# Algorithms Design and Analysis [ETCS-301]

Dr. A K Yadav
Amity School of Engineering and Technology
(affiliated to GGSIPU, Delhi)
akyadav1@amity.edu
akyadav@akyadav.in
www.akyadav.in
+91 9911375598

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# Recursion tree method

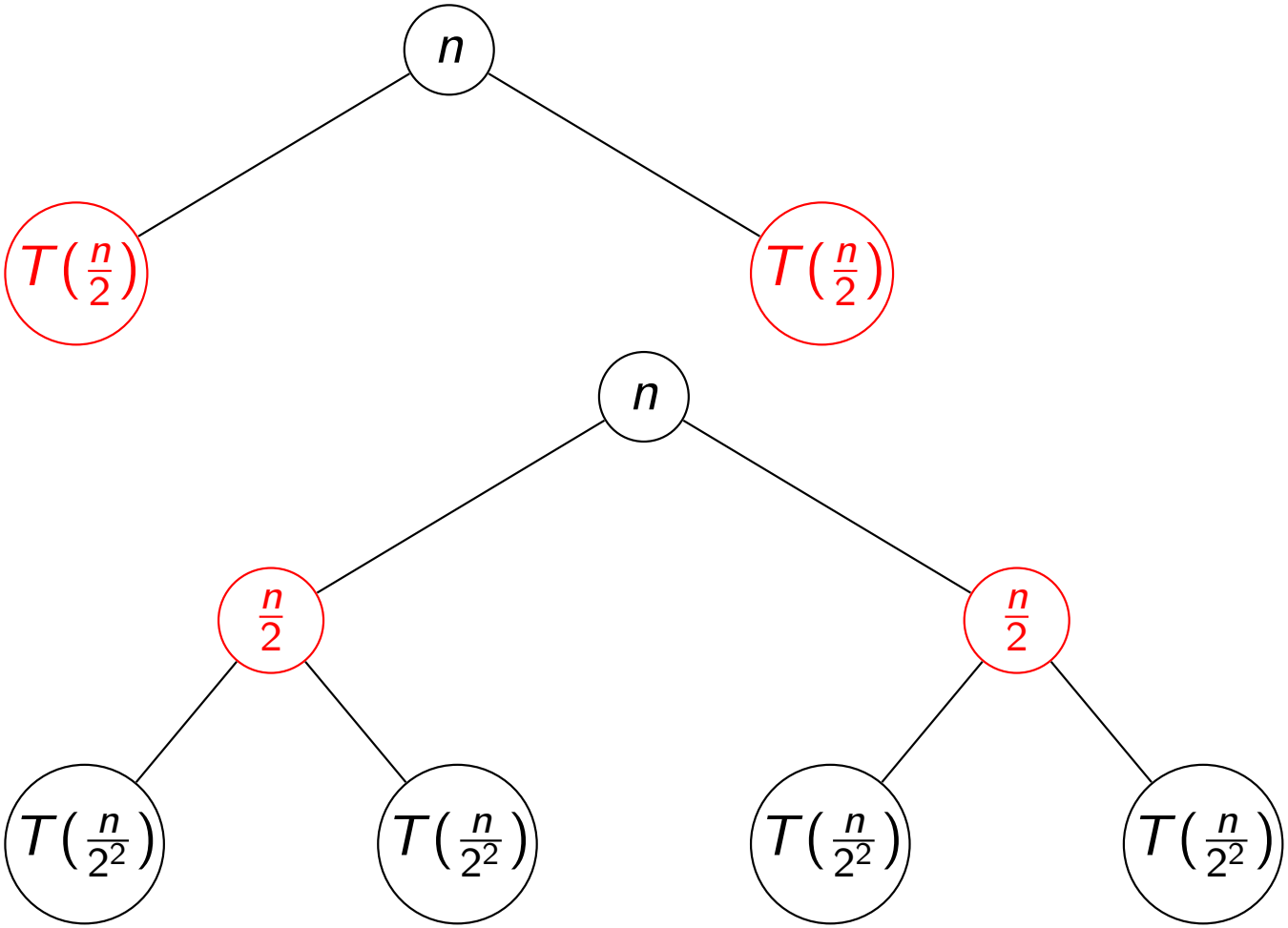
- Represent the problem as a tree taking non recurrence term on the root
- Expend the leaf node by using the recurrence relation
- Stop the process when input size reaches at a particular level
- Each node represent the cost of a sub problem
- Sum of all nodes of a level is level-cost
- Sum of all level is the cost of the problem

# Examples of Recursion tree method

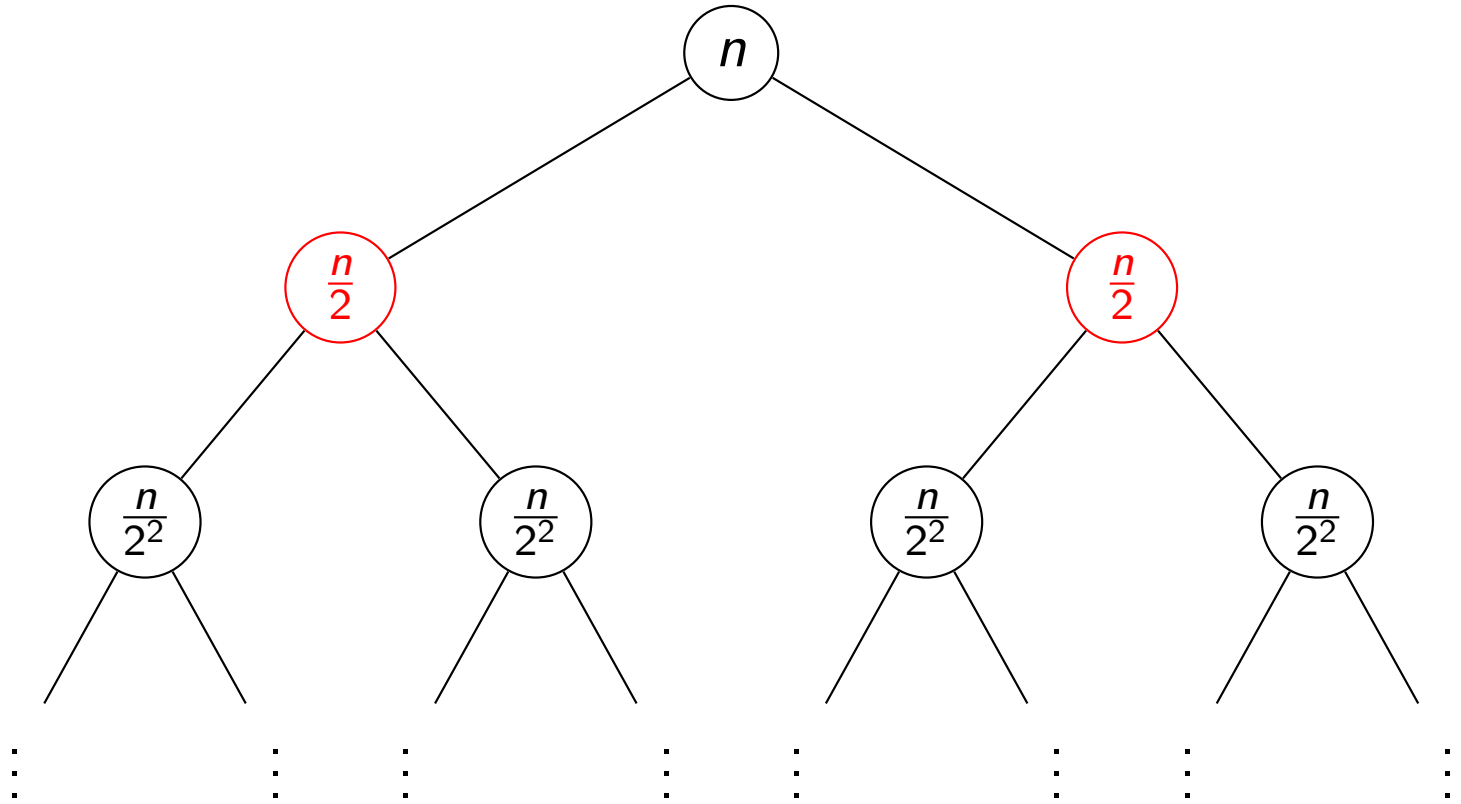
1. Find the solution of $T(n) = 2T(n/2) + n$
2. Find the solution of $T(n) = 3T(n/4) + cn^2$
3. Find the solution of $T(n) = T(n/2) + 1$
4. Find the upper and lower bound solution of $T(n) = T(n/3) + T(2n/3) + cn$
5. Determine a good asymptotic upper bound on the recurrence $T(n) = 3T(n/2) + n$.
6. Determine a good asymptotic upper bound on the recurrence $T(n) = T(n/2) + n^2$.
7. Determine a good asymptotic upper bound on the recurrence $T(n) = T(n-1) + T(n/2) + n$.
8. Give an asymptotically tight solution to the recurrence $T(n) = T(n-a) + T(a) + cn$, where $a \geq 1$ and $c > 0$ are constants.

# Example 1 of Recursion tree method I

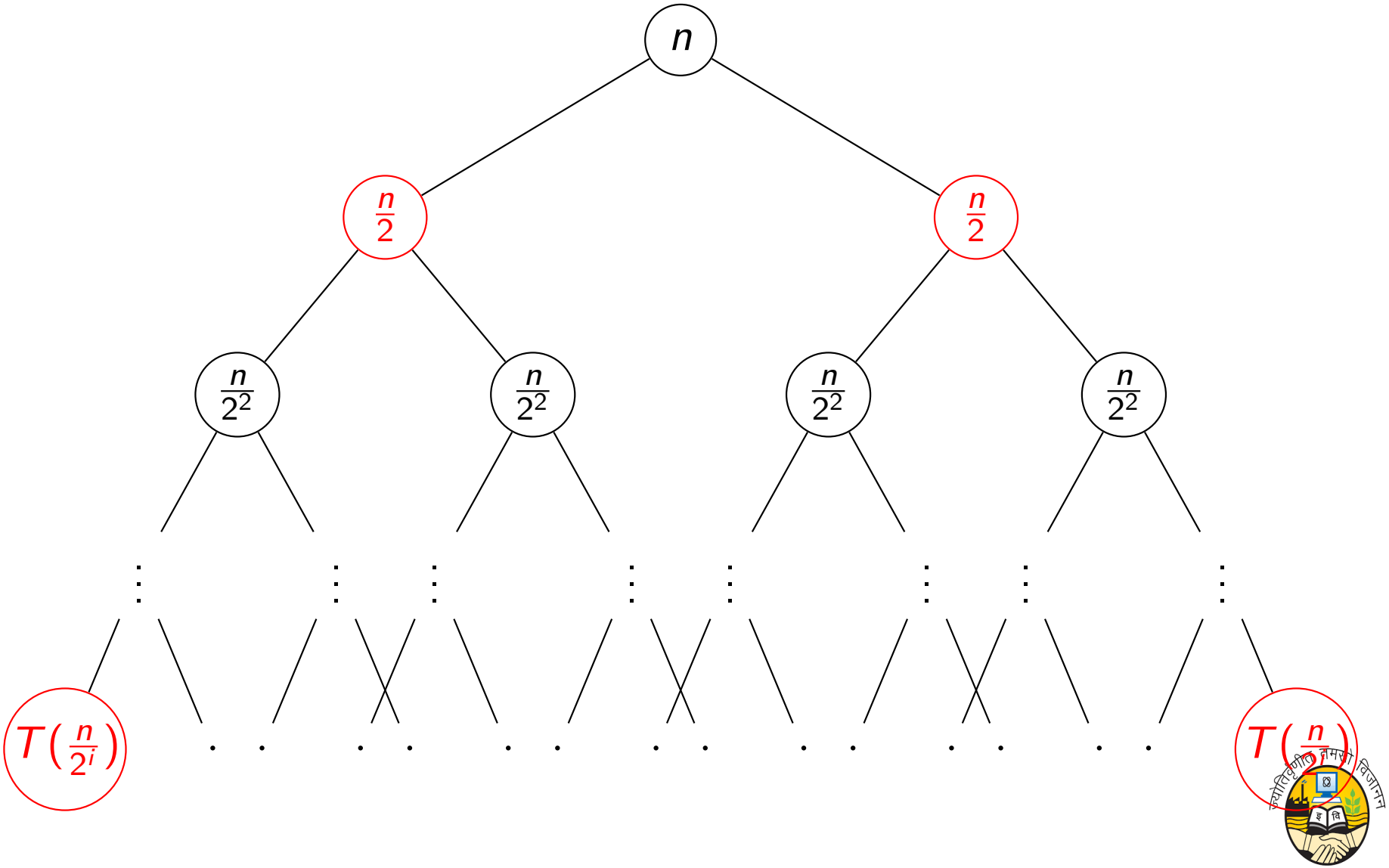
1. Find the solution of $T(n) = 2T(n/2) + n$



# Example 1 of Recursion tree method II

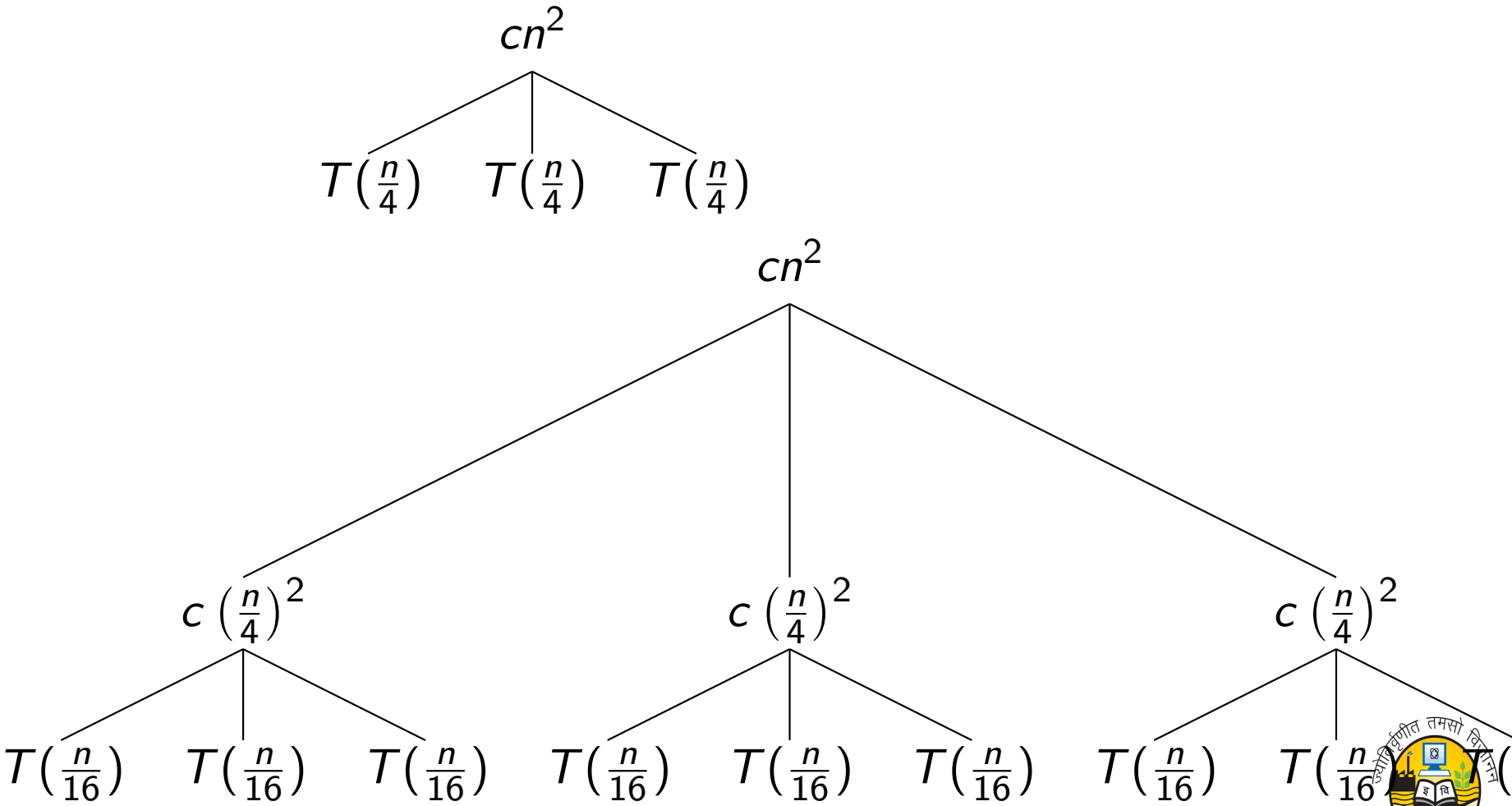


# Example 1 of Recursion tree method III

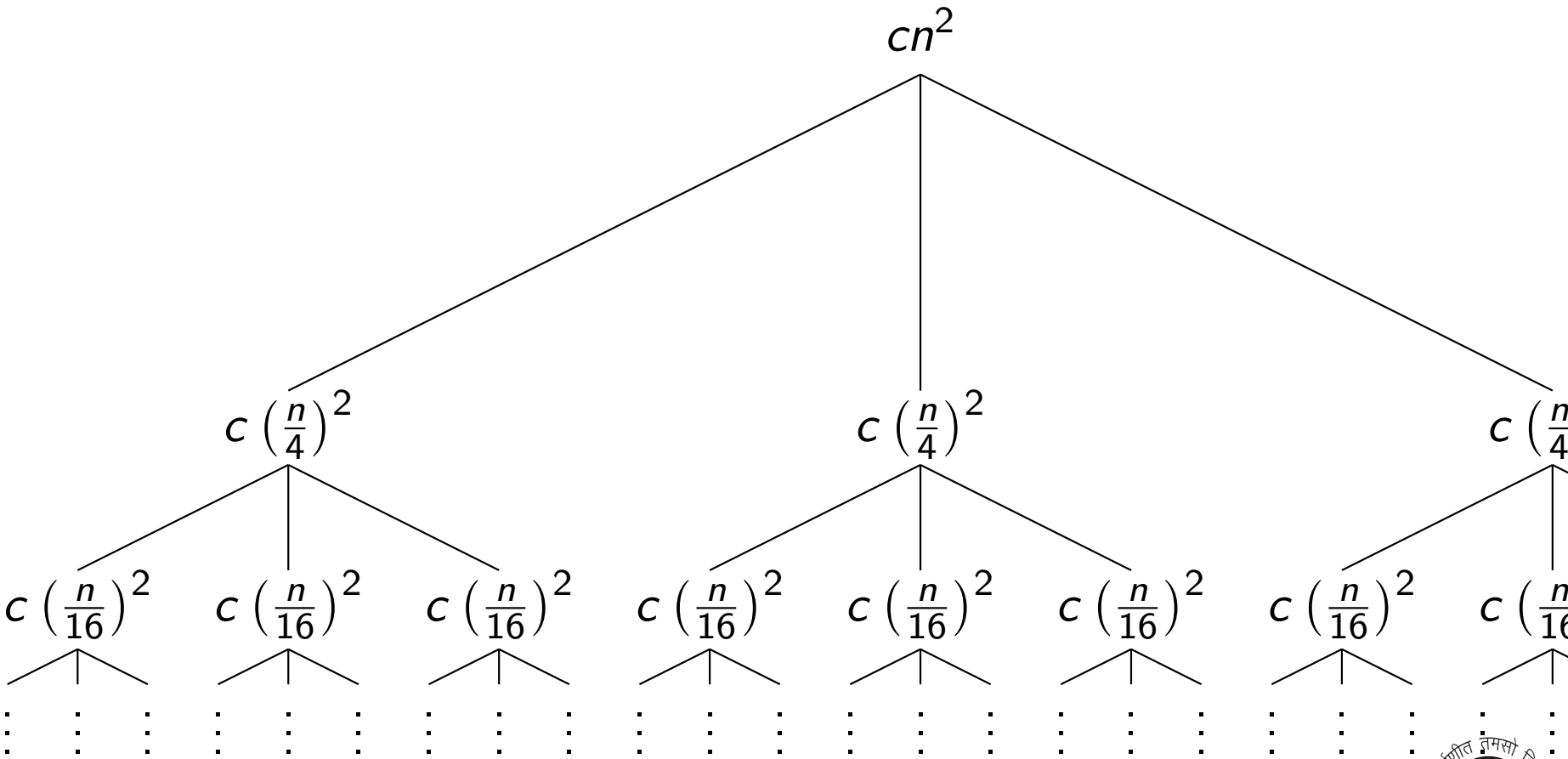


# Example 2 of Recursion tree method I

1. Find the solution of $T(n) = 3T(n/4) + cn^2$



# Example 2 of Recursion tree method I



# Thank you

Please send your feedback or any queries to akyadav1@amity.edu, akyadav@akyadav.in or contact me on +91 9911375598