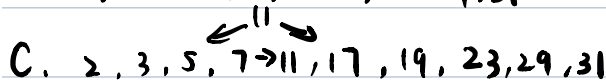
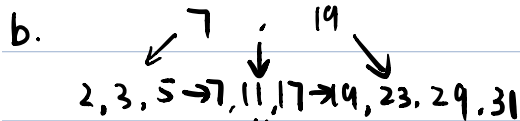
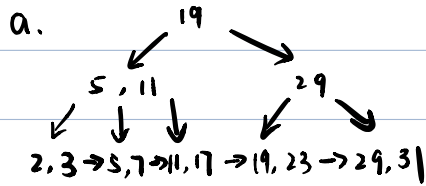


11.3 用下面的键码值集合建立一个 B<sup>+</sup> 树

(2, 3, 5, 7, 11, 17, 19, 23, 29, 31)

假设树初始为空，值按上升顺序加入。根据一个结点所能容纳指针数的下列情况分别构造 B<sup>+</sup> 树：

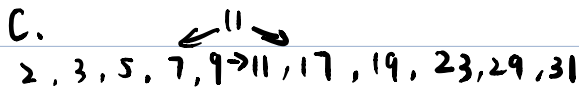
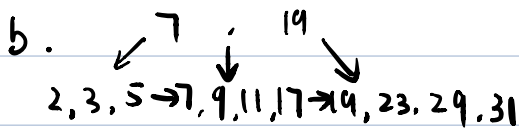
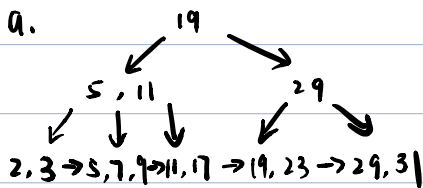
- a. 4
- b. 6
- c. 8



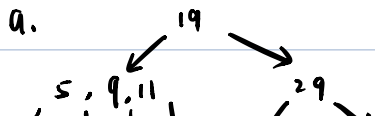
11.4 对习题 11.3 中的每一棵 B<sup>+</sup> 树，给出下列各操作后树的形状：

- a. 插入 9
- b. 插入 10
- c. 插入 8
- d. 删除 23
- e. 删除 19

a.



b.



$\swarrow \downarrow \downarrow \downarrow \swarrow \searrow$   
 $2, 3 \rightarrow 5, 7 \rightarrow 9, 10, 11, 17 \rightarrow 19, 23 \rightarrow 29, 31$

b.  $\swarrow \downarrow \searrow$   
 $2, 3, 5 \rightarrow 7, 9, 10, 11, 17 \rightarrow 19, 23, 29, 31$

c.  $\swarrow \searrow$   
 $2, 3, 5, 7, 9, 10 \rightarrow 11, 17, 19, 23, 29, 31$

c.

a.  $\swarrow \searrow$   
 $5, 9, 11$   
 $\swarrow \downarrow \searrow$   
 $2, 3 \rightarrow 5, 7, 8 \rightarrow 9, 10, 11, 17 \rightarrow 19, 23 \rightarrow 29, 31$

b.  $\swarrow \searrow$   
 $7, 10, 19$   
 $\swarrow \downarrow \searrow$   
 $2, 3, 5 \rightarrow 7, 8, 9 \rightarrow 10, 11, 17 \rightarrow 19, 23, 29, 31$

c.  $\swarrow \searrow$   
 $2, 3, 5, 7, 8, 9, 10 \rightarrow 11, 17, 19, 23, 29, 31$

d.

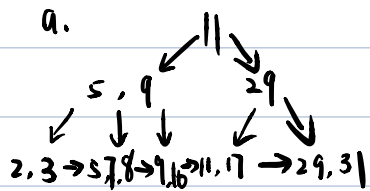
a.  $\swarrow \searrow$   
 $5, 9$   
 $\swarrow \downarrow \searrow$   
 $2, 3 \rightarrow 5, 7, 8 \rightarrow 9, 10, 11, 17 \rightarrow 19, 29, 31$

b.  $\swarrow \searrow$   
 $7, 10, 19$

2, 3, 5 → 7, 8, 9 → 10, 11, 17 → 19, 29, 31

c.  
2, 3, 5, 7, 8, 9, 10 → 11, 17, 19, 29, 31

e.



b.  
2, 3, 5 → 7, 8, 9 → 10, 11, 17, 29, 31

c.  
2, 3, 5, 7, 8, 9, 10 → 11, 17, 29, 31