
http://algs4.cs.princeton.edu

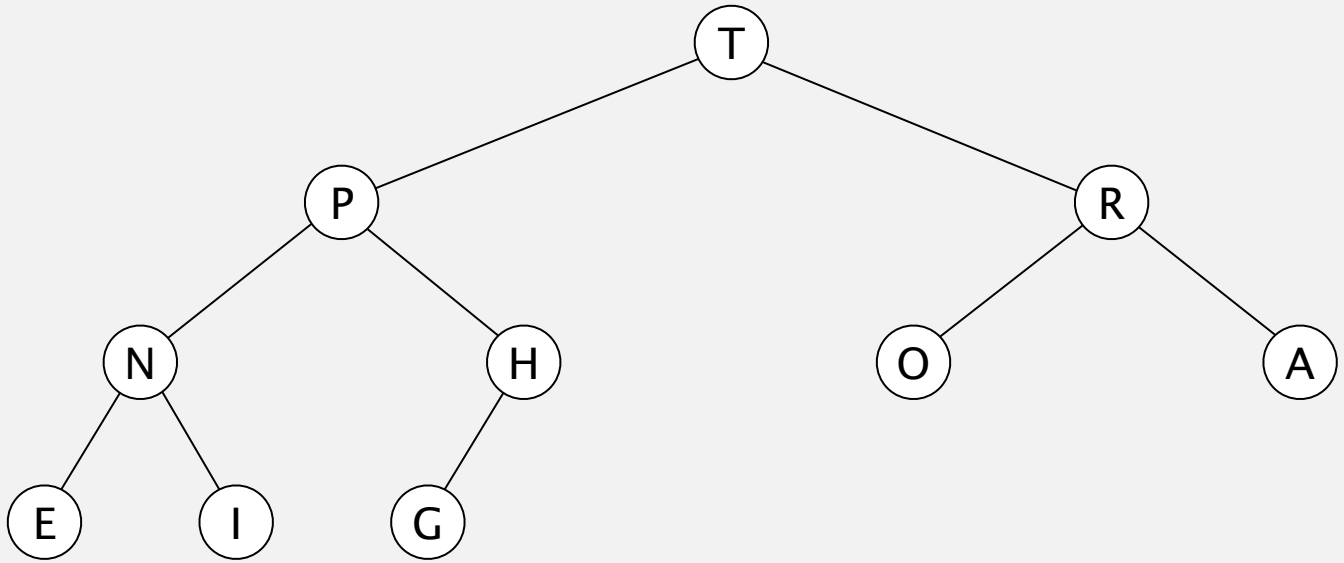
# 2.4 BINARY HEAP DEMO

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**heap ordered**



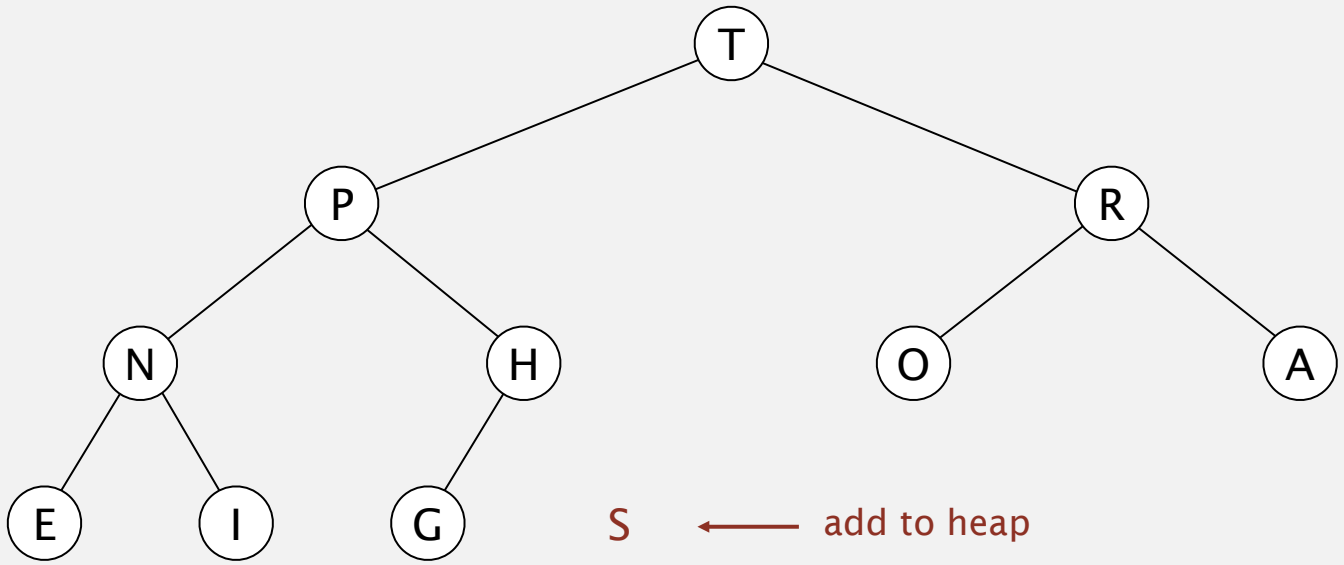

| T | P | R | N | H | O | A | E | I | G | |
|---|---|---|---|---|---|---|---|---|---|---|

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**insert S**




| T | P | R | N | H | O | A | E | I | G | |
|---|---|---|---|---|---|---|---|---|---|---|

# Binary heap demo

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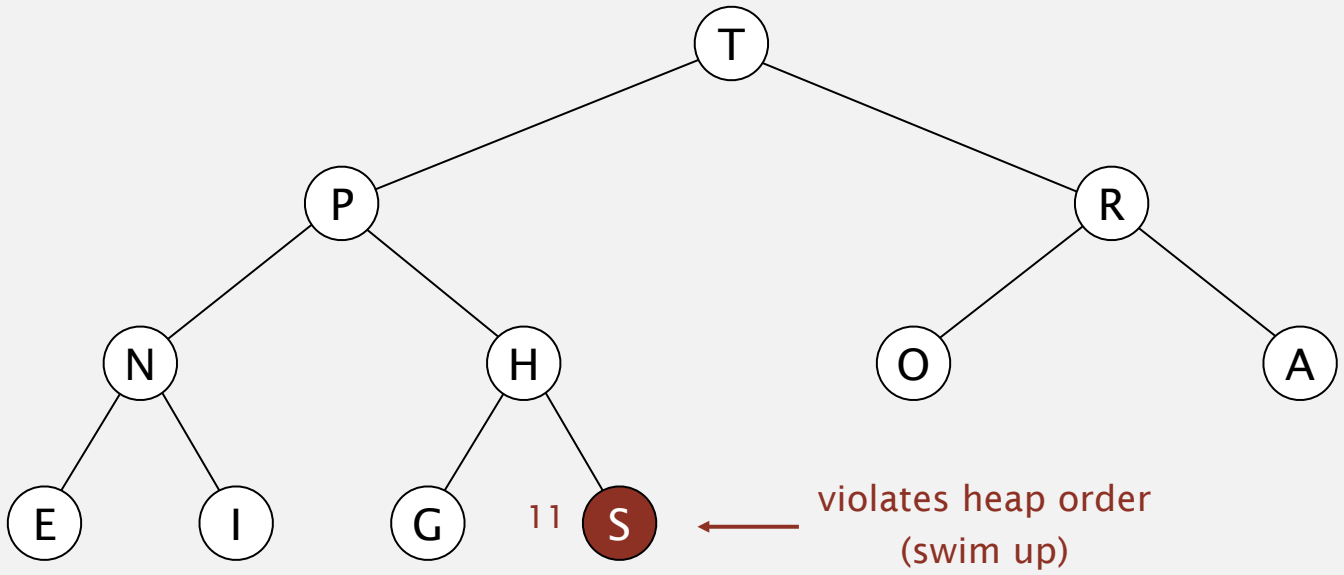
**insert S**




| T | P | R | N | H | O | A | E | I | G | S |
|---|---|---|---|---|---|---|---|---|---|---|

# Binary heap demo

Insert. Add node at end, then swim it up.

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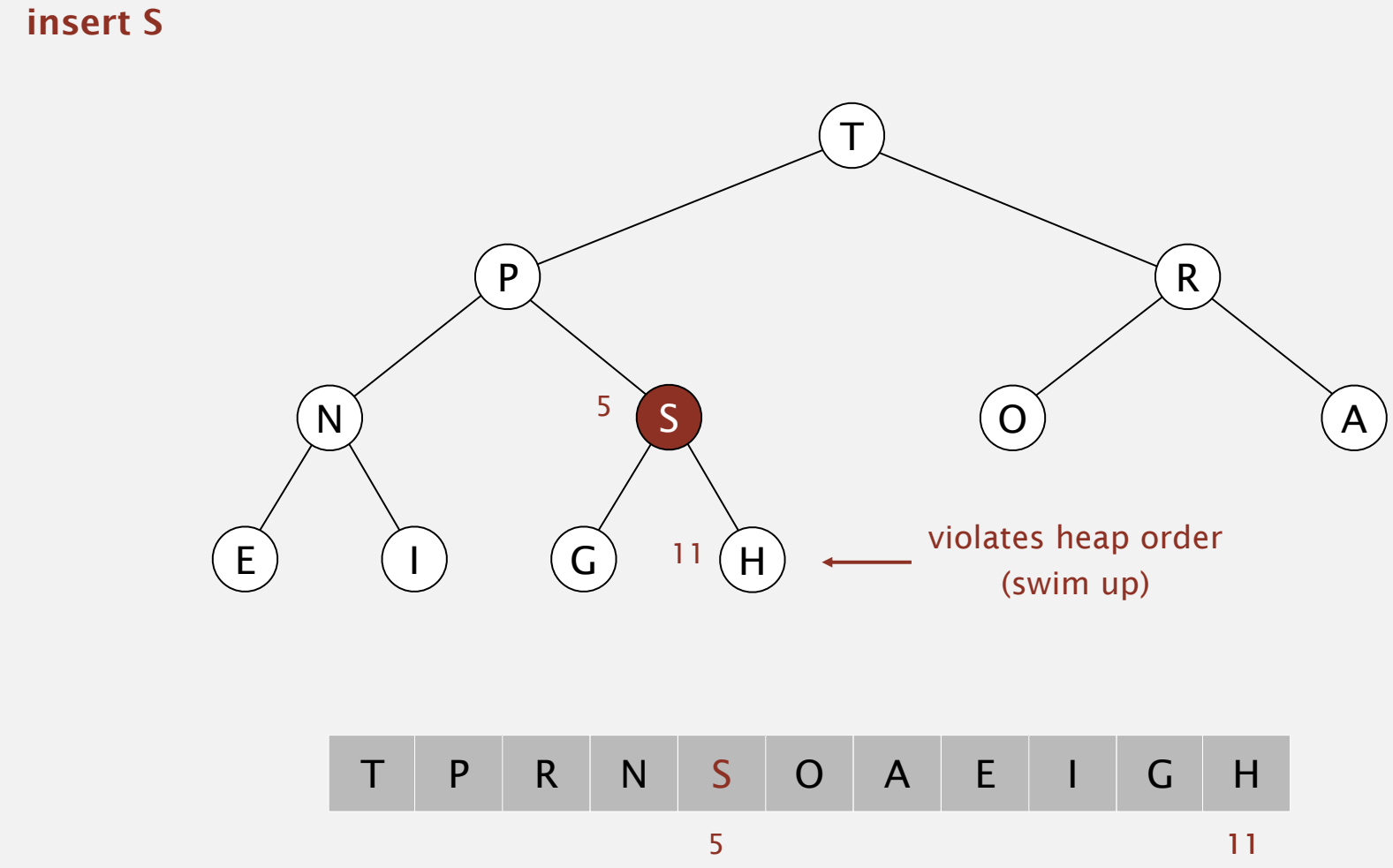
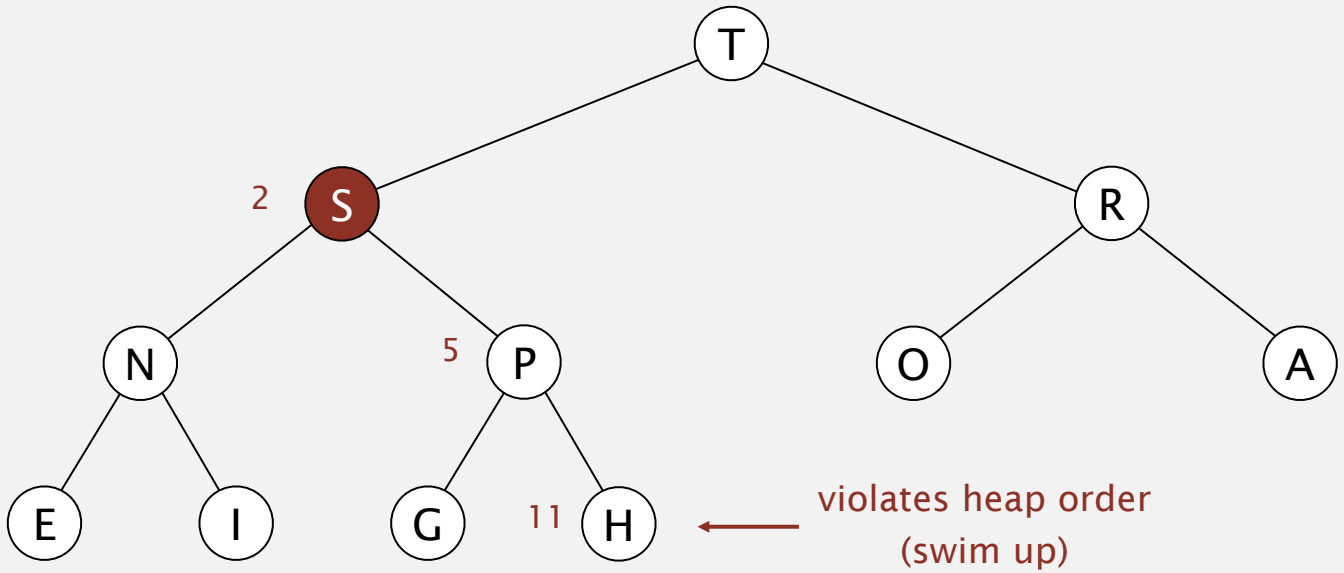


# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**insert S**



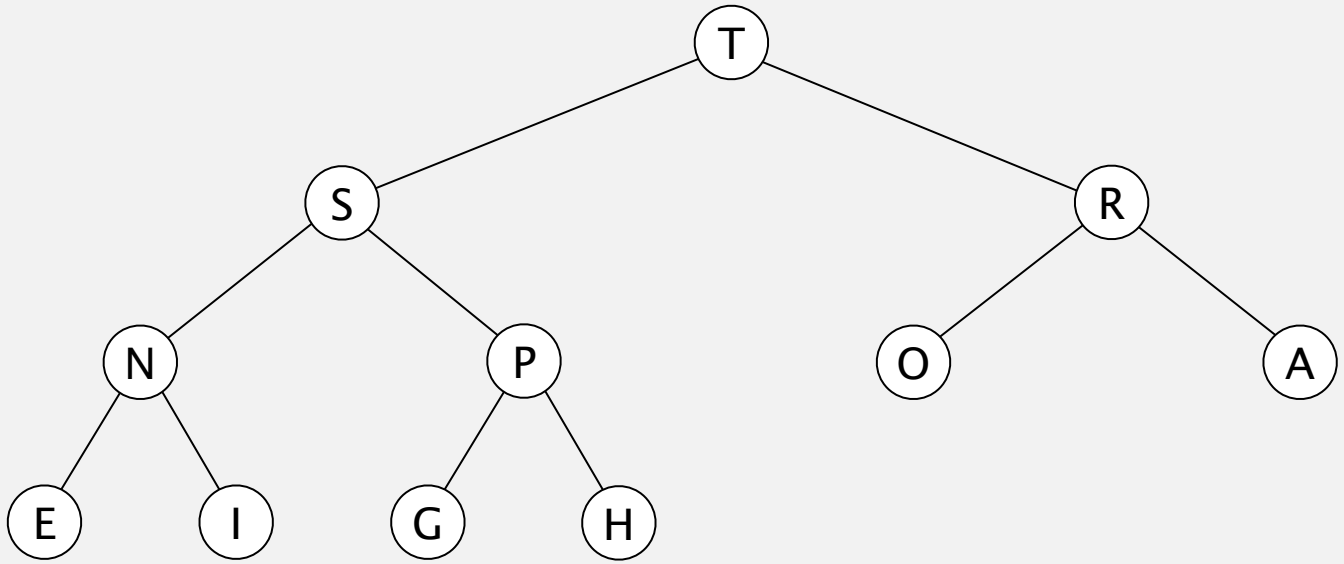

| T | S | R | N | P | O | A | E | I | G | H |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | | 5 | | | | | | 11 |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**heap ordered**



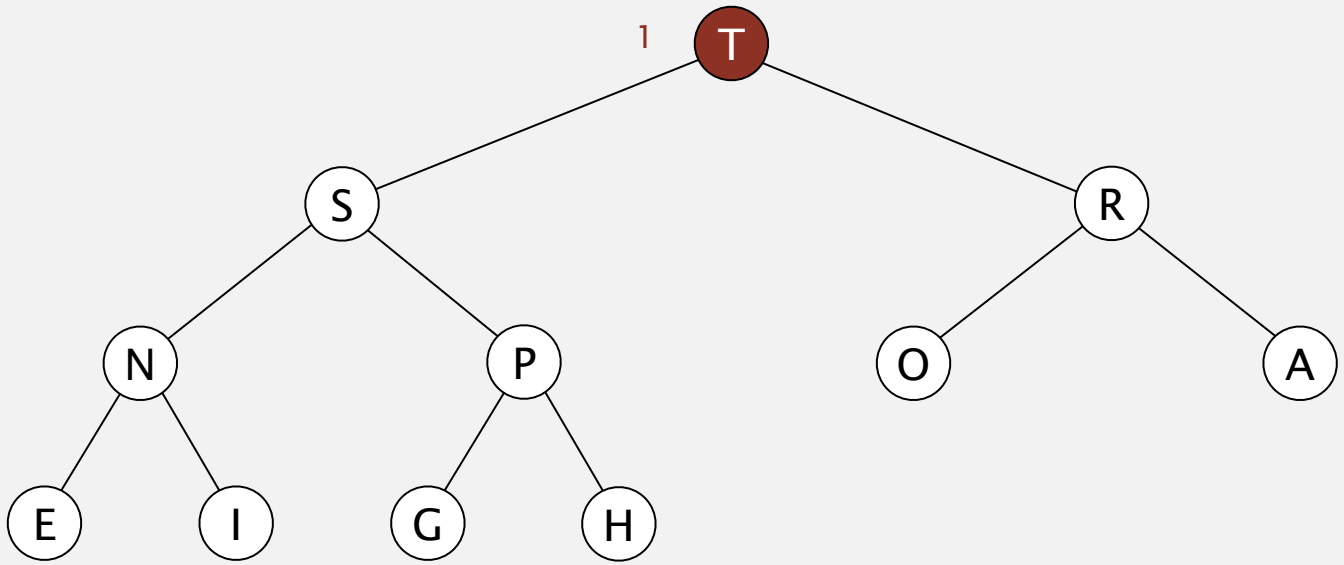

| T | S | R | N | P | O | A | E | I | G | H |
|---|---|---|---|---|---|---|---|---|---|---|

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**remove the maximum**

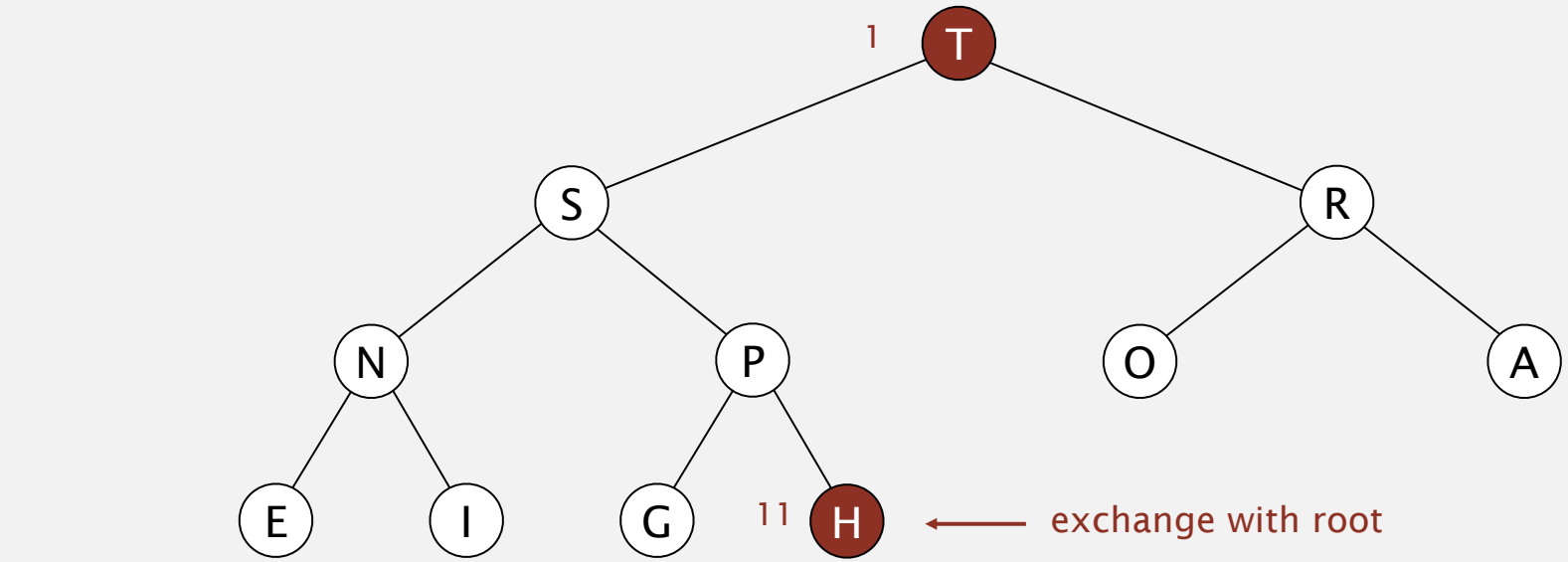



| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| T | S | R | N | P | O | A | E | I | G | H |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

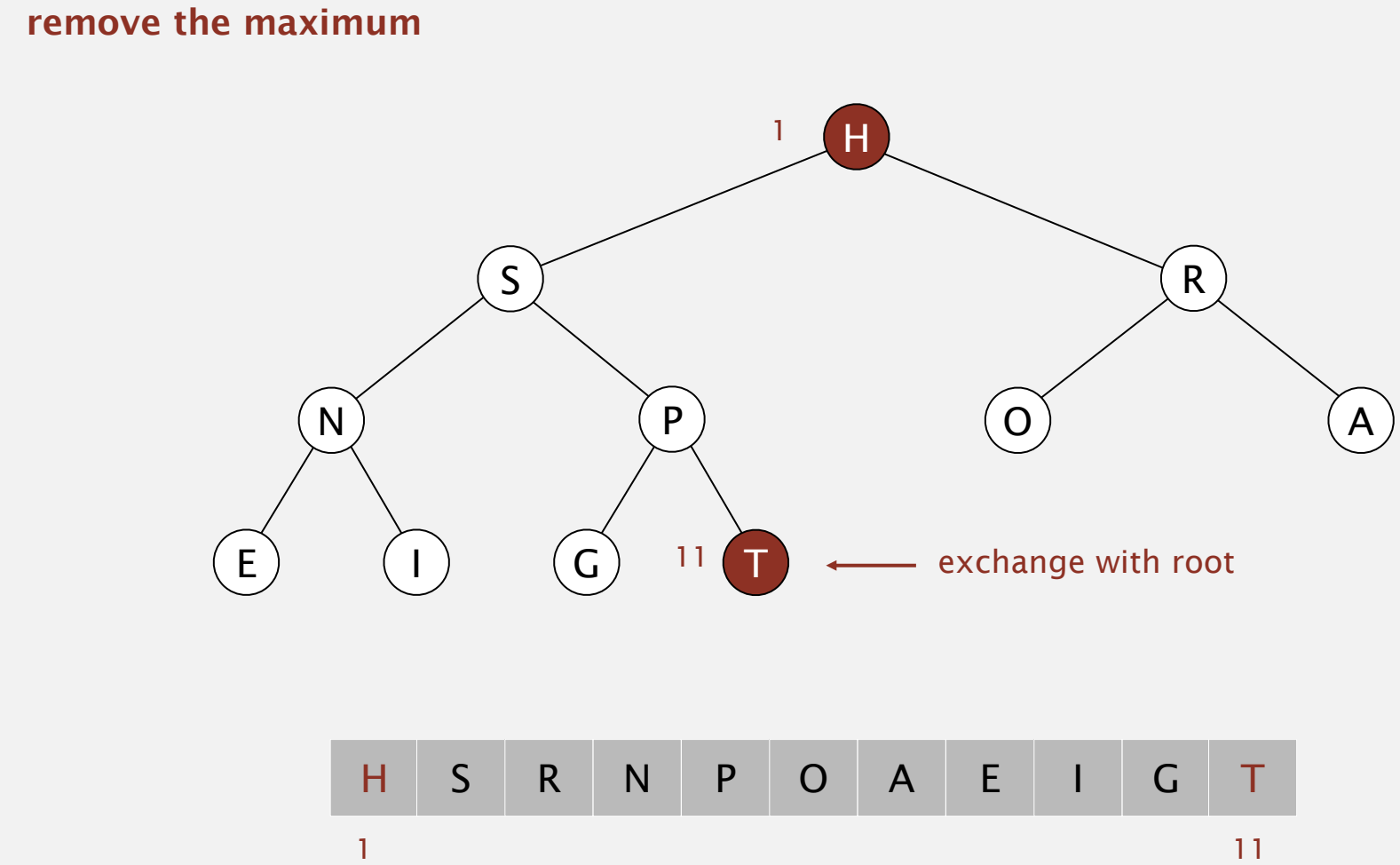



| T | S | R | N | P | O | A | E | I | G | H |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | 11 |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

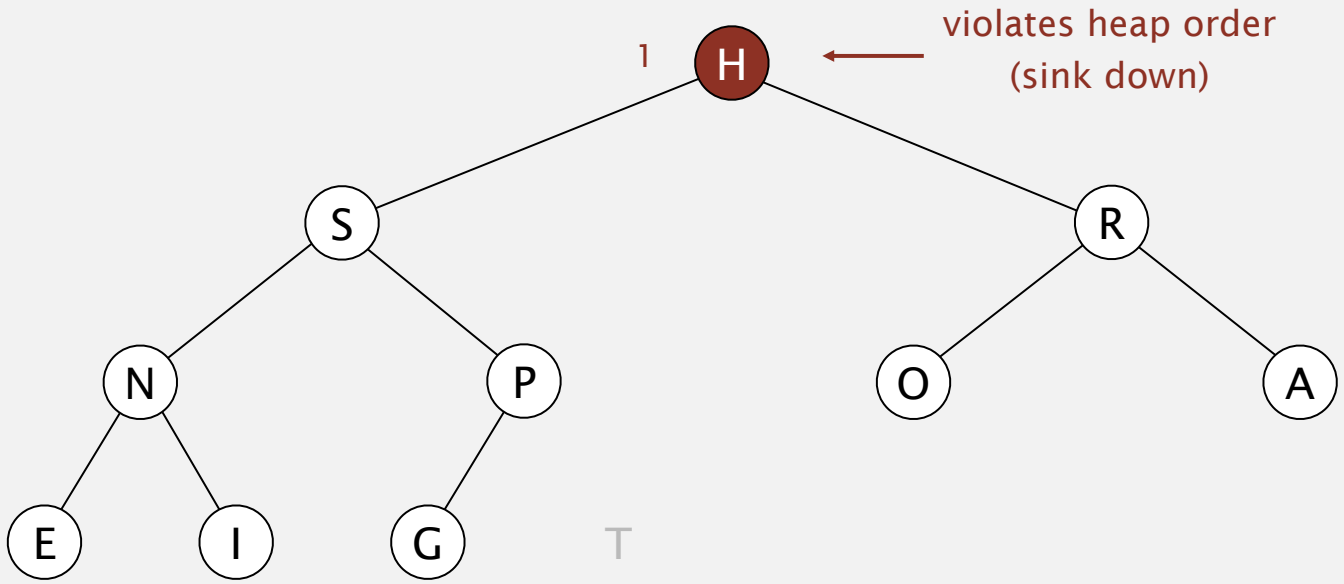


# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**remove the maximum**



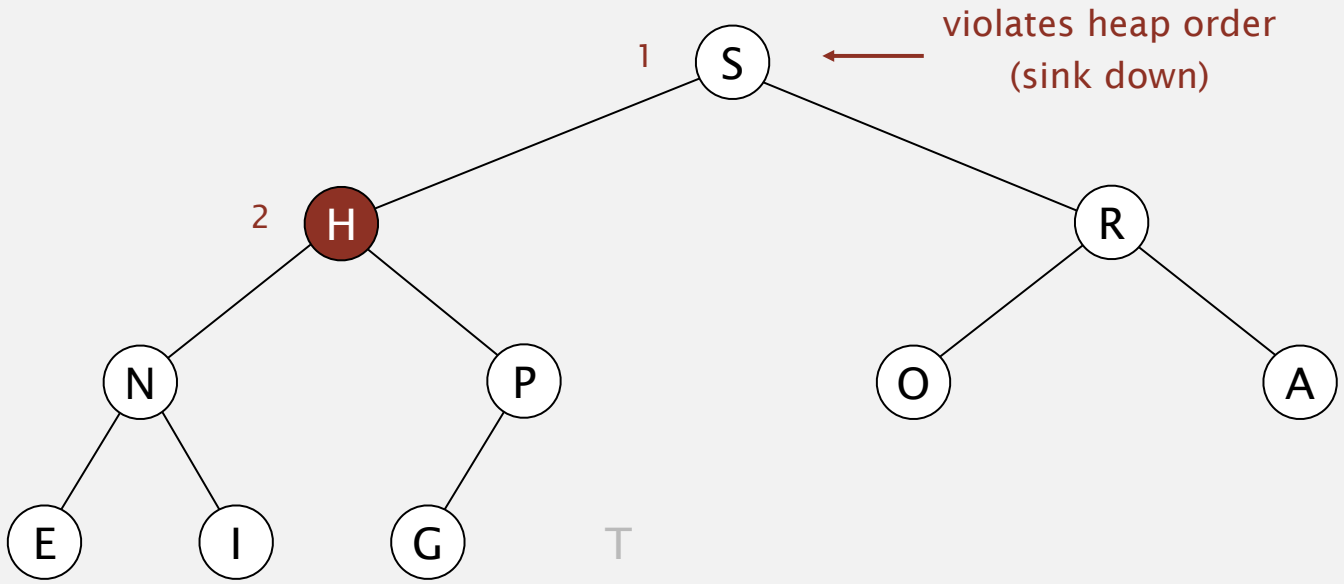

| H | S | R | N | P | O | A | E | I | G | T |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**remove the maximum**



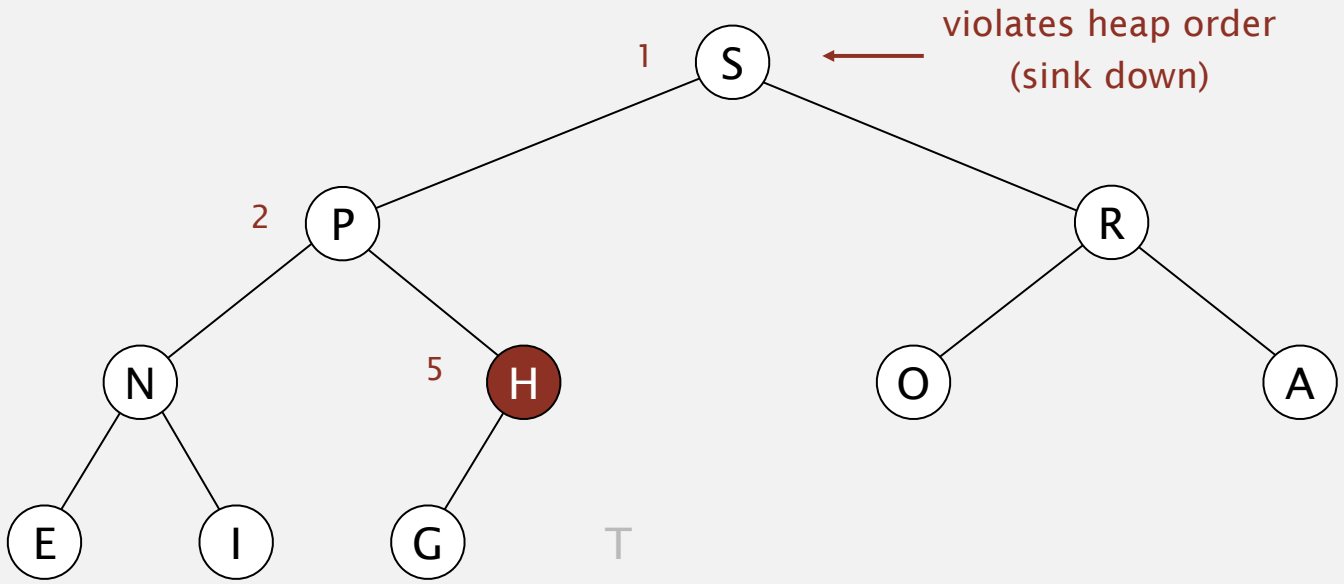

| S | H | R | N | P | O | A | E | I | G | T |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | | | | | | | | | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**remove the maximum**



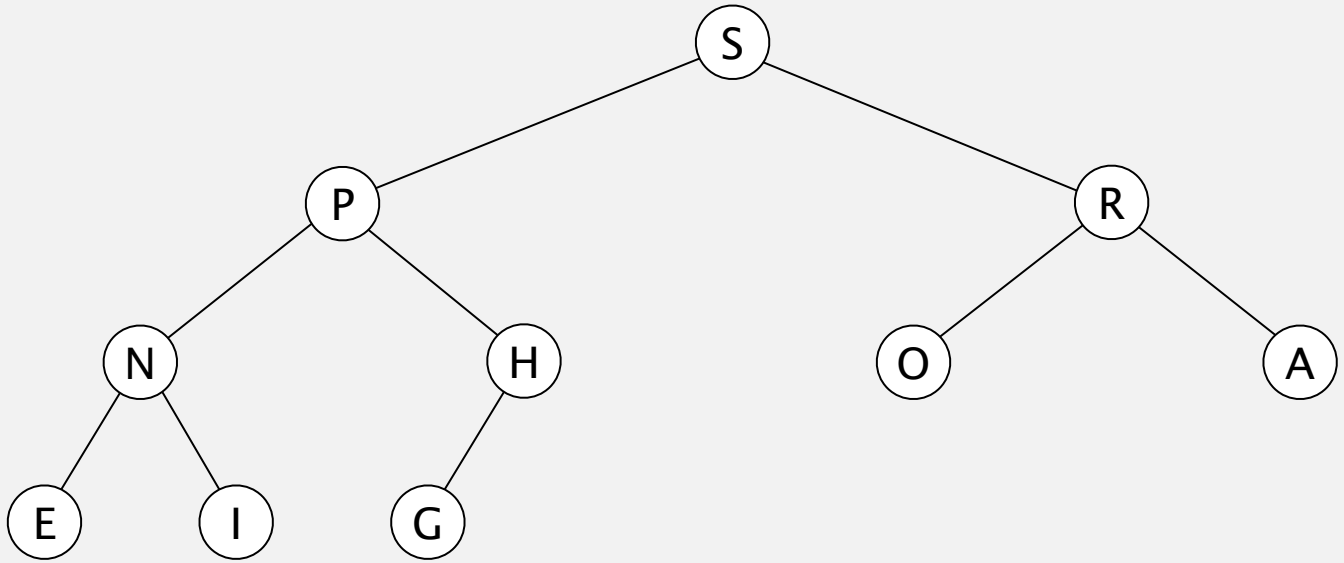

| S | P | R | N | H | O | A | E | I | G | T |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | | | 5 | | | | | | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**heap ordered**



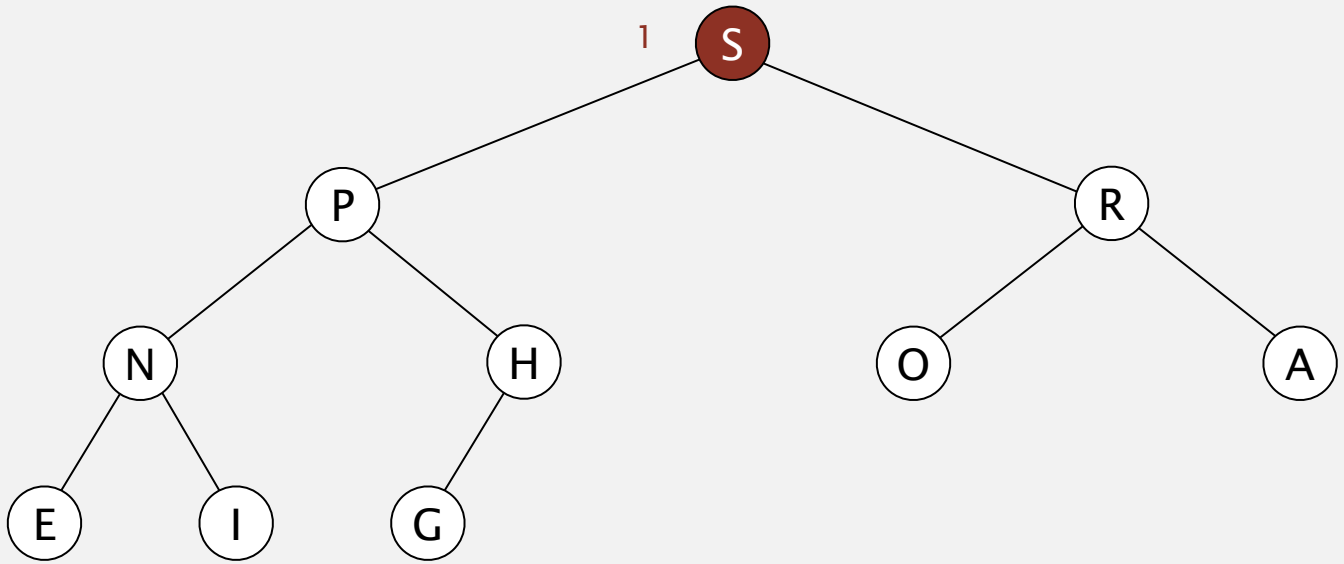

| S | P | R | N | H | O | A | E | I | G | |
|---|---|---|---|---|---|---|---|---|---|---|

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**remove the maximum**

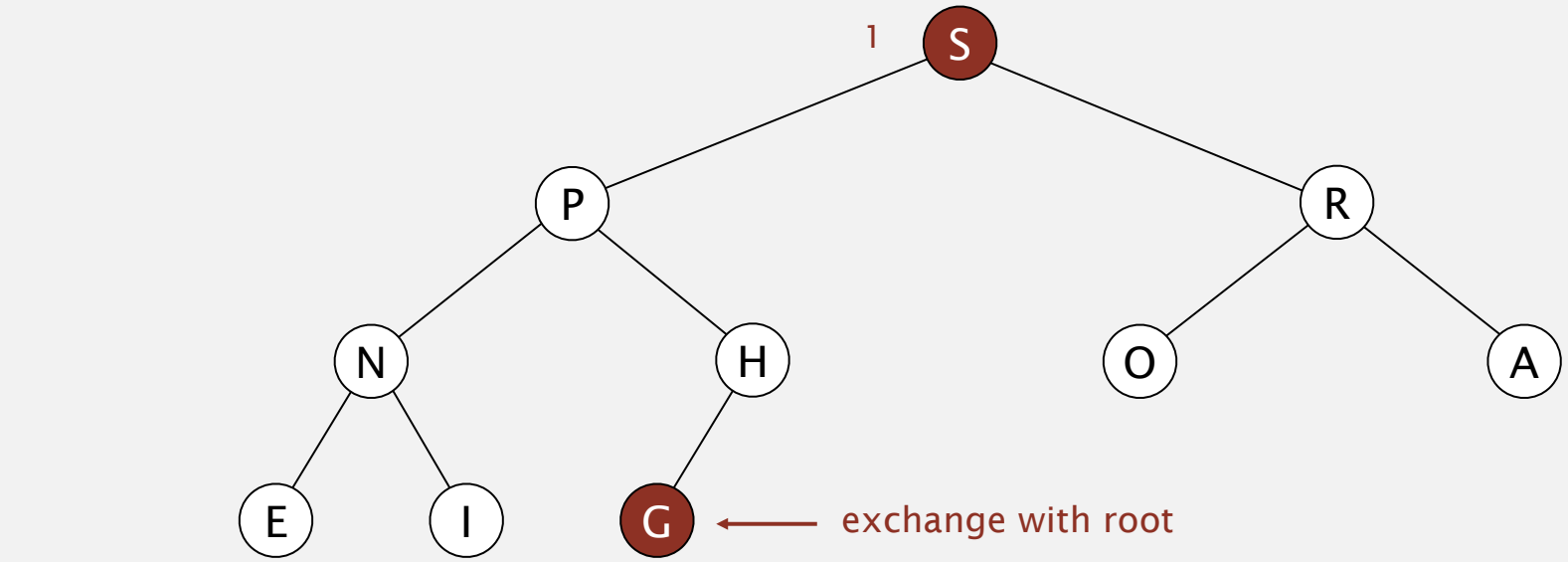



| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| S | P | R | N | H | O | A | E | I | G | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.



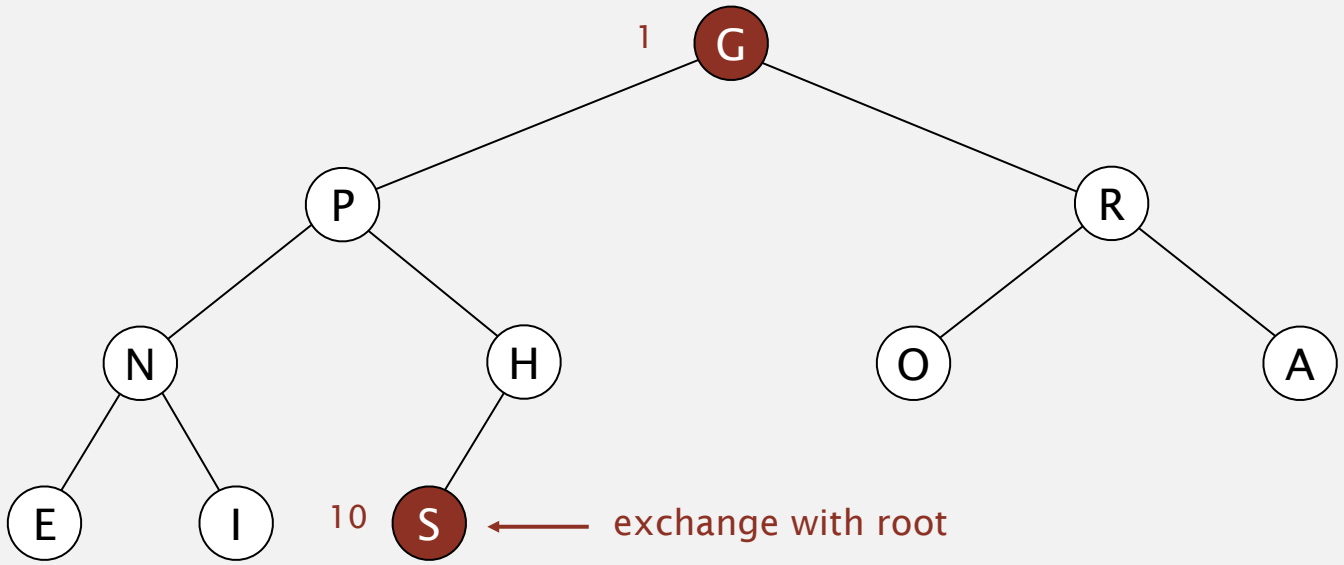

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| S | P | R | N | H | O | A | E | I | G | |
| 1 | | | | | | | | | | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**remove the maximum**



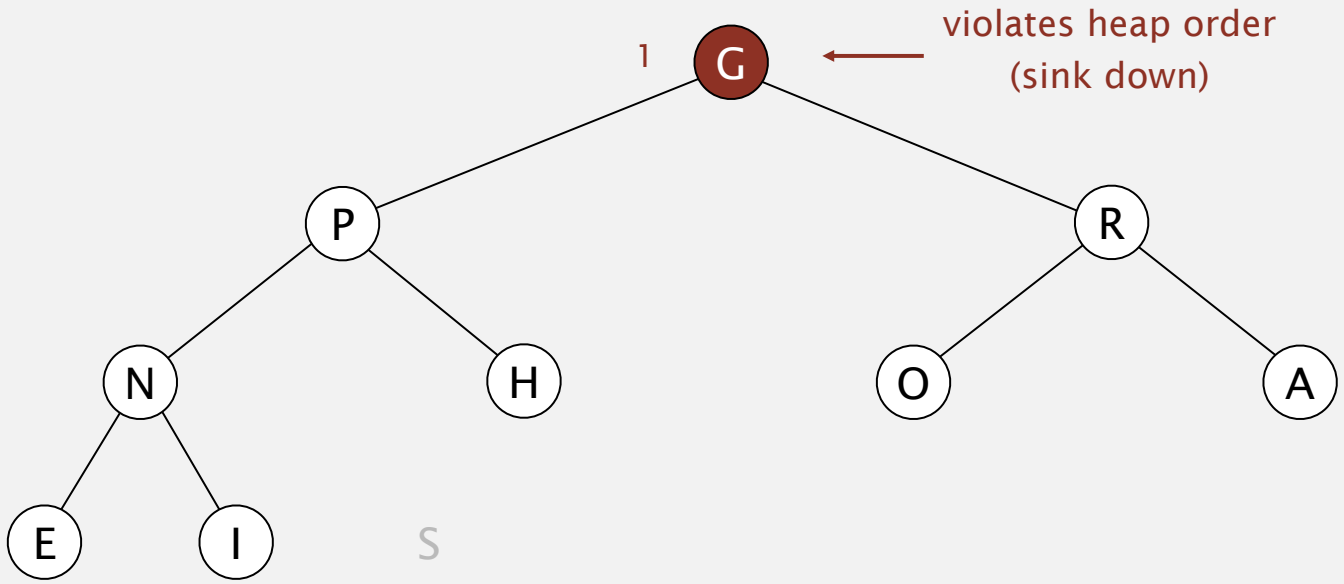

| G | P | R | N | H | O | A | E | I | S | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | 10 | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**remove the maximum**

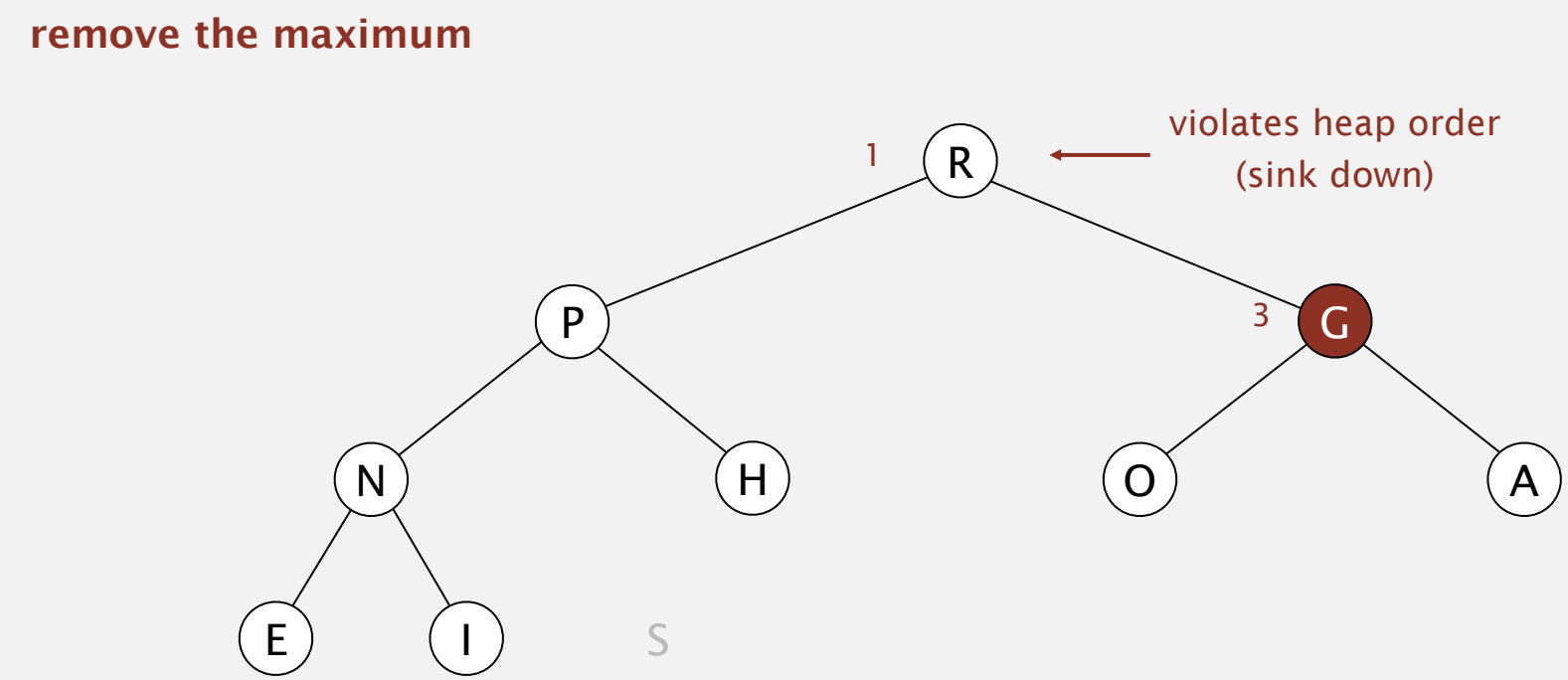



| G | P | R | N | H | O | A | E | I | S | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.



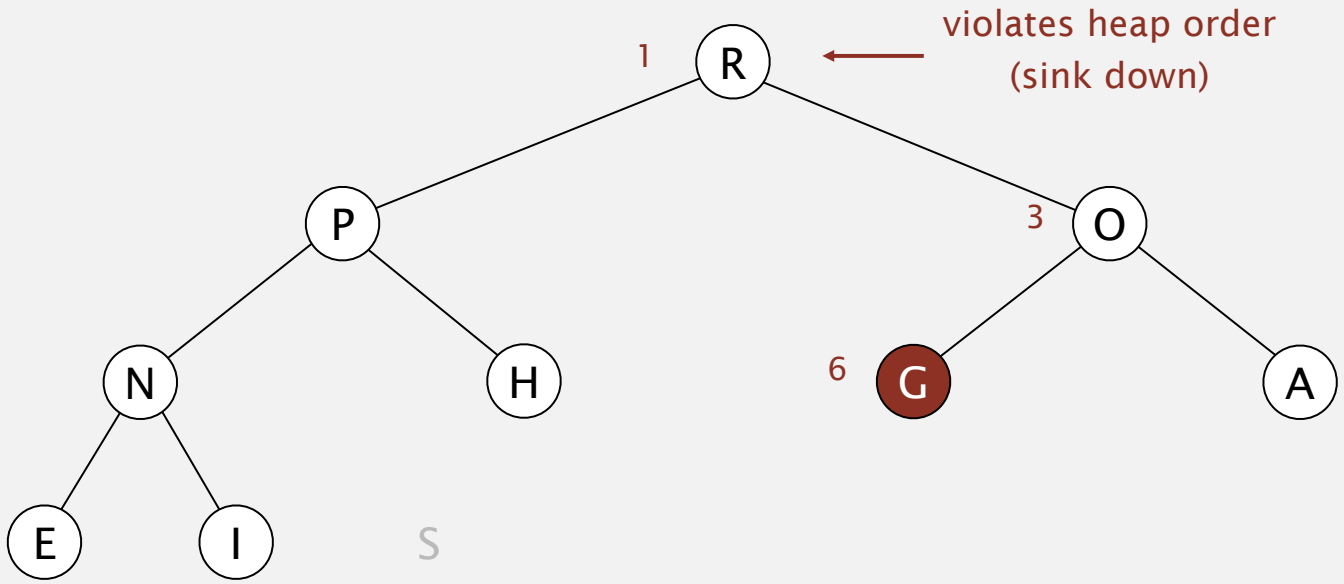

| R | P | G | N | H | O | A | E | I | S | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 3 | | | | | | | | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**remove the maximum**



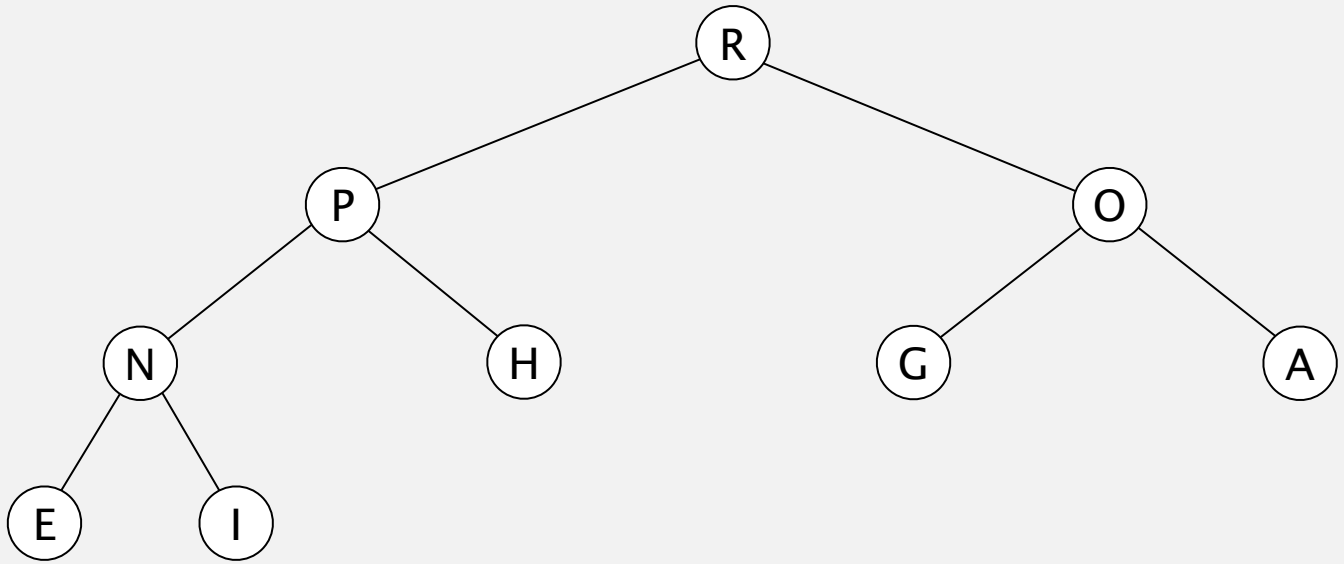

| R | P | O | N | H | G | A | E | I | S | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 3 | | | 6 | | | | | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**heap ordered**



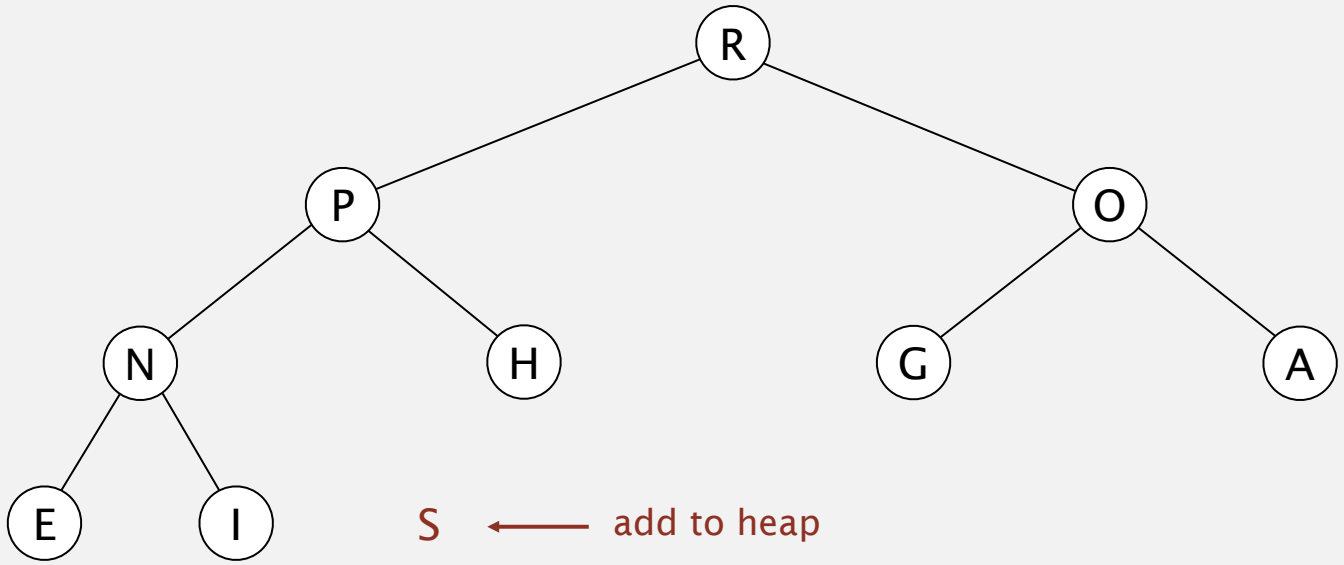

| R | P | O | N | H | G | A | E | I | | |
|---|---|---|---|---|---|---|---|---|---|---|

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**insert S**



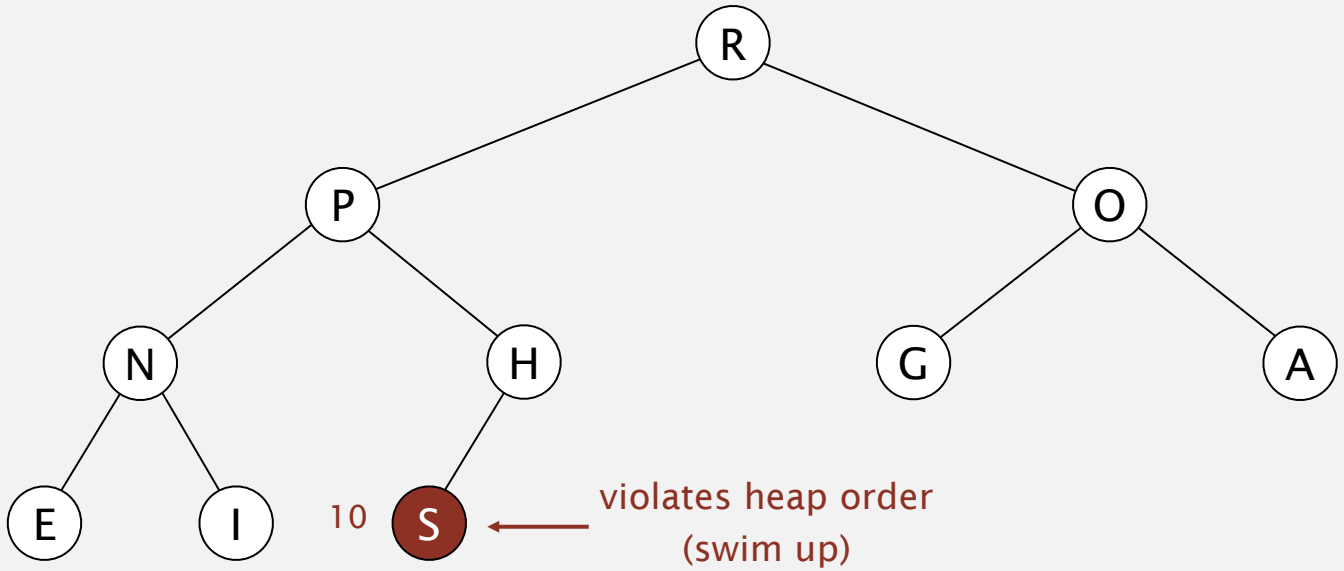

| R | P | O | N | H | G | A | E | I | S | |
|---|---|---|---|---|---|---|---|---|---|---|

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**insert S**



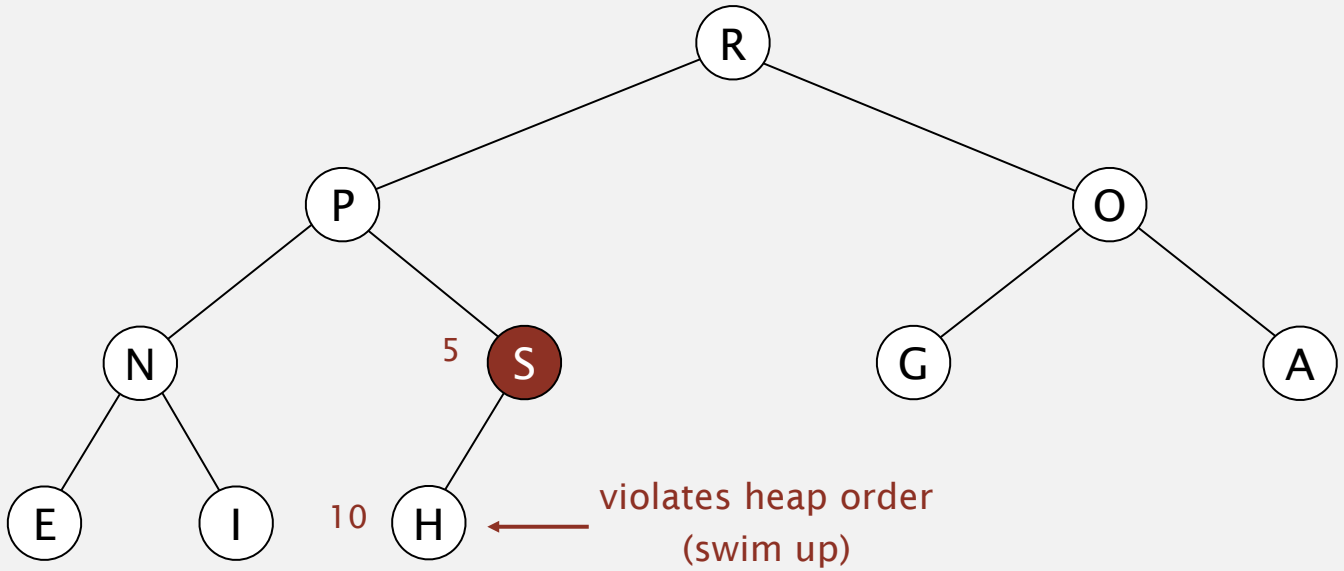

| R | P | O | N | H | G | A | E | I | S | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 10 | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**insert S**



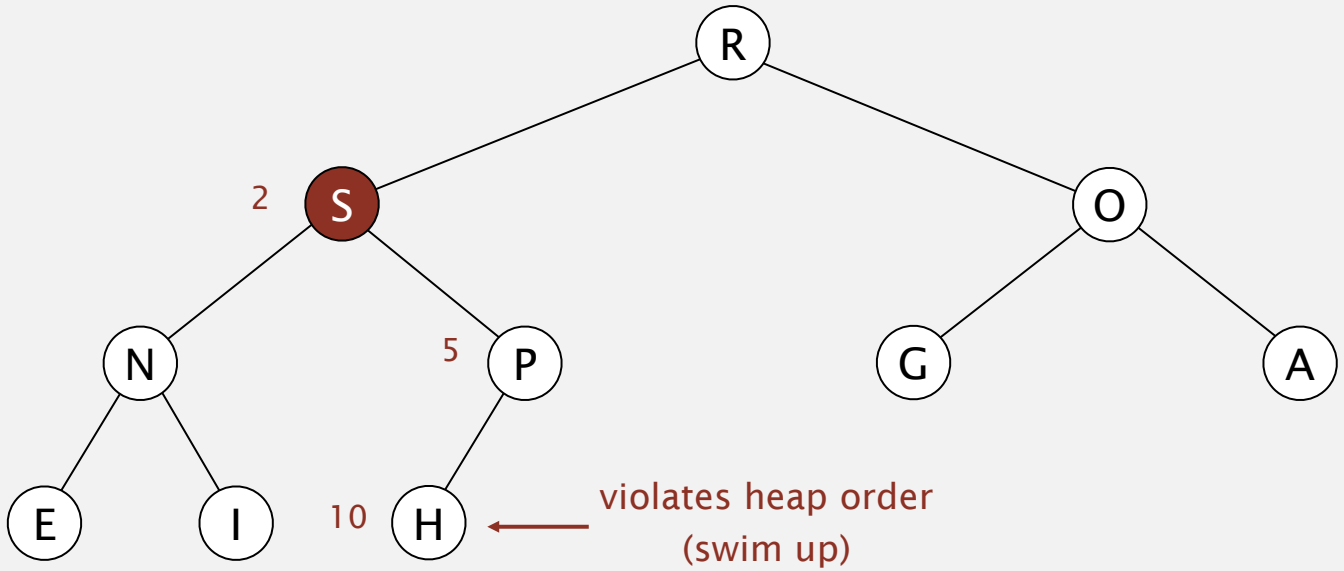

| R | P | O | N | S | G | A | E | I | H | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5 | | | | | 10 | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**insert S**



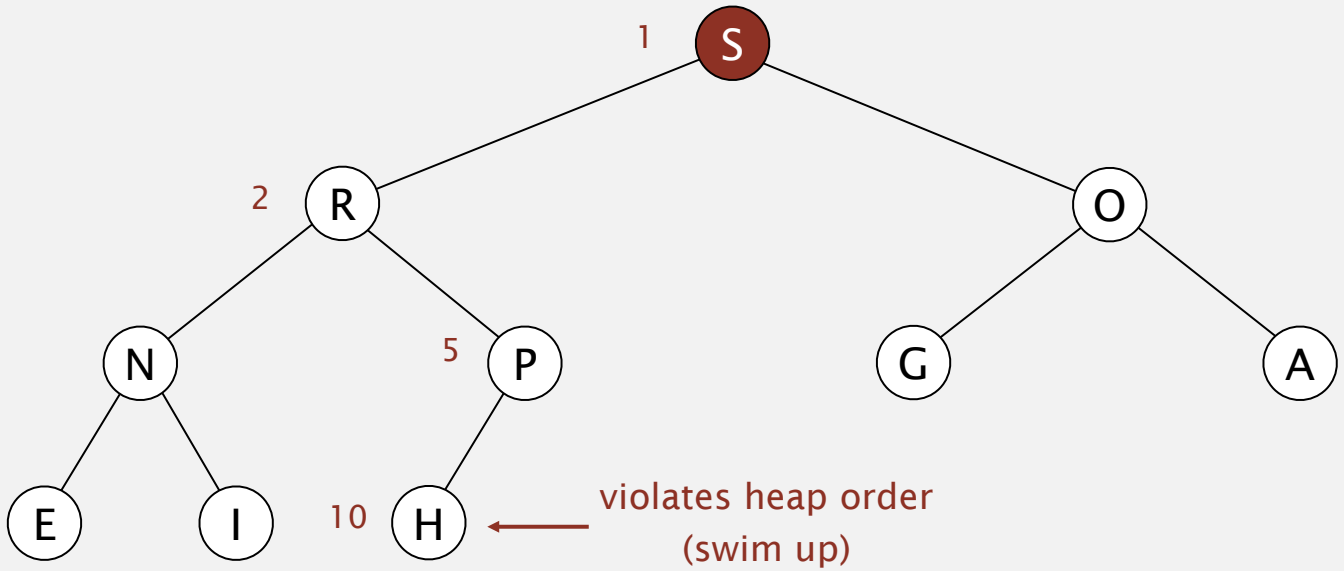

| R | S | O | N | P | G | A | E | I | H | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | | 5 | | | | | 10 | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**insert S**



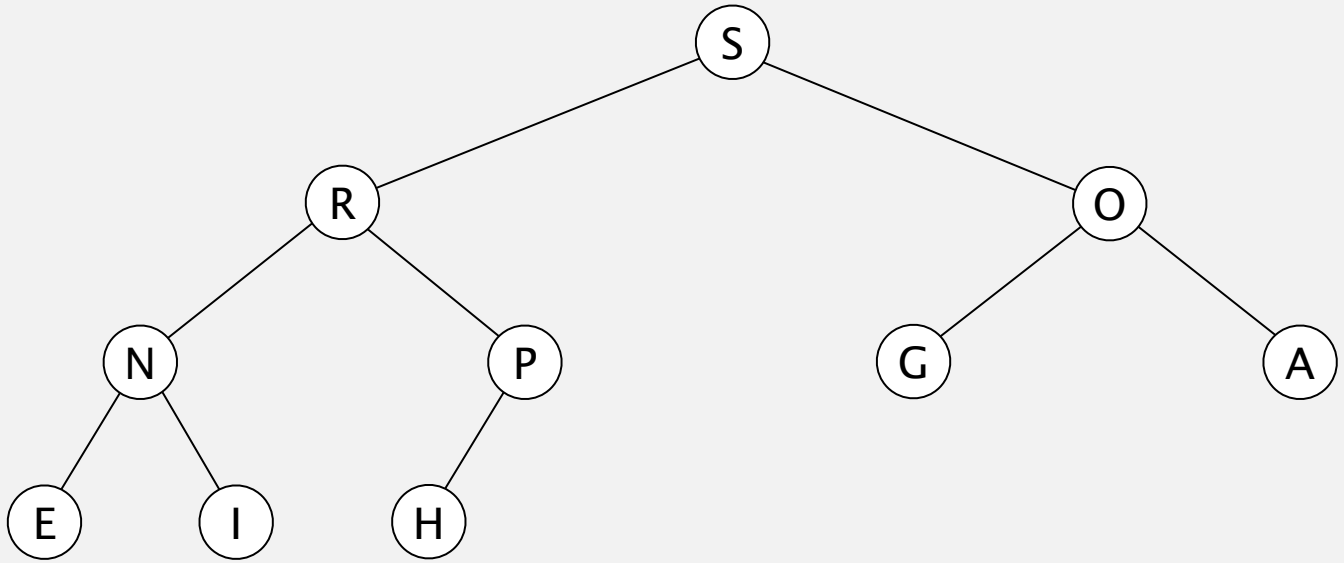

| S | R | O | N | P | G | A | E | I | H | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | | | 5 | | | | | 10 | |

# Binary heap demo

Insert. Add node at end, then swim it up.

Remove the maximum. Exchange root with node at end, then sink it down.

**heap ordered**




| S | R | O | N | P | G | A | E | I | H | |
|---|---|---|---|---|---|---|---|---|---|---|