

handout: lower bounds,

Two Techniques:

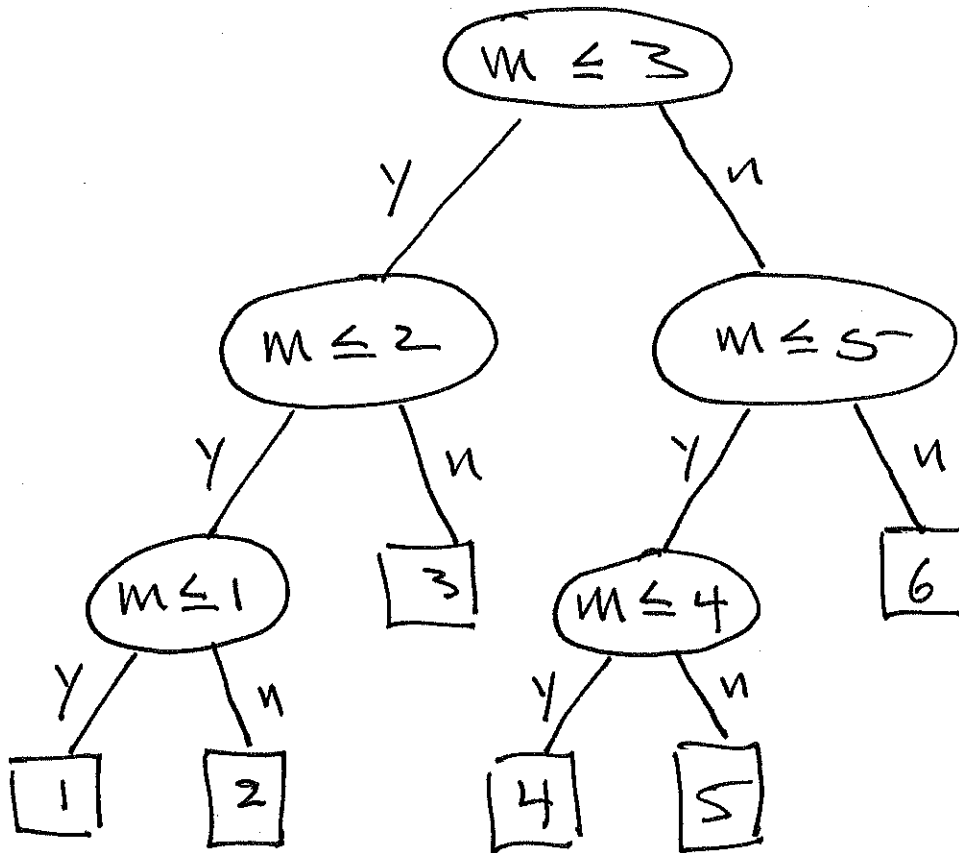
- decision trees
- adversary arguments.

Decision Trees

Ex. let $m \in \{1, 2, 3, 4, 5, 6\}$ be unknown. Game: determine m by asking only yes/no

Questions.

Decision tree for Binary Search.



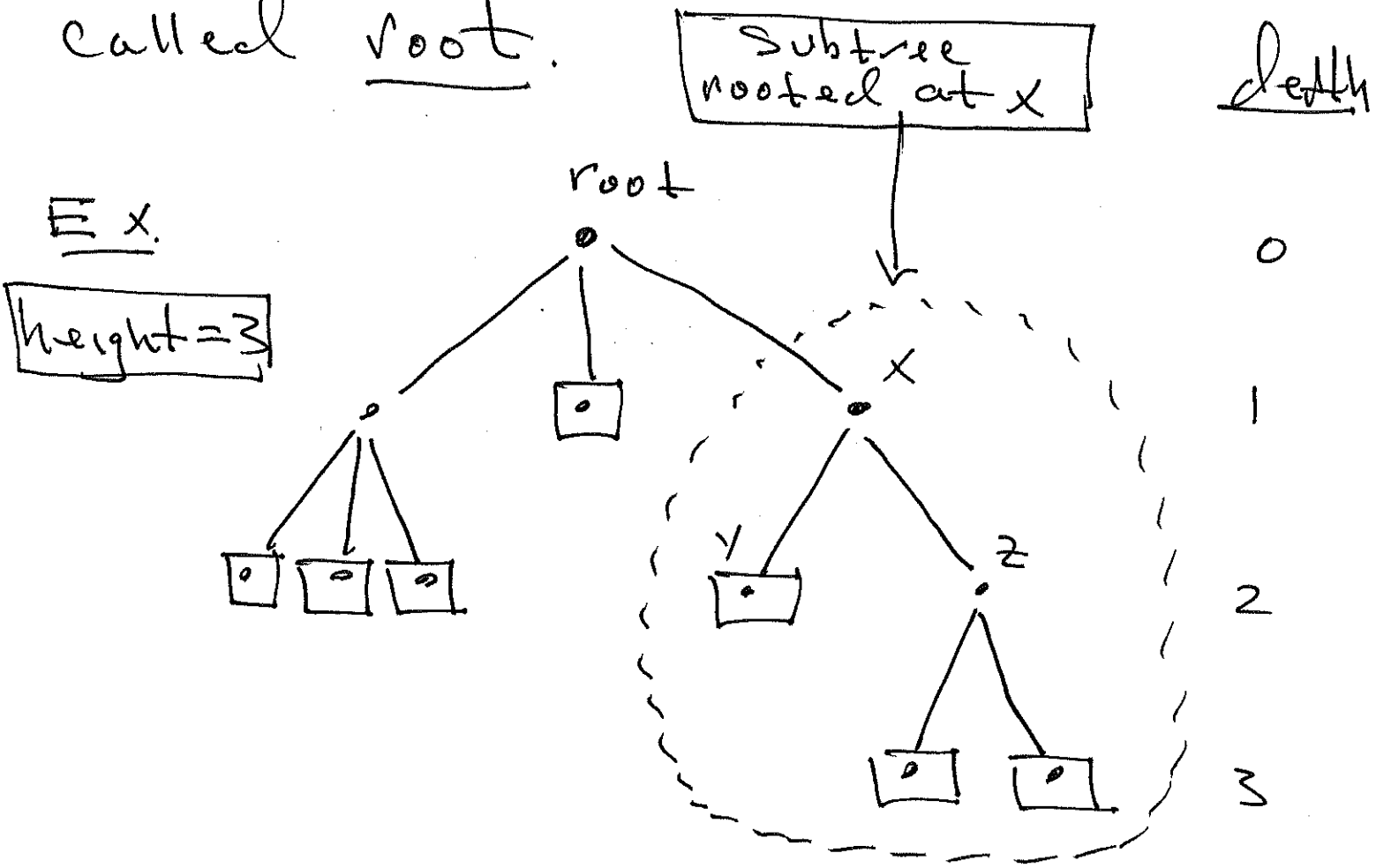
worst case # questions = 3

avg. case # of questions

$$= \frac{4 \cdot 3 + 2 \cdot 2}{6} = \frac{16}{6} = \frac{8}{3}$$

Trees

A rooted tree is a tree with a distinguished vertex called root.



- depth : dist. to root
- Parent : unique neighbor closer to root

- root has no parent
- children: neighbors other than parent,
- leaf: node with no children
- internal node: non-leaf.
- height of a tree: max leaf depth
- height of a node: height of subtree rooted at that node: $\text{height}(x) = z$

• height of leaf is 0

Defn

a k -ary tree is a rooted tree where each node has at most k children.