



## DATA STRUCTURES II

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► *heapify demo*

Lecture slides by Kevin Wayne

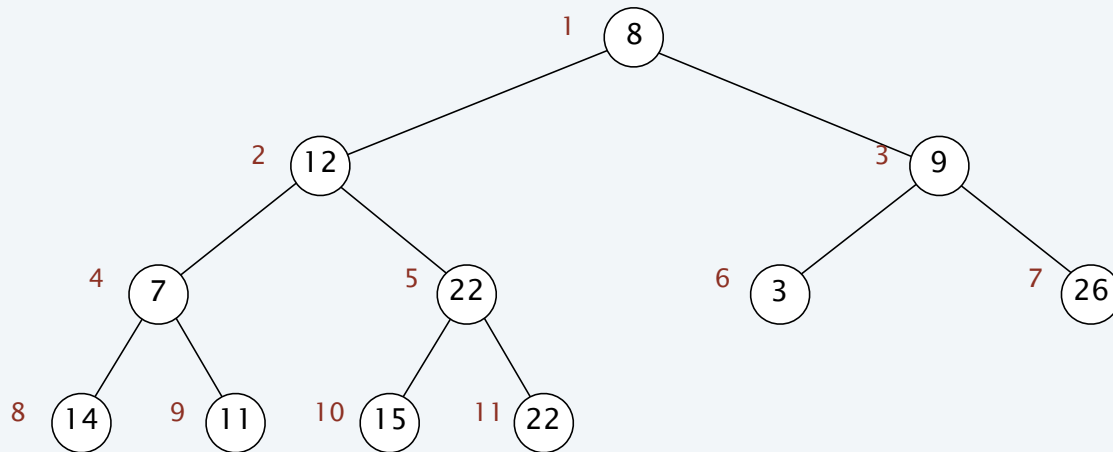
<http://www.cs.princeton.edu/~wayne/kleinberg-tardos>

# Heapify demo

**Heapify.** For each element in reverse-array order, sink it down.

↖ we assume array entries are indexed 1 to n

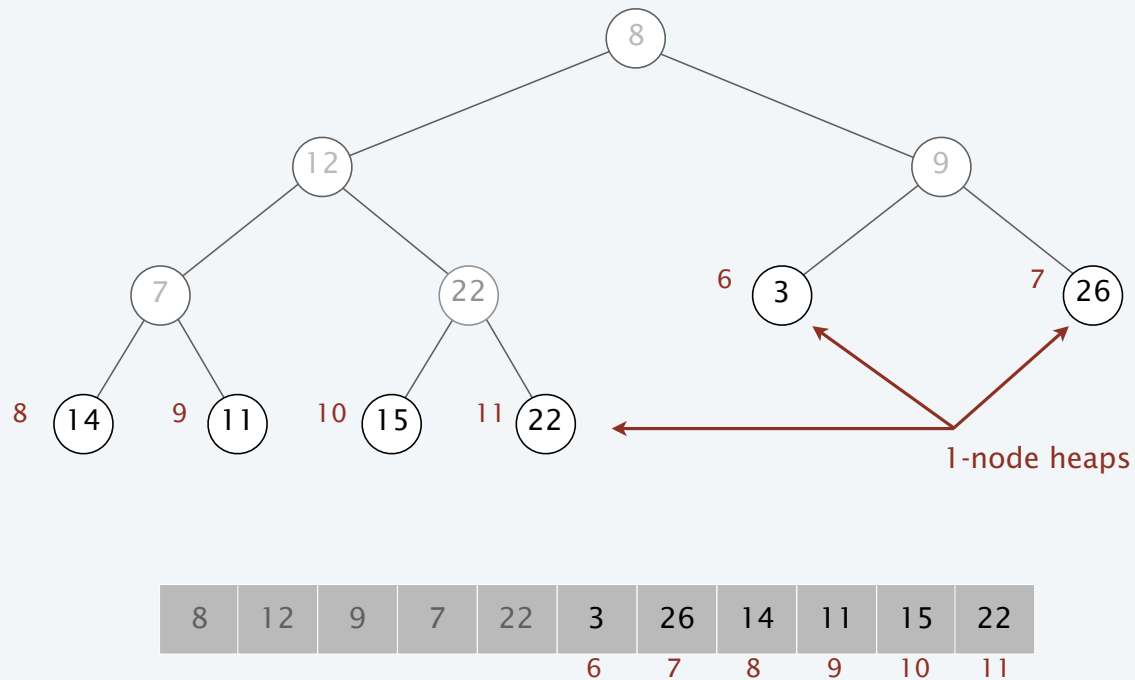
array in arbitrary order



|   |    |   |   |    |   |    |    |    |    |    |
|---|----|---|---|----|---|----|----|----|----|----|
| 8 | 12 | 9 | 7 | 22 | 3 | 26 | 14 | 11 | 15 | 22 |
| 1 | 2  | 3 | 4 | 5  | 6 | 7  | 8  | 9  | 10 | 11 |

# Heapify demo

**Heapify.** For each element in reverse-array order, sink it down.

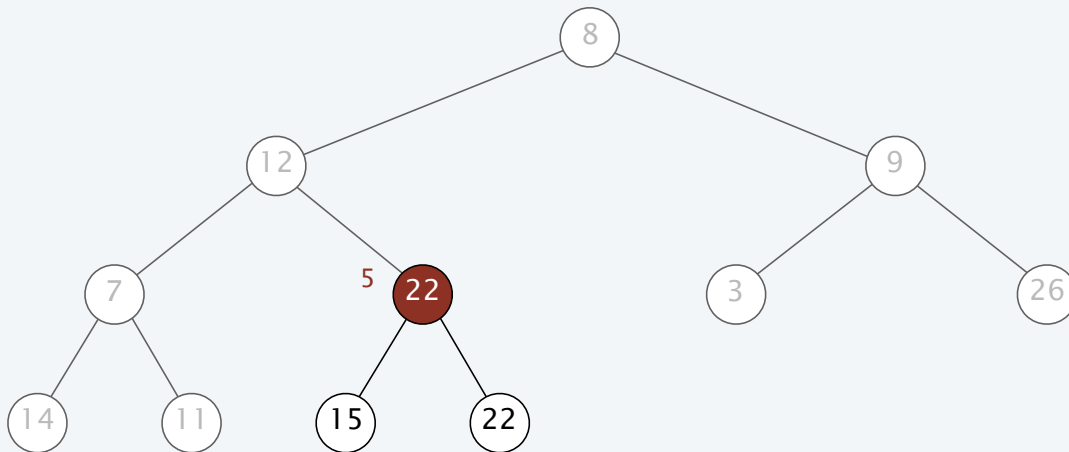


# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 5**

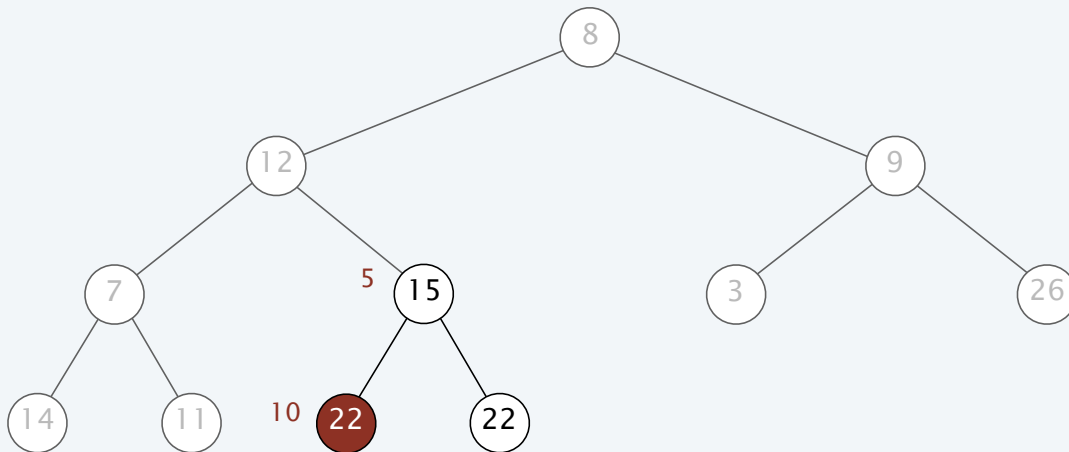


# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 5**



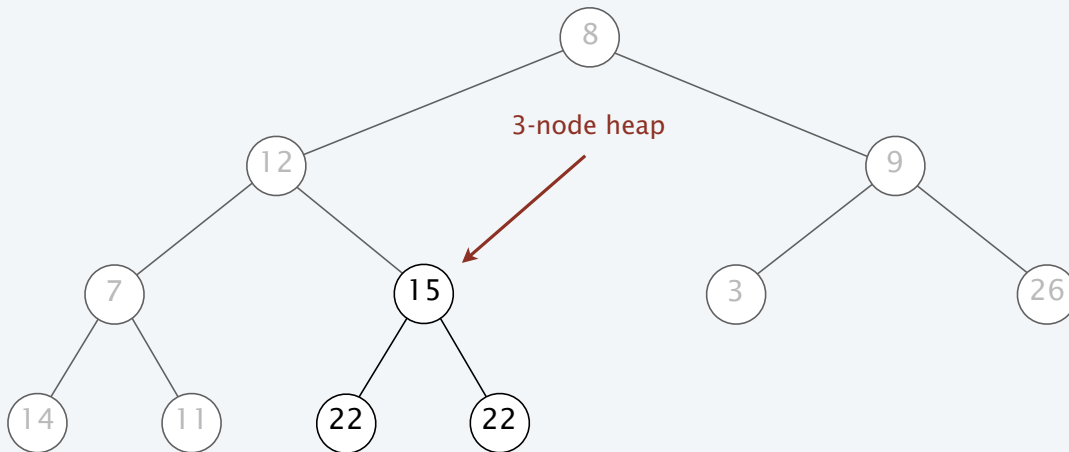
|   |    |   |   |    |   |    |    |    |    |    |
|---|----|---|---|----|---|----|----|----|----|----|
| 8 | 12 | 9 | 7 | 15 | 3 | 26 | 14 | 11 | 22 | 22 |
|   |    |   |   | 5  |   |    |    |    | 10 |    |

# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 5**



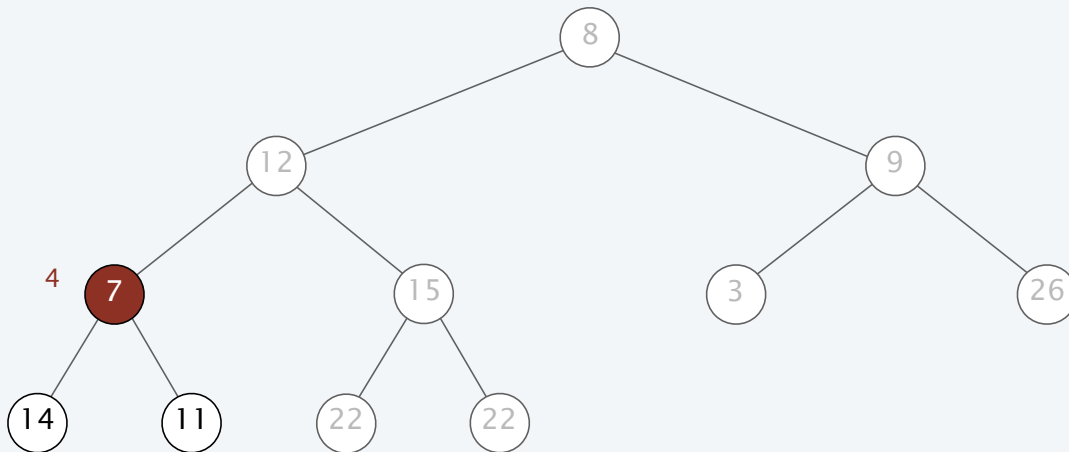
|   |    |   |   |    |   |    |    |    |    |    |
|---|----|---|---|----|---|----|----|----|----|----|
| 8 | 12 | 9 | 7 | 15 | 3 | 26 | 14 | 11 | 22 | 22 |
|---|----|---|---|----|---|----|----|----|----|----|

# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

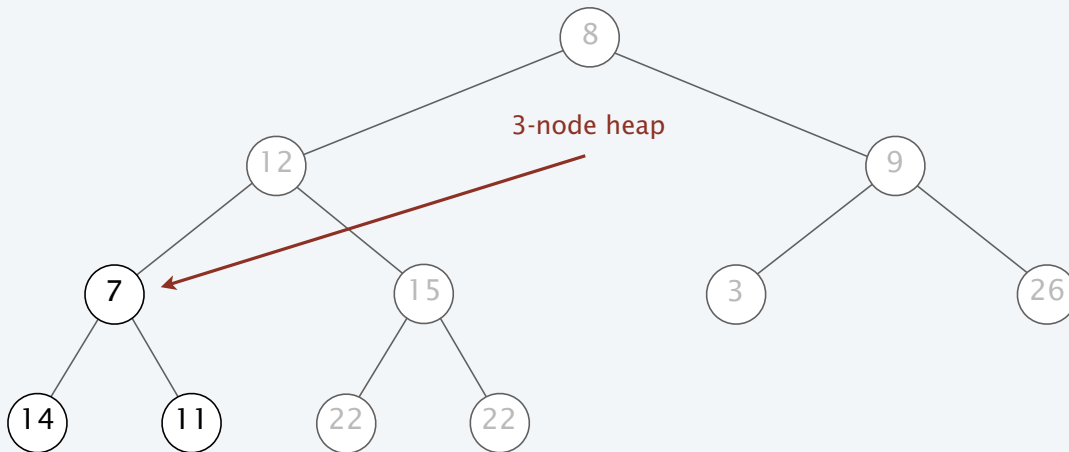
**sink 4**



# Heapify demo

**Heapify.** For each element in reverse-array order, sink it down.

**sink 4**



|   |    |   |   |    |   |    |    |    |    |    |
|---|----|---|---|----|---|----|----|----|----|----|
| 8 | 12 | 9 | 7 | 15 | 3 | 26 | 14 | 11 | 22 | 22 |
|---|----|---|---|----|---|----|----|----|----|----|

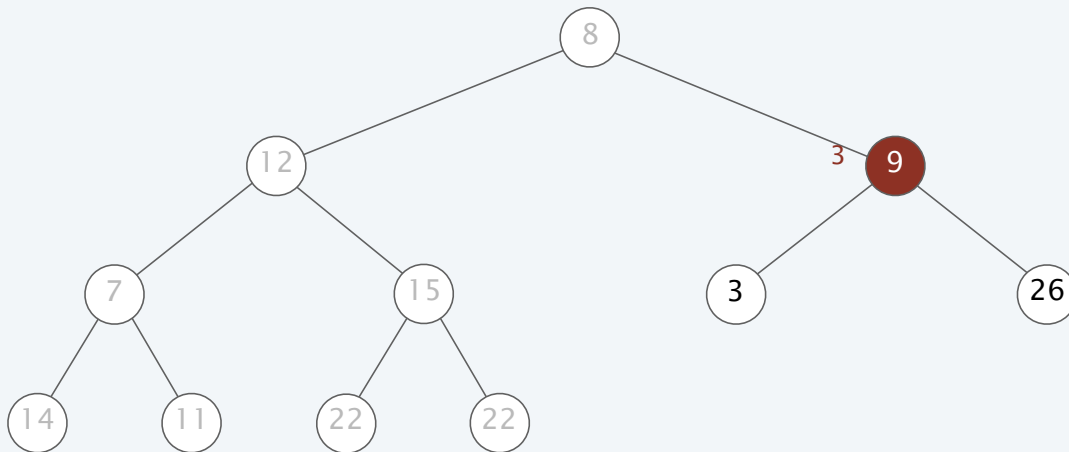


# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 3**

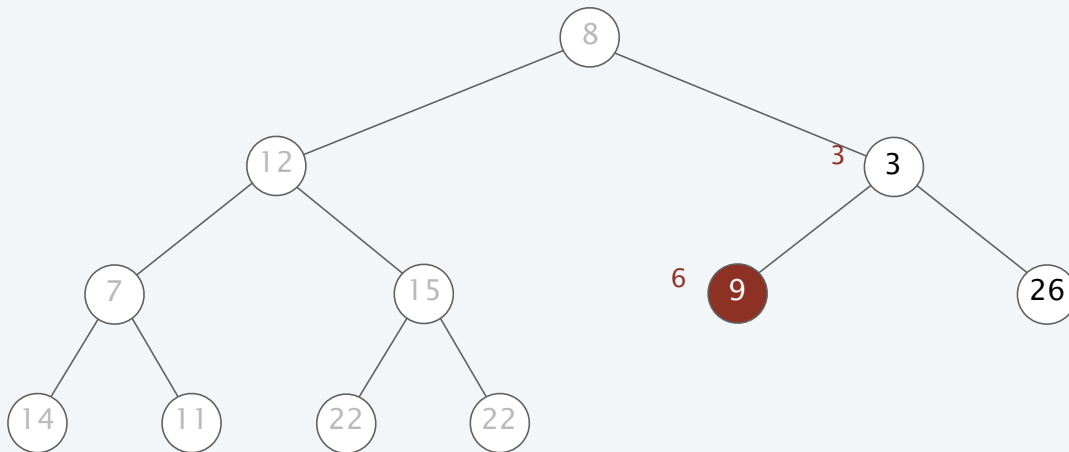


# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 3**



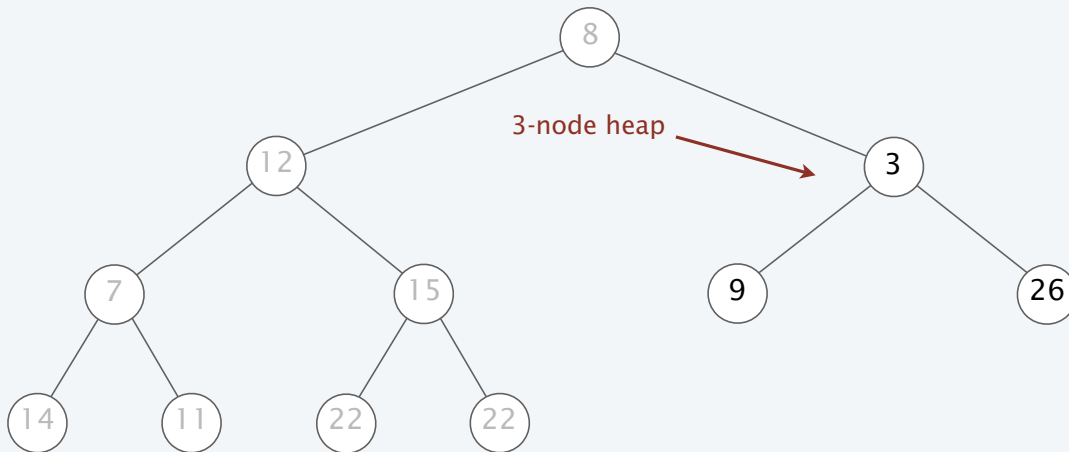
|   |    |   |   |    |   |    |    |    |    |    |
|---|----|---|---|----|---|----|----|----|----|----|
| 8 | 12 | 3 | 7 | 15 | 9 | 26 | 14 | 11 | 22 | 22 |
|   |    | 3 |   |    | 6 |    |    |    |    |    |

# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 3**



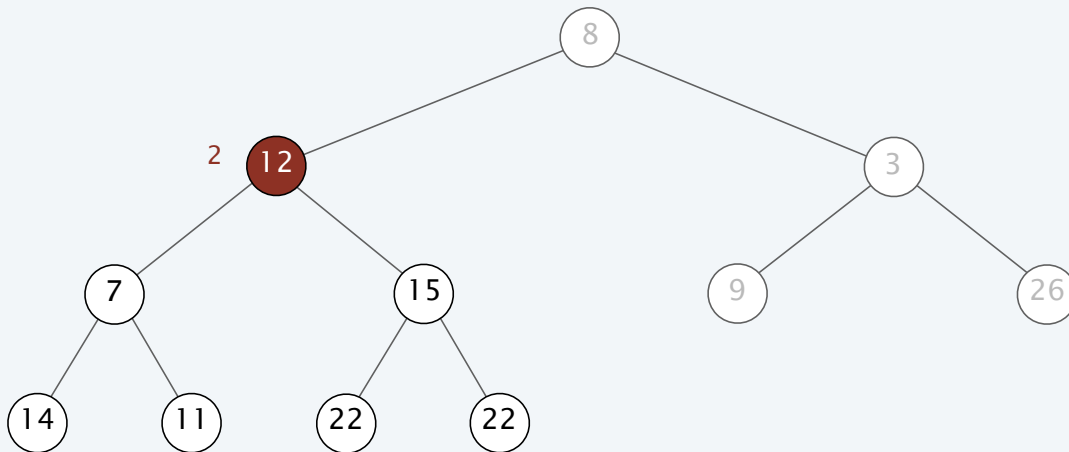
|   |    |   |   |    |    |    |    |    |    |    |
|---|----|---|---|----|----|----|----|----|----|----|
| 8 | 12 | 3 | 7 | 15 | 26 | 26 | 14 | 11 | 22 | 22 |
|---|----|---|---|----|----|----|----|----|----|----|

# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 2**



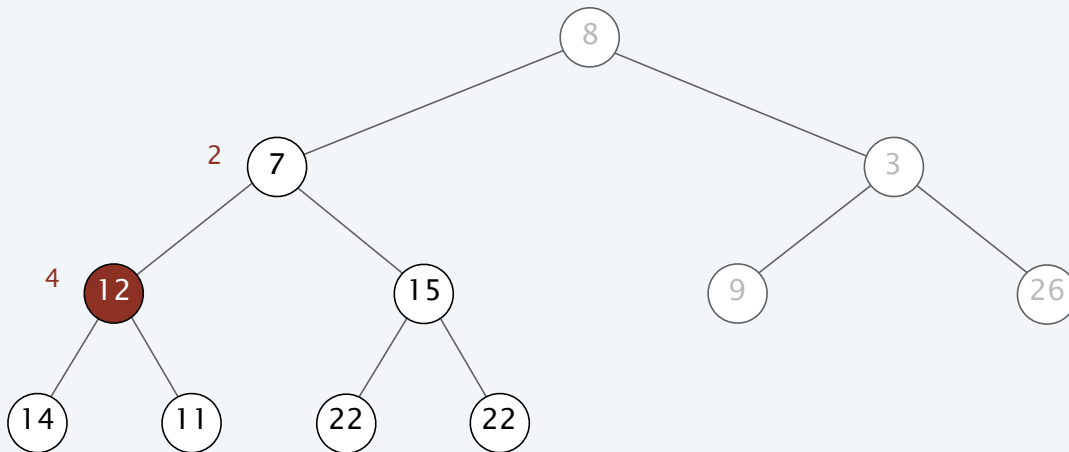
|   |    |   |   |    |   |    |    |    |    |    |
|---|----|---|---|----|---|----|----|----|----|----|
| 8 | 12 | 3 | 7 | 15 | 9 | 26 | 14 | 11 | 22 | 22 |
|   | 2  |   |   |    |   |    |    |    |    |    |

# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 2**



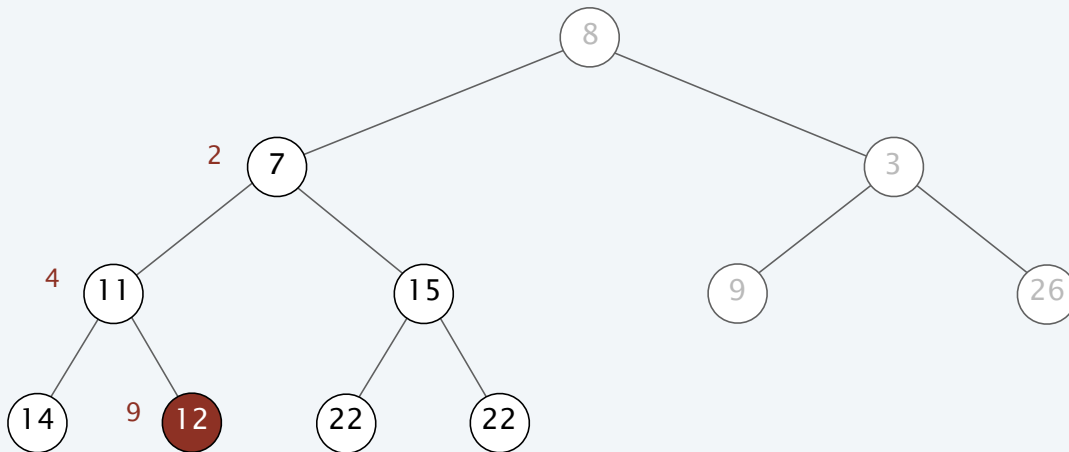
|   |   |   |    |    |   |    |    |    |    |    |
|---|---|---|----|----|---|----|----|----|----|----|
| 8 | 7 | 3 | 12 | 15 | 9 | 26 | 14 | 11 | 22 | 22 |
|   | 2 |   | 4  |    |   |    |    |    |    |    |

# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 2**



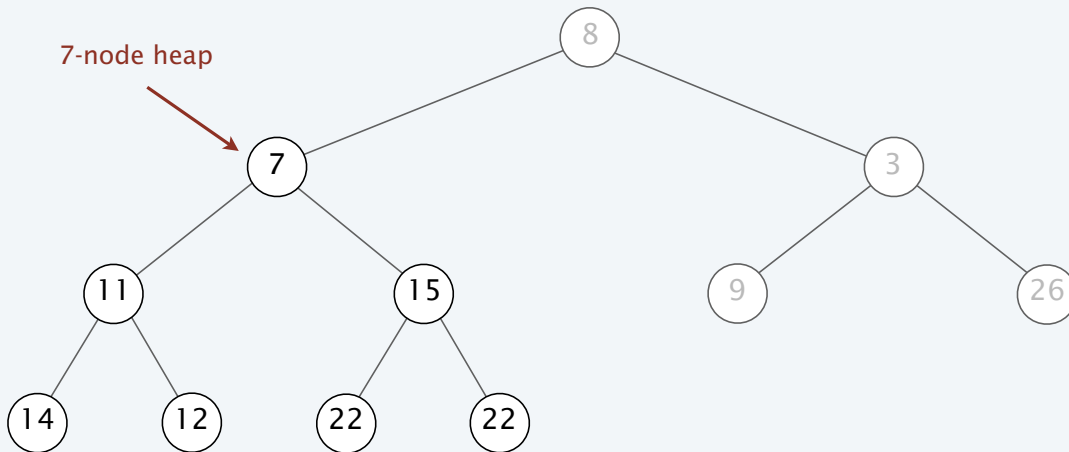
|   |   |   |    |    |   |    |    |    |    |    |
|---|---|---|----|----|---|----|----|----|----|----|
| 8 | 7 | 3 | 11 | 15 | 9 | 26 | 14 | 12 | 22 | 22 |
|   | 2 |   | 4  |    |   |    |    | 9  |    |    |

# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 2**



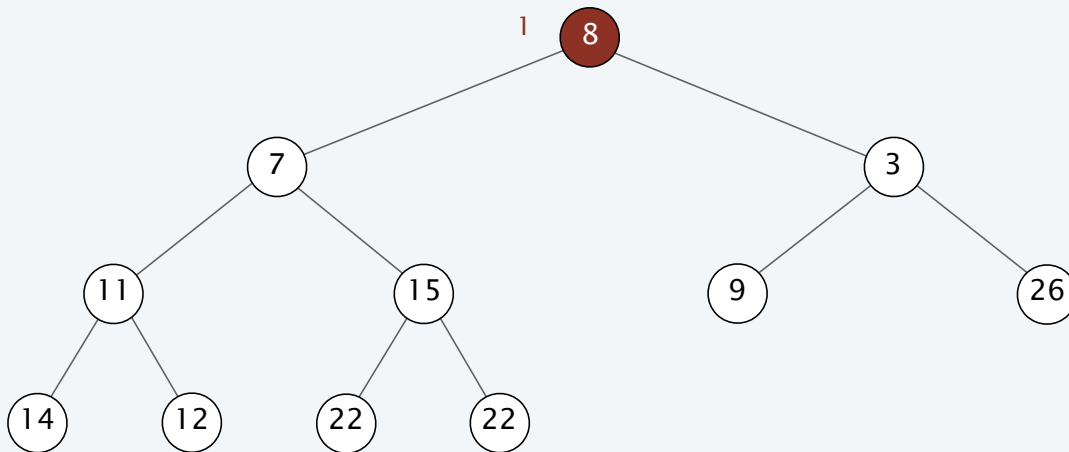
|   |   |   |    |    |   |    |    |    |    |    |
|---|---|---|----|----|---|----|----|----|----|----|
| 8 | 7 | 3 | 11 | 15 | 9 | 26 | 14 | 12 | 22 | 22 |
|---|---|---|----|----|---|----|----|----|----|----|

# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**sink 1**

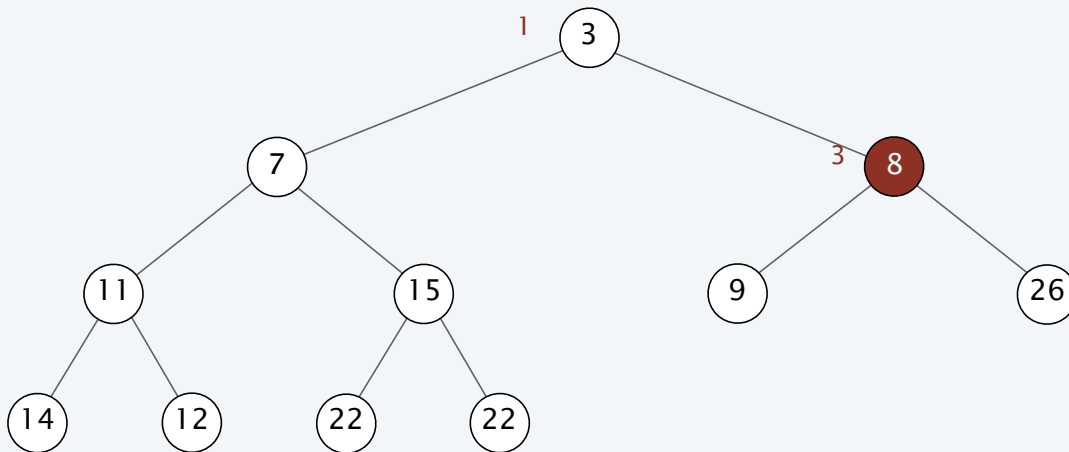




# Heapify demo

**Heapify.** For each element in reverse-array order, sink it down.

**sink 1**



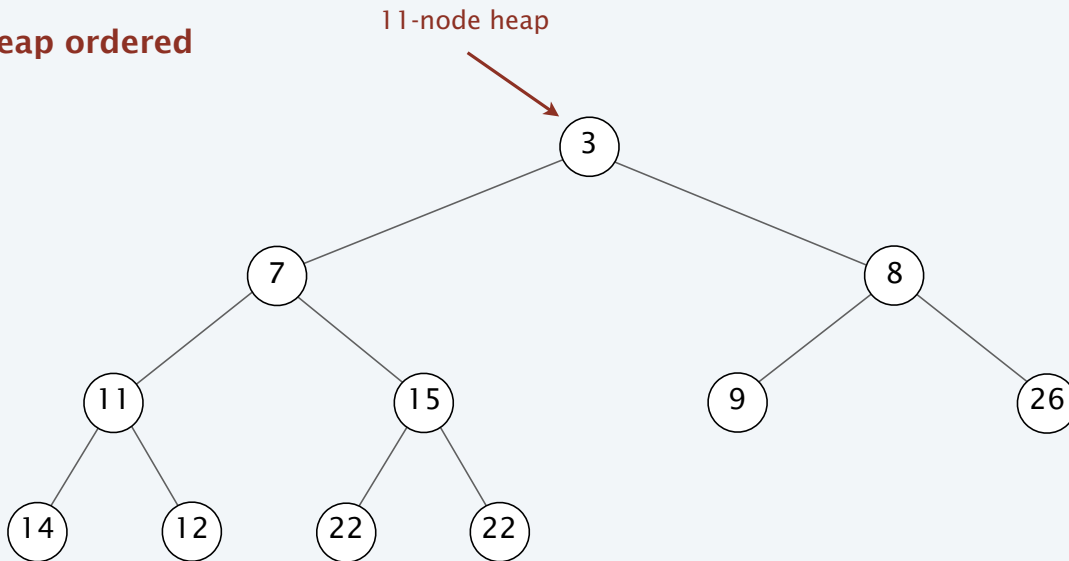
|   |   |   |    |    |   |    |    |    |    |    |
|---|---|---|----|----|---|----|----|----|----|----|
| 3 | 7 | 8 | 11 | 15 | 9 | 26 | 14 | 12 | 22 | 22 |
| 1 |   | 3 |    |    |   |    |    |    |    |    |

# Heapify demo

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**Heapify.** For each element in reverse-array order, sink it down.

**array is heap ordered**



|   |   |   |    |    |   |    |    |    |    |    |
|---|---|---|----|----|---|----|----|----|----|----|
| 3 | 7 | 8 | 11 | 15 | 9 | 26 | 14 | 12 | 22 | 22 |
|---|---|---|----|----|---|----|----|----|----|----|