05-H1

二叉树

层次遍历：算法及分析

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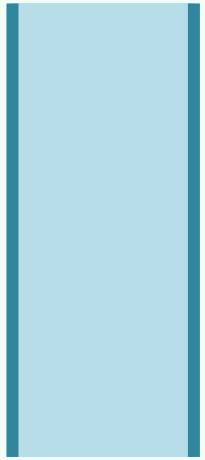
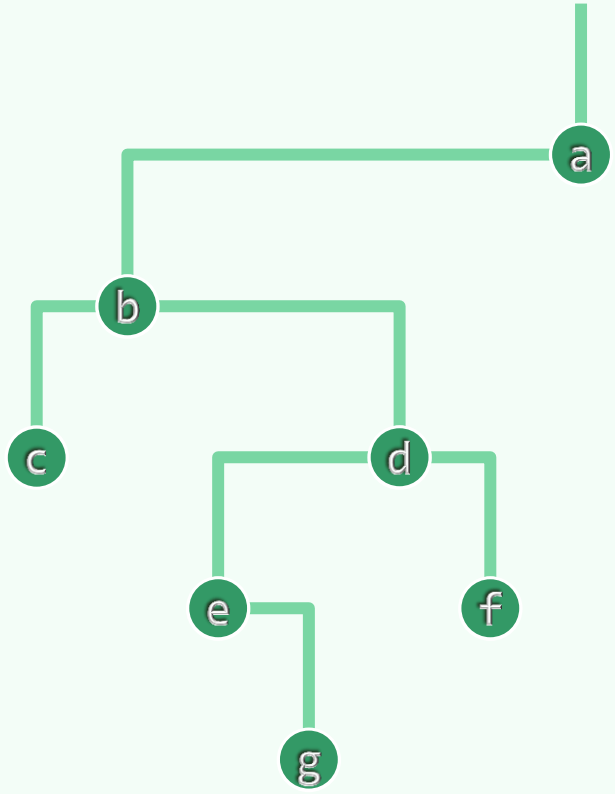
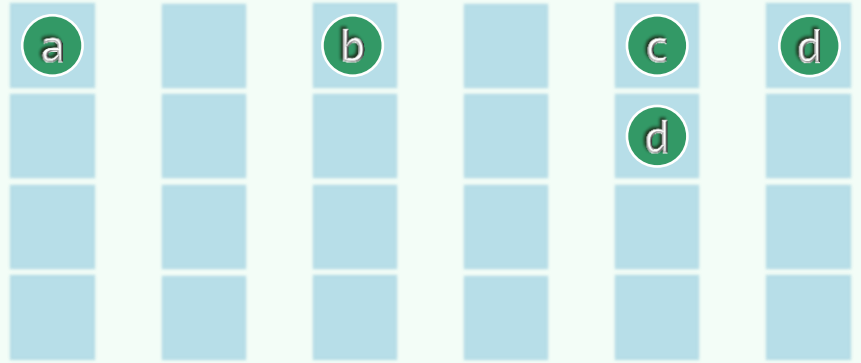
算法实现

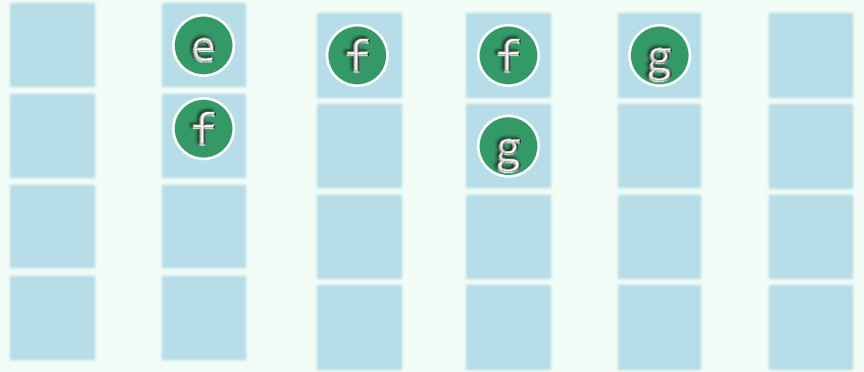
```
❖template <typename T> template <typename VST>
  void BinNode<T>::travLevel( VST & visit ) { //二叉树层次遍历
     Queue< BinNodePosi(T) > Q; //引入辅助队列
     Q.enqueue( this ); //根节点入队
     while ( ! Q.empty() ) { //在队列再次变空之前，反复迭代
        BinNodePosi(T) x = Q.dequeue(); //取出队首节点，并随即
        visit( x->data ); //访问之
        if ( HasLChild( * x ) ) Q.enqueue( x->lc ); //左孩子入队
        if ( HasRChild( * x ) ) Q.enqueue( x->rc ); //右孩子入队
     }
  }
```

实例

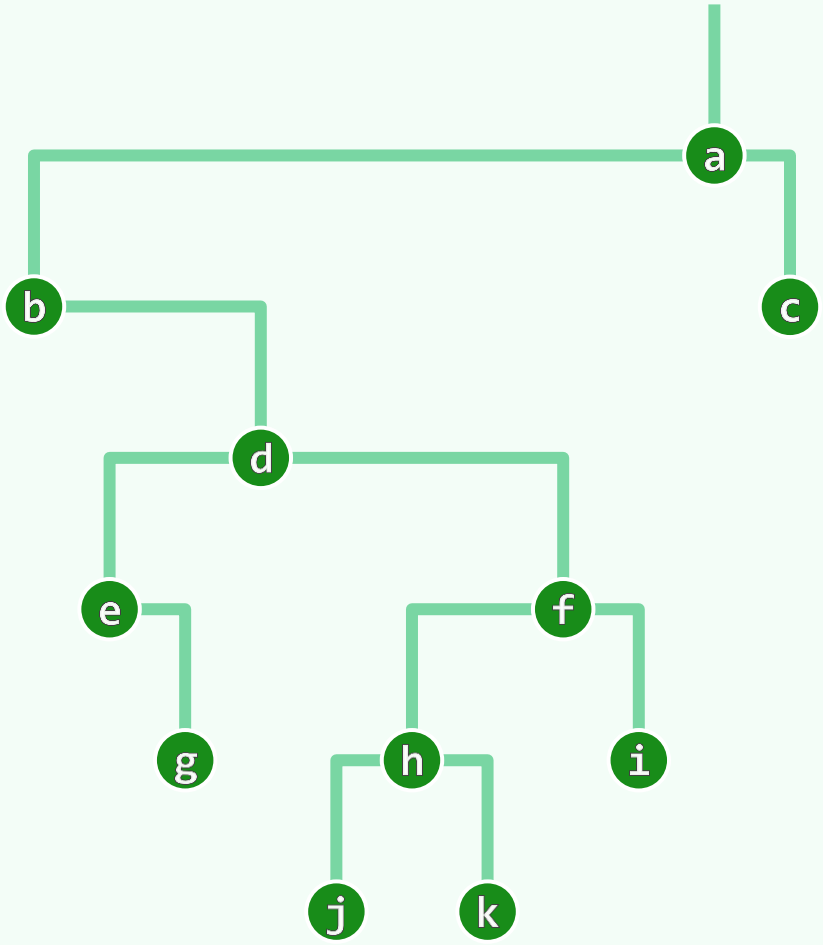








实例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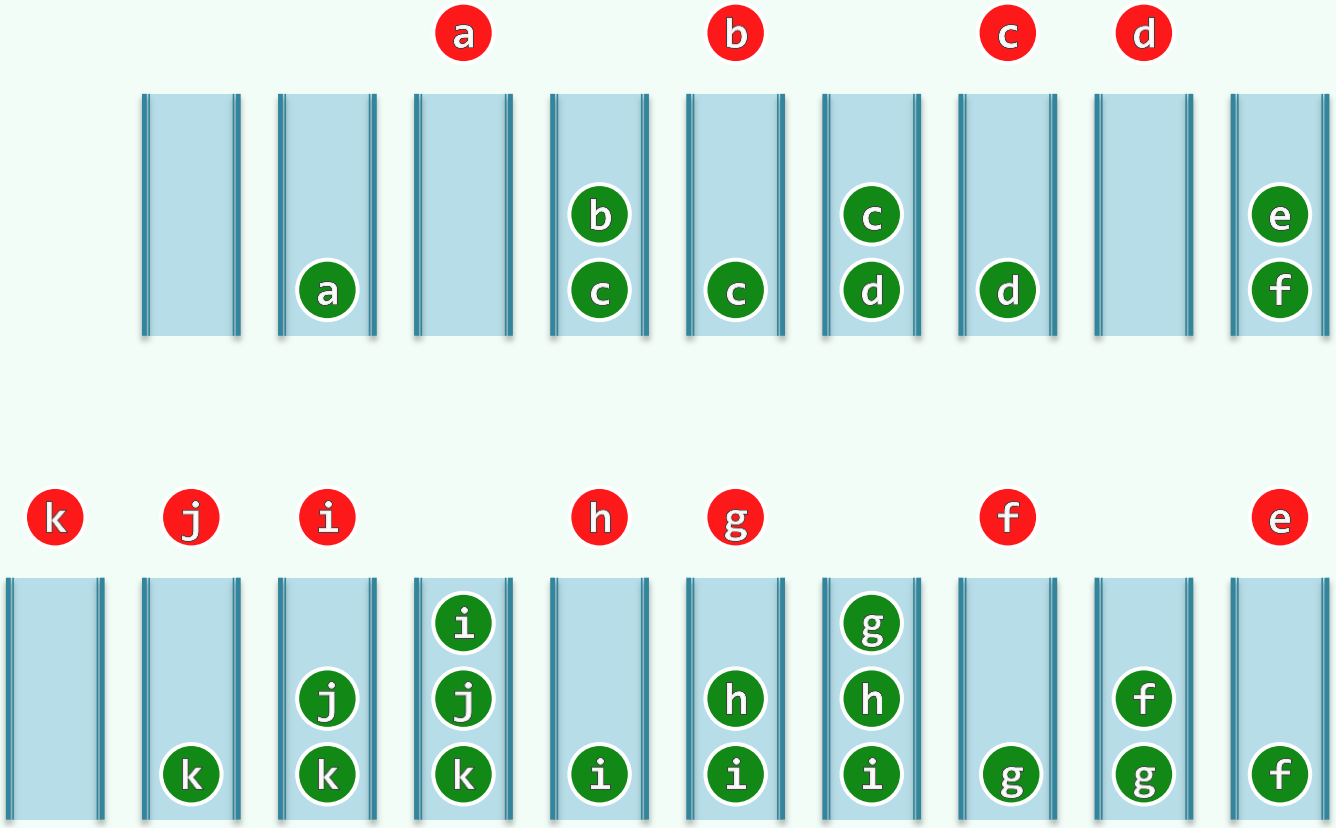
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分析

- 正确性何以见得？以上迭代算法符合广度优先遍历的规则...
- 每次迭代，入队节点（若存在）都是出队节点的孩子，深度增加一层
- 任何时刻，队列中各节点按深度单调排列，而且（相邻）节点的深度相差不超过1层
- 进一步地，所有节点迟早都会入队，而且

  更高/低的节点，更早/晚入队；更左/右的节点，更早/晚入队
- 每次迭代，都有恰好一个节点出队并接受访问，同时有不超过两个节点入队

  每个节点入、出队恰好各一次，故知整体只需$O(n)$时间