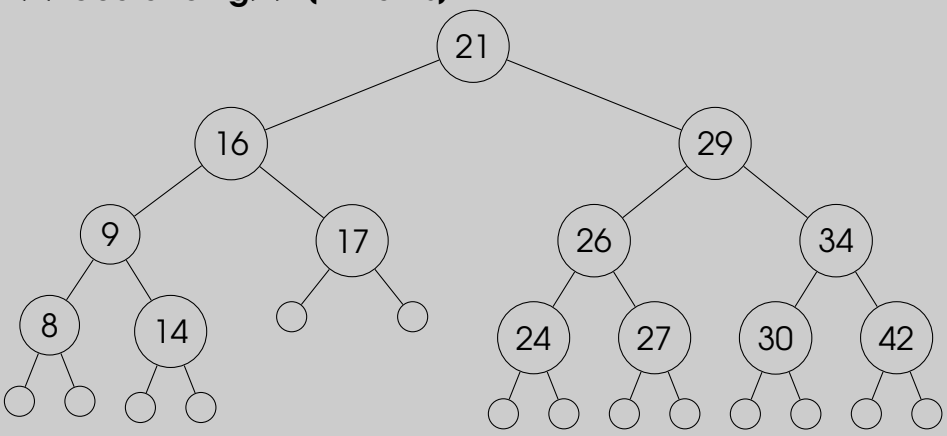


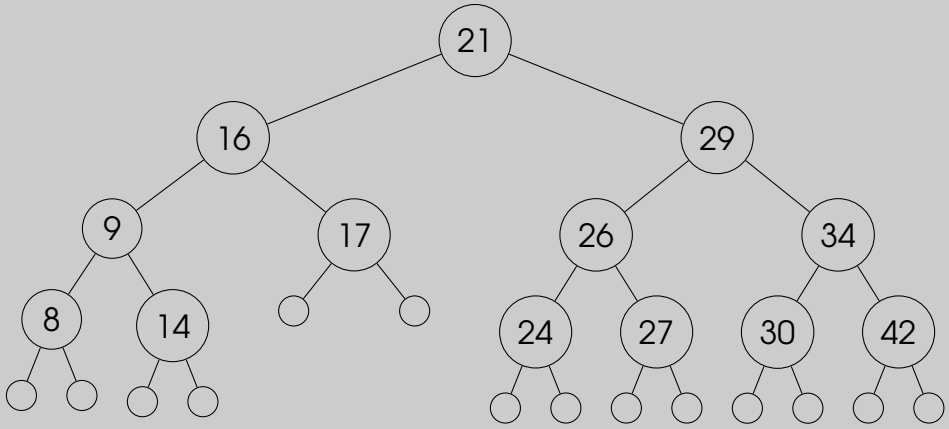
Remove 32

(1 mark):



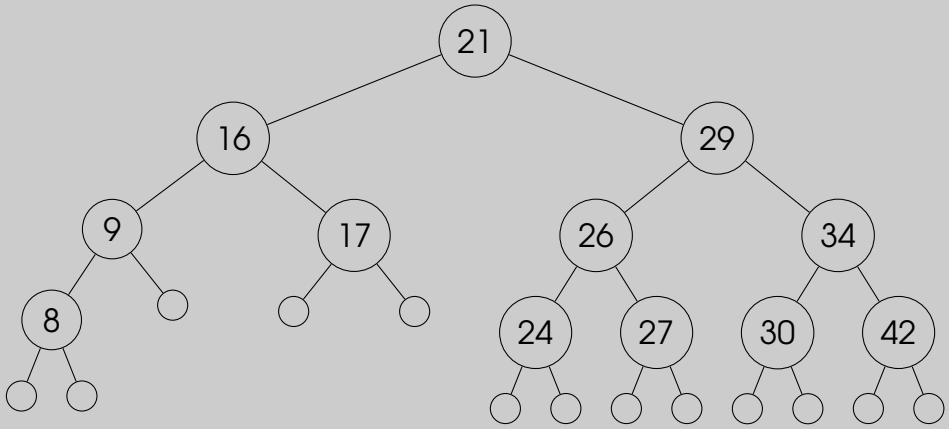
<<**Rebalancing**>> **(2 marks):**





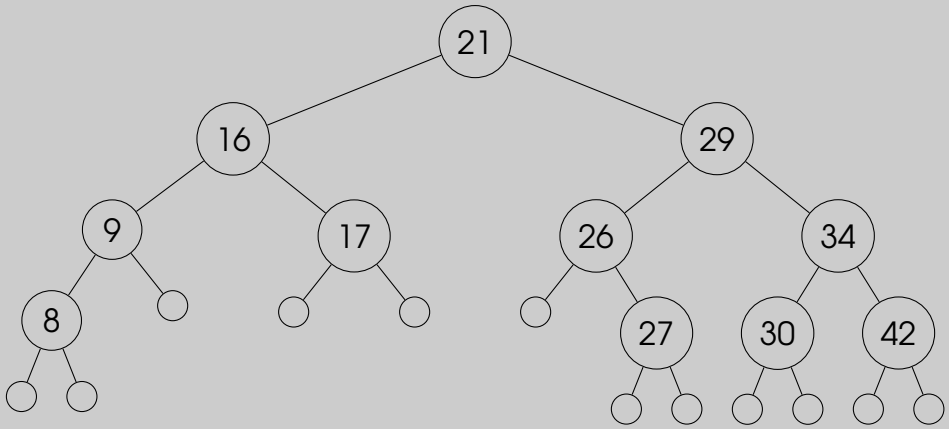
Remove 14

(1 mark):



Remove 24

(1 mark):



Total: 15 marks

(b) Consider the following AVL tree provided below. Draw the AVL tree state after each of the following operations. If the tree is rebalanced (15)

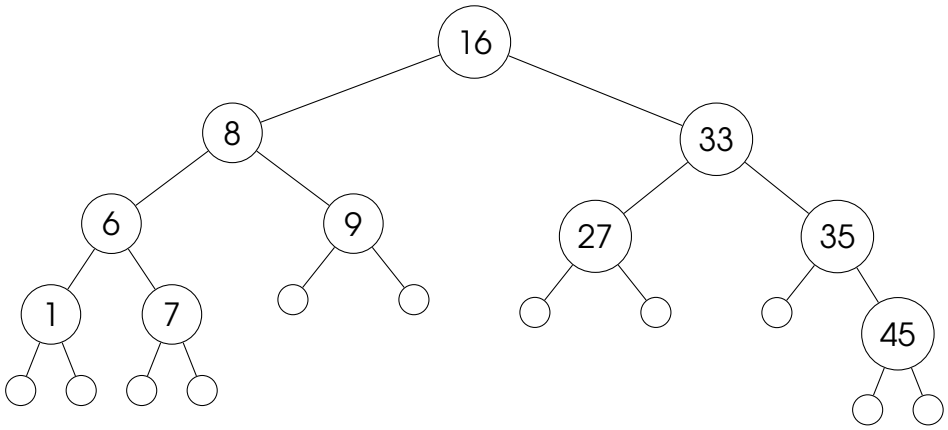
draw the state before and after it being balanced. Removal operations should follow from the tree that resulted from the insertion operations.

1. Insert nodes that contain the following keys: (inserted one-by-one, in the given order)

   23, 23, 20, 29, 8

2. Delete nodes that contain the following keys: (removed one-by-one, in the given order)

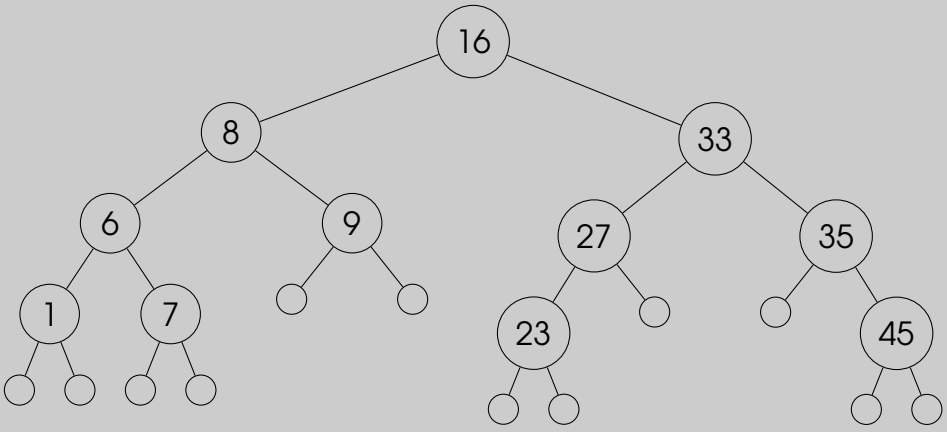
   1, 33, 9, 27



Solution:

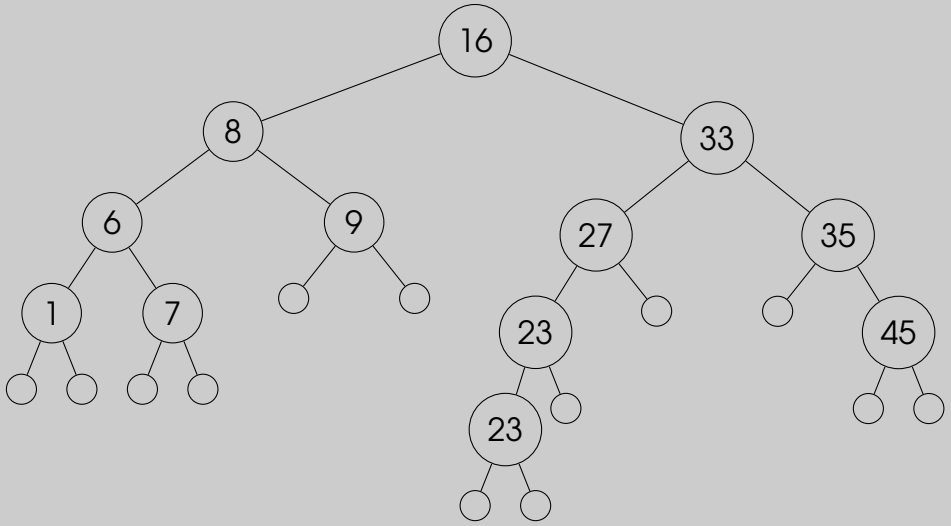
Insert 23

(1 mark):

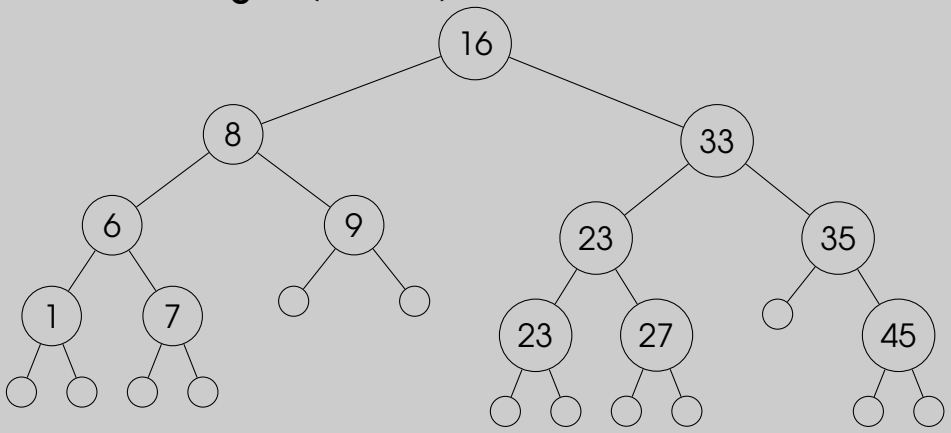


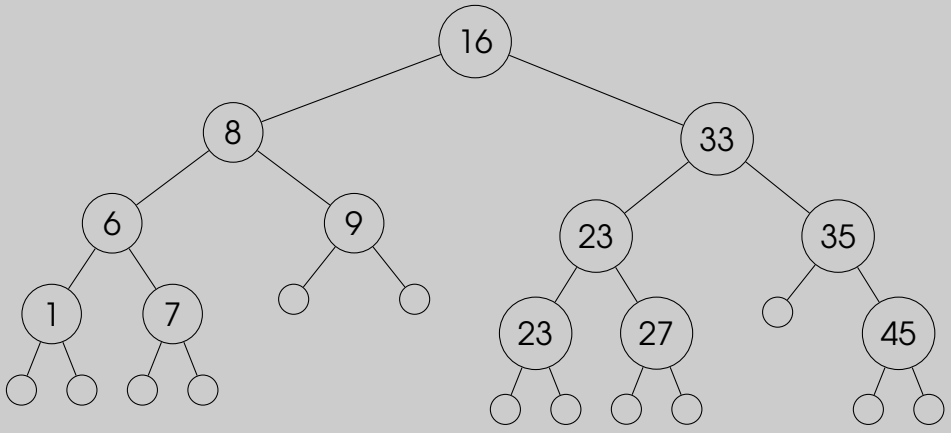
Insert 23

(1 mark):



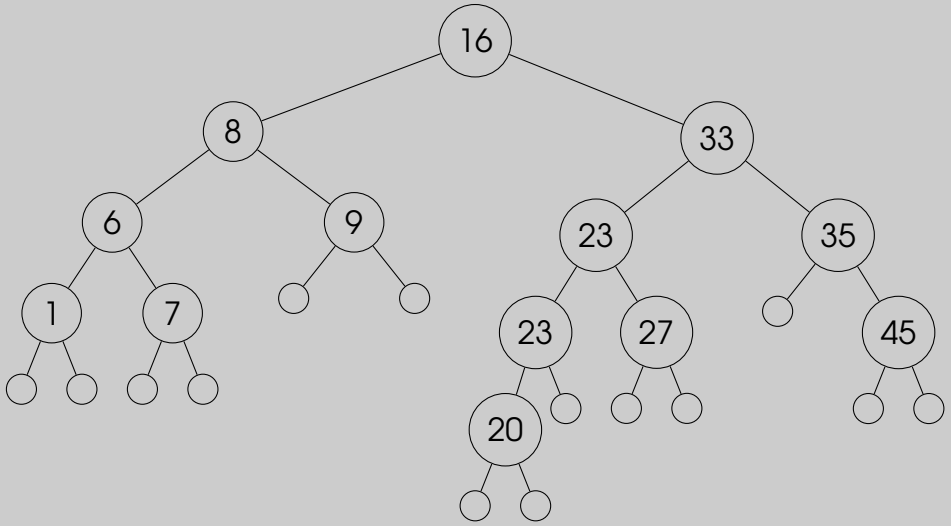
<<**Rebalancing**>> **(2 marks):**





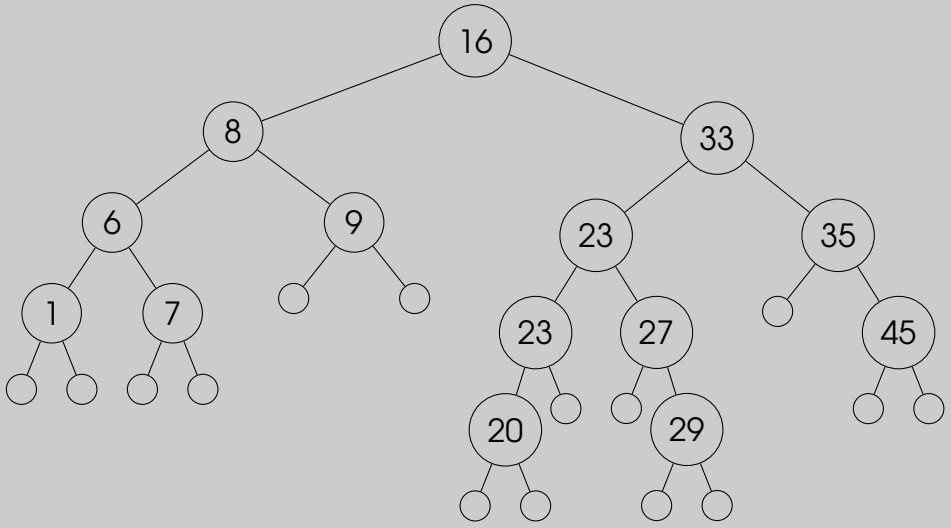
Insert 20

(1 mark):



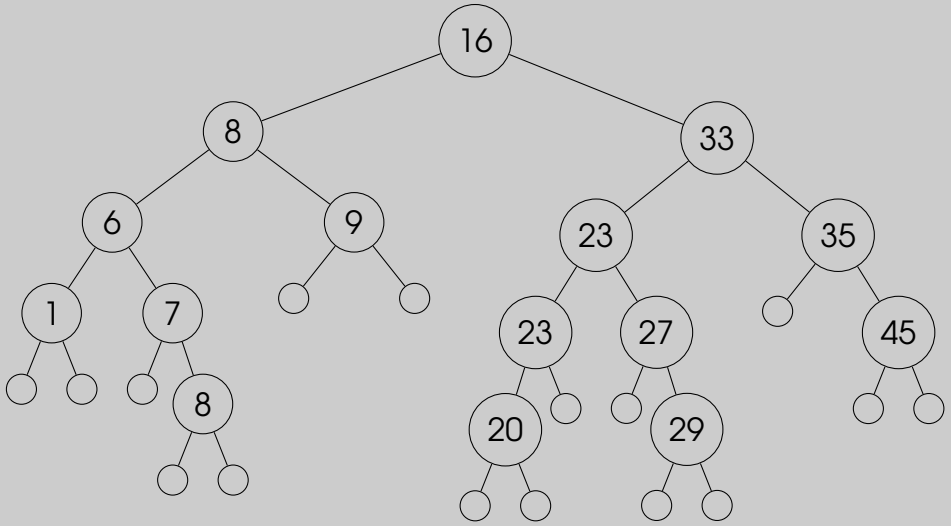
Insert 29

(1 mark):

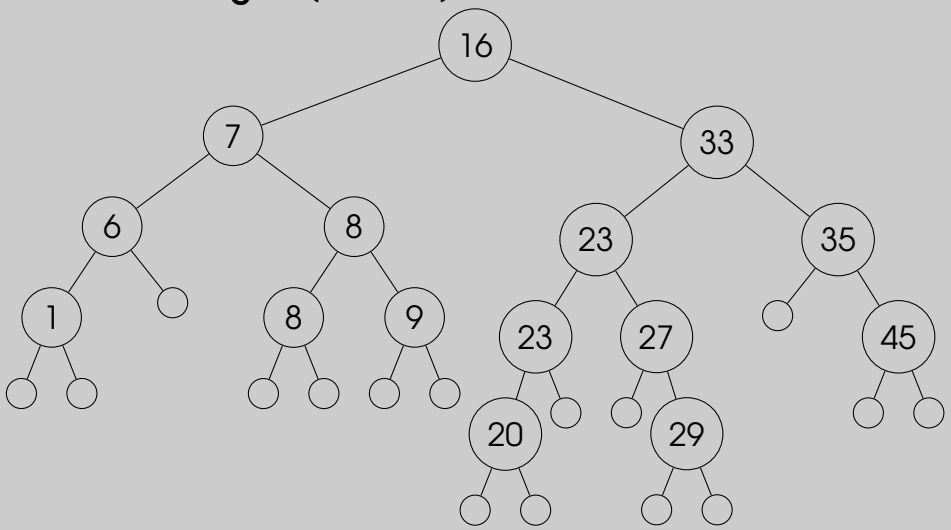


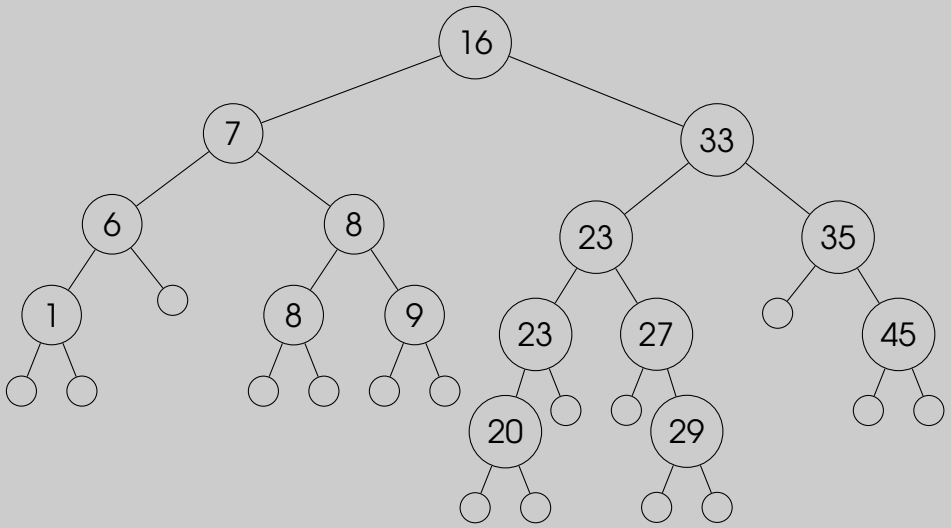
Insert 8

(1 mark):



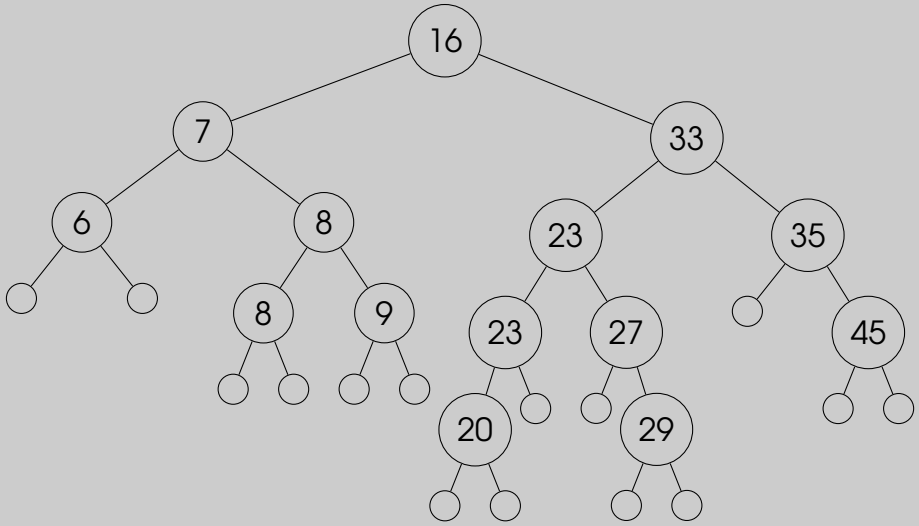
<<**Rebalancing**>> **(2 marks):**





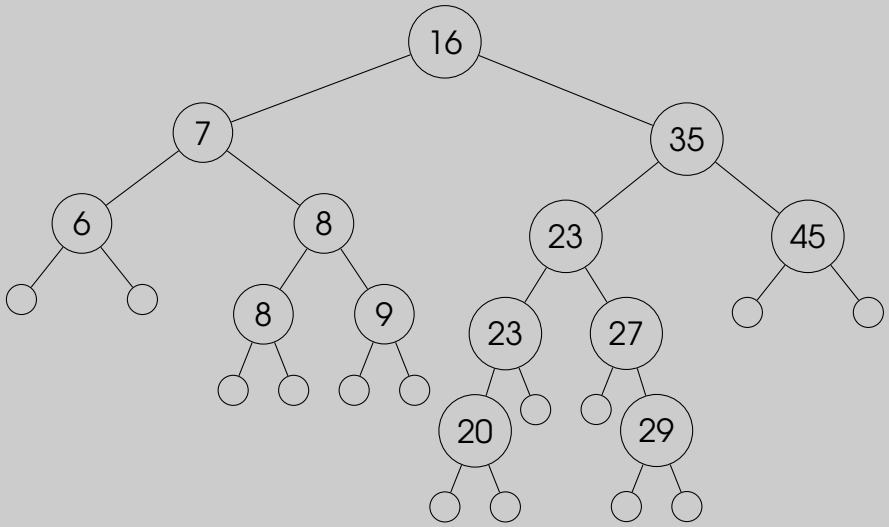
Remove 1

(1 mark):

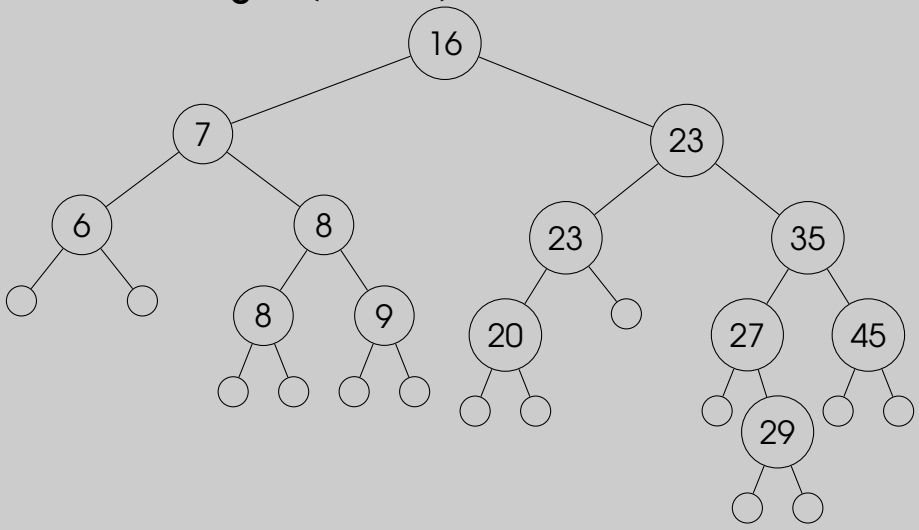


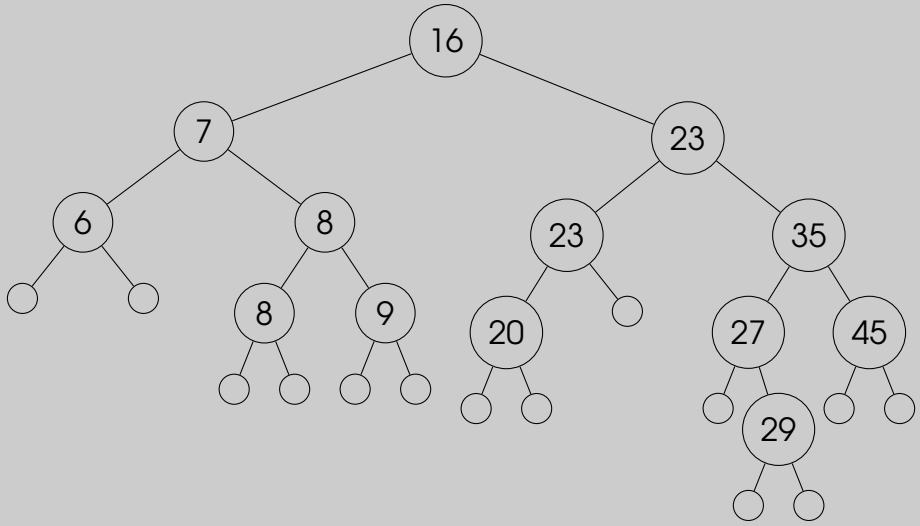
Remove 33

(1 mark):



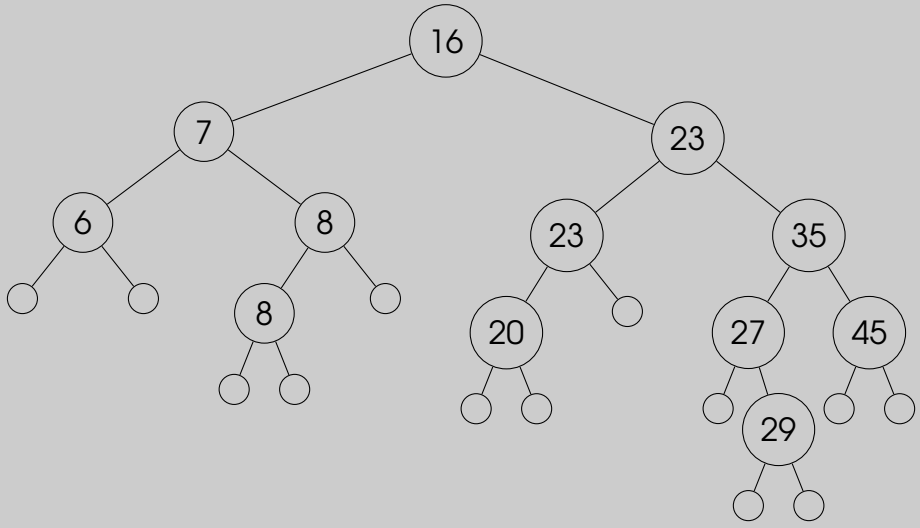
<<**Rebalancing**>> **(2 marks):**





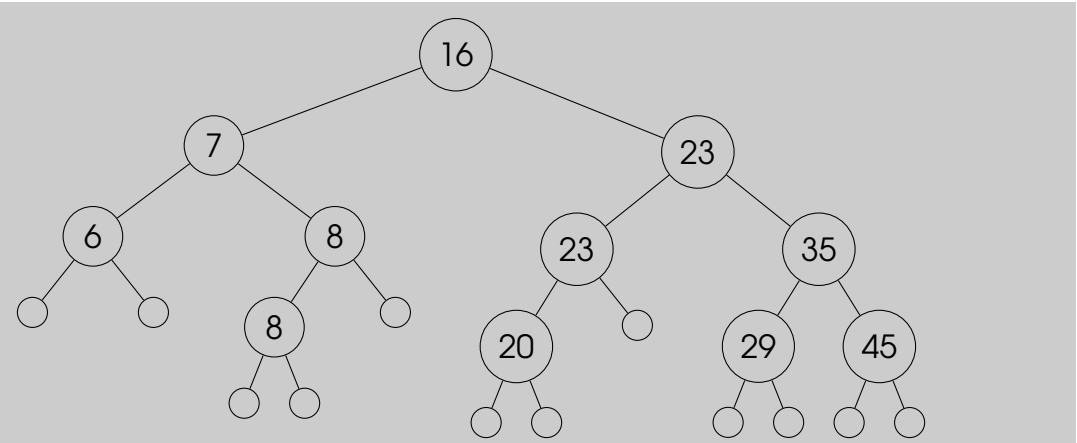
Remove 9

(1 mark):



Remove 27

(1 mark):



Total: 15 marks

Total: 30

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