(1) Let $A$ be a heap with $n$ elements, and suppose that the largest element of $A$ appears in $A$ exactly twice. Where may these two largest elements of $A$ be found? Specify all the possible indices.

Answers:


(2) $A[\lceil n/2 \rceil +1]$, ..., $A[n]$. The smallest element appears in a leaf.

(3) Four elements:
Level 0 - 1 element
Level 1 - 2 elements
Level 2 - 1 element
(1) Let \( A \) be a heap with \( n \) elements, and suppose that the largest element of \( A \) appears in \( A \) exactly three times. Where may these three largest elements of \( A \) be found? Specify all the possible indices.

(2) Let \( A \) be a heap with \( n \) distinct elements. Where may the smallest element of \( A \) be found? Specify all the possible indices.

(3) Let \( A \) be a heap with height \( h = 3 \) and the smallest possible number of elements. What is the number of elements in \( A \) ?

Answers:

One of the largest elements appears in the root. The next two largest elements appear in the level below the root, or in two levels such that one is a parent of the other.

(2) \( A\lceil \lfloor n/2 \rfloor +1 \rceil, \ldots, A[n] \).
The smallest element appears in a leaf.

(3) Eight elements:
Level 0 - 1 element
Level 1 - 2 elements
Level 2 - 4 element
Level 3 - 1 element