click to begin demo

Algorithms
FOURTH EDITION

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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	

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 ← add to heap

T	P	R	N	H	O	A	E	I	G	S

11

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

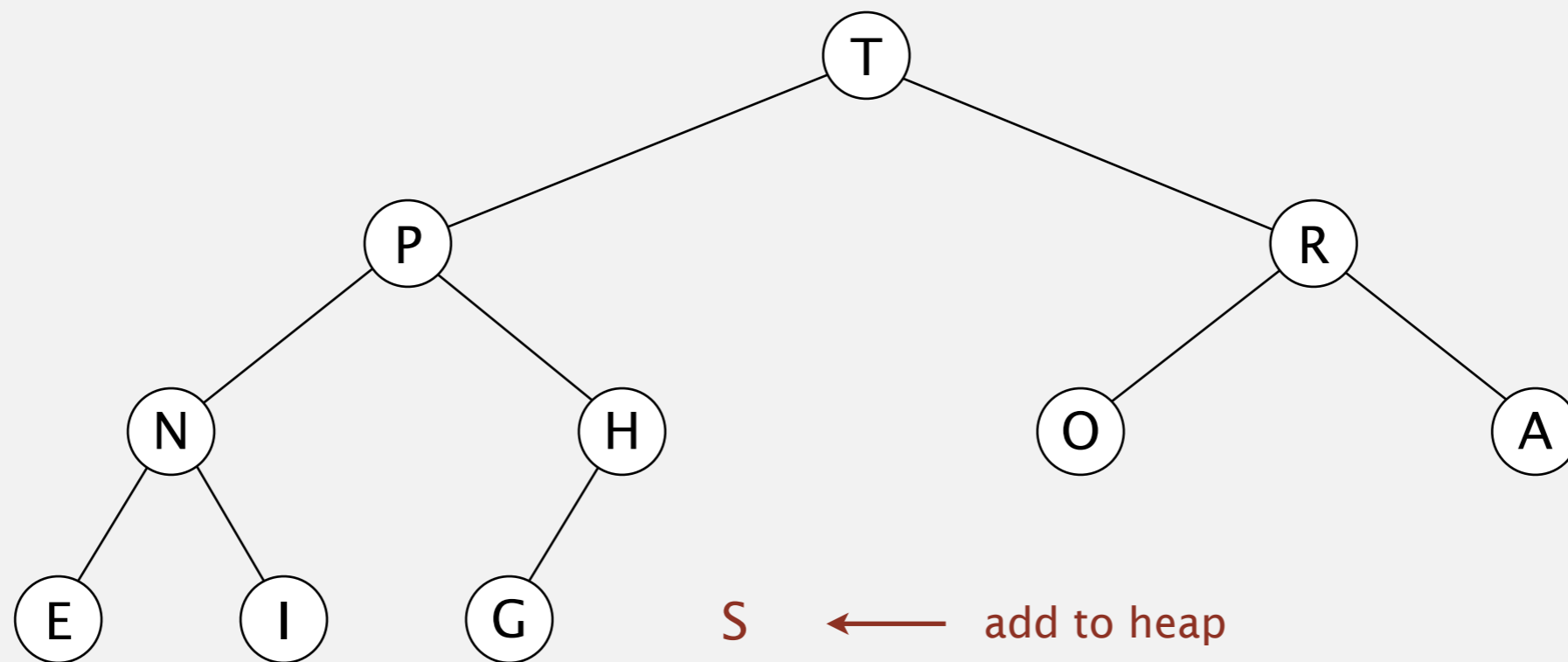Remove the maximum. Exchange root with node at end, then sink it down.

insert S

violates heap order
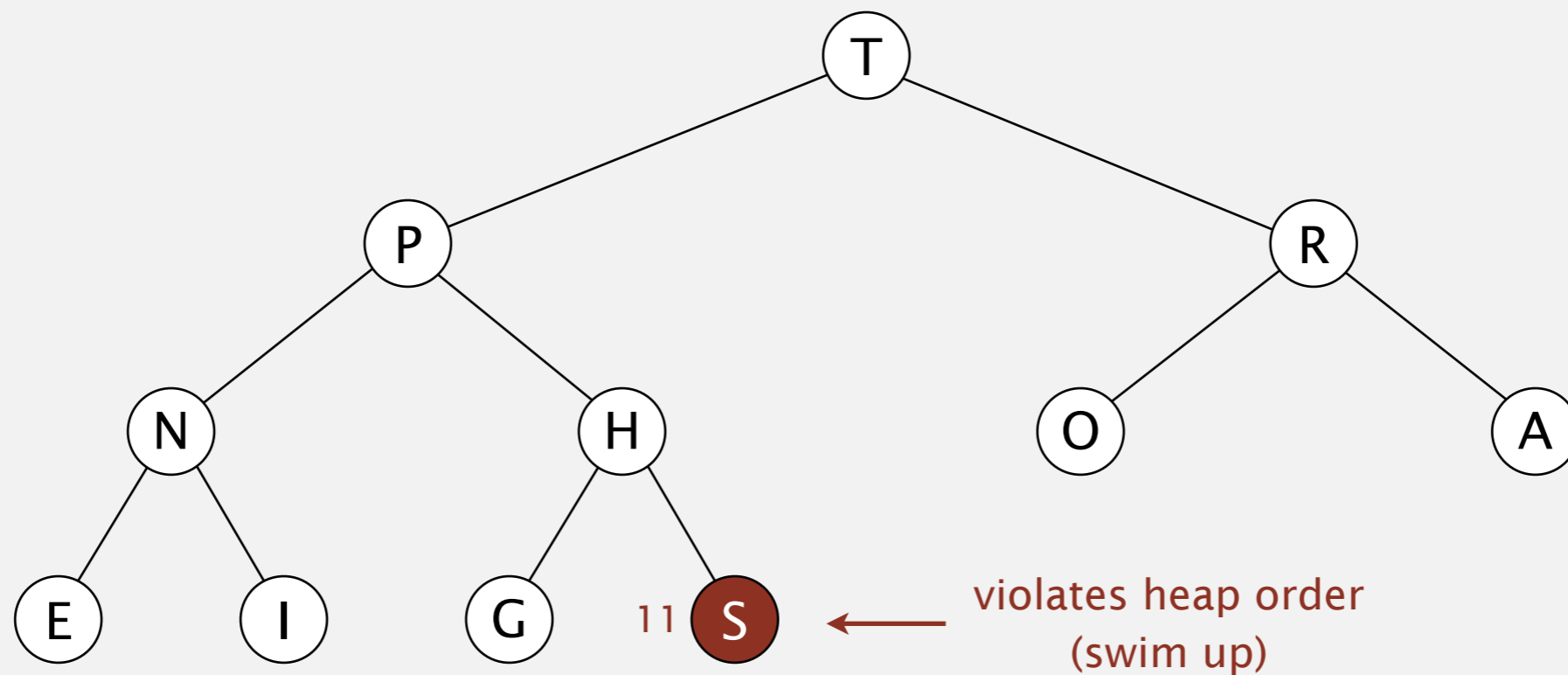(swim up)

T	P	R	N	H	O	A	E	I	G	S

11

4

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

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

insert S

violates heap order
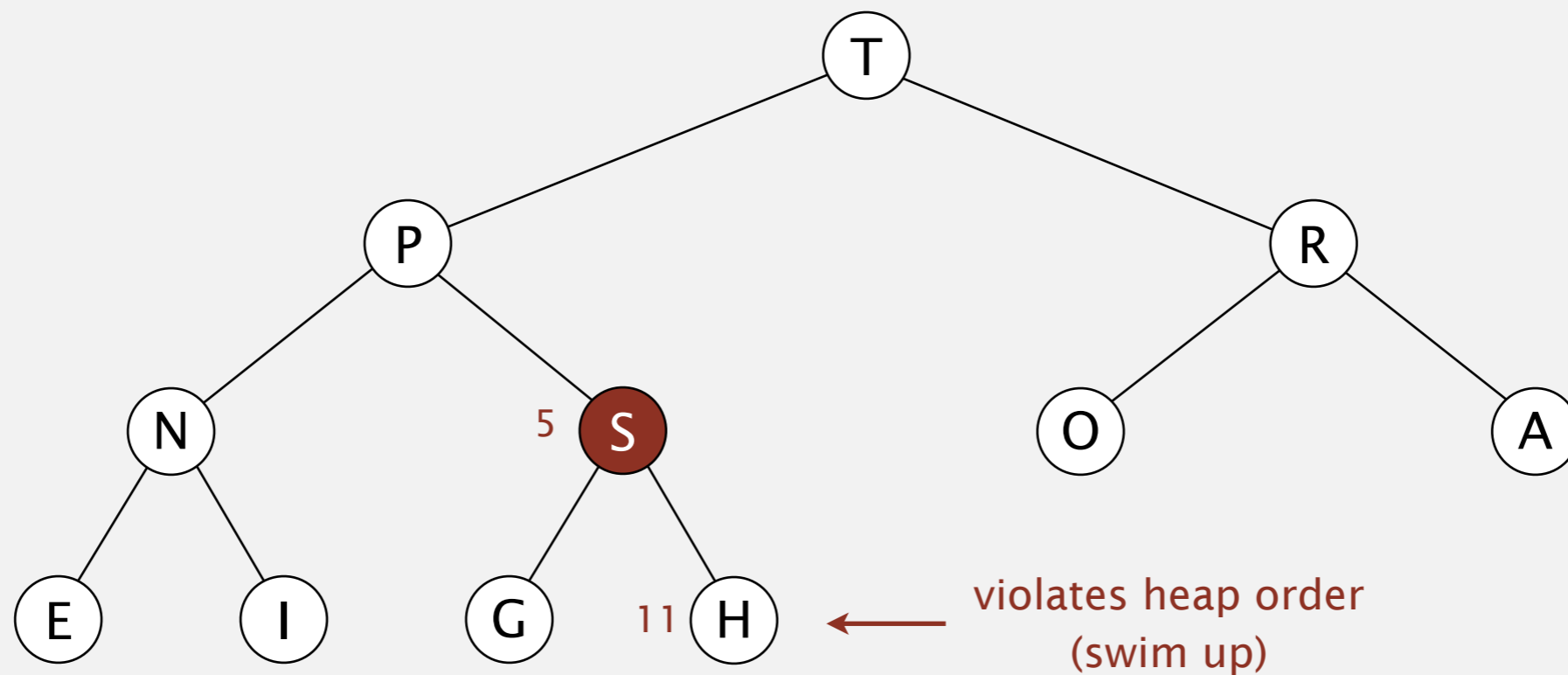(swim up)

T	P	R	N	S	O	A	E	I	G	H

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

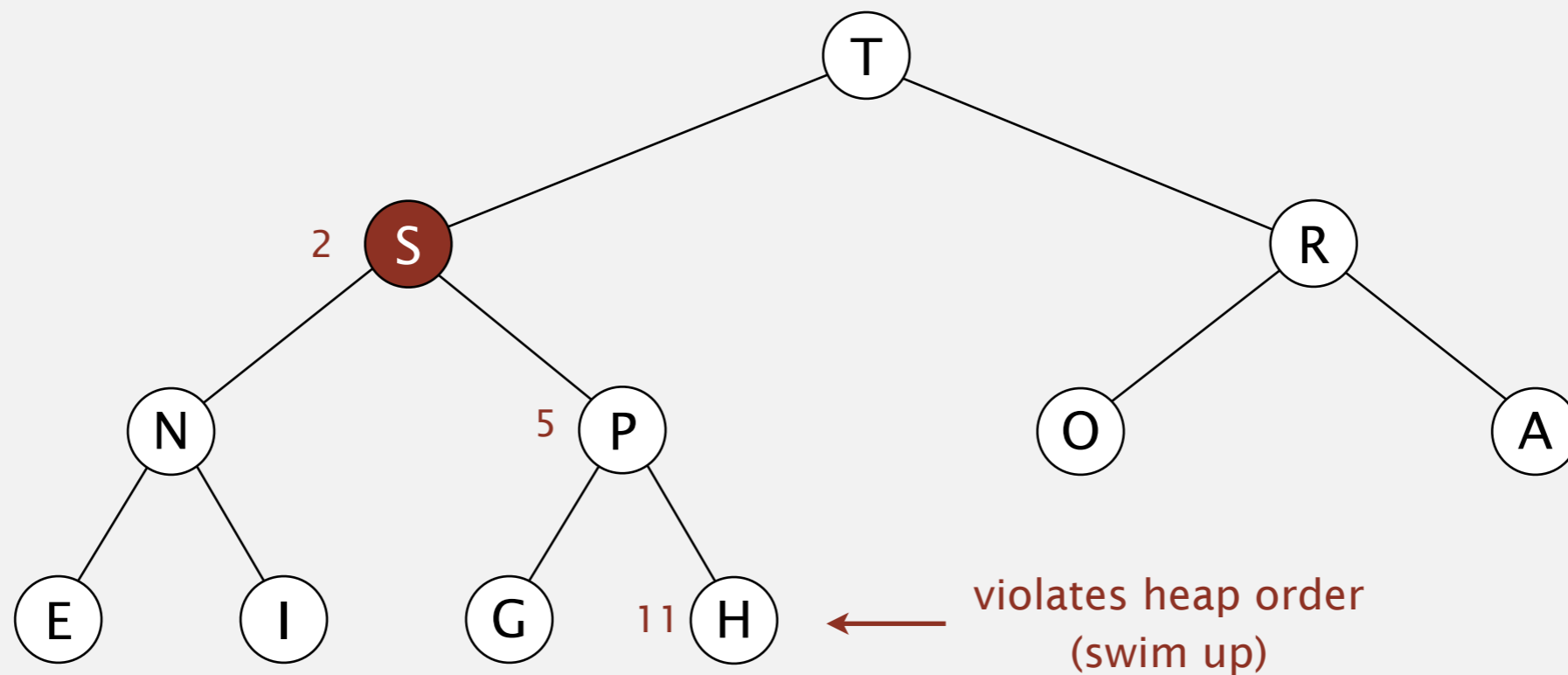Remove the maximum. Exchange root with node at end, then sink it down.

insert S

violates heap order
(swim up)

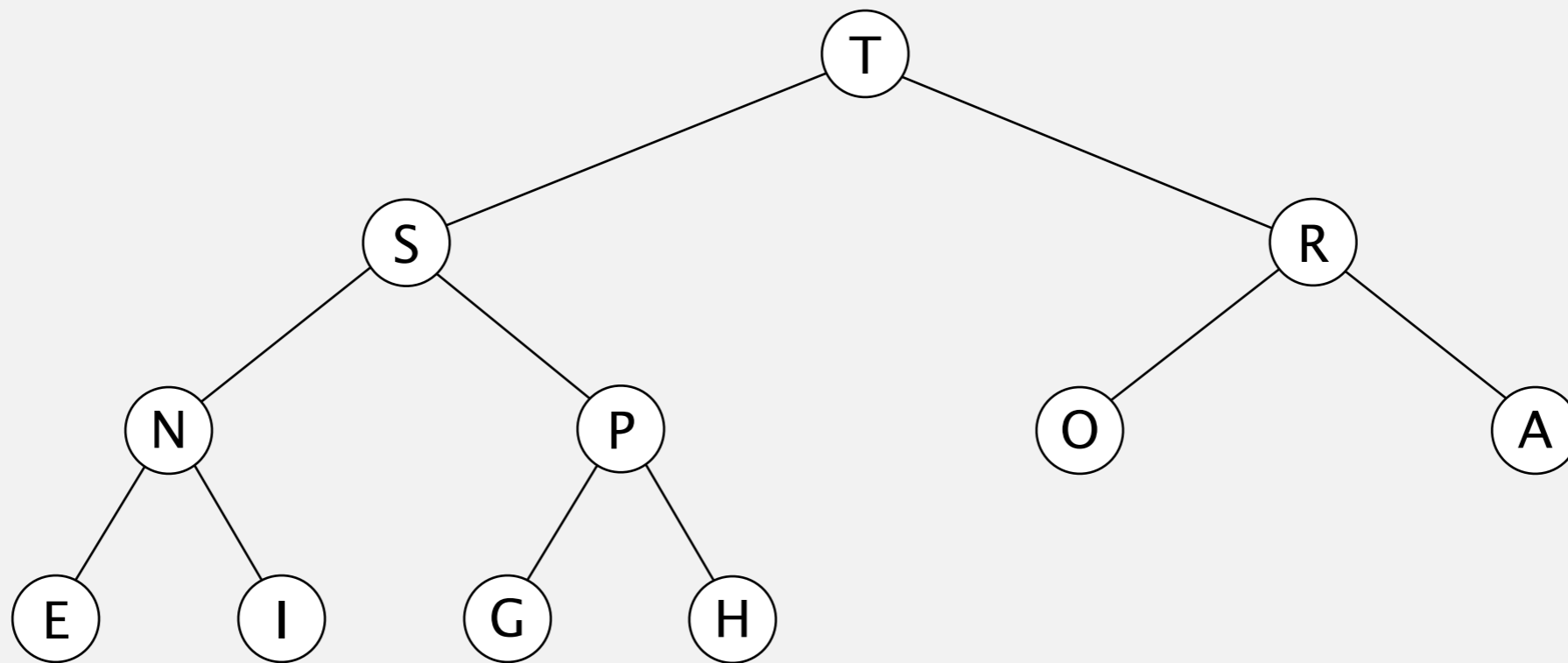| T	S	R	N	P	O	A	E	I	G	H

2   5   11

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

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

T	S	R	N	P	O	A	E	I	G	H

Binary heap operations

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

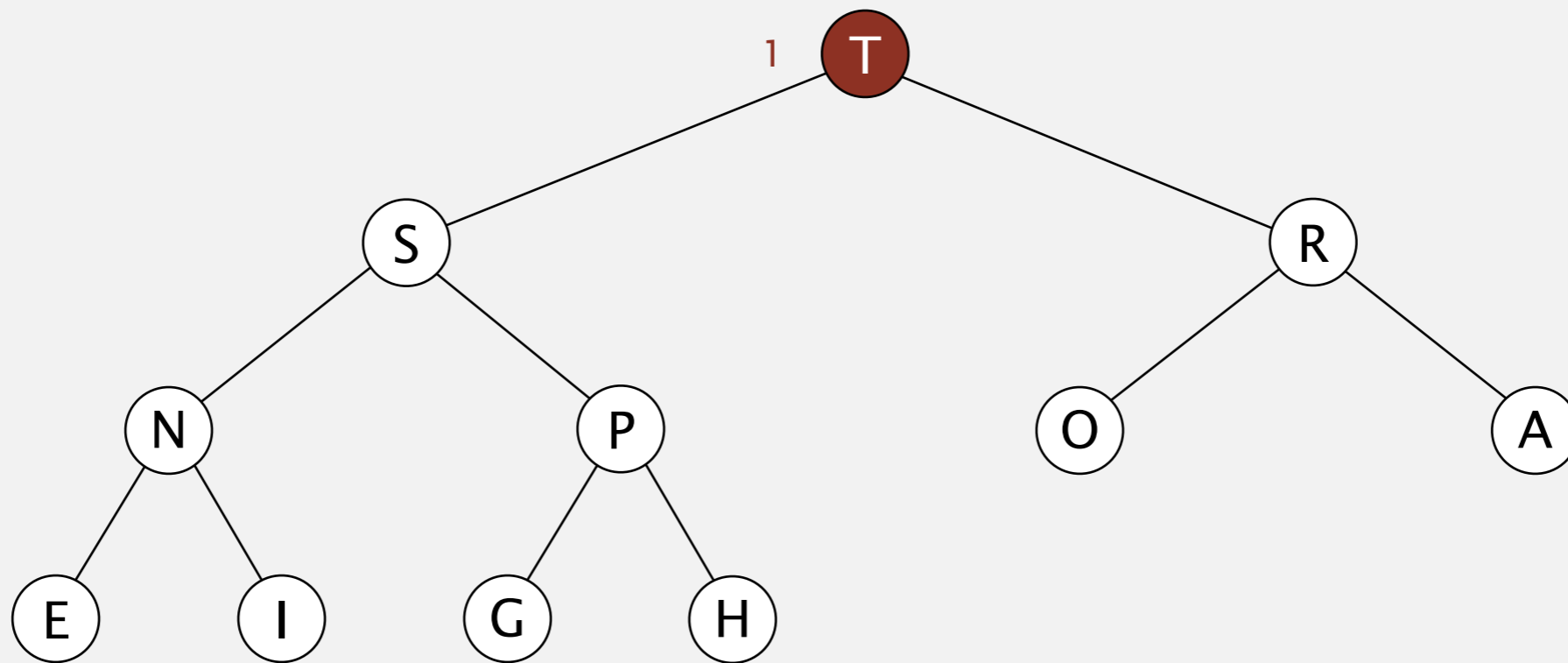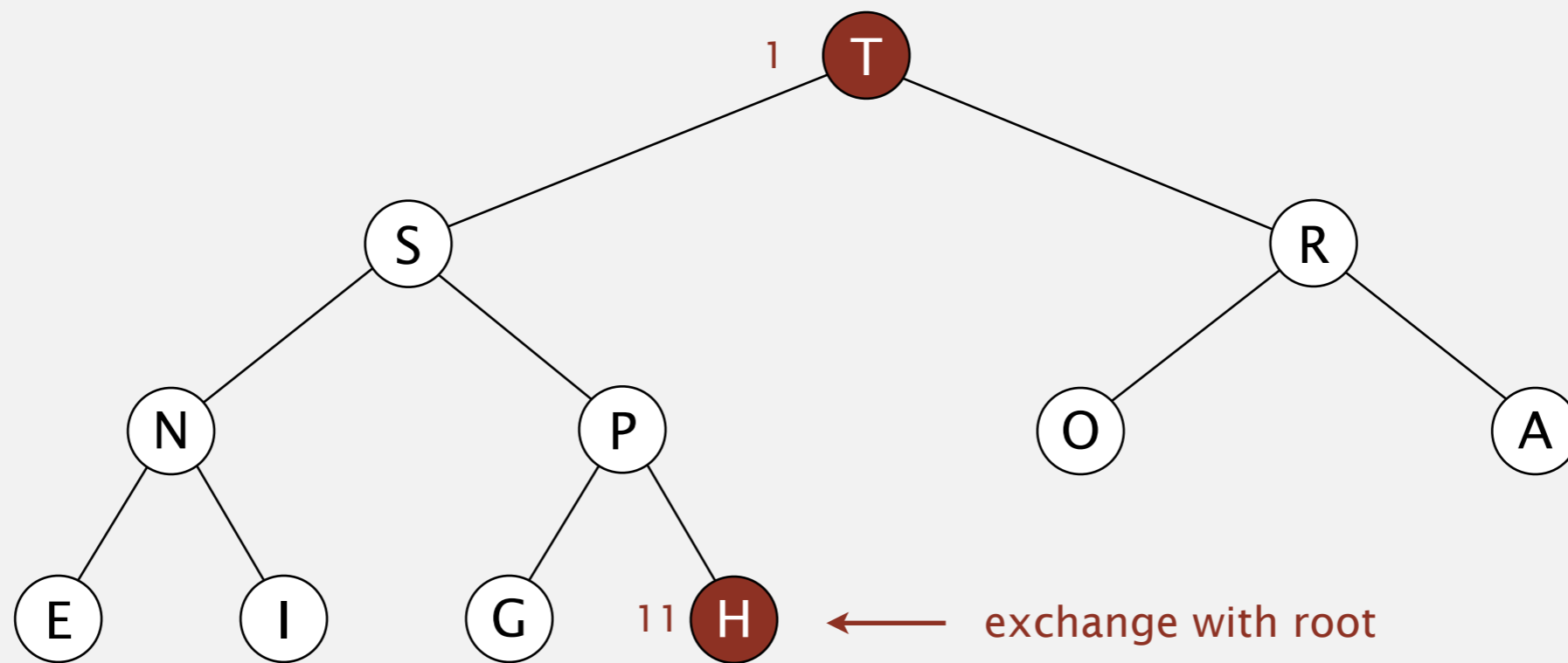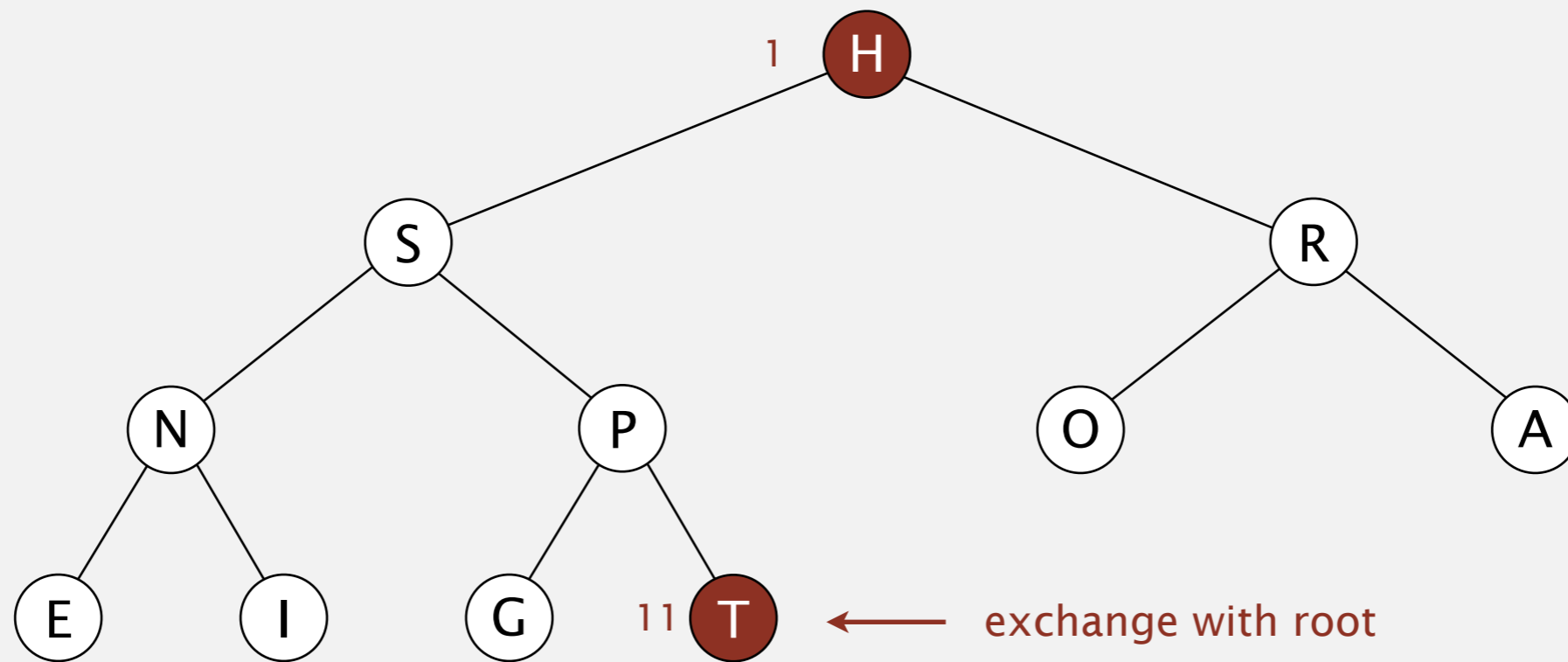Remove the maximum. Exchange root with node at end, then sink it down.

remove the maximum

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

exchange with root

H	S	R	N	P	O	A	E	I	G	T

1   11

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

violates heap order
(sink down)

H	S	R	N	P	O	A	E	I	G	T

1

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

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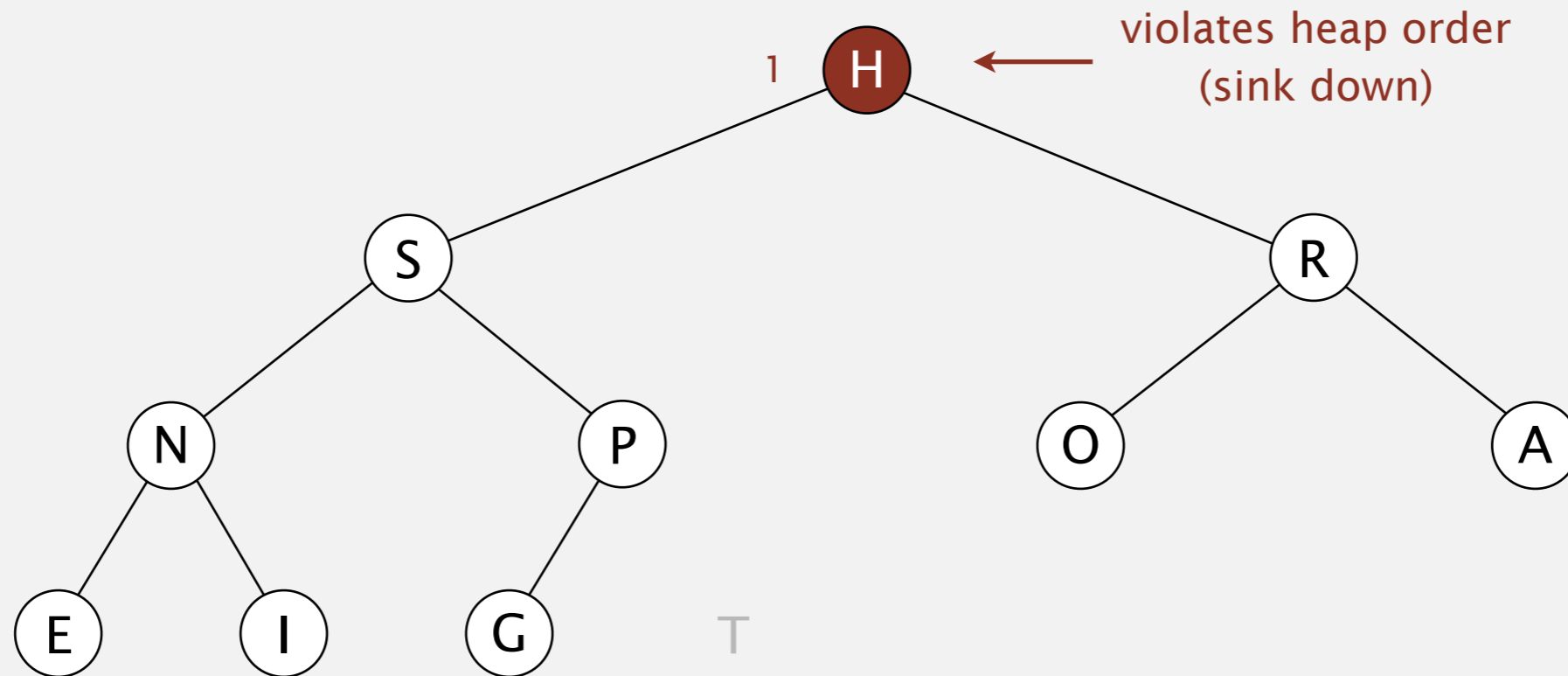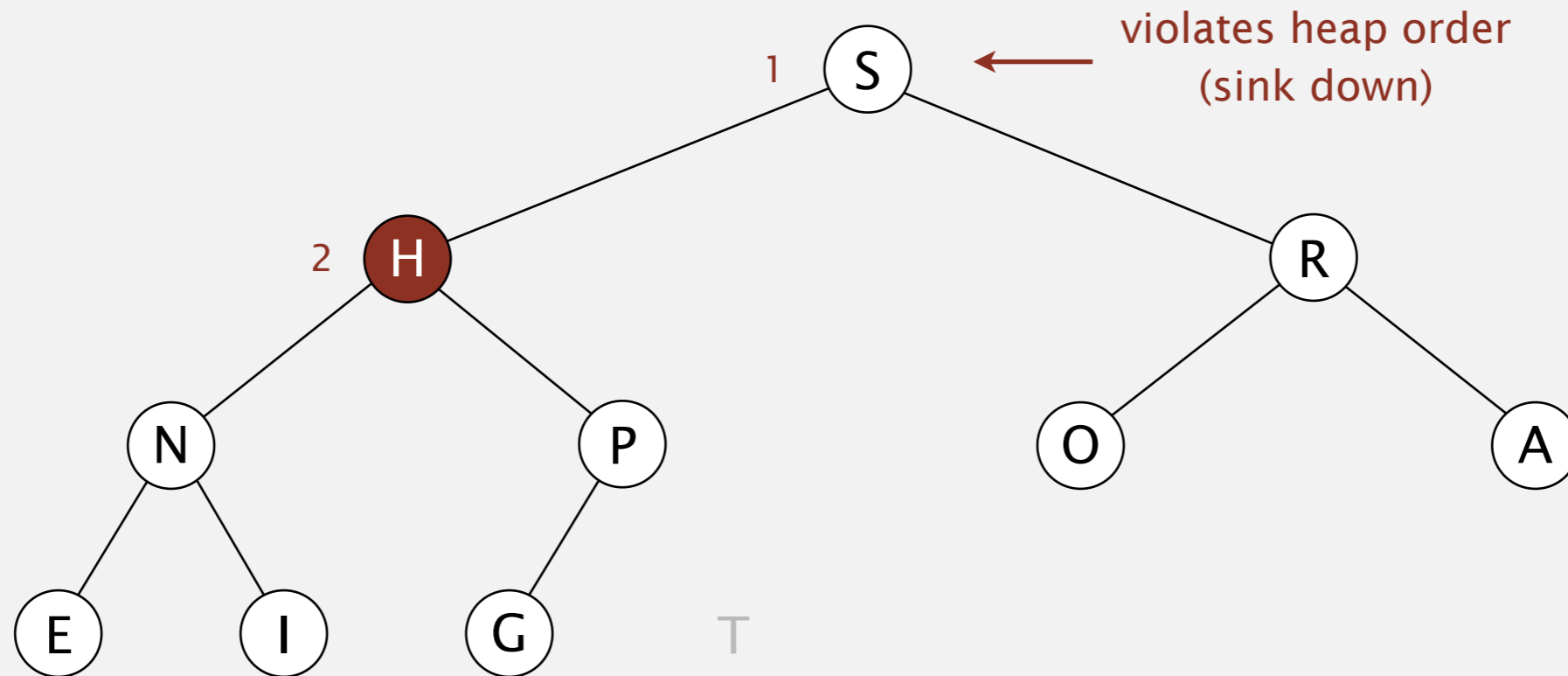
remove the maximum

violates heap order
(sink down)

1 S

2 H R

N P O A

E I G T

S	H	R	N	P	O	A	E	I	G	T

1   2

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

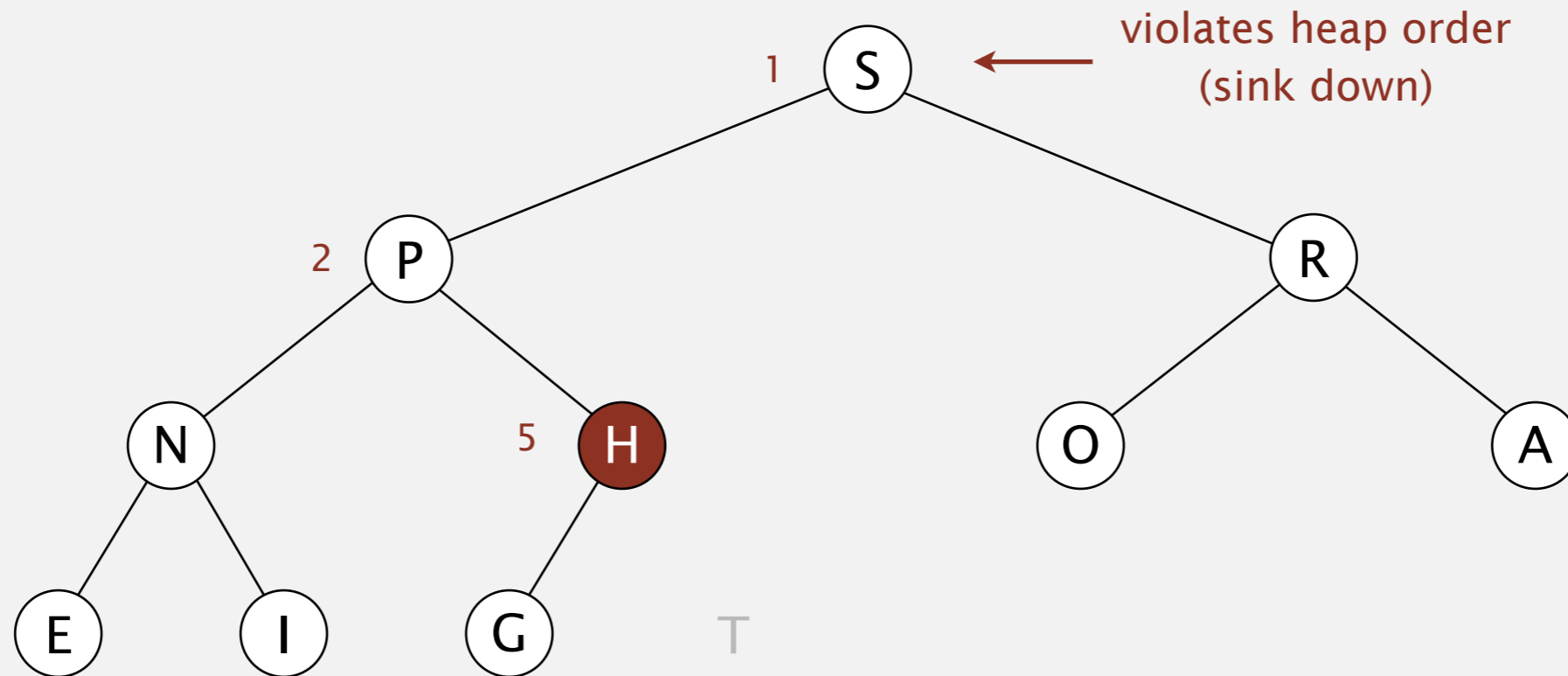violates heap order
(sink down)

S	P	R	N	H	O	A	E	I	G	T

1   2   5

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	

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

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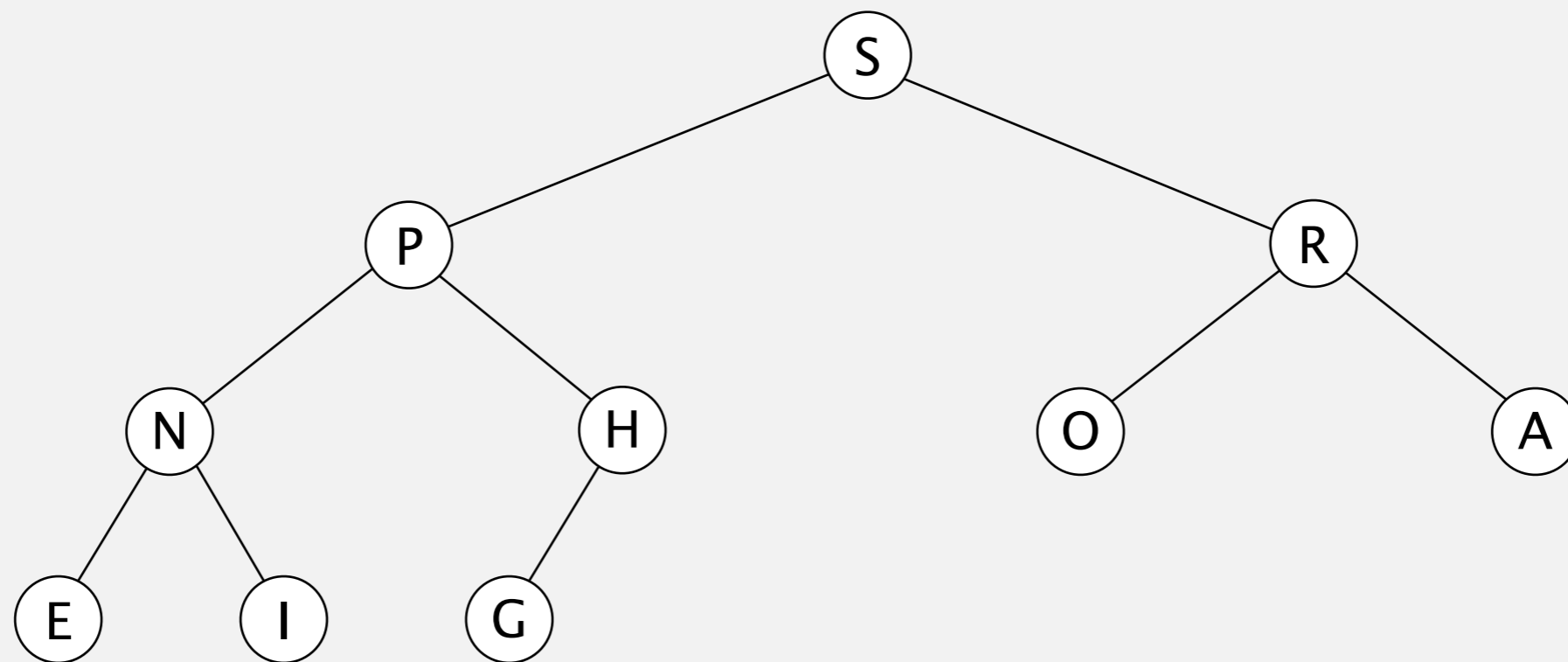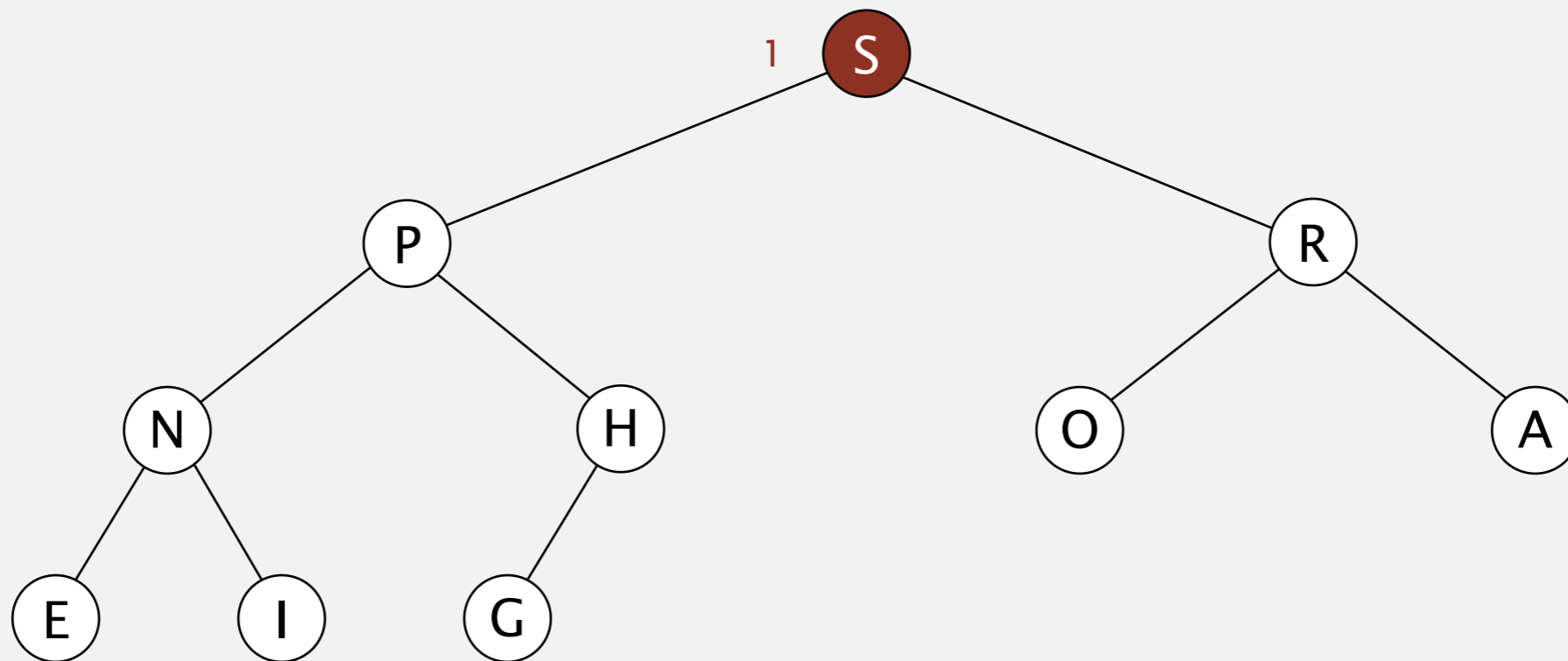
remove the maximum

S	P	R	N	H	O	A	E	I	G	

1

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

exchange with root

S	P	R	N	H	O	A	E	I	G	

1
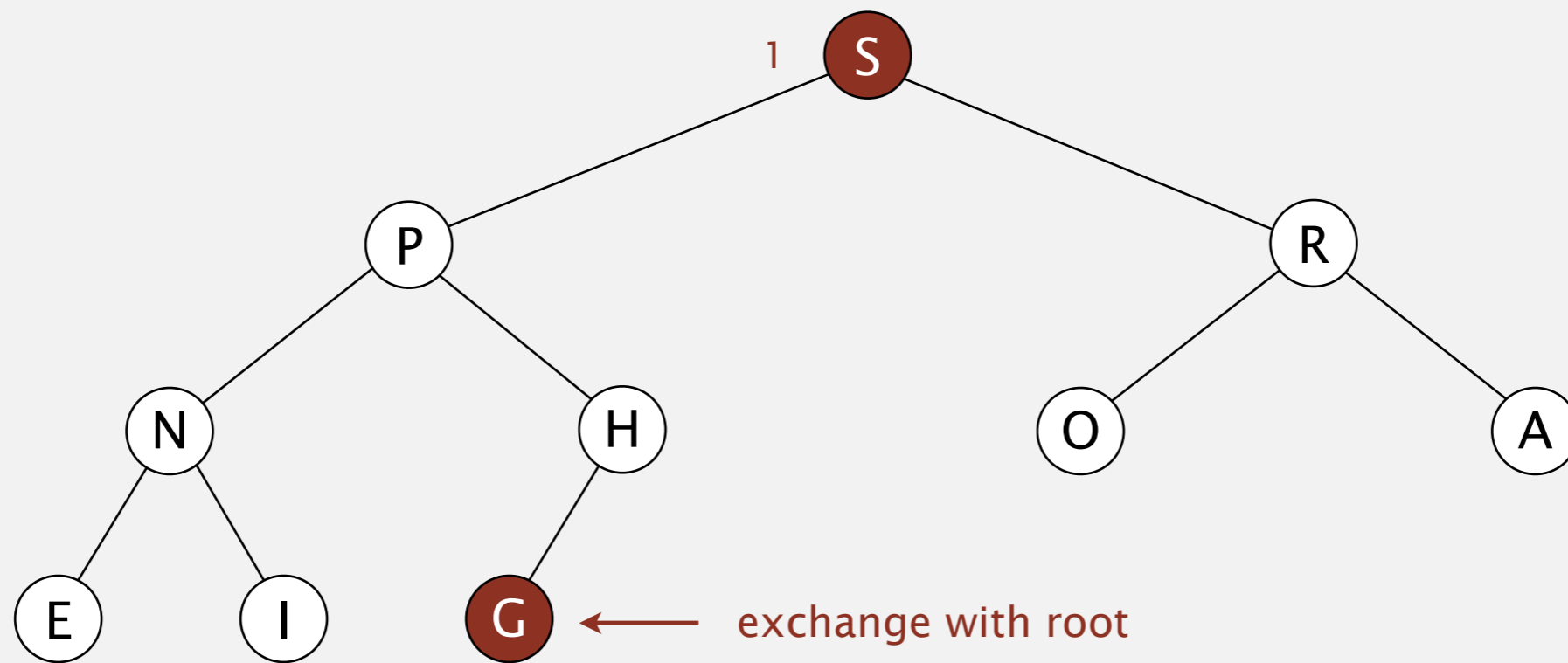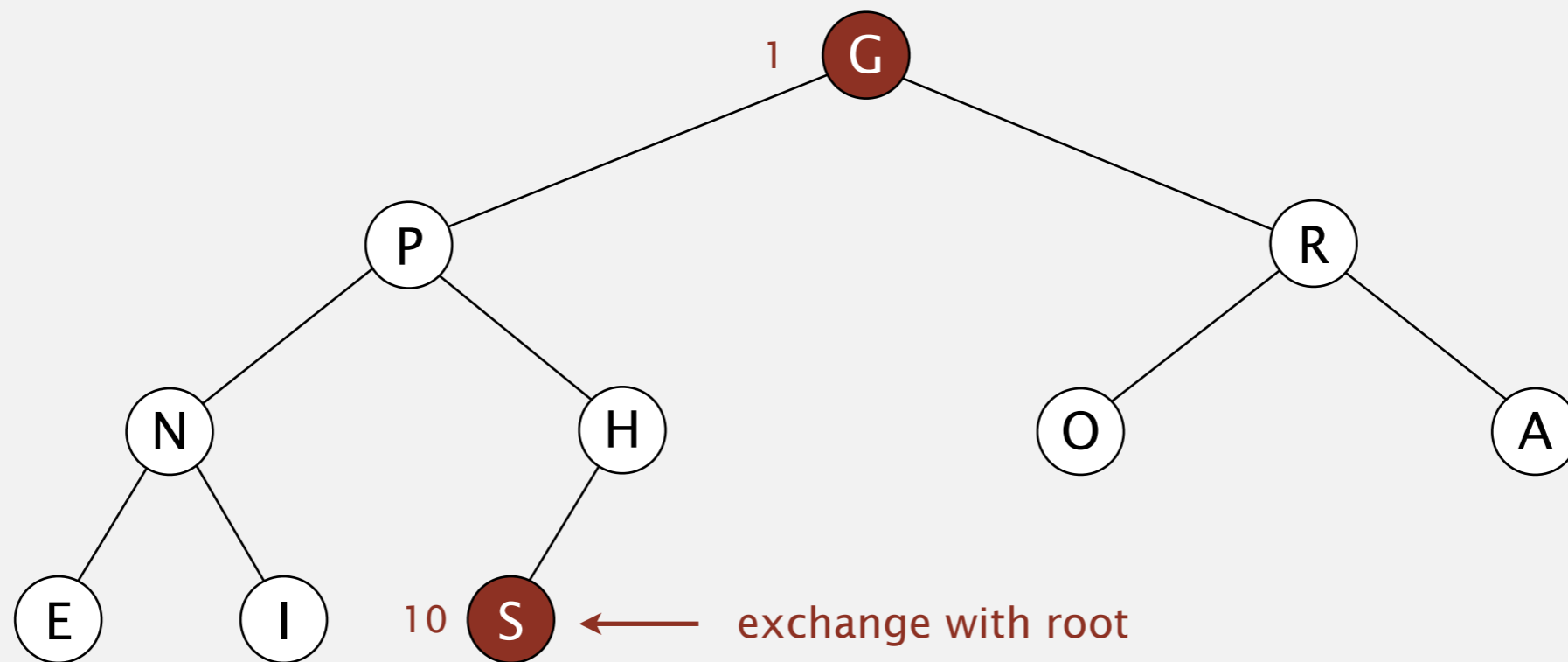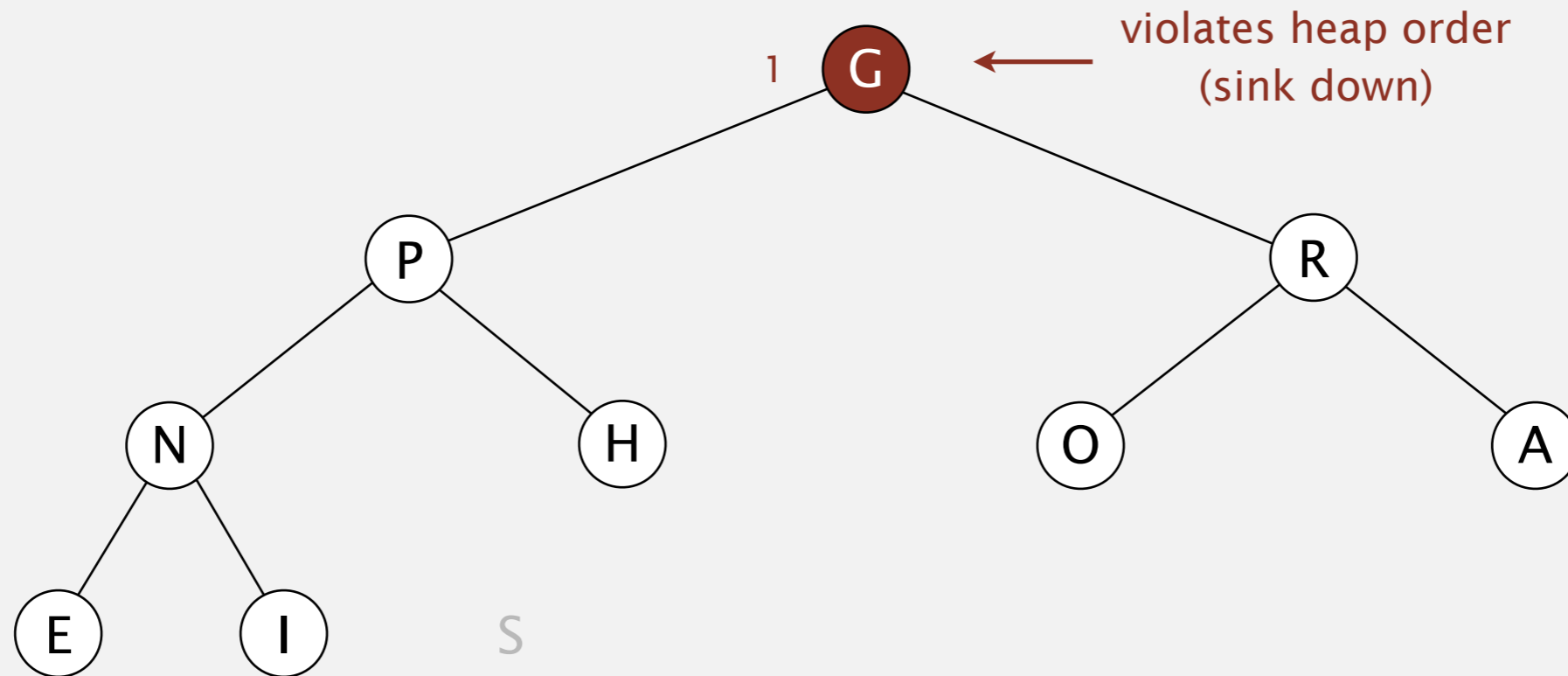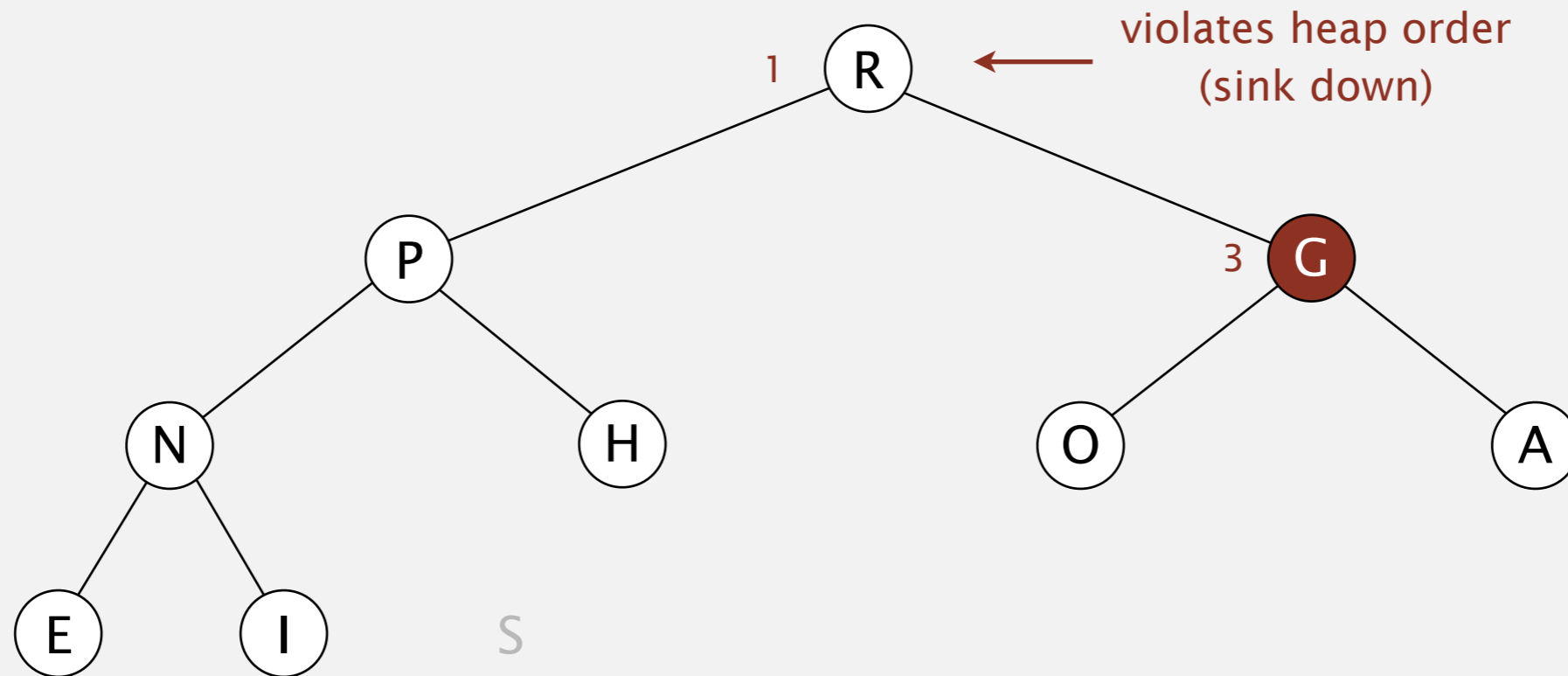
Binary heap operations

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

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

violates heap order
(sink down)

G	P	R	N	H	O	A	E	I	S	

1

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

violates heap order
(sink down)

R	P	G	N	H	O	A	E	I	S	

1   3

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
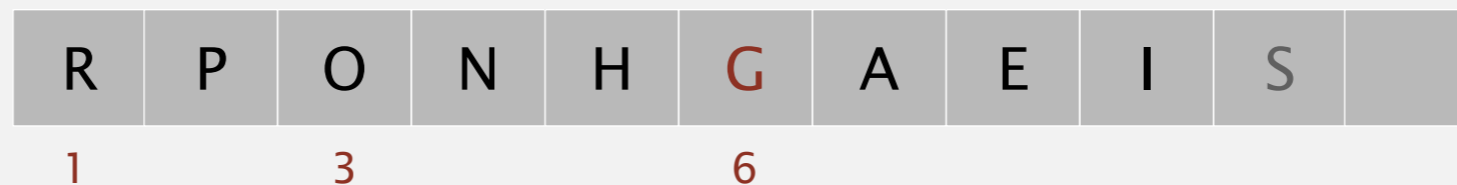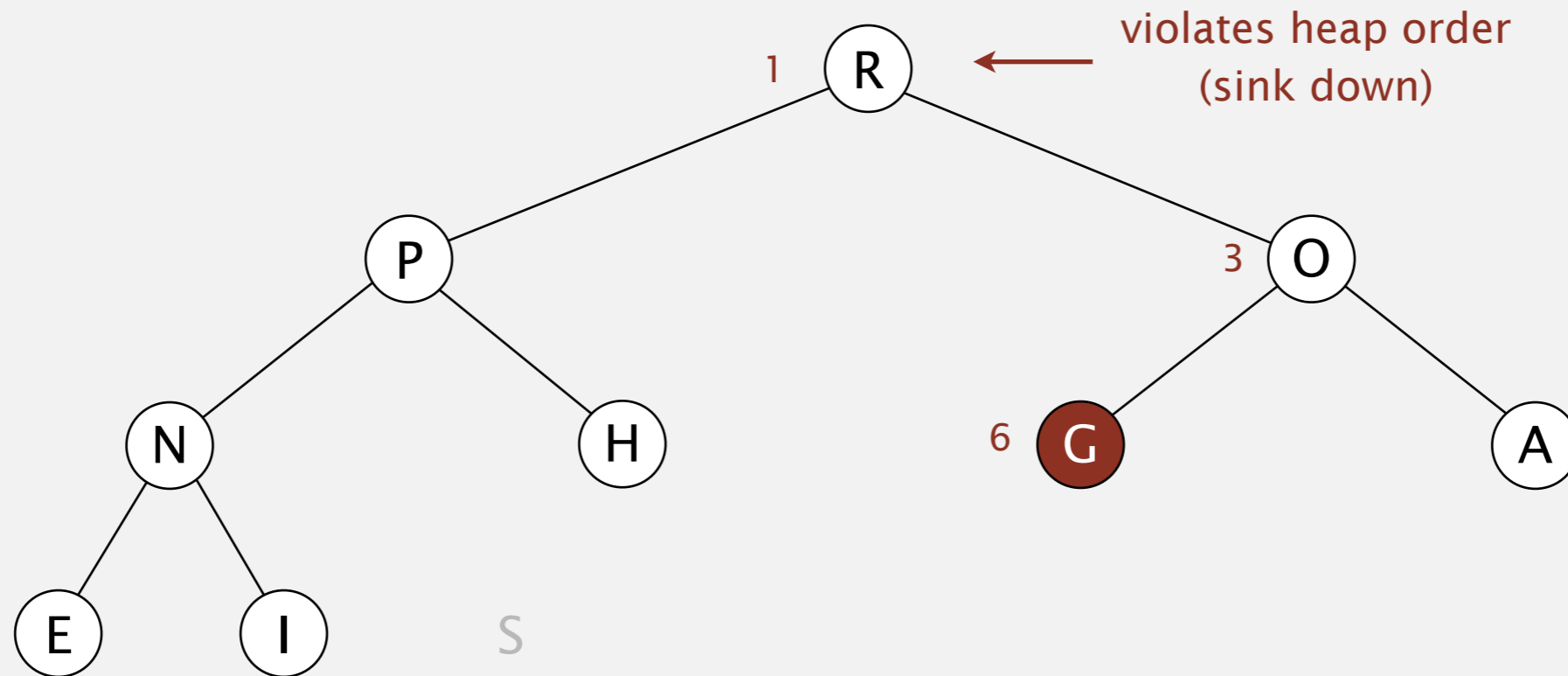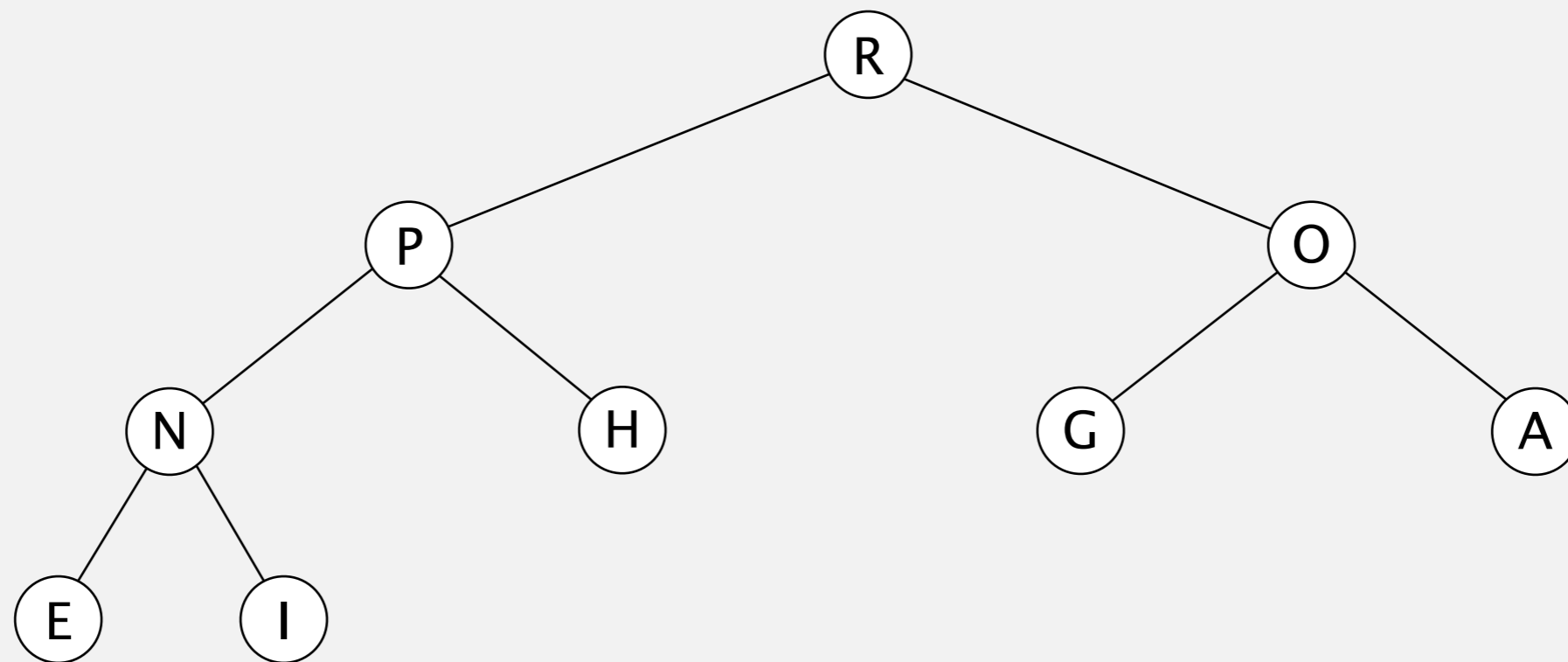
violates heap order
(sink down)

1 R

P

3 O

N

H

6 G

A

E

I

S

R	P	O	N	H	G	A	E	I	S	

1   3   6

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

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

heap ordered
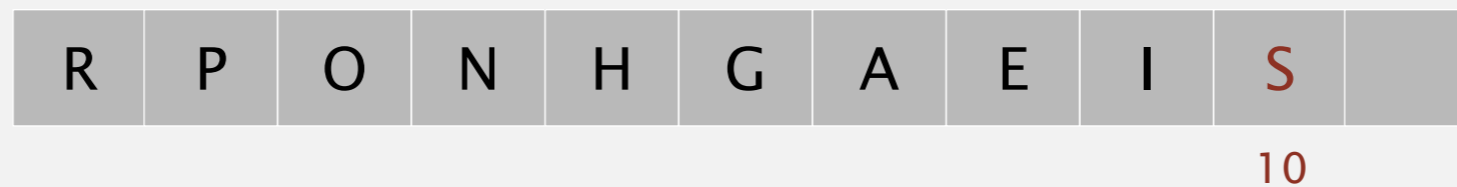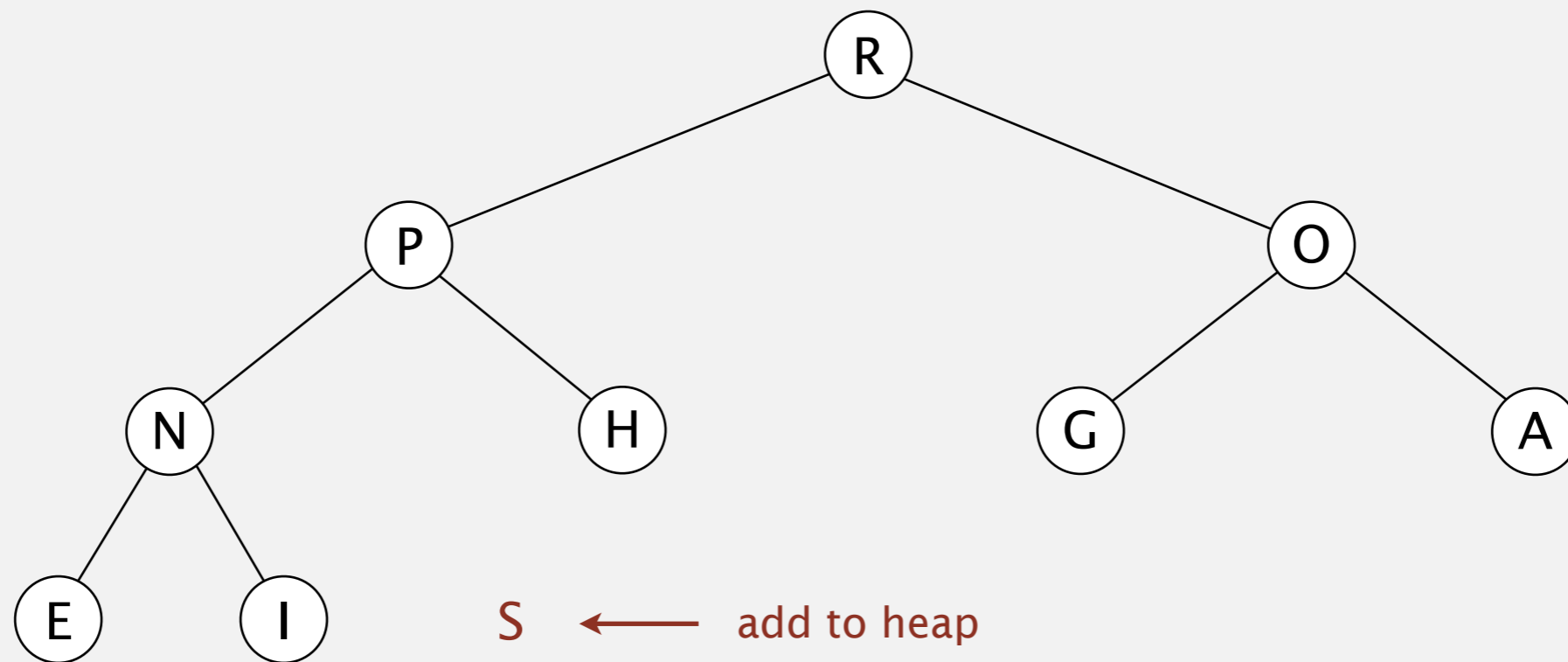

R	P	O	N	H	G	A	E	I		

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 ⟵   add to heap

R	P	O	N	H	G	A	E	I	S	

10

22

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

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

insert S

violates heap order
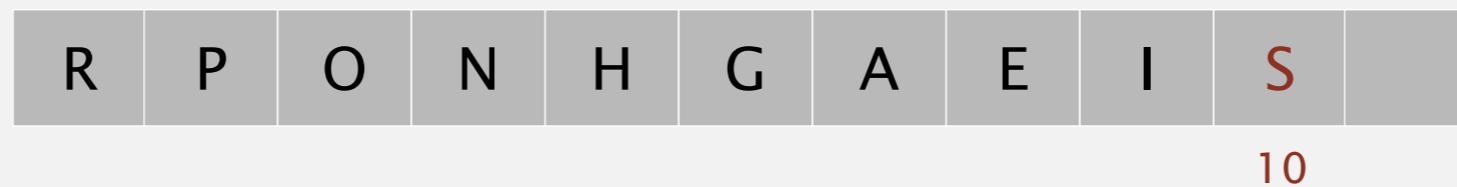(swim up)

R	P	O	N	H	G	A	E	I	S	

10

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

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

insert S

violates heap order
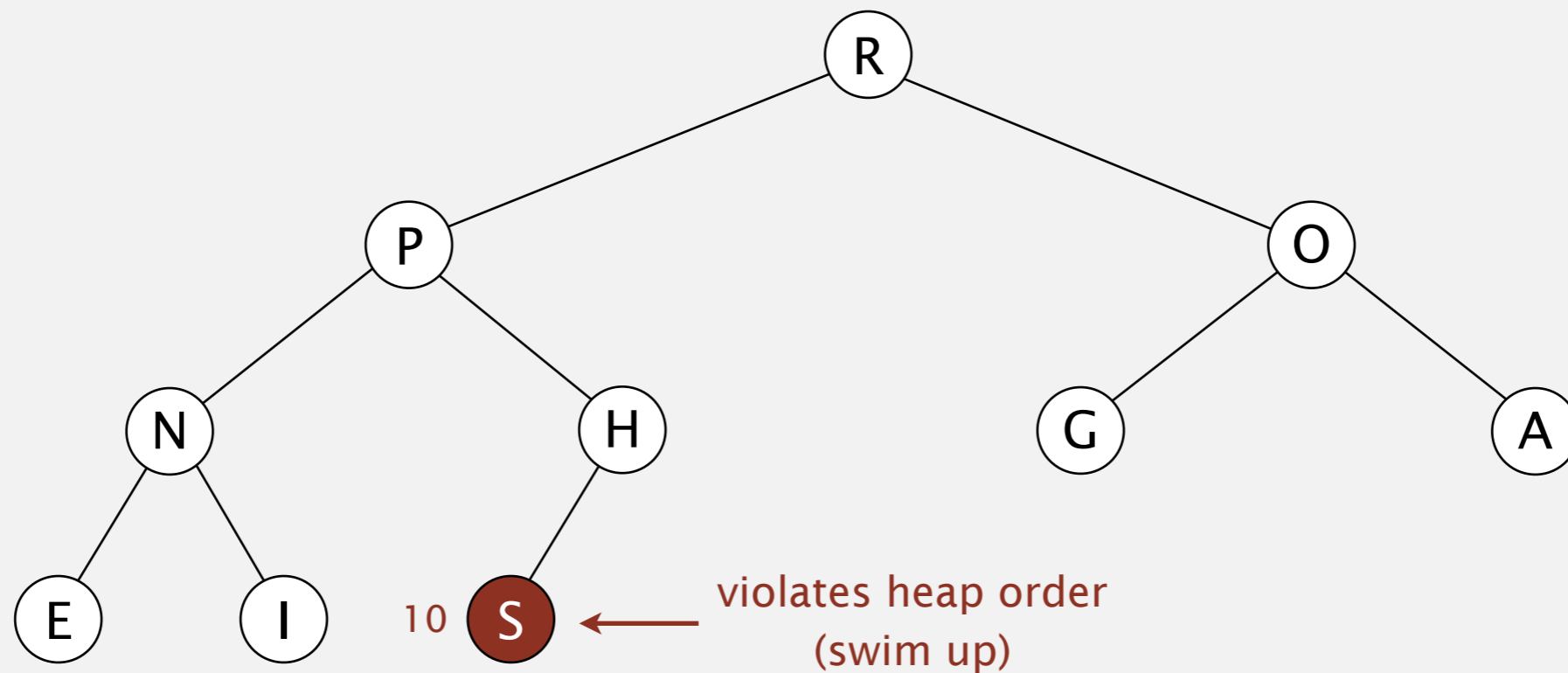(swim up)

R	P	O	N	S	G	A	E	I	H	

5   10

24

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

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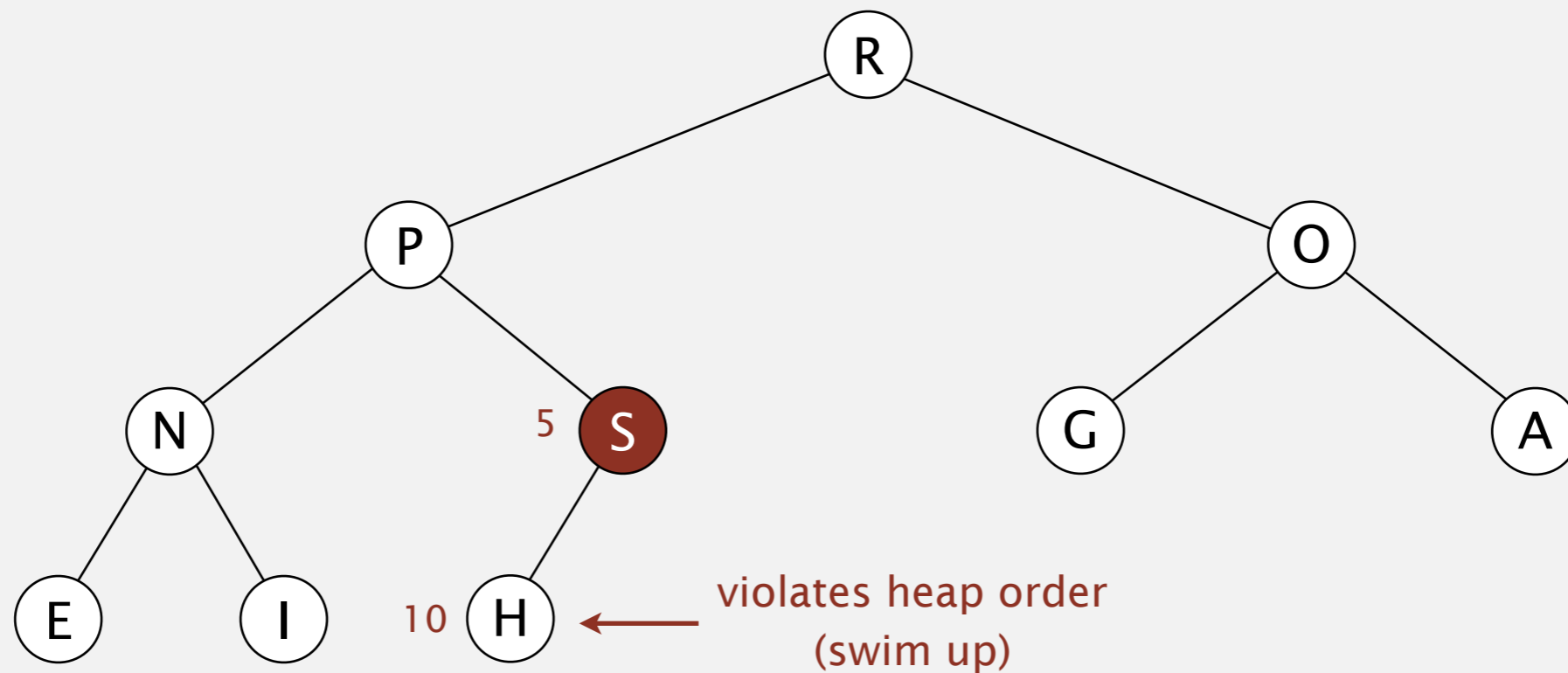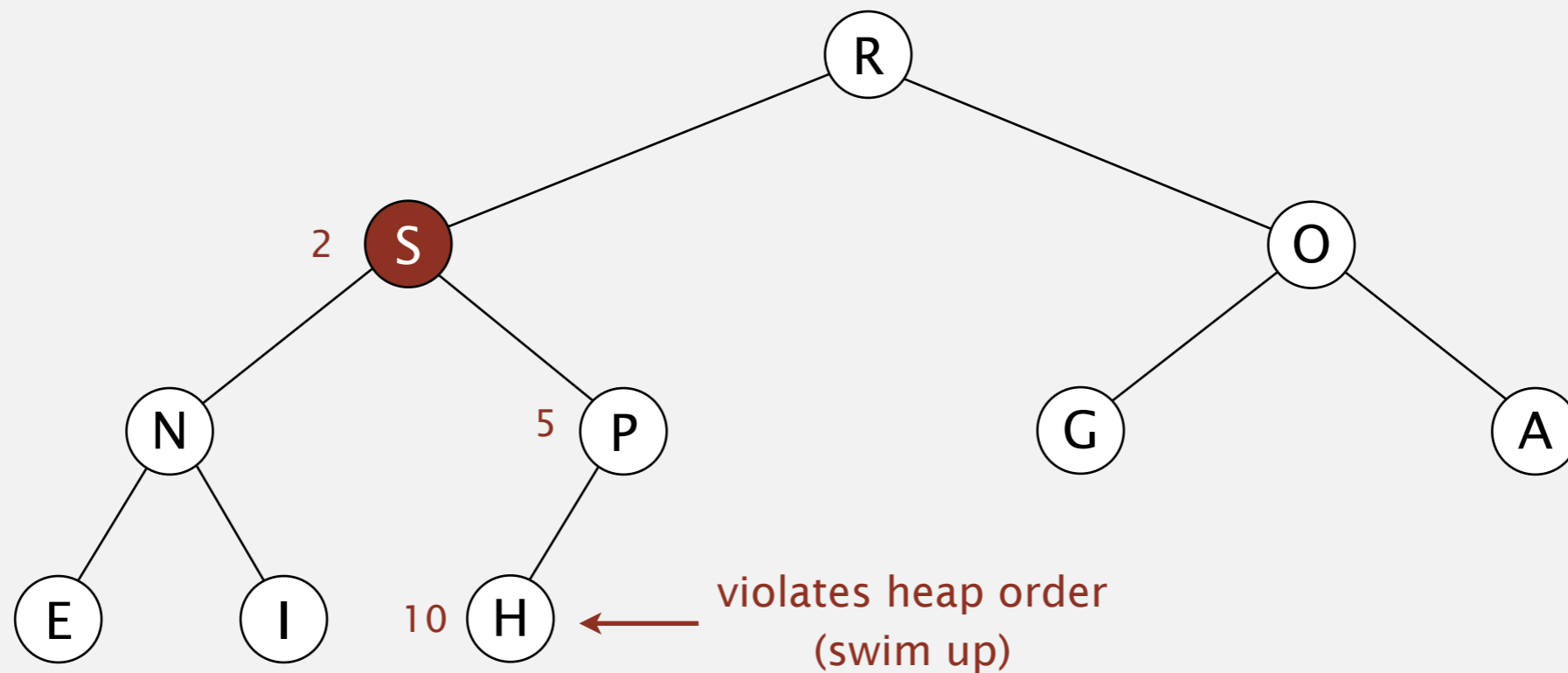
insert S

violates heap order
(swim up)

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

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

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

insert S

violates heap order
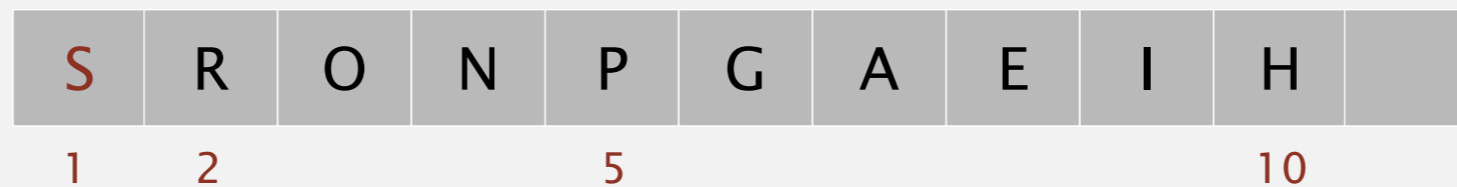(swim up)

S	R	O	N	P	G	A	E	I	H	

1   2   5   10

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

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

heap ordered

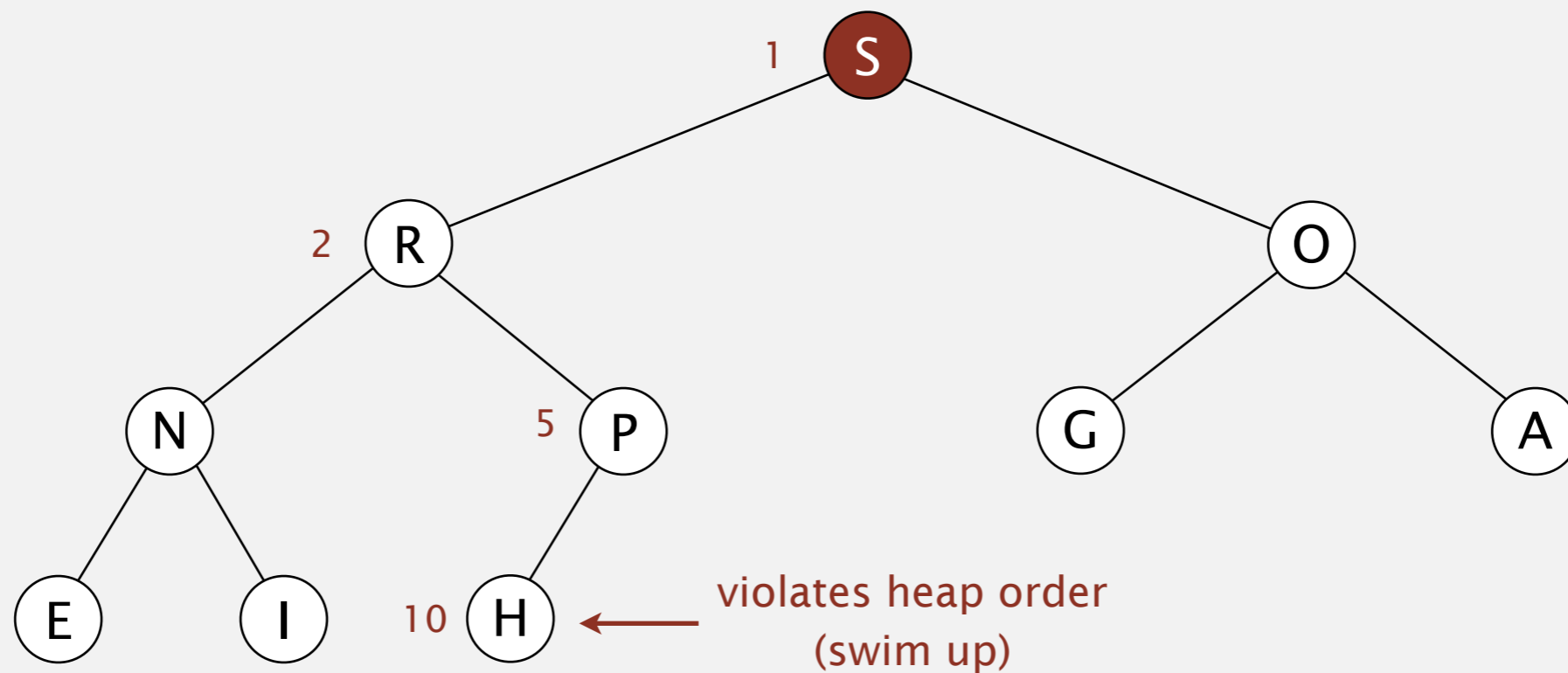|	S	R	O	N	P	G	A	E	I	H	