

算法与数据结构

慕课网《算法与数据结构》

讲师：liuyubobobo

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图论 Graph Theory

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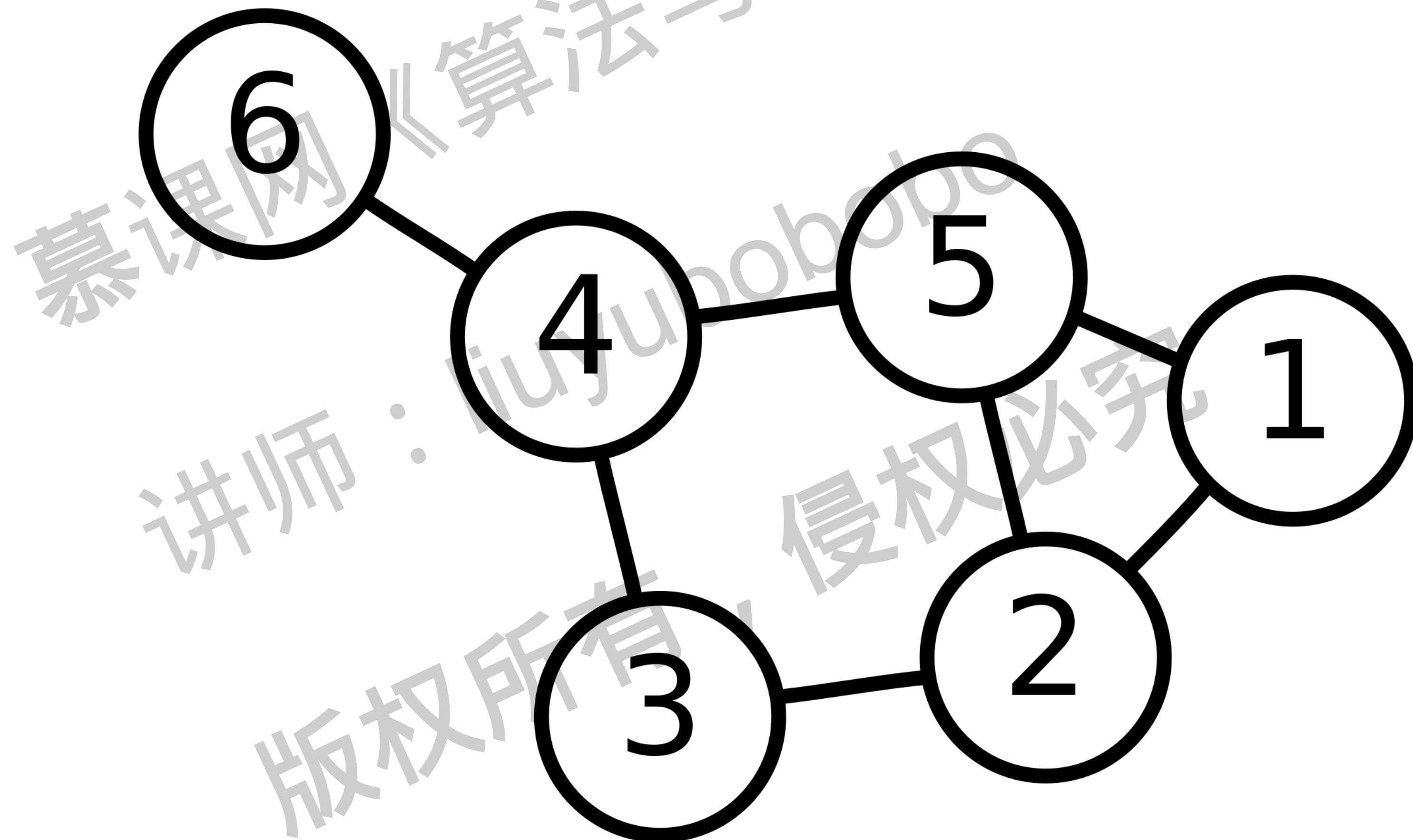
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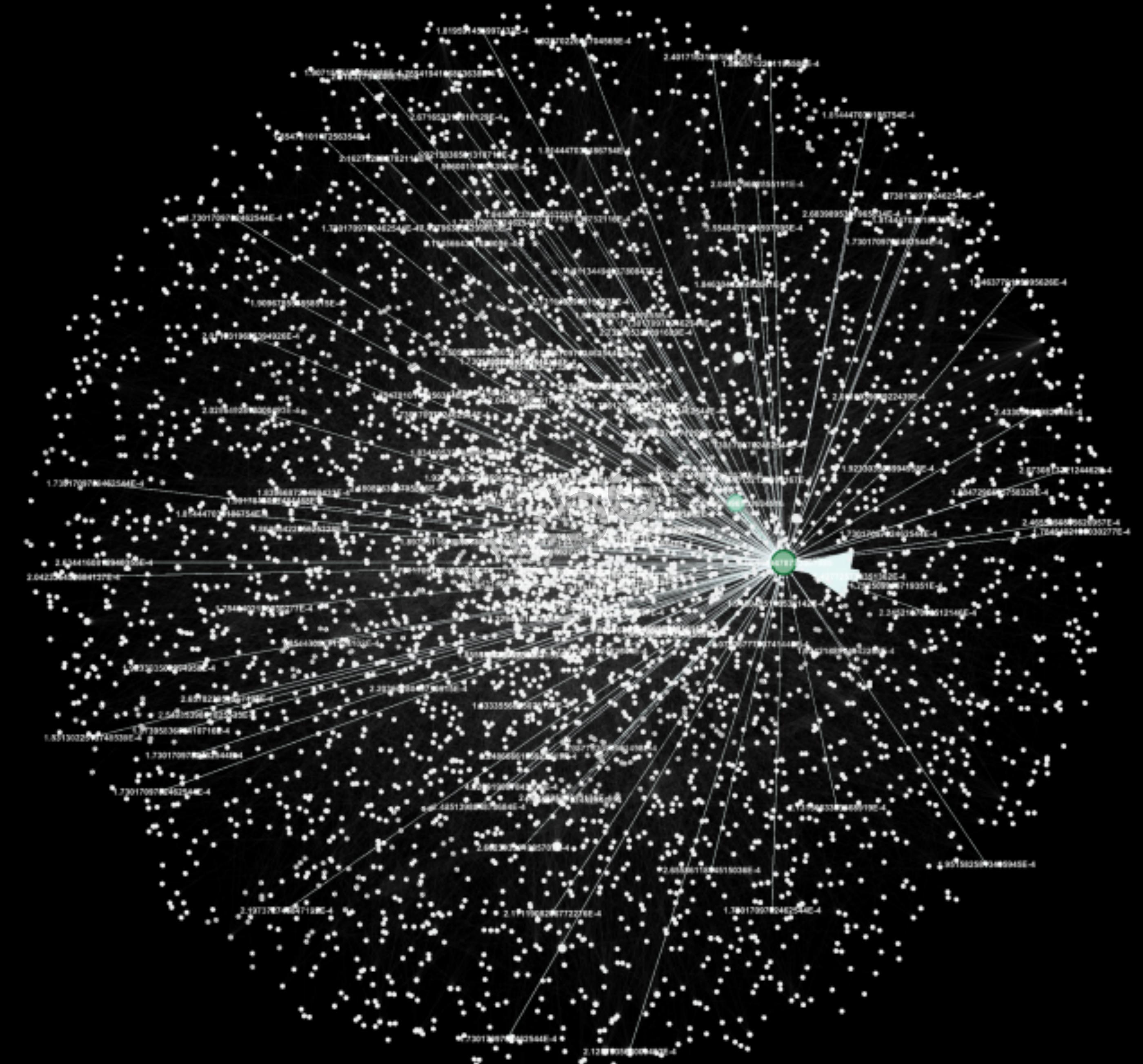
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Graphic Novel

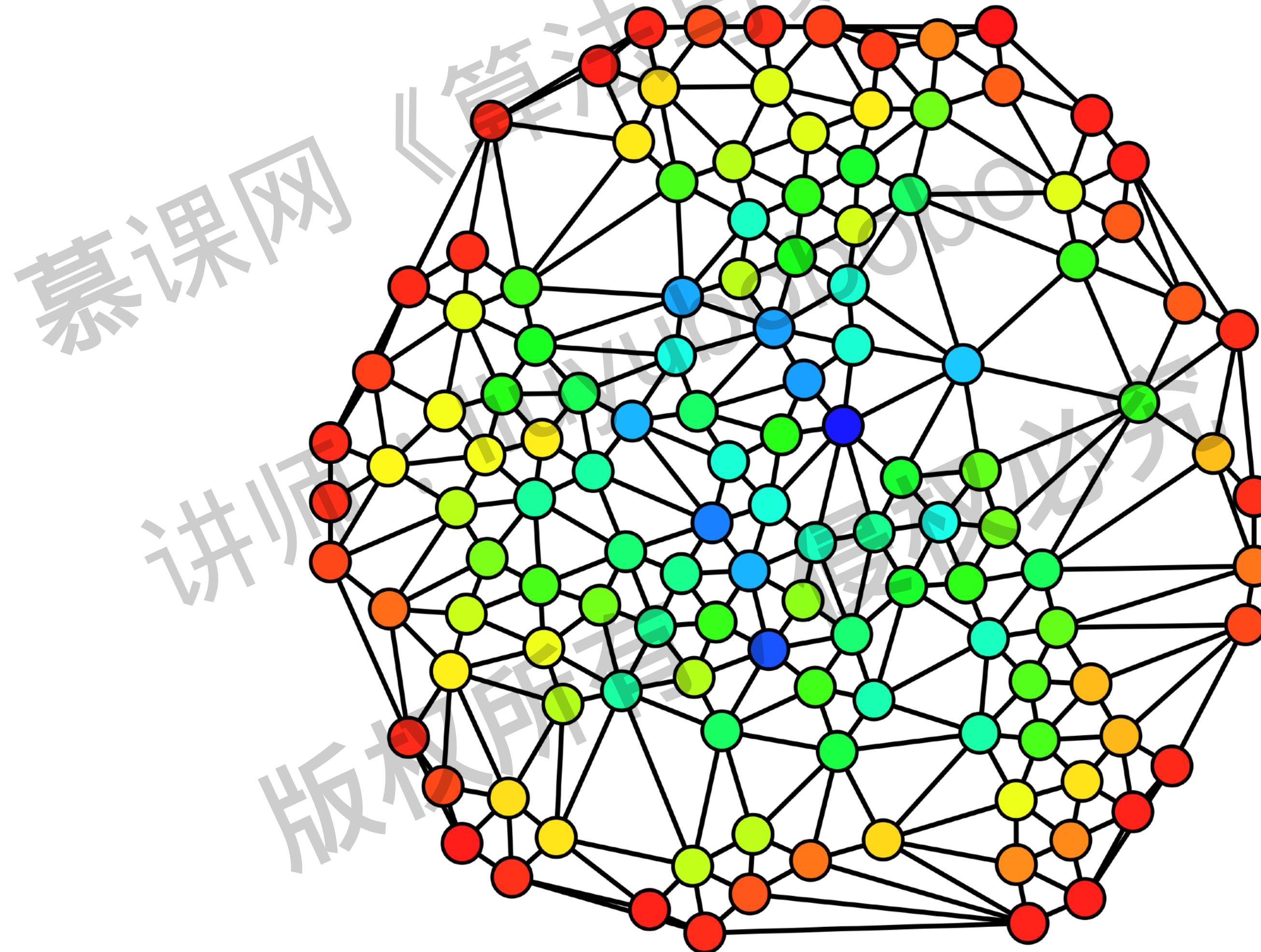


图论 Graph Theory





图论 Graph Theory

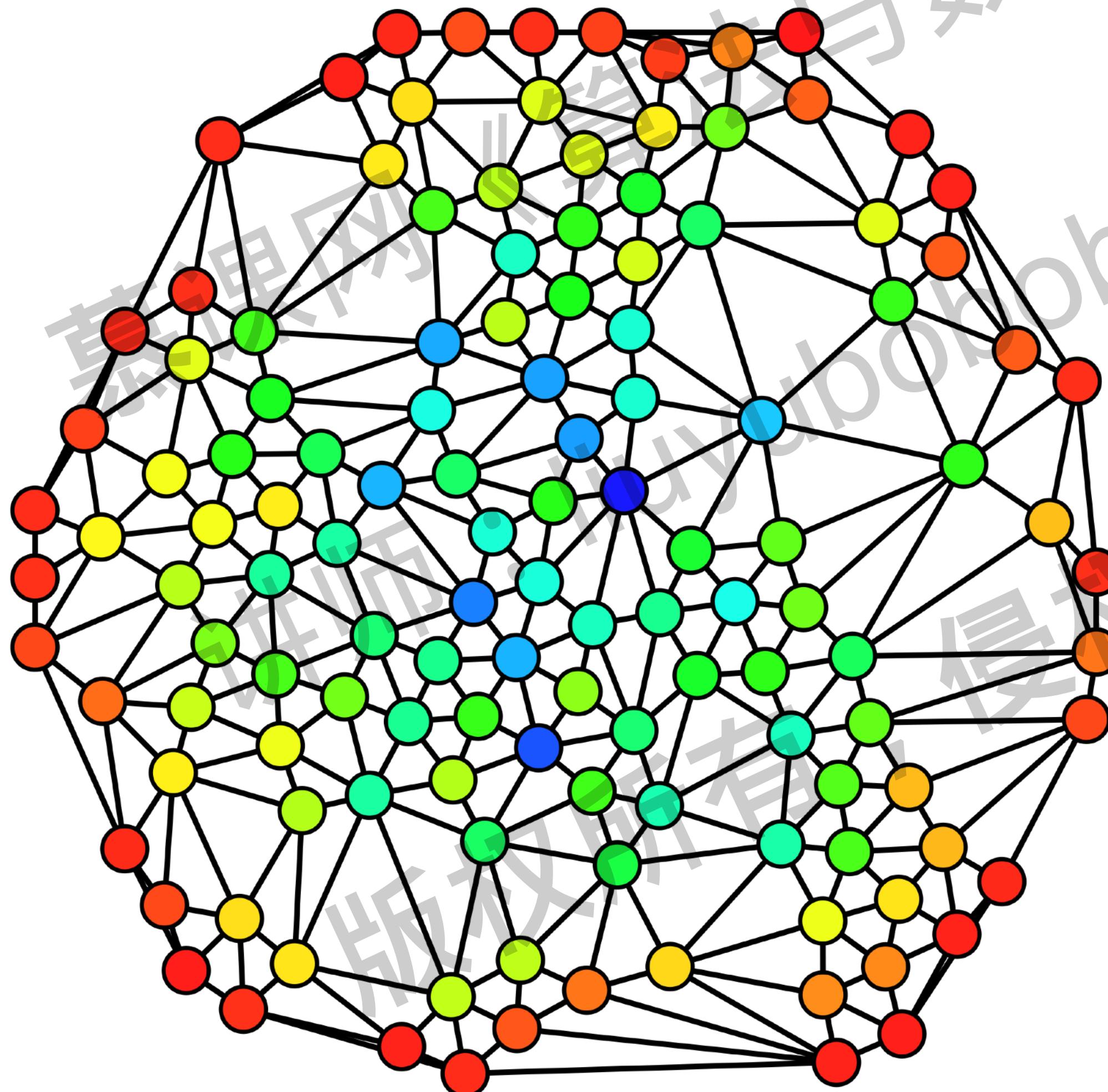


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讲义

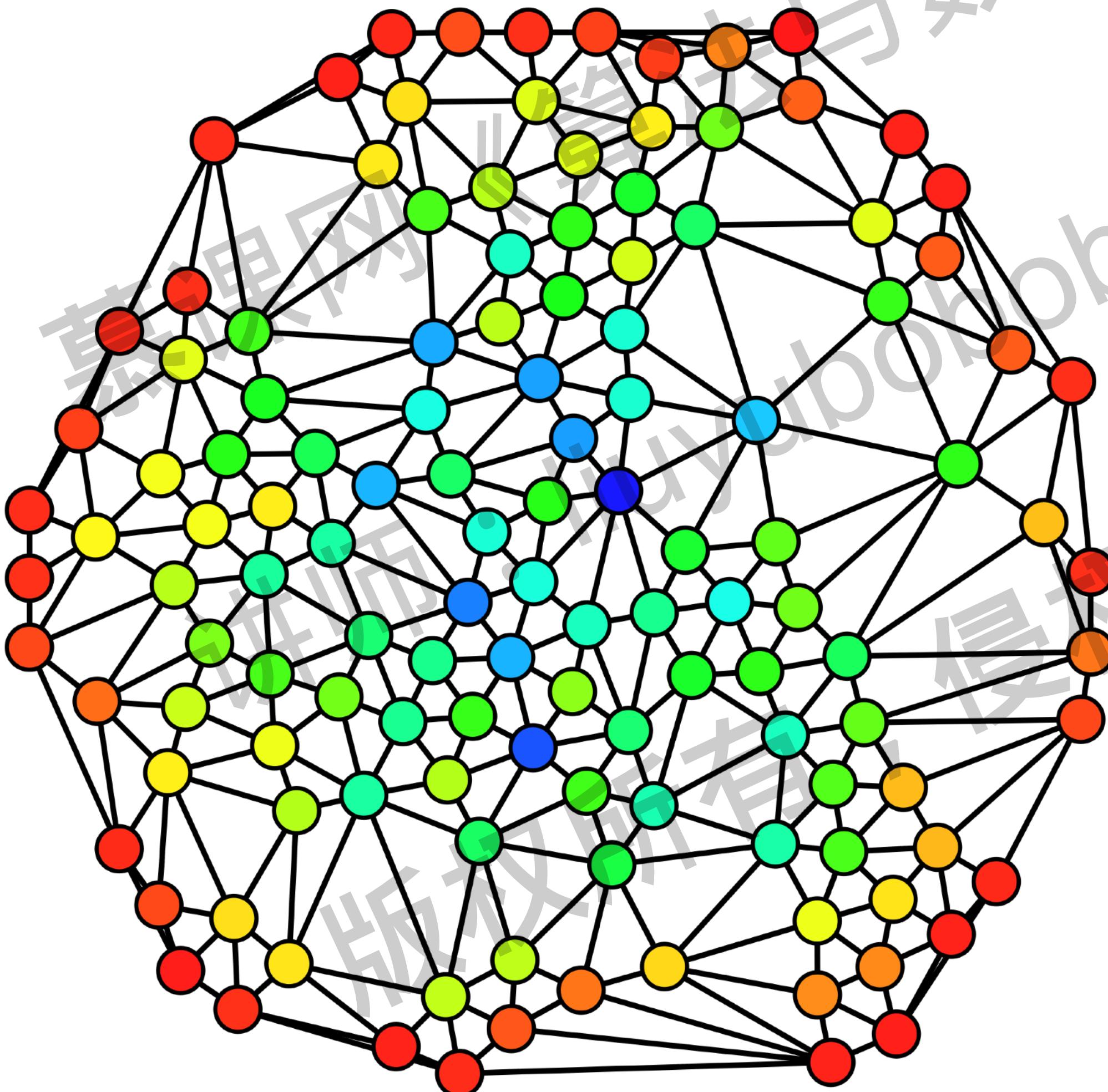
版本

图论 Graph Theory



节点 (Vertex)
边 (Edge)

图论 Graph Theory



交通运输

社交网络

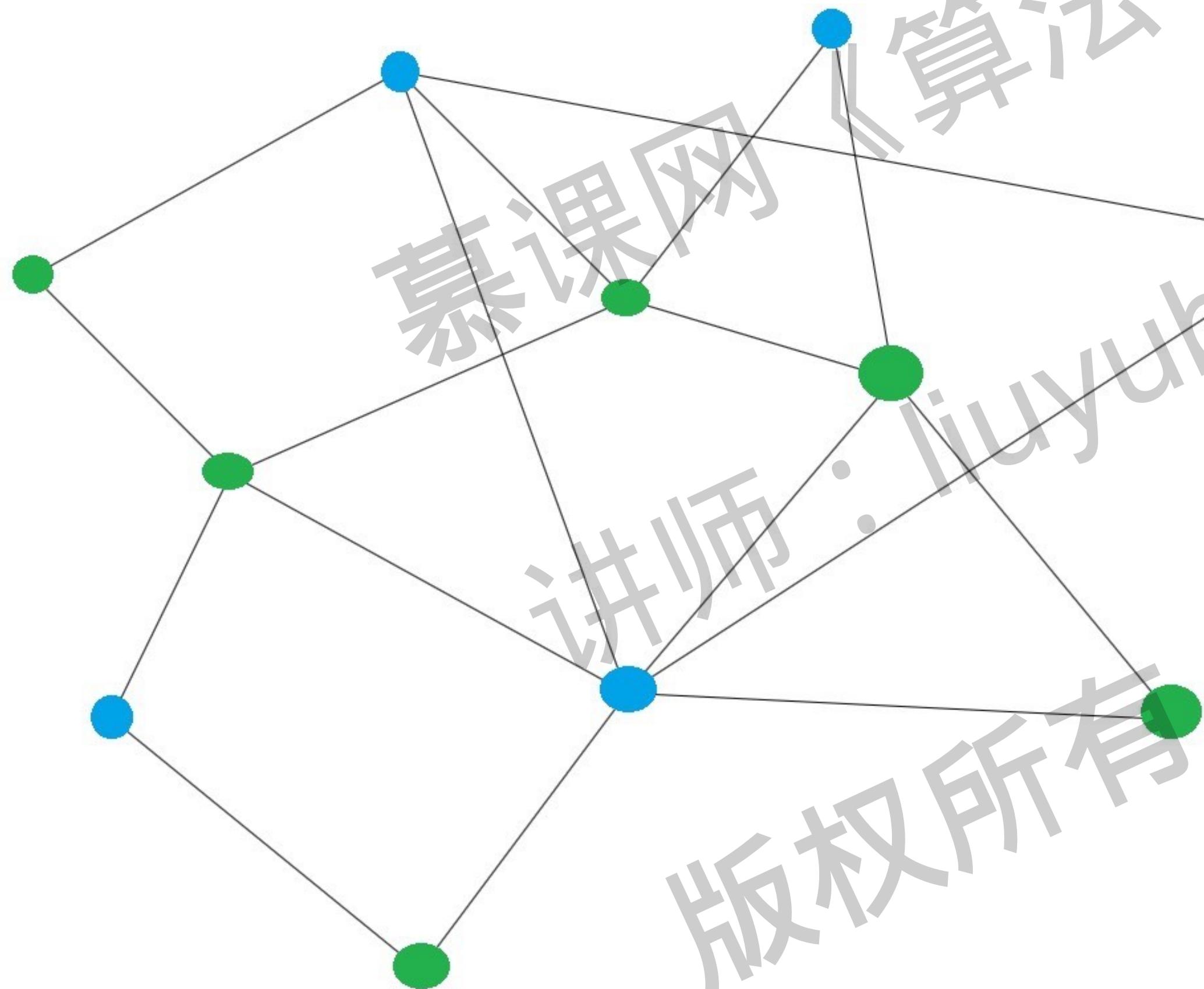
互联网

工作安排

脑区活动

程序状态执行

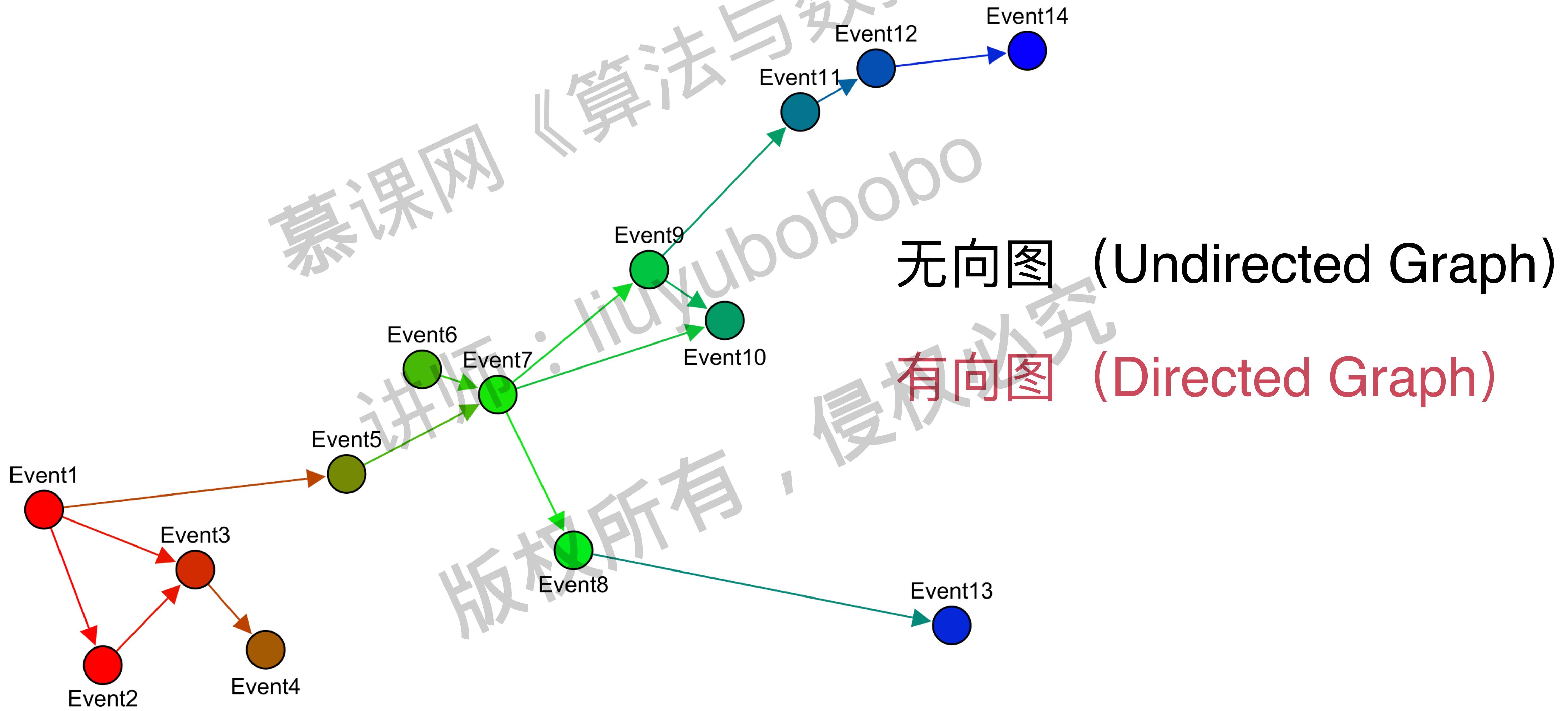
图的分类



无向图 (Undirected Graph)

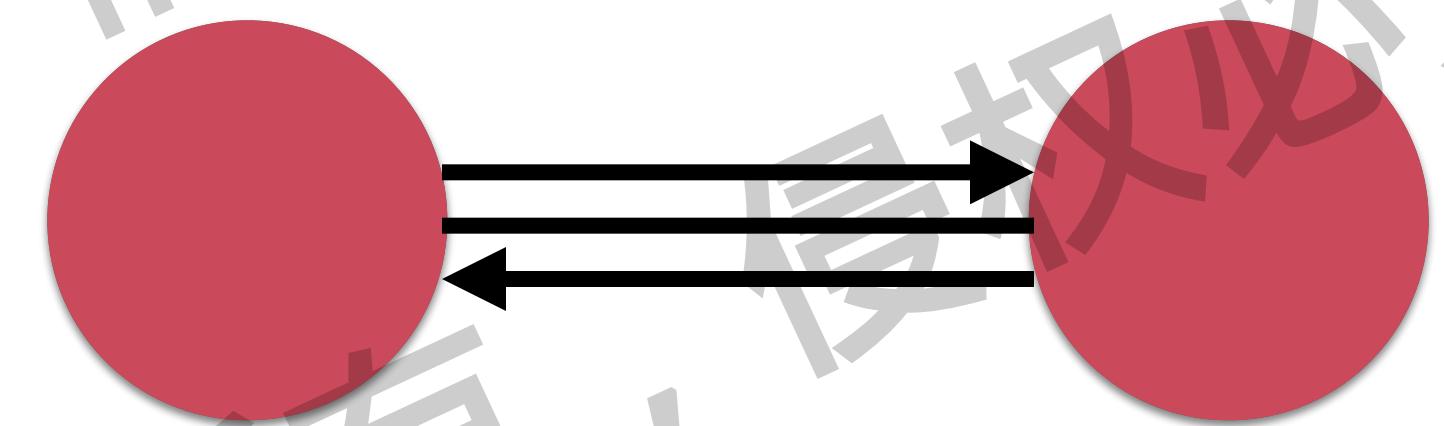
有向图 (Directed Graph)

图的分类

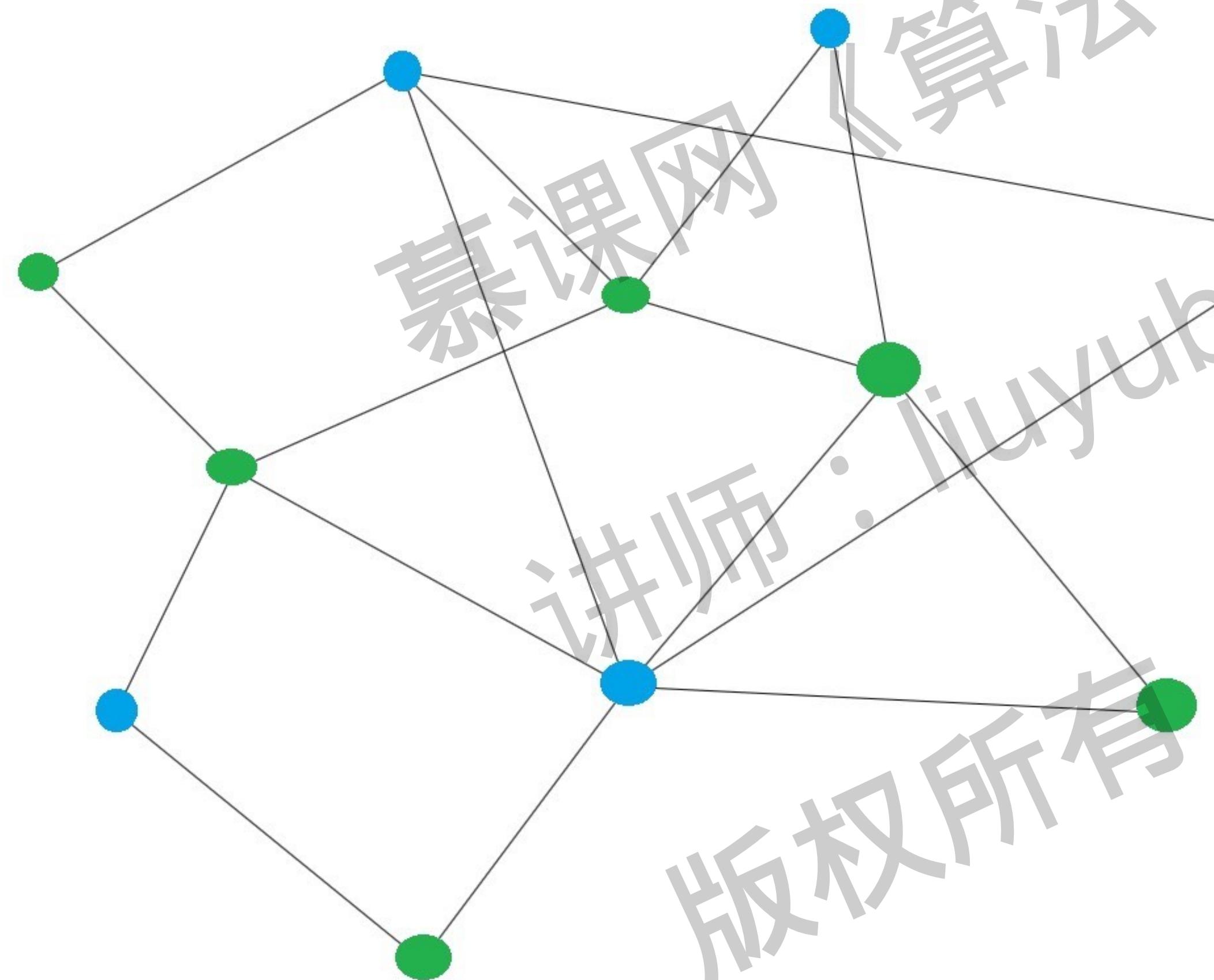


我们的课程以无向图为主

无向图是一种特殊的有向图



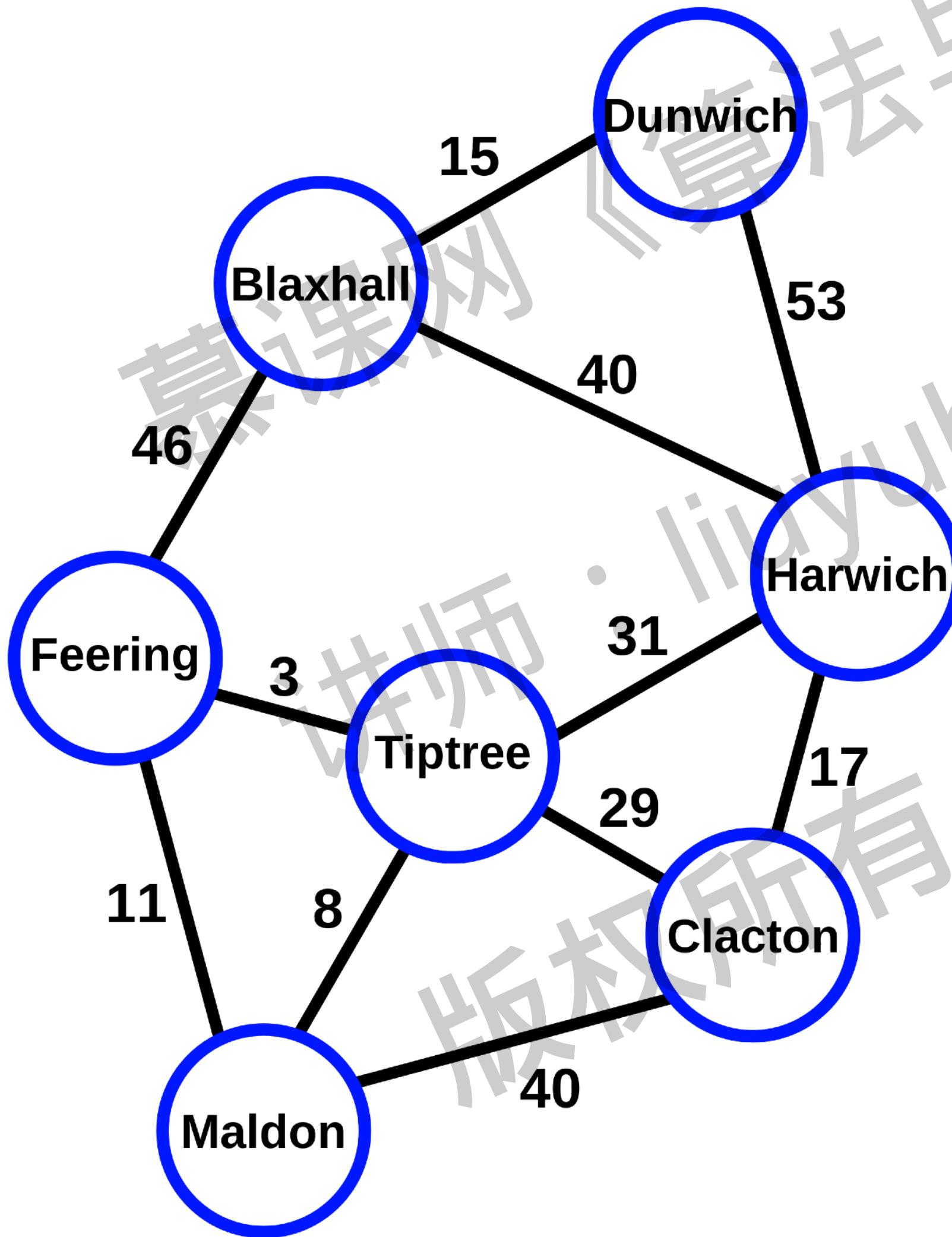
图的分类



无权图 (Unweighted Graph)

有权图 (Weighted Graph)

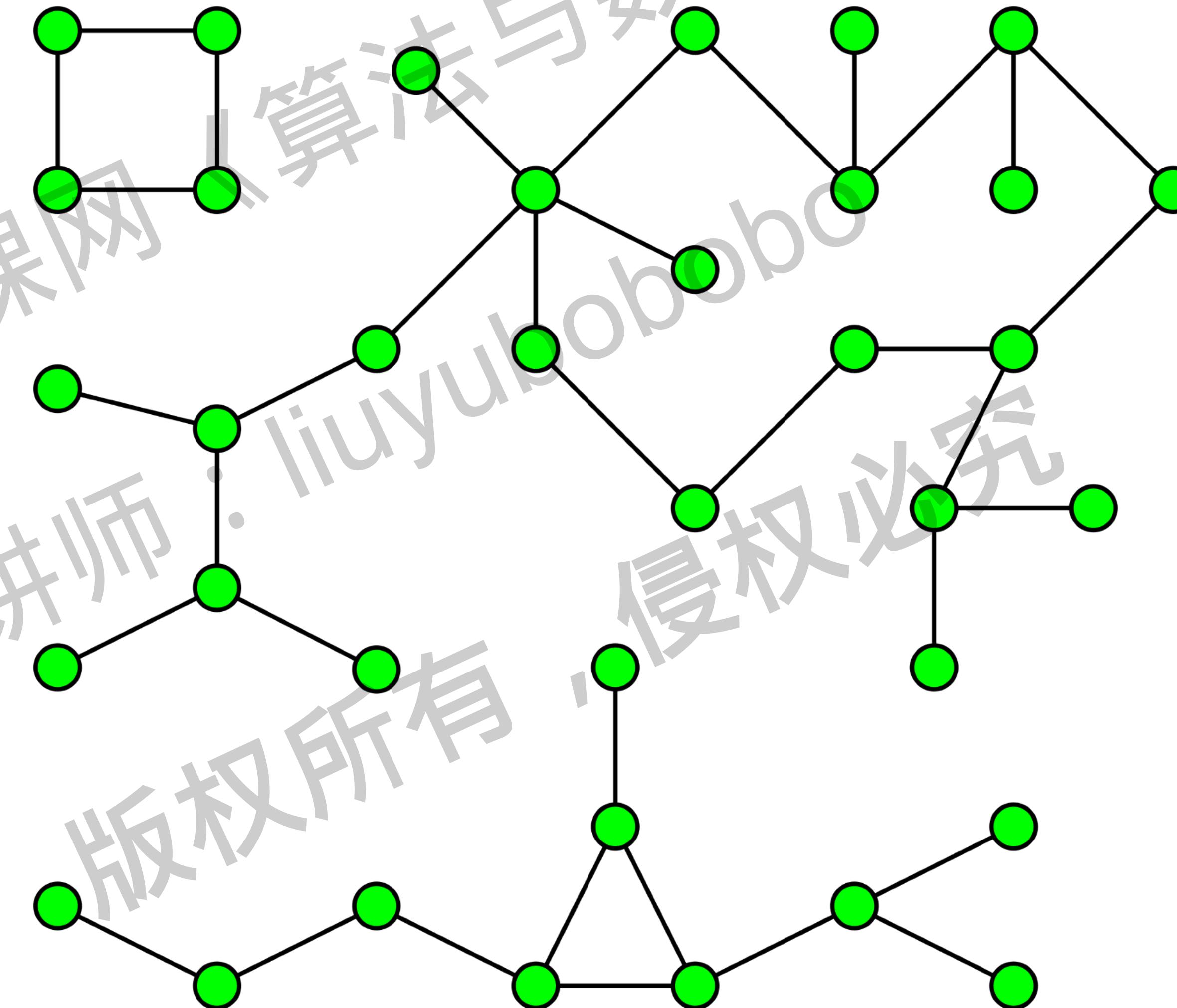
图的分类



无权图 (Unweighted Graph)

有权图 (Weighted Graph)

图的连通性

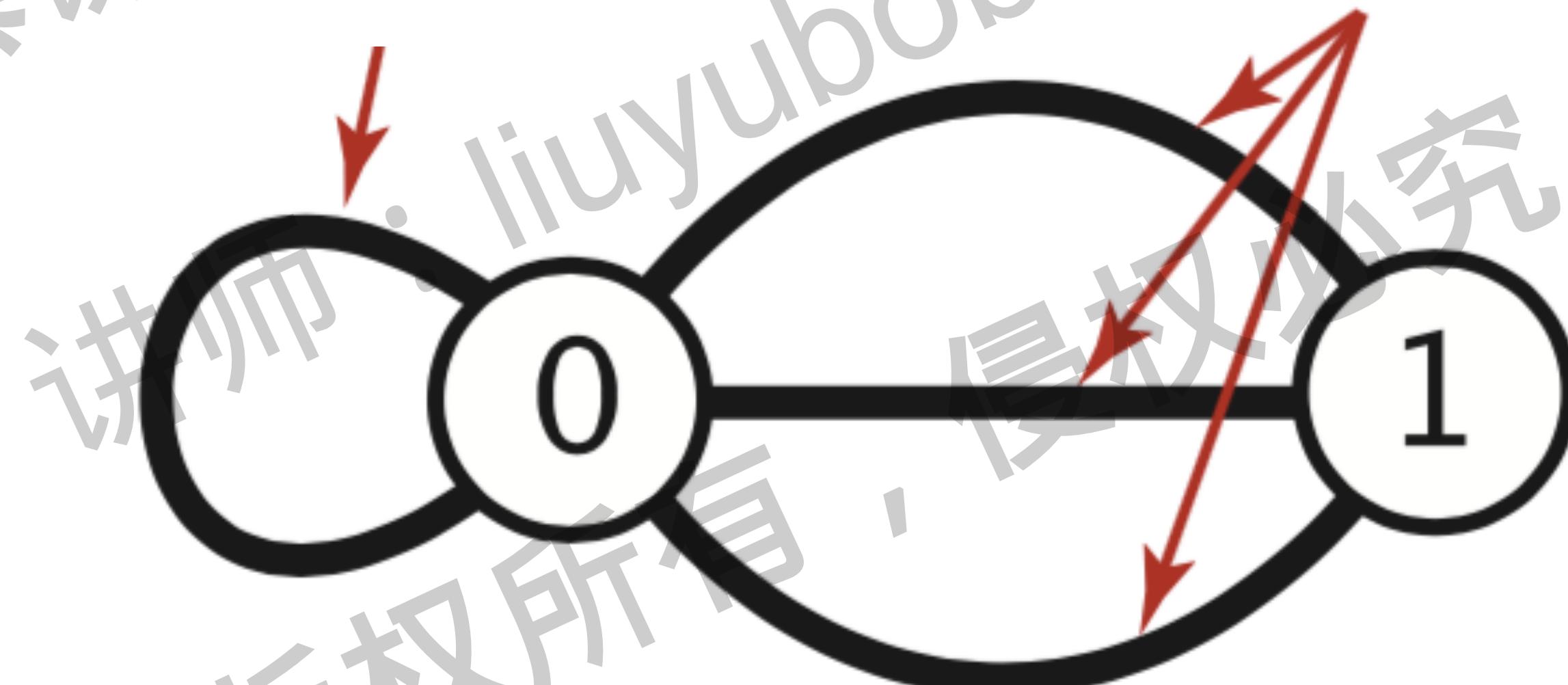


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简单图 (Simple Graph)

自环边 (self-loop)

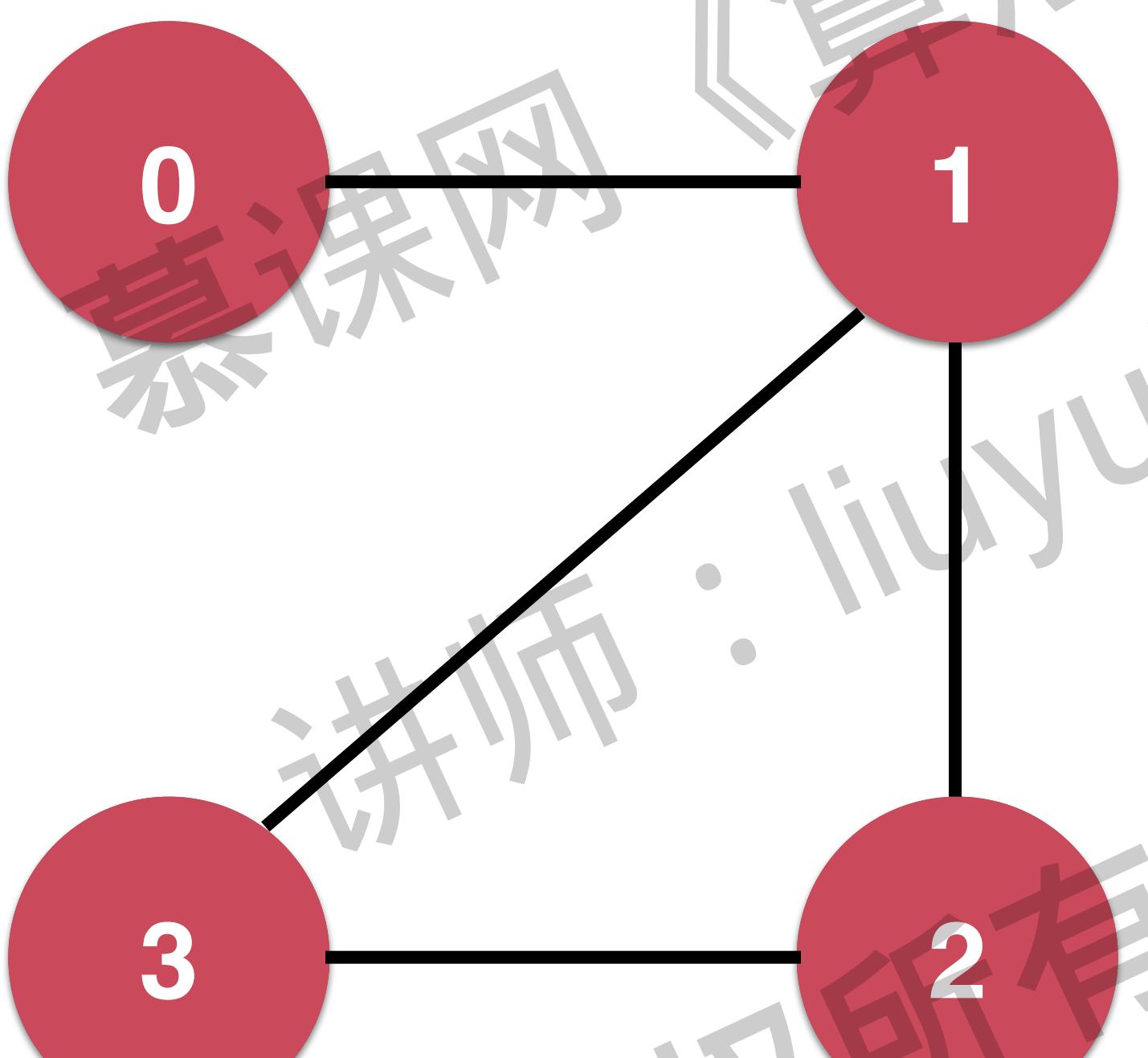
平行边 (parallel-edges)



图的表示

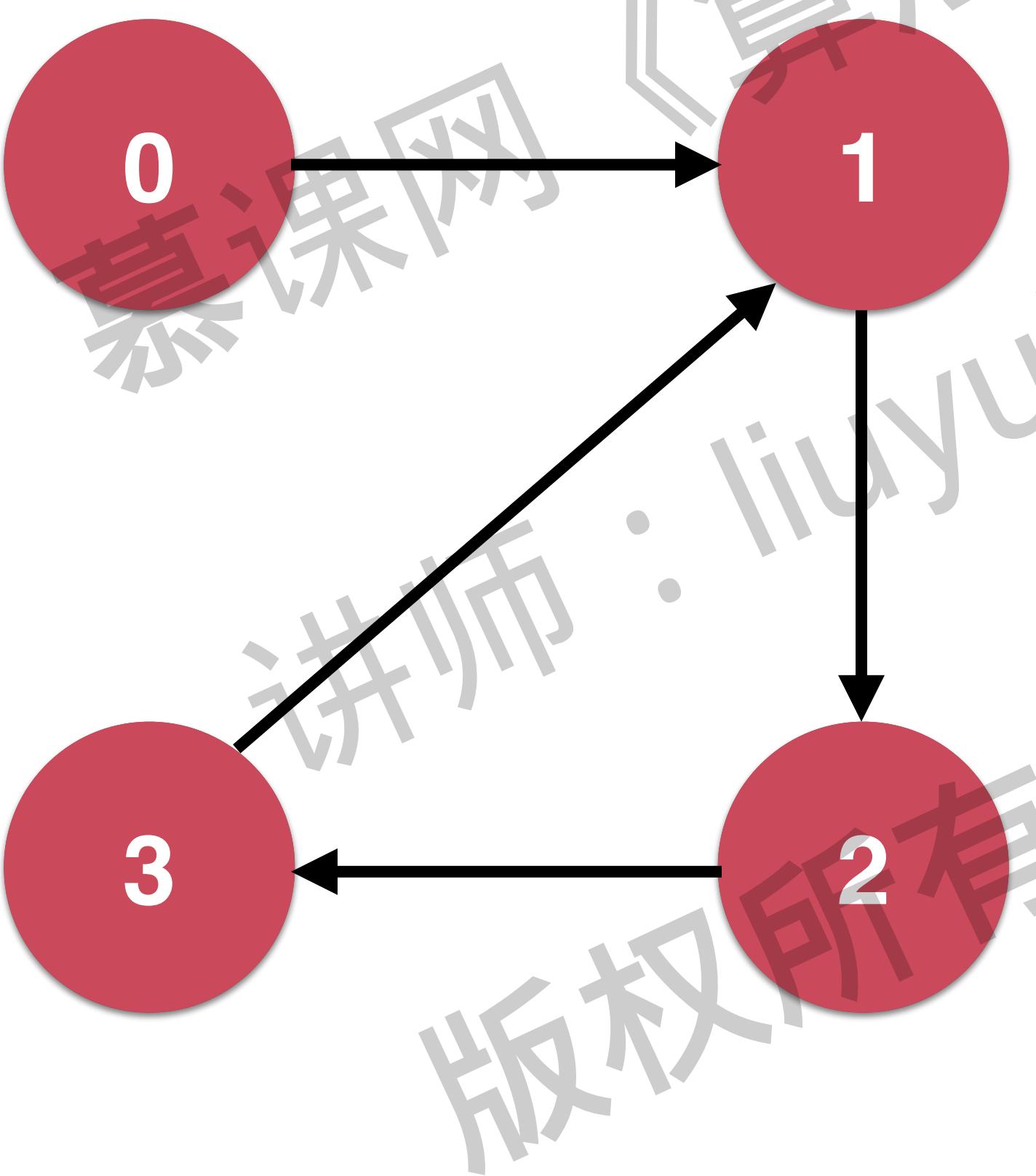
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邻接矩阵 (Adjacency Matrix)



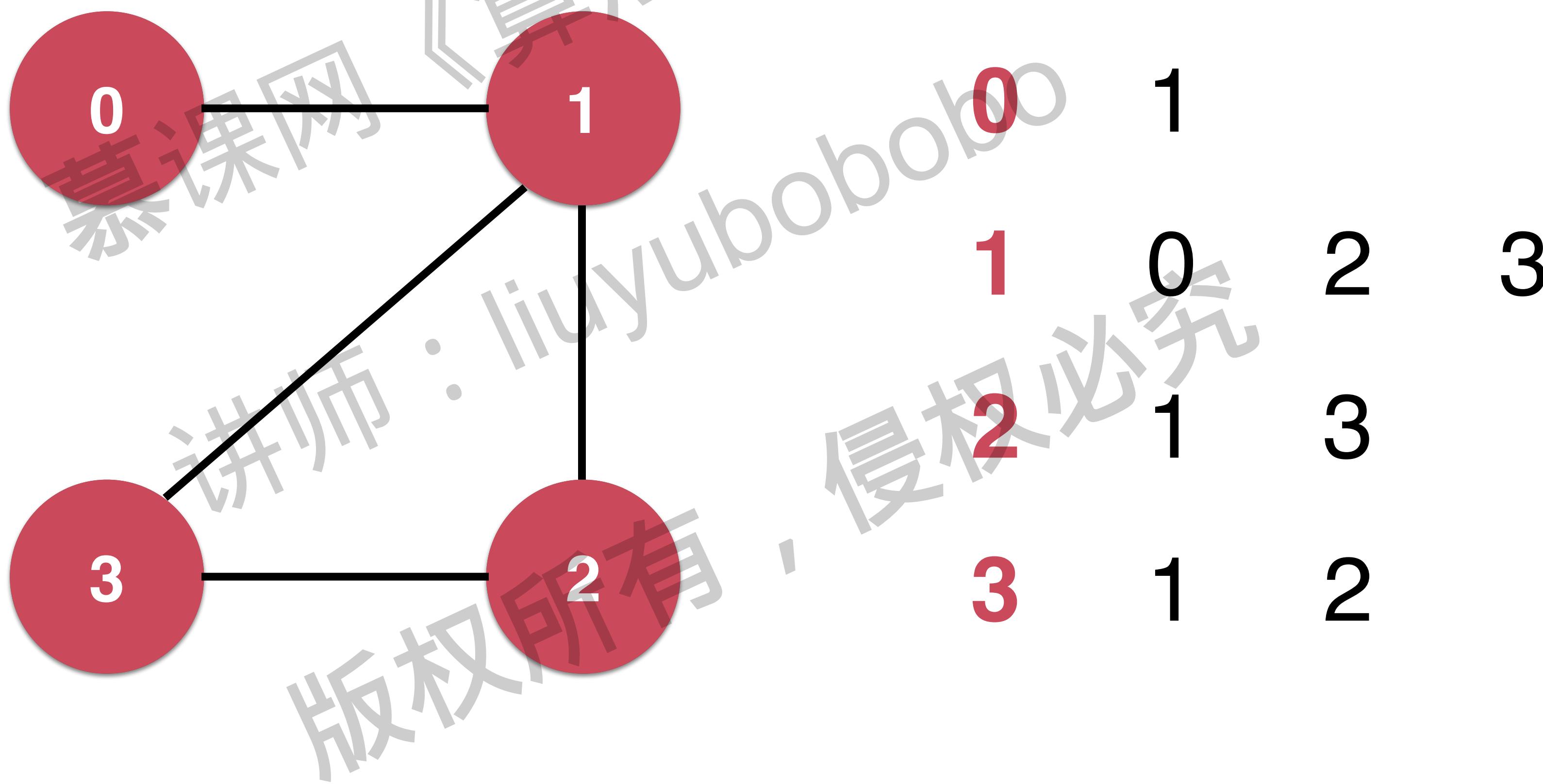
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邻接矩阵 (Adjacency Matrix)

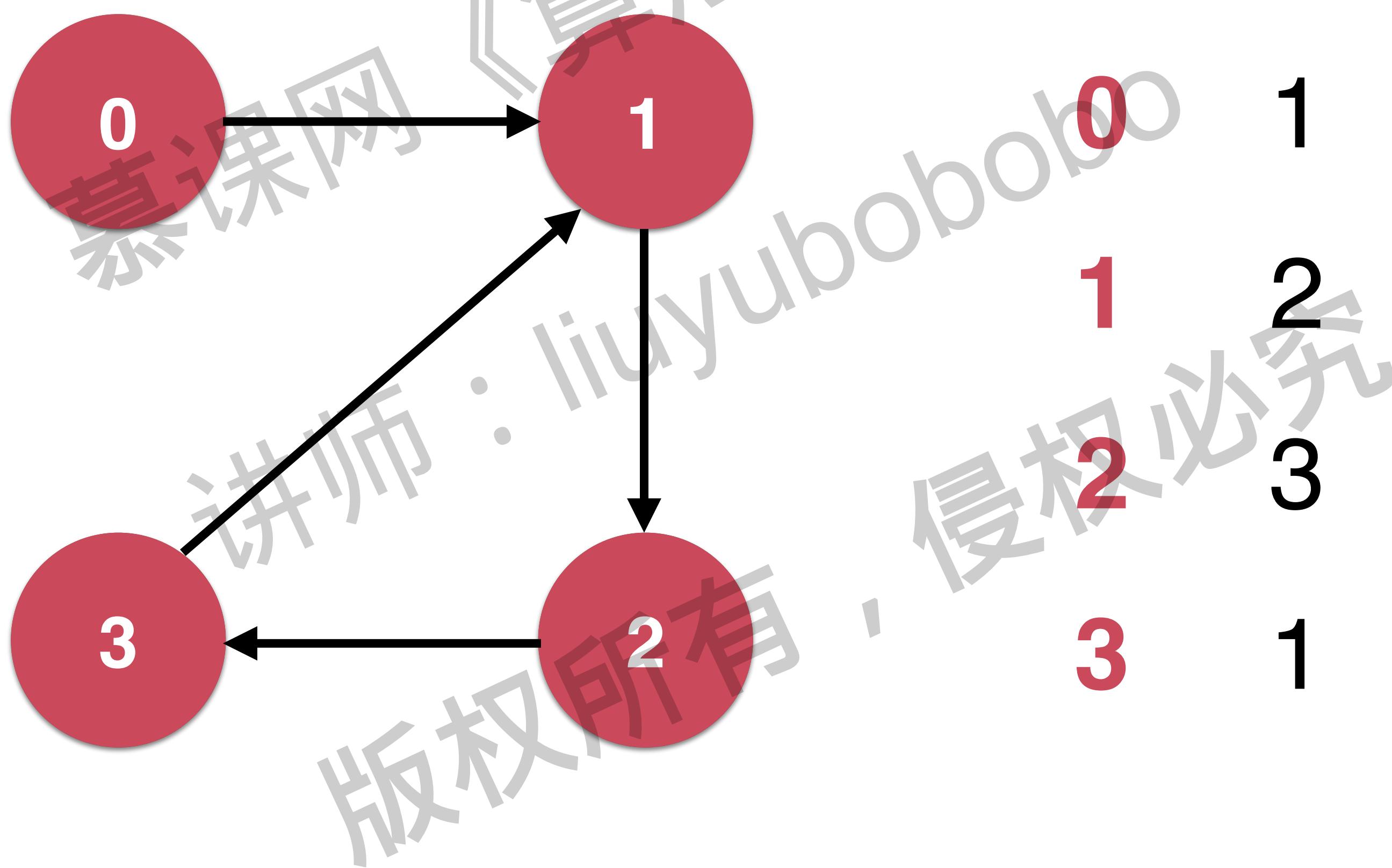


0	1	2	3
0	1	0	0
1	0	1	0
2	0	0	1
3	1	0	0

邻接表 (Adjacency Lists)



邻接表 (Adjacency Lists)

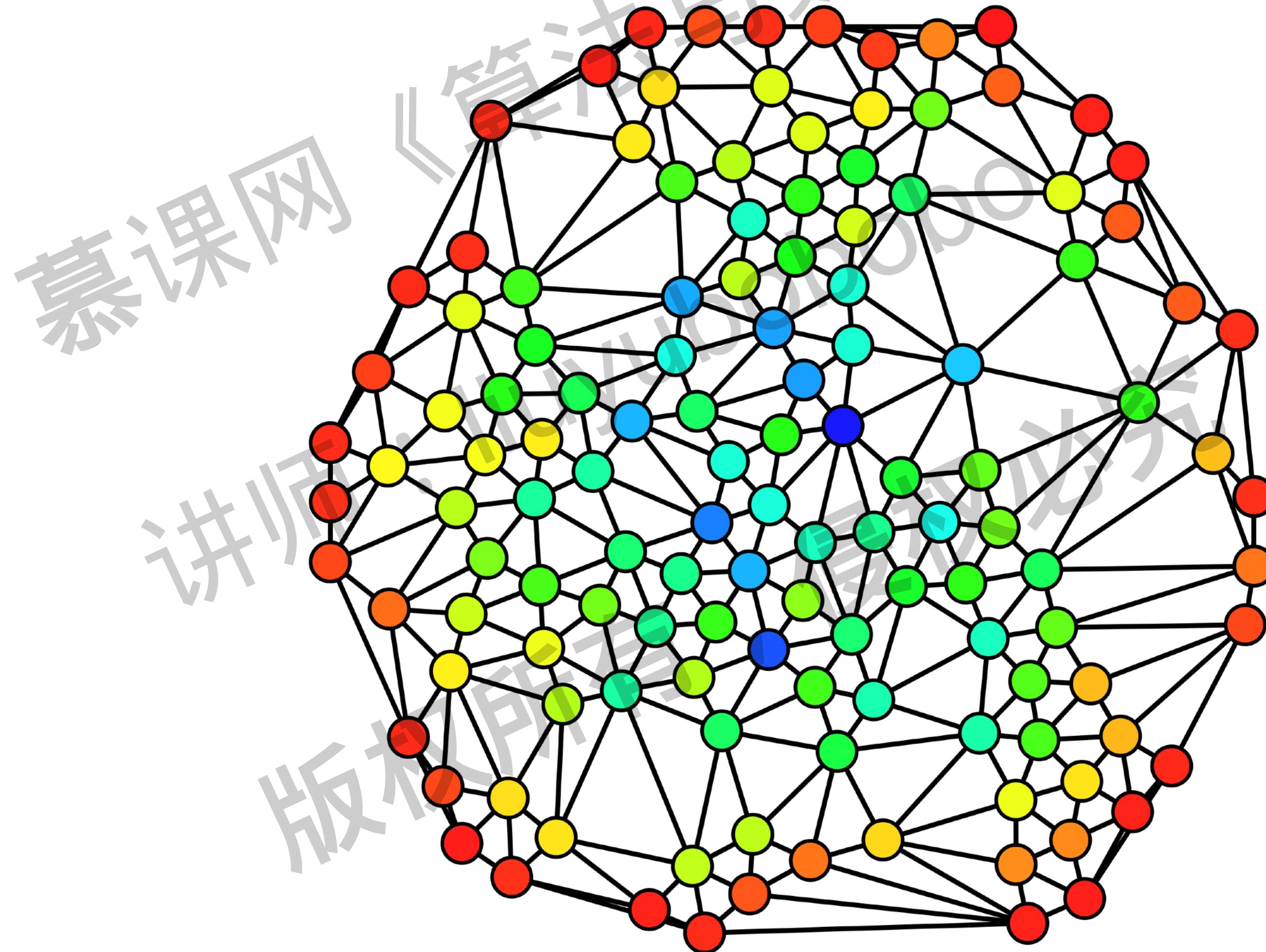


邻接矩阵和邻接表

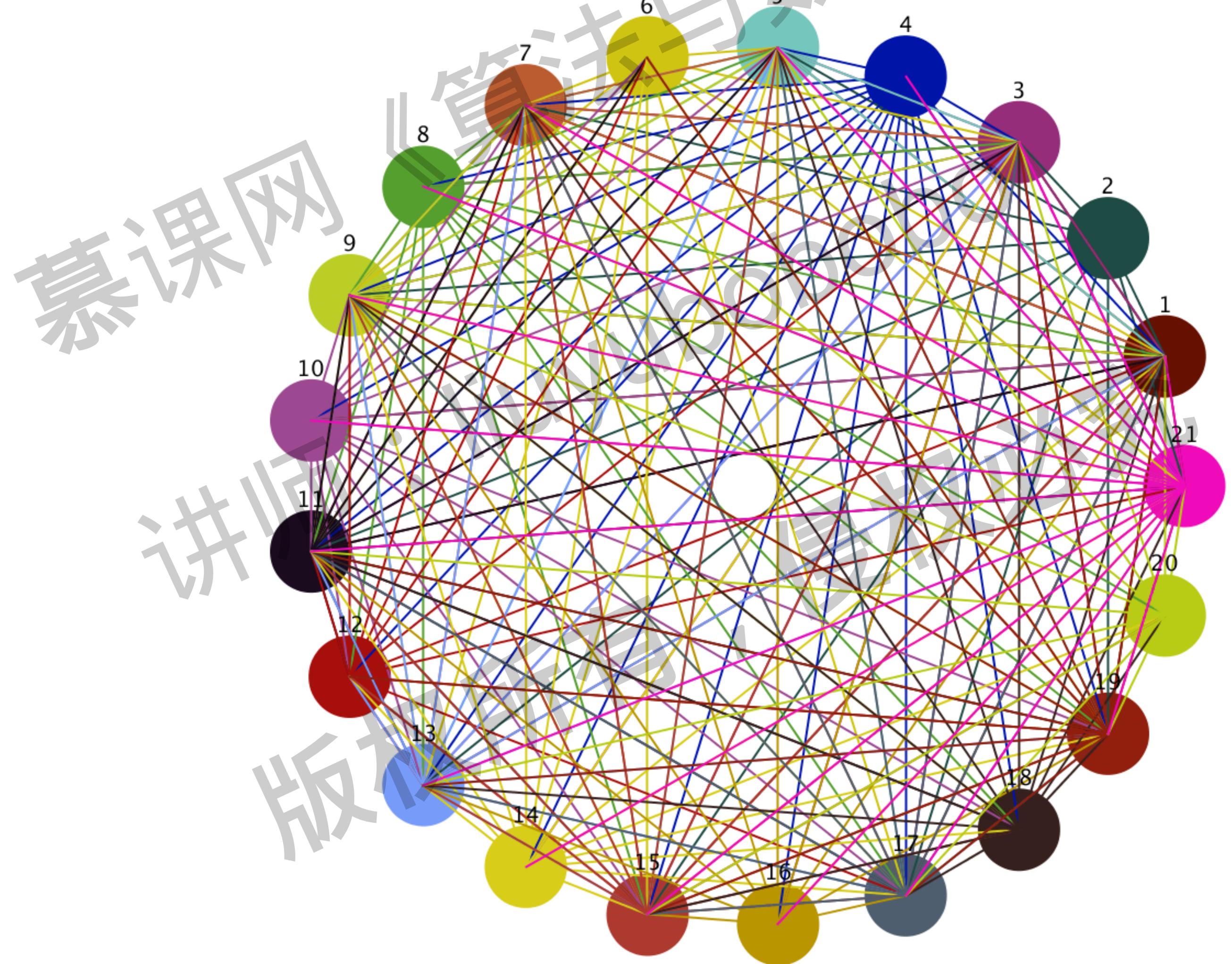
邻接表适合表示稀疏图 (Sparse Graph)

邻接矩阵适合表示稠密图 (Dense Graph)

稀疏图



稠密图 和 完全图



操作：图的两种表示

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遍历邻边 - 图算法中最常见的操作



相邻结点迭代器

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操作：相邻结点迭代器

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图算法框架

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图的读取

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操作：图的读取

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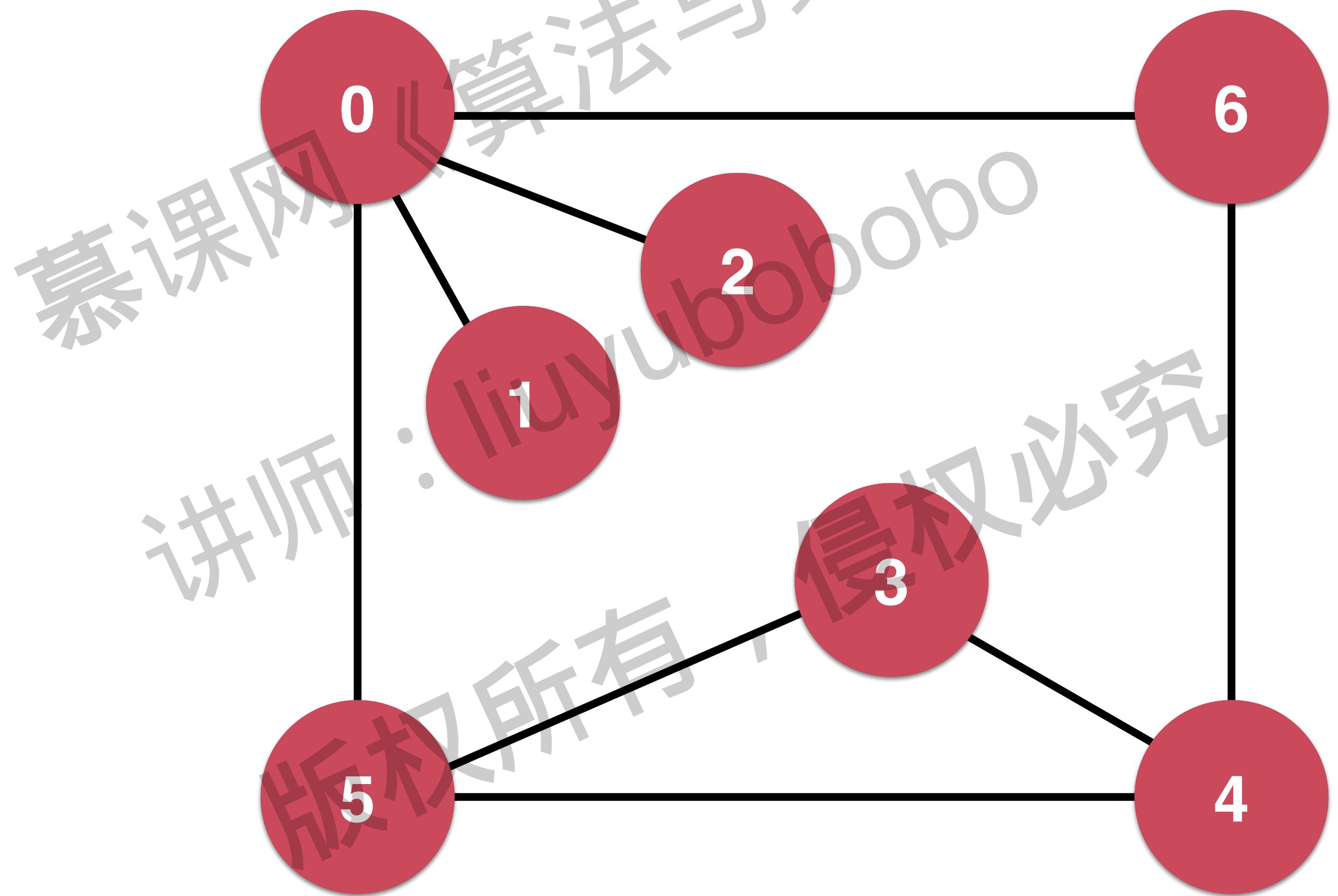
图的遍历

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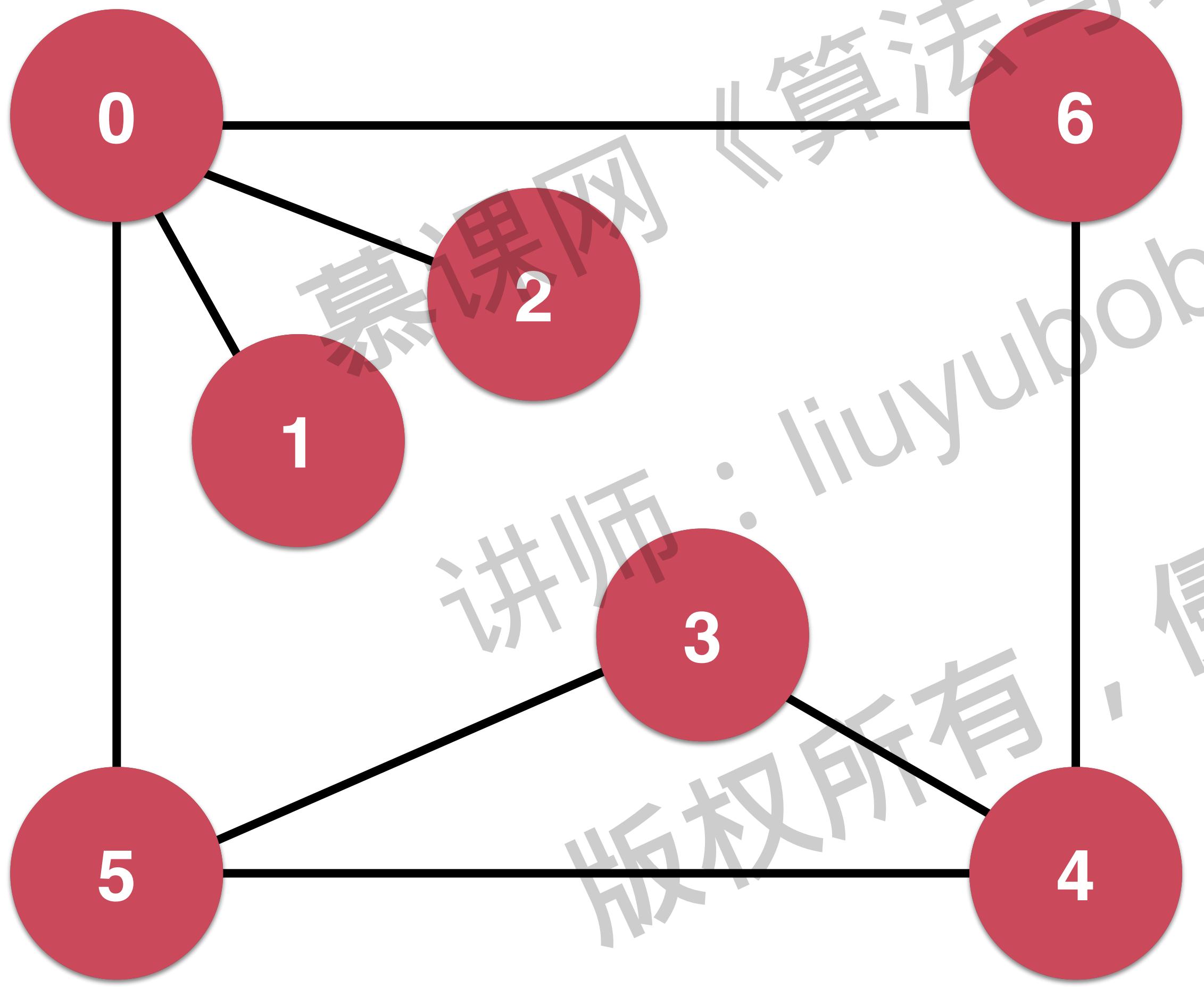
深度优先遍历

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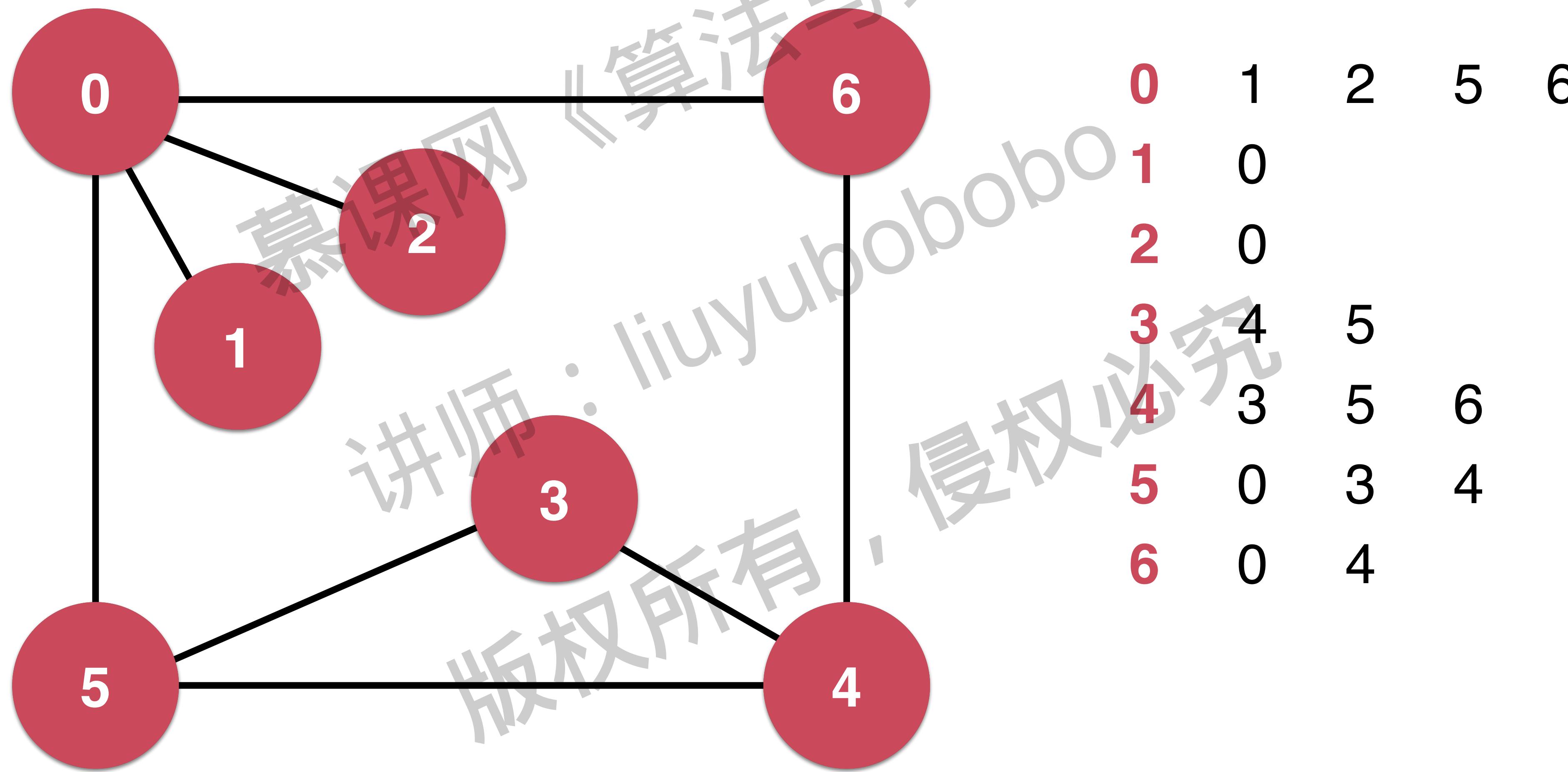
深度优先遍历



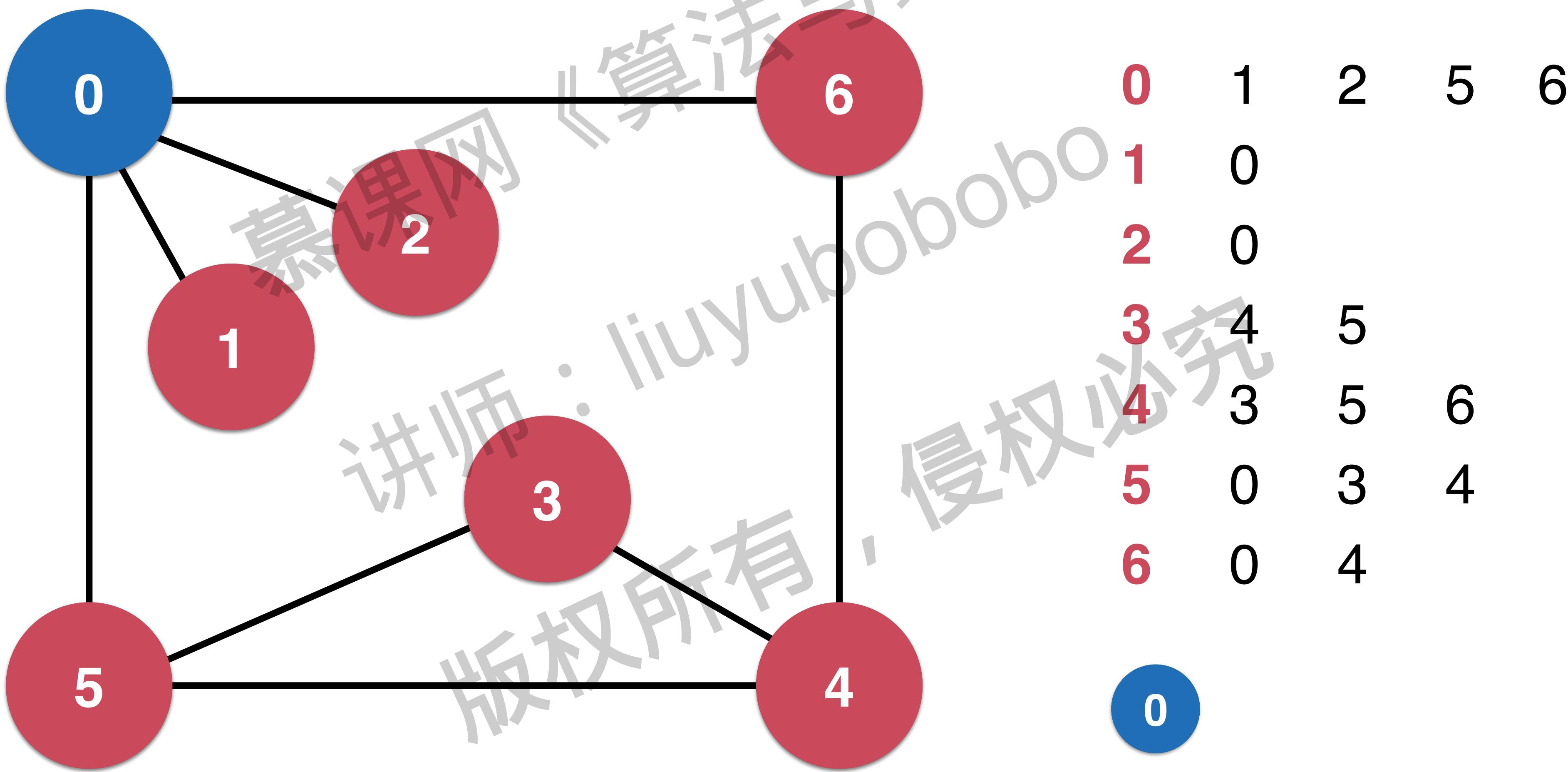
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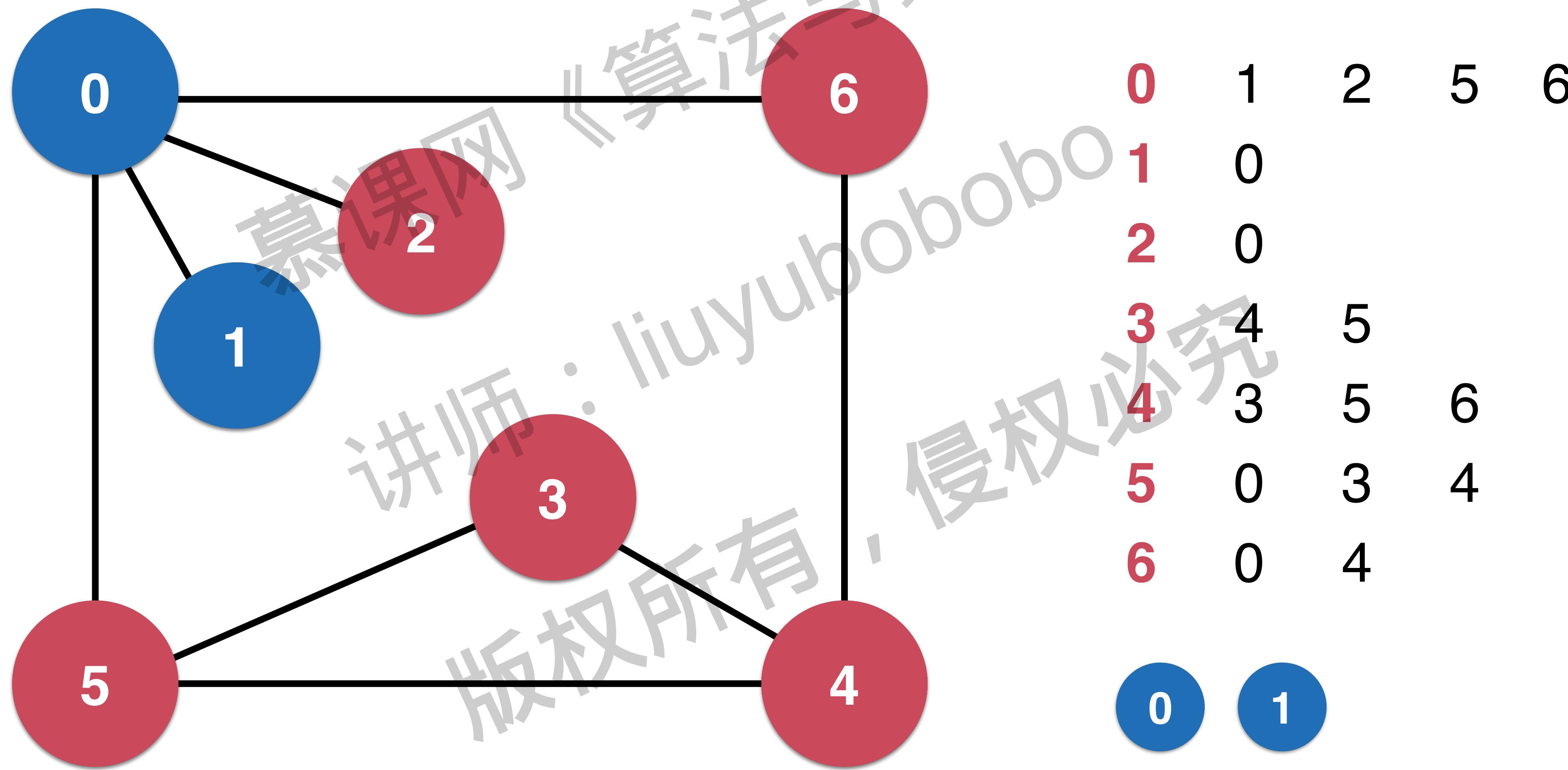
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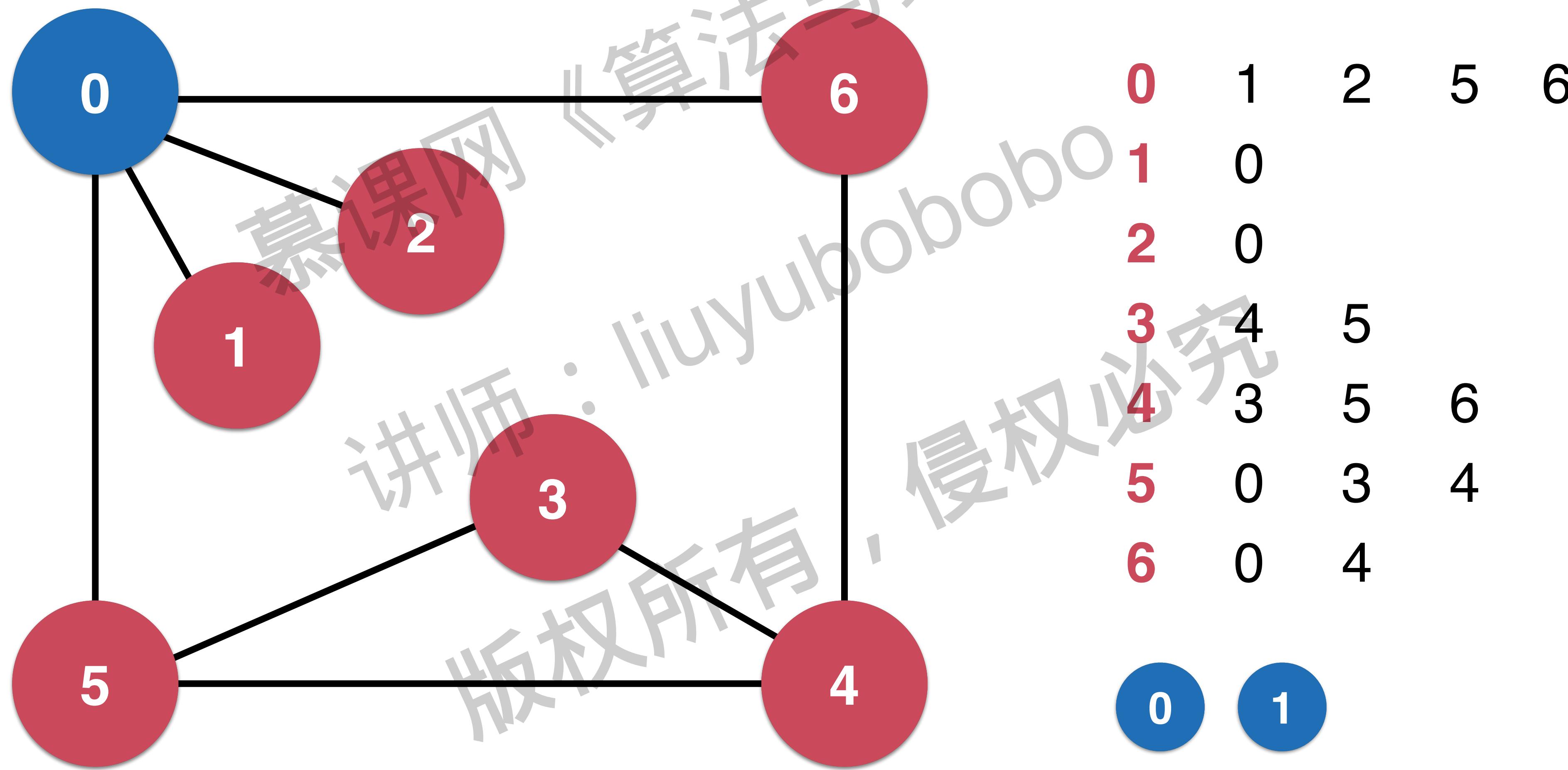
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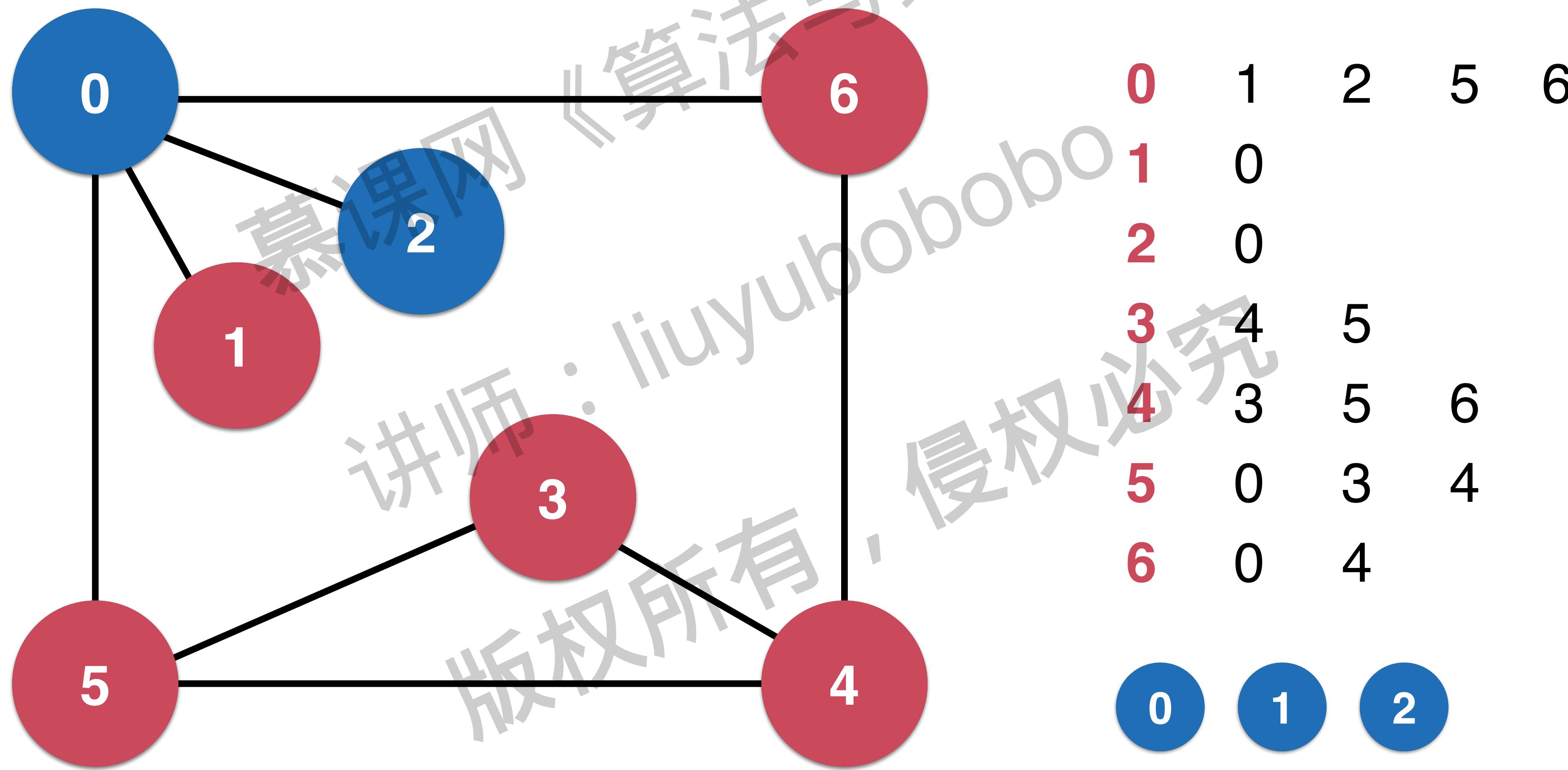
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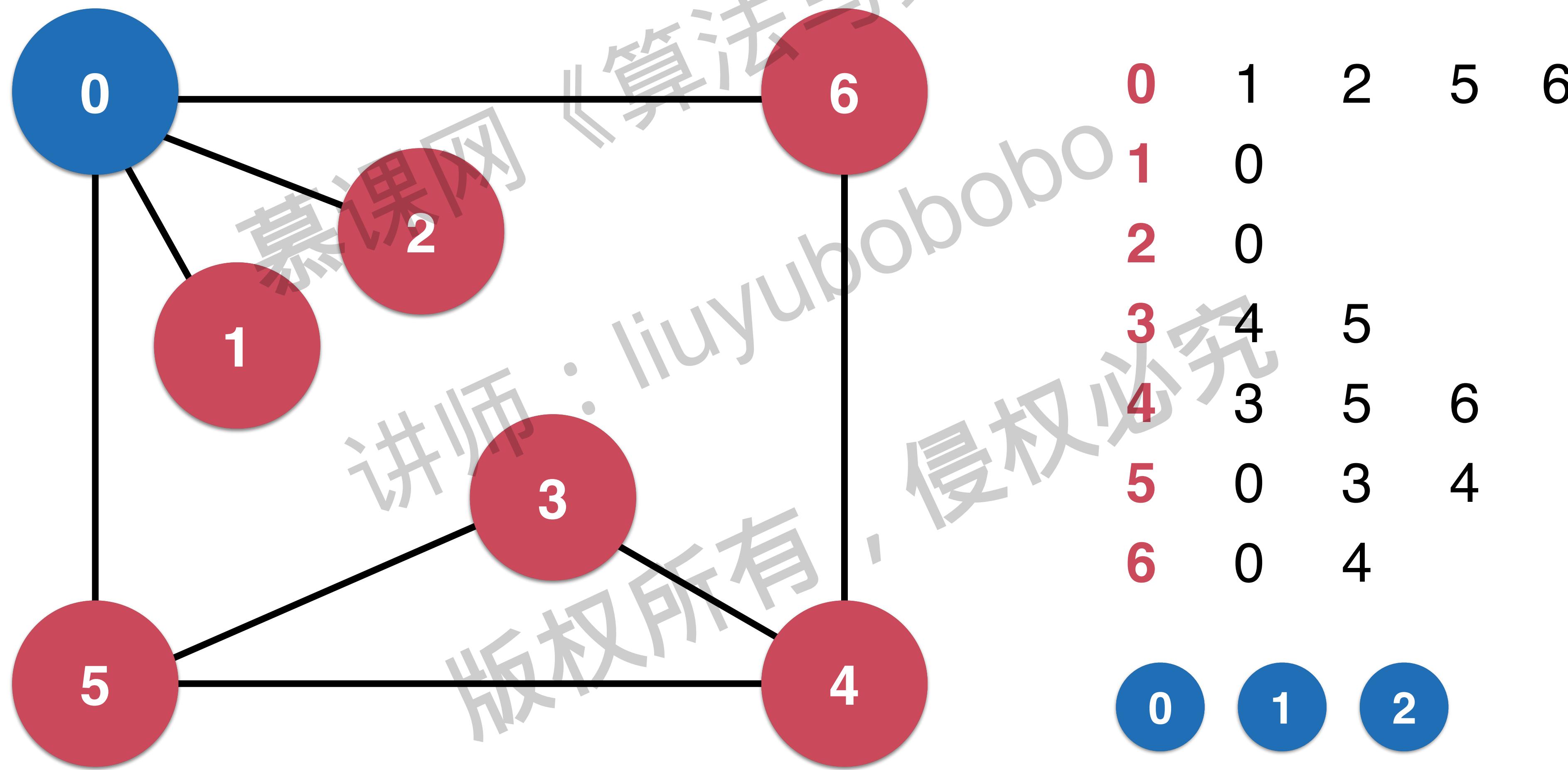
深度优先遍历



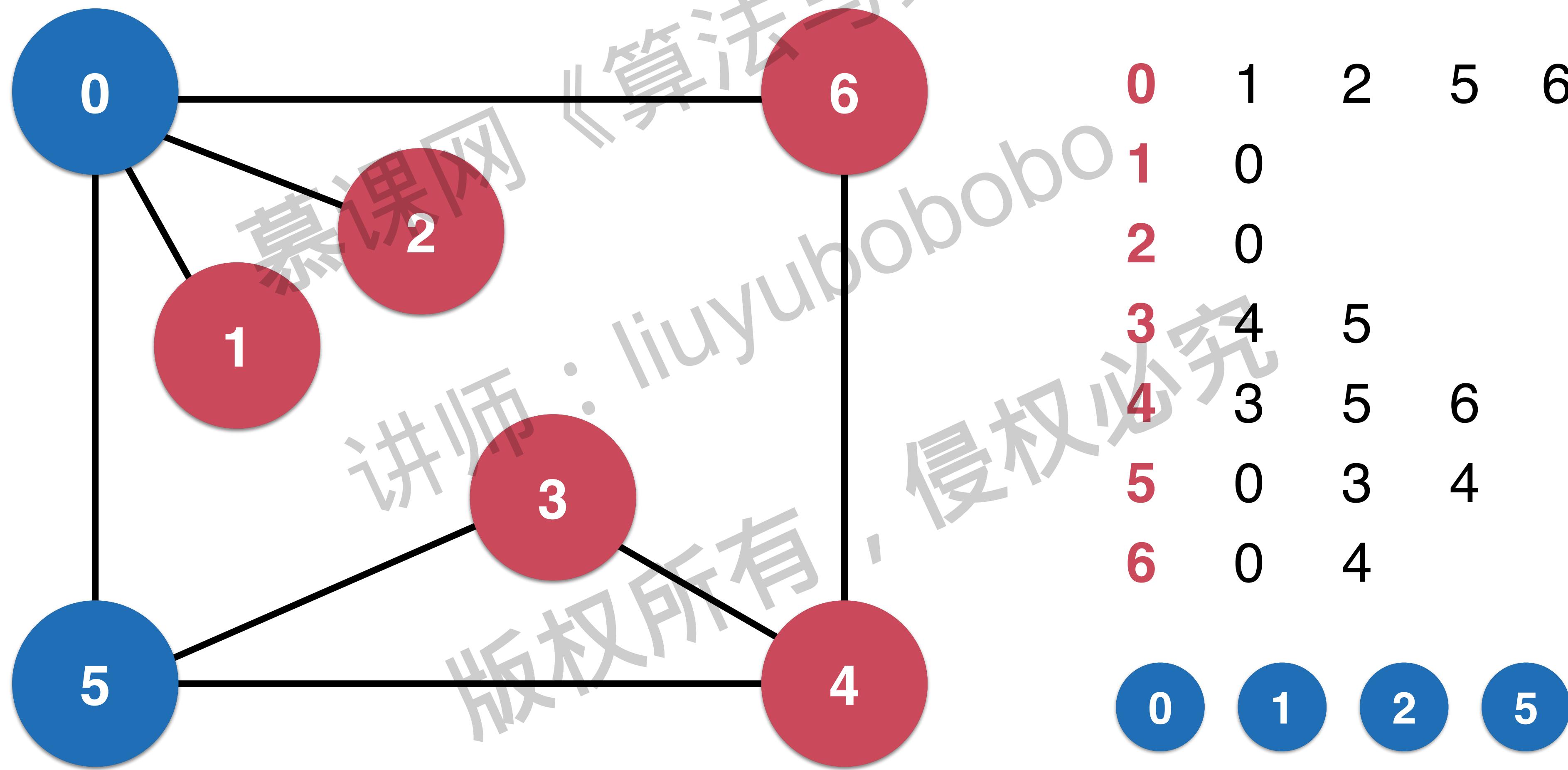
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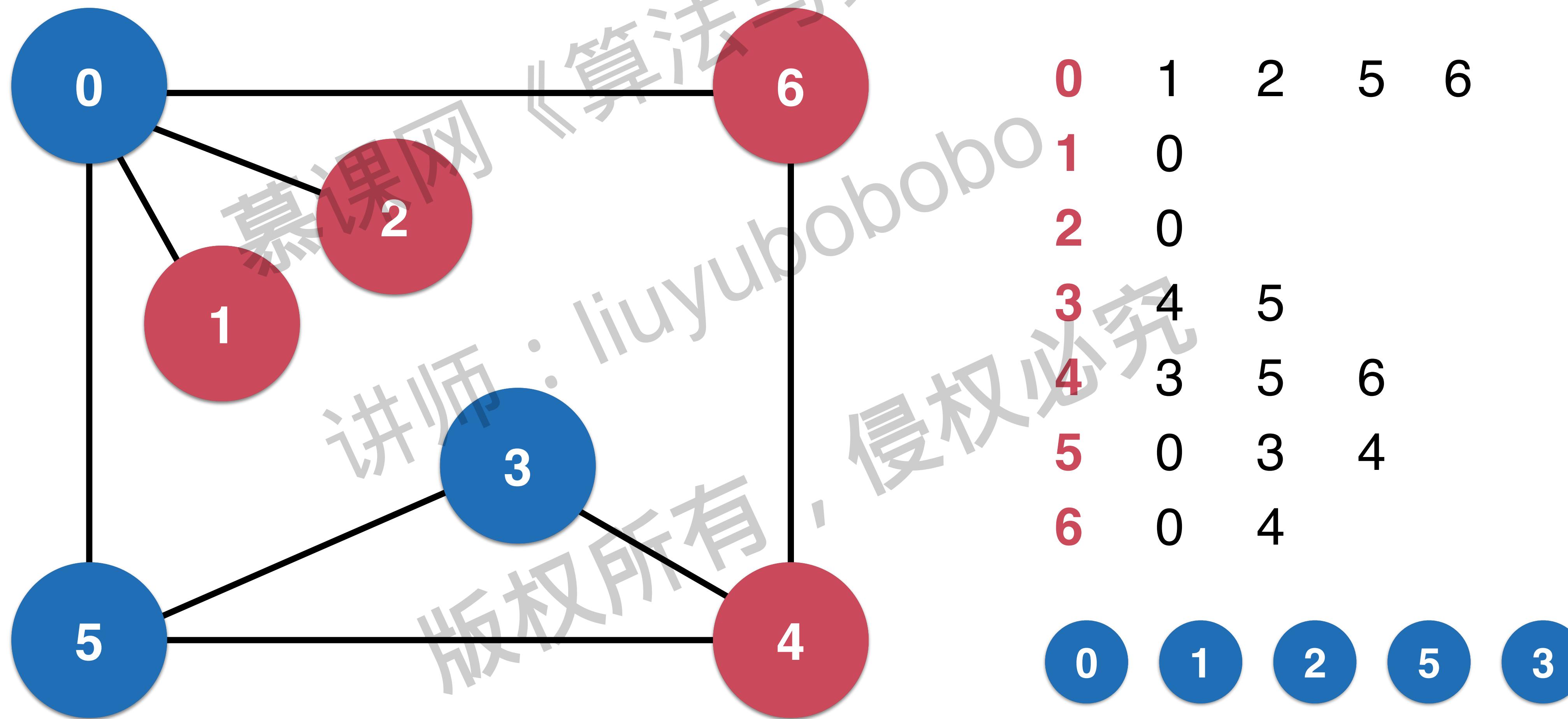
深度优先遍历



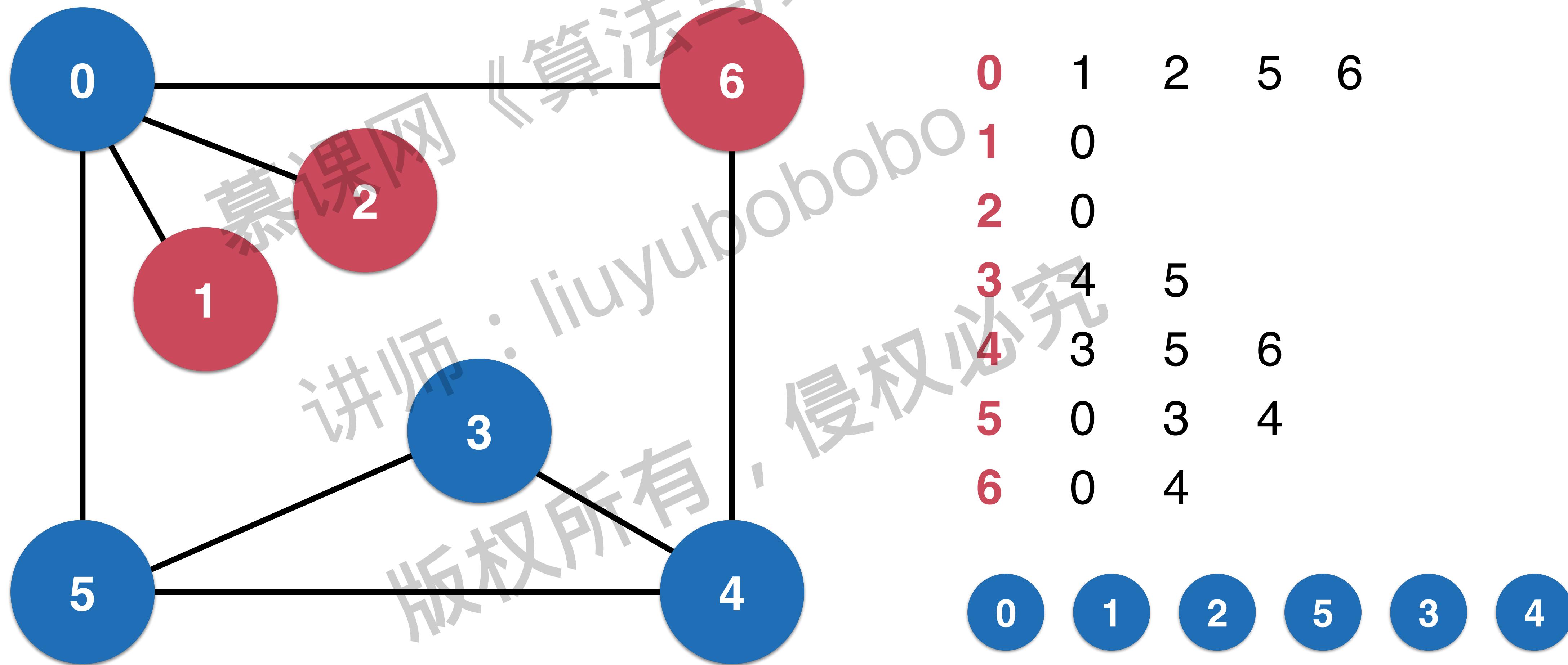
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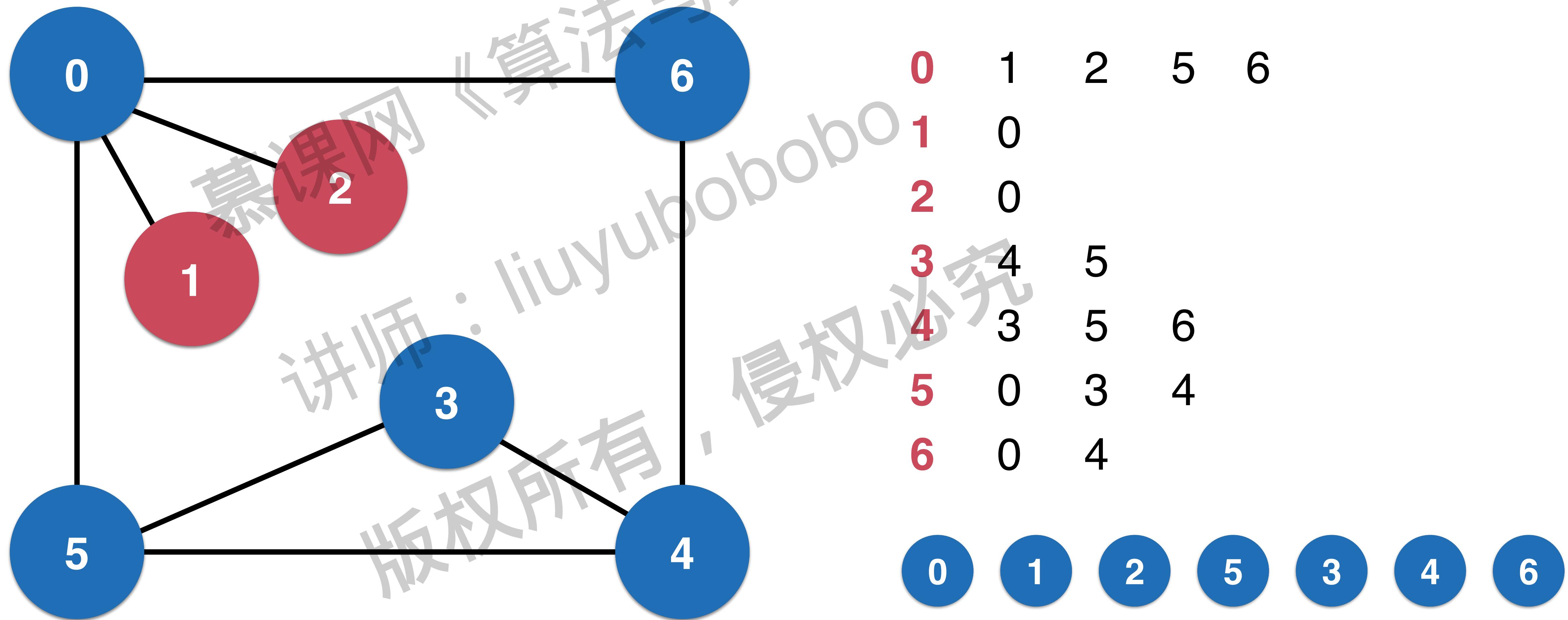
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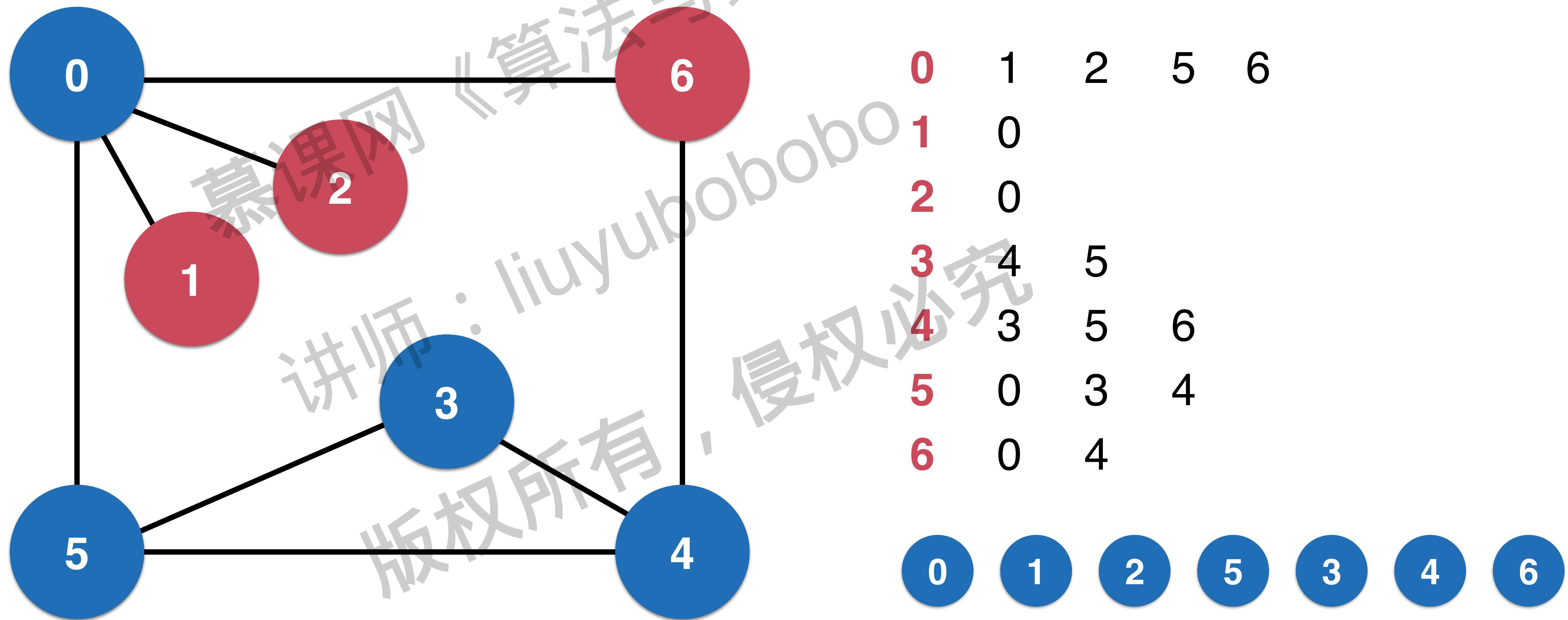
深度优先遍历



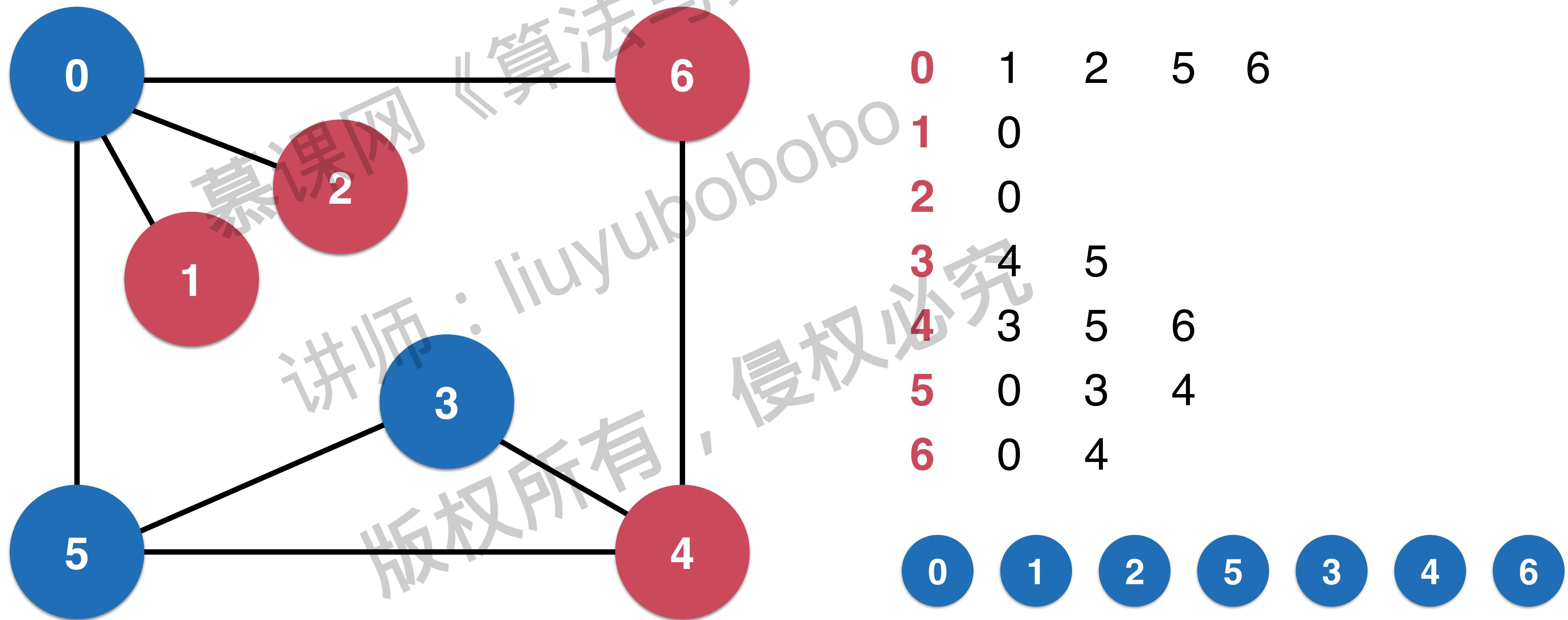
深度优先遍历



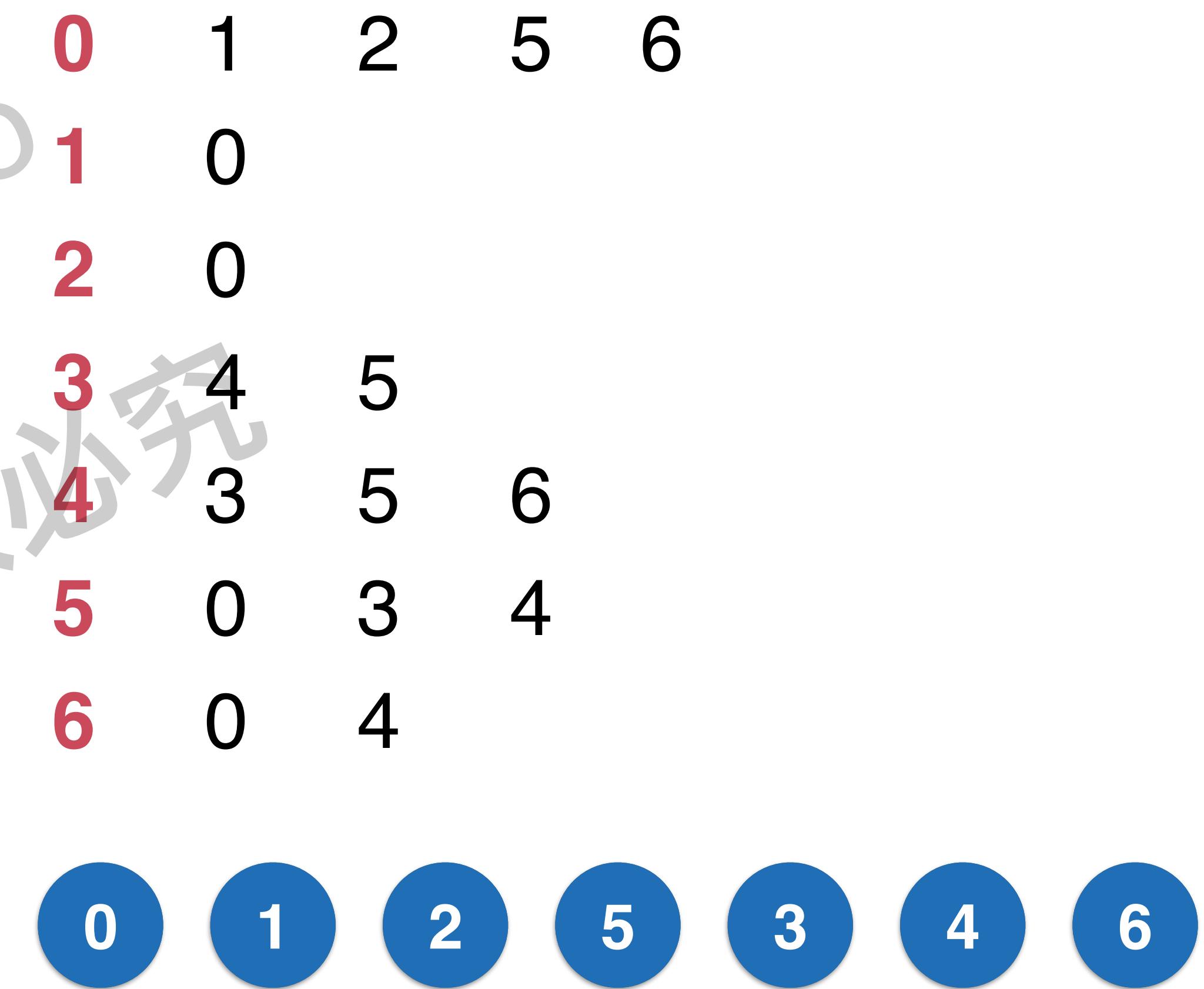
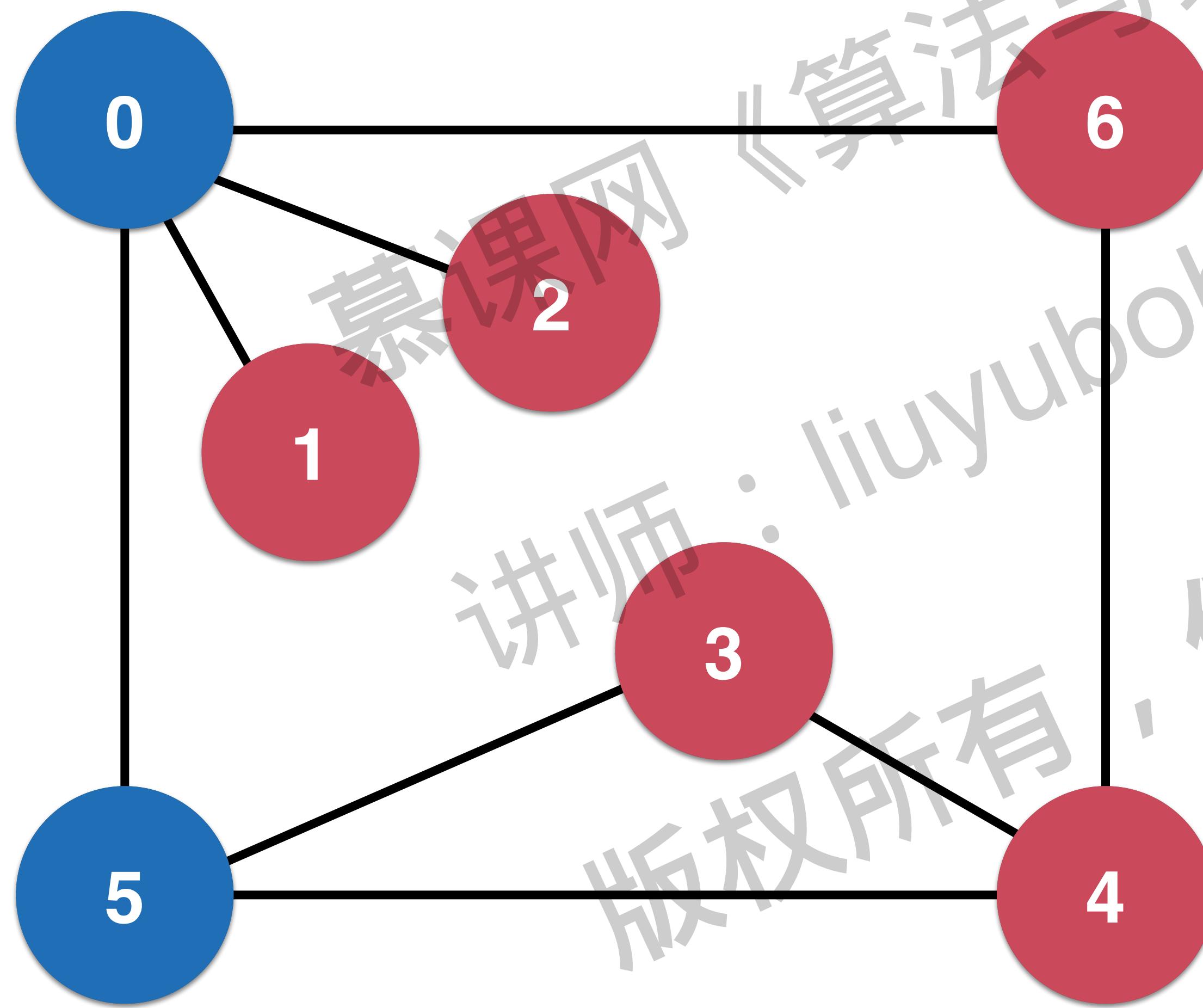
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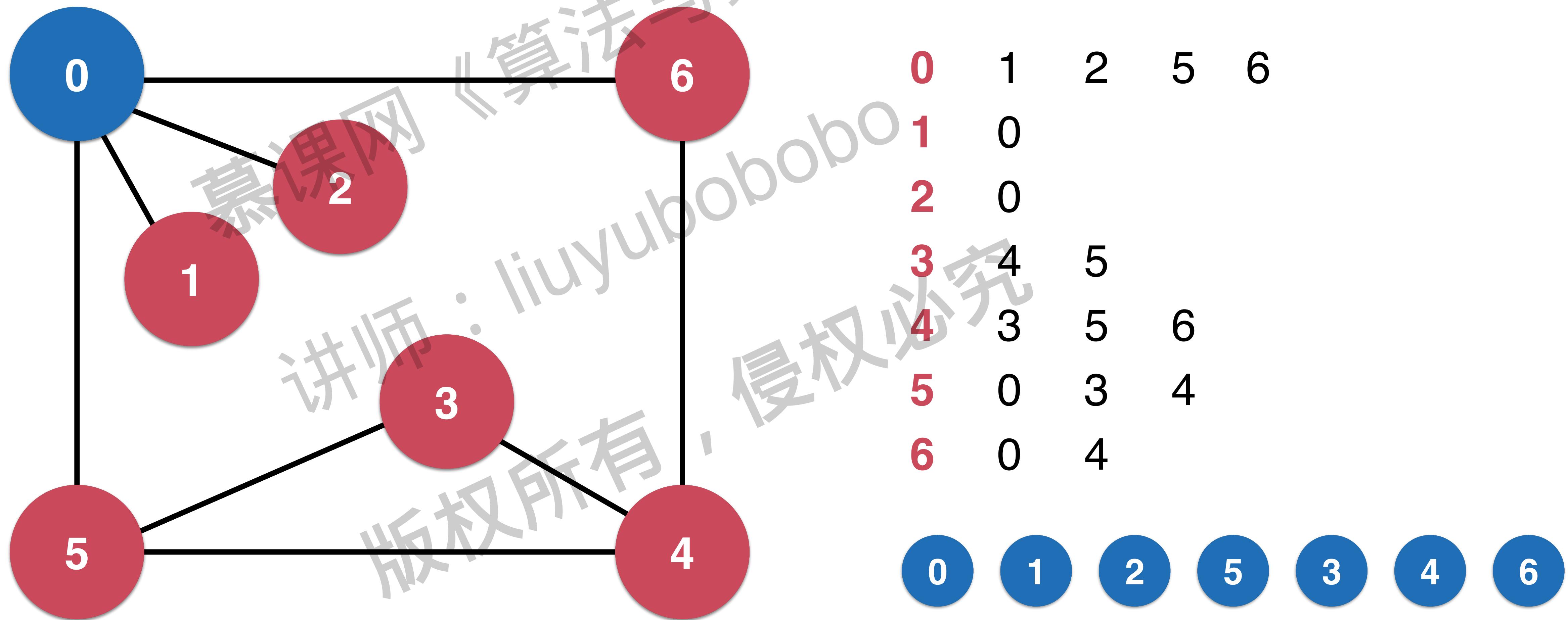
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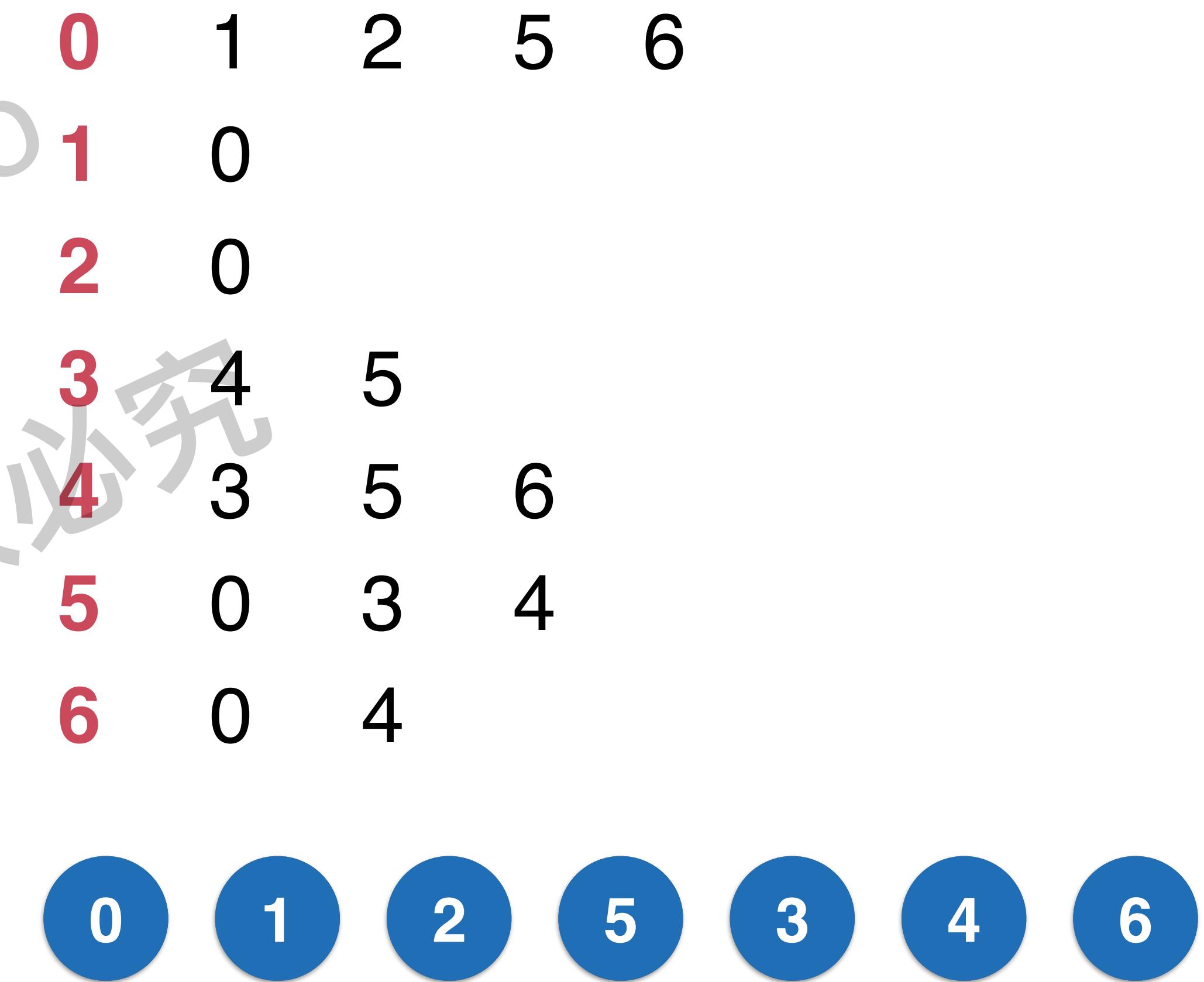
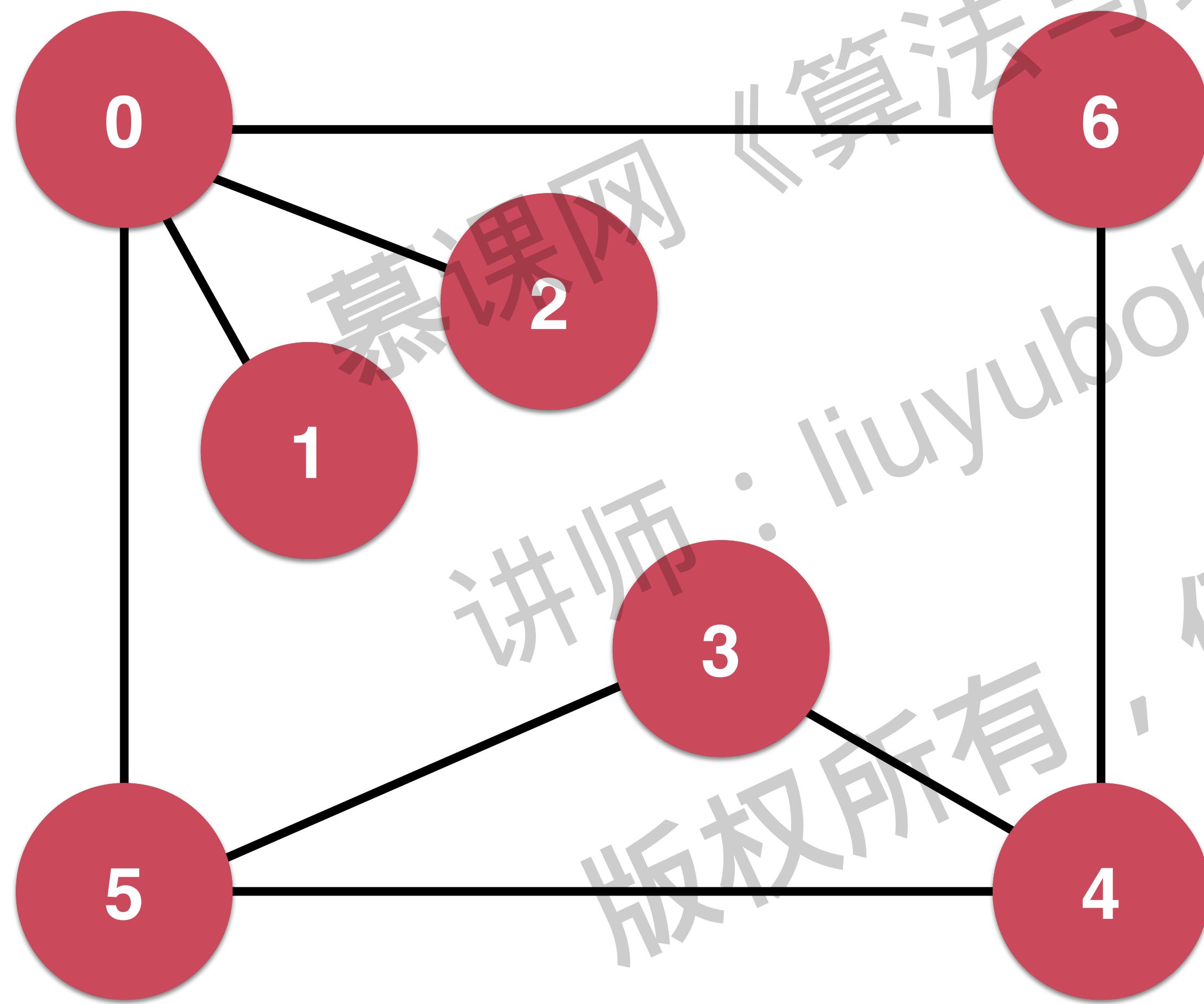
深度优先遍历



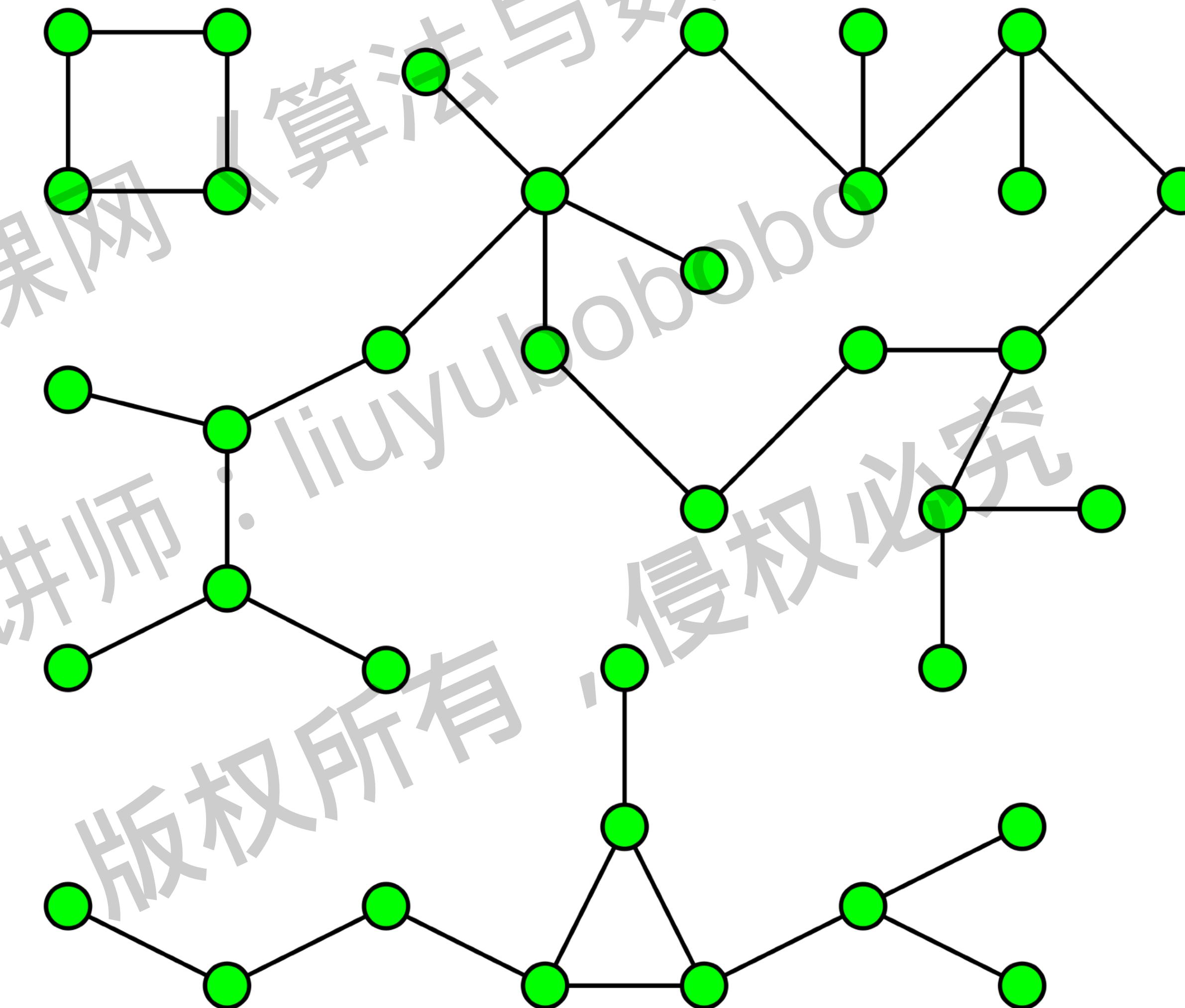
深度优先遍历



深度优先遍历



连通分量



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操作：Component

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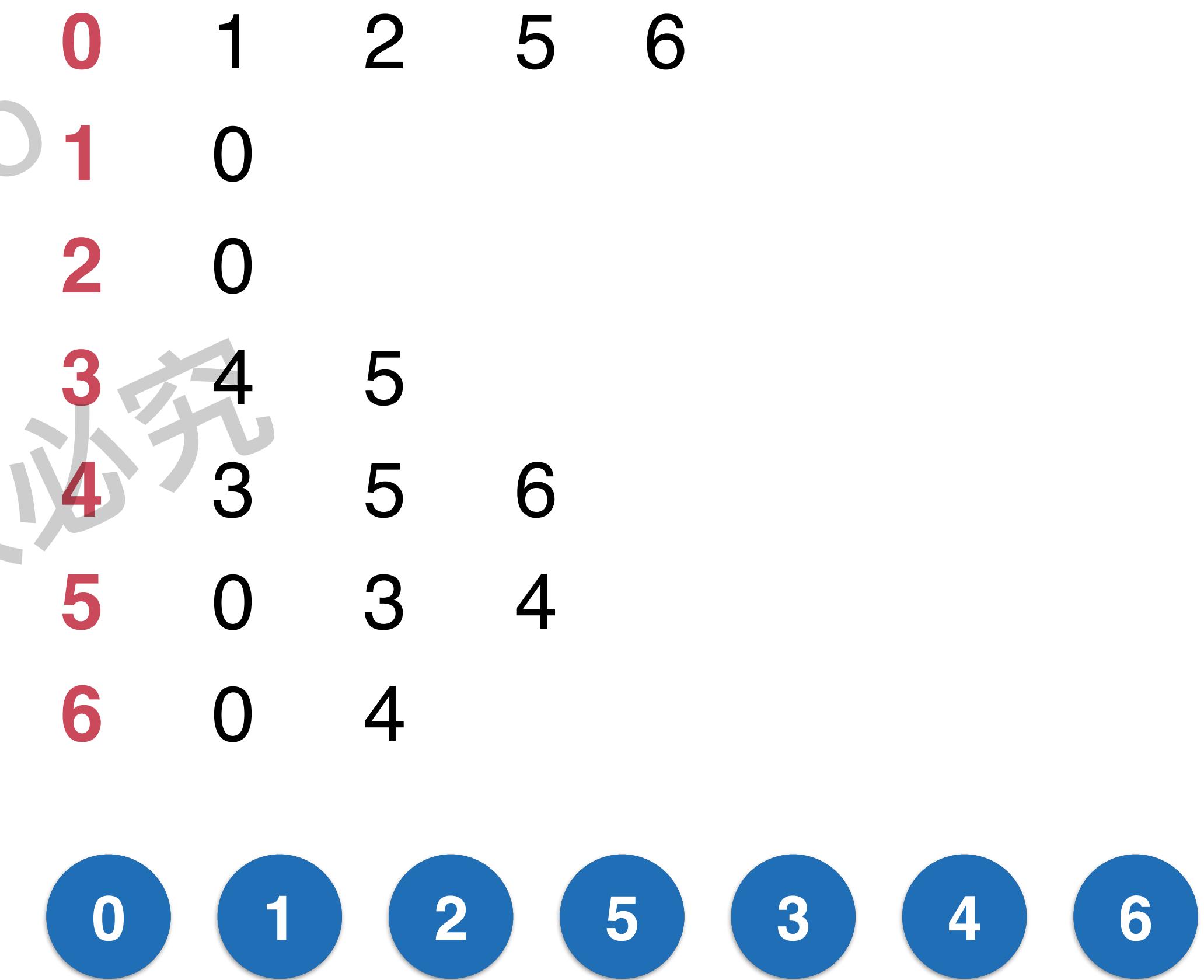
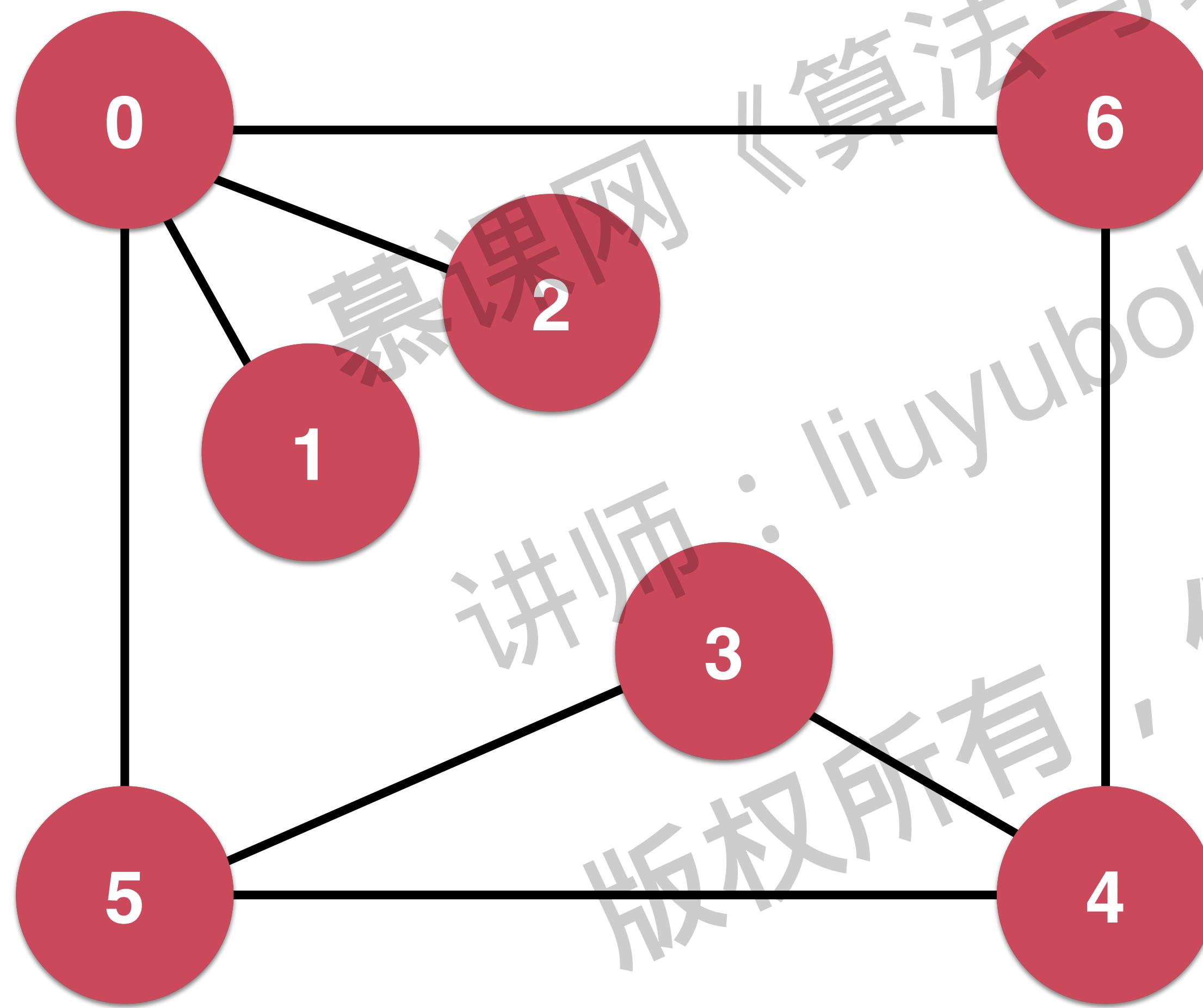
操作：测试连通性

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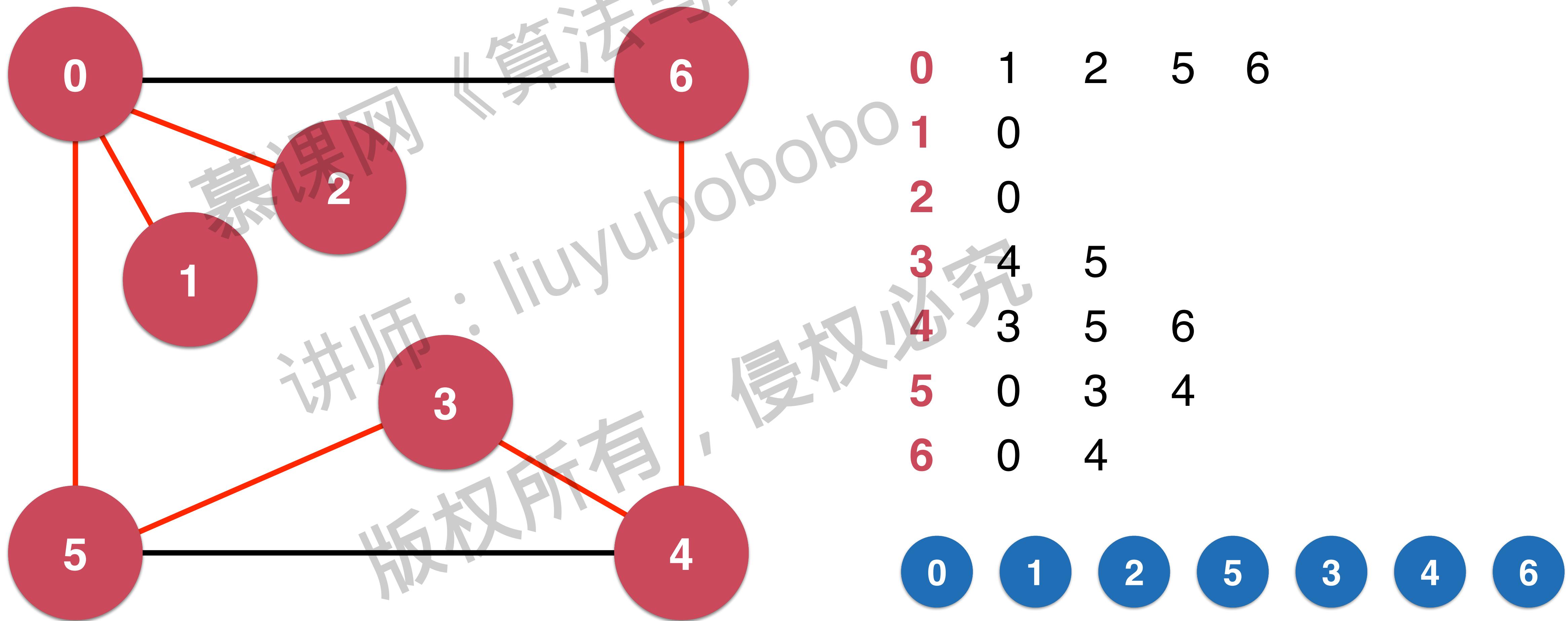
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深度优先遍历



获得两点间的一条路径



图的深度优先遍历-复杂度

稀疏图 (邻接表) : $O(V + E)$

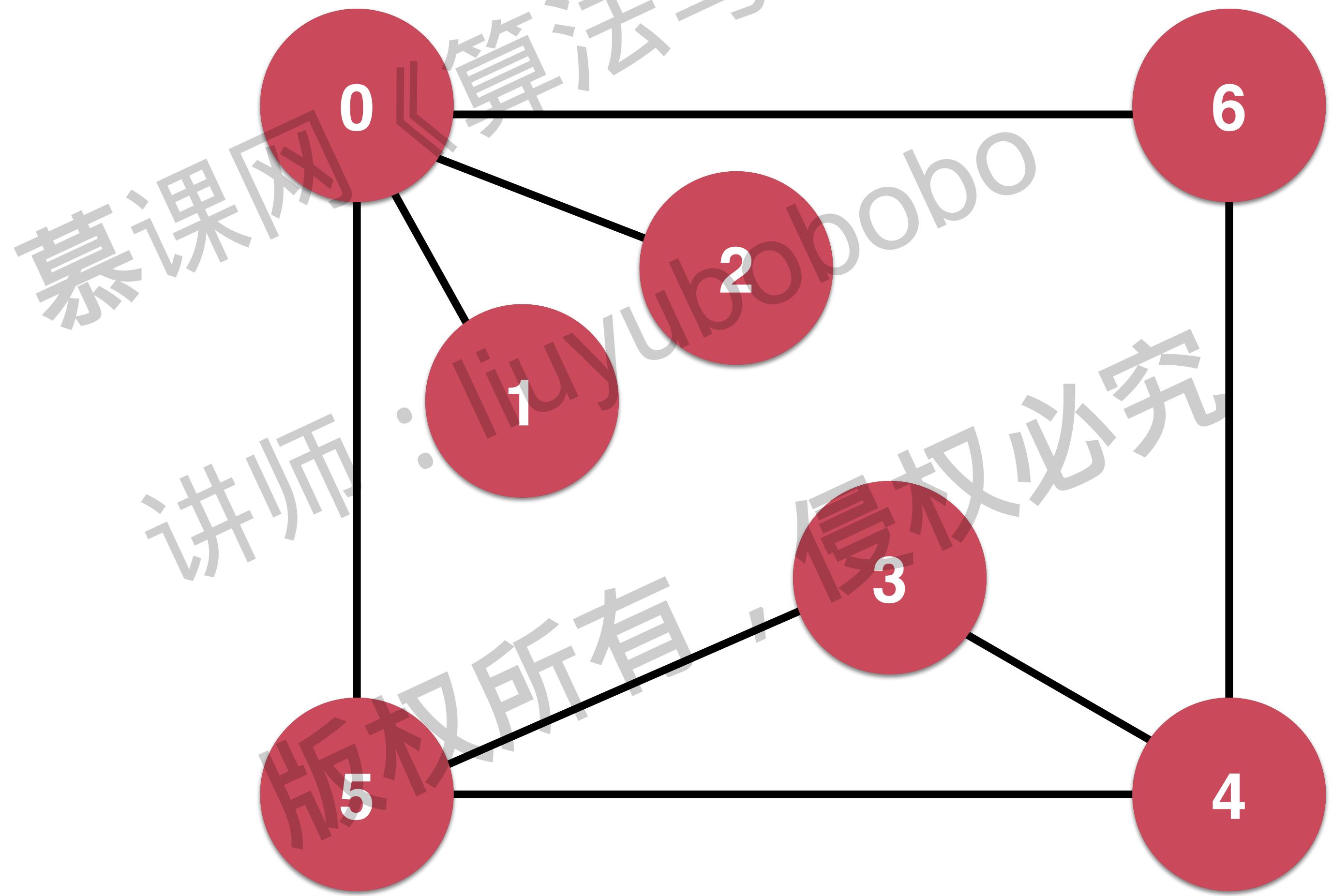
稠密图 (邻接矩阵) : $O(V^2)$

深度优先遍历算法对有向图依然有效

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深度优课网《算法与数据结构》

查看图中的环



广度优先遍历

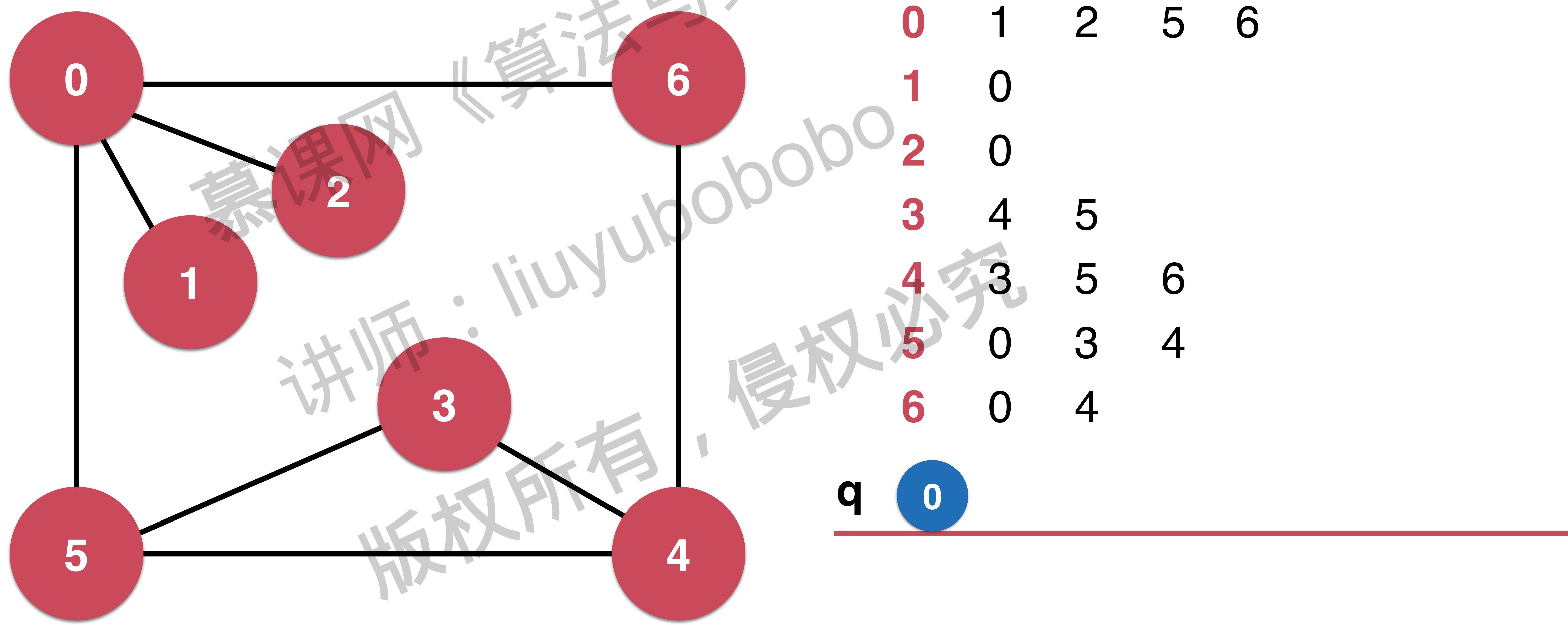
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讲师：

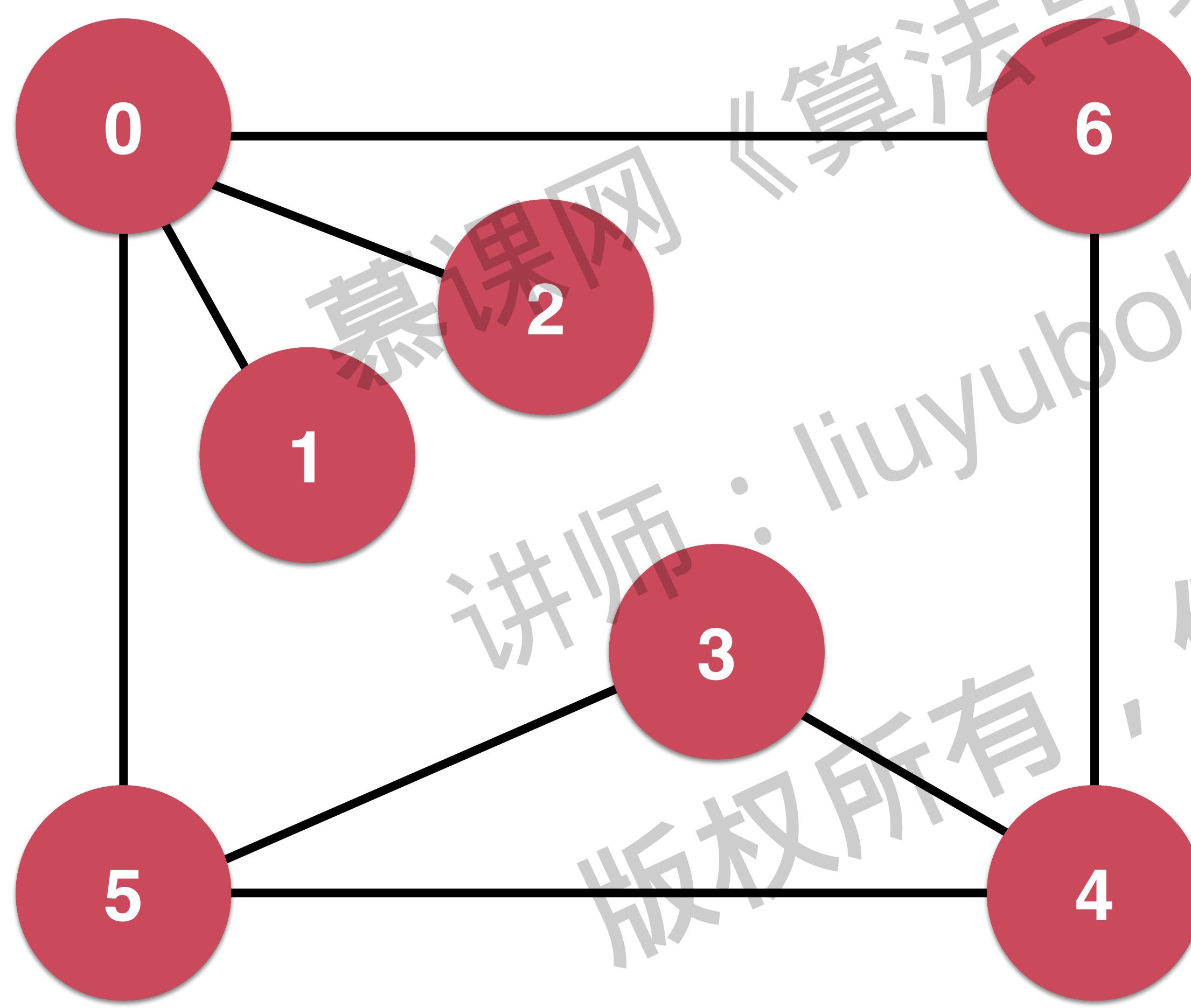
liuyujie@bobo

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广度优先遍历



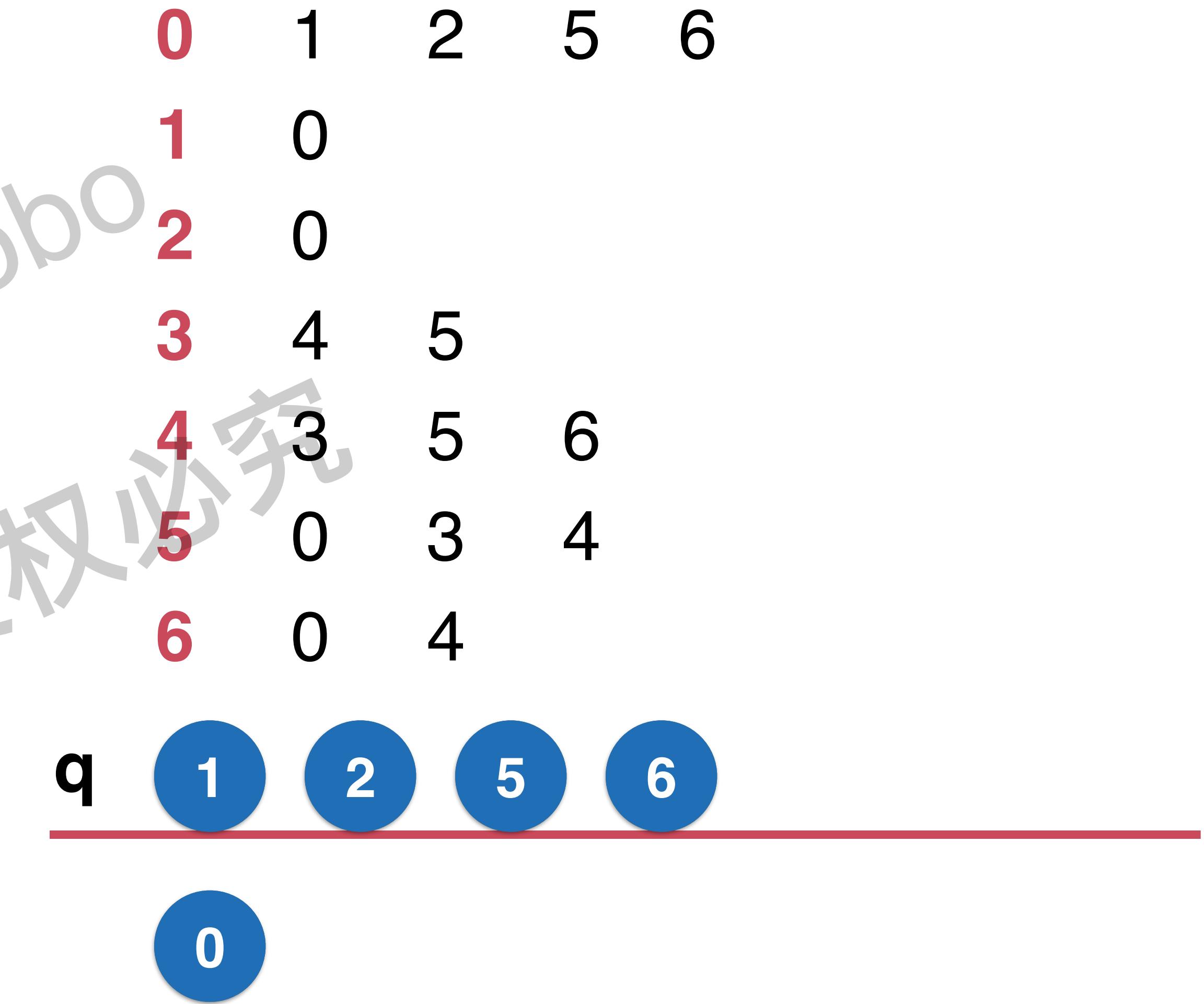
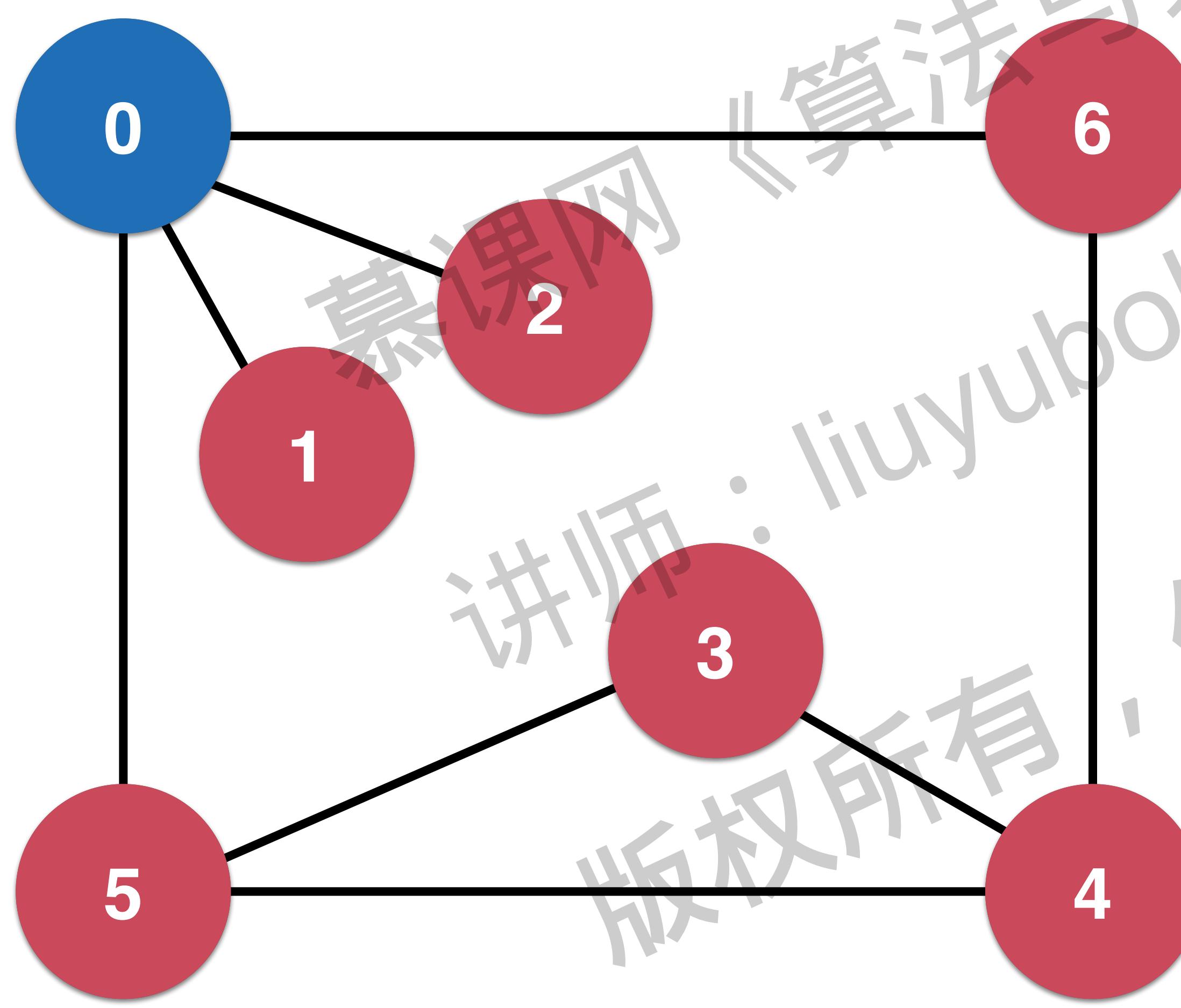
广度优先遍历



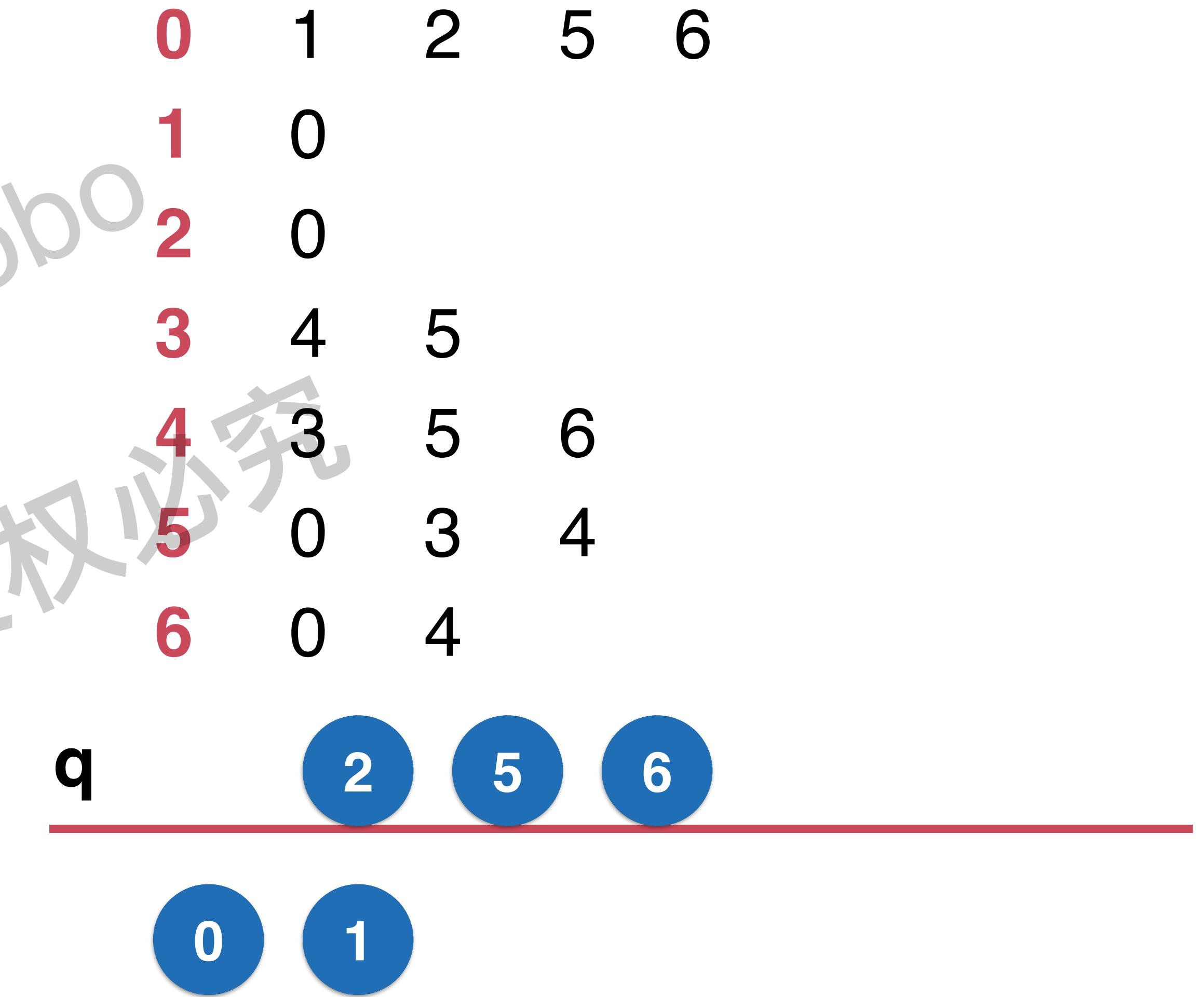
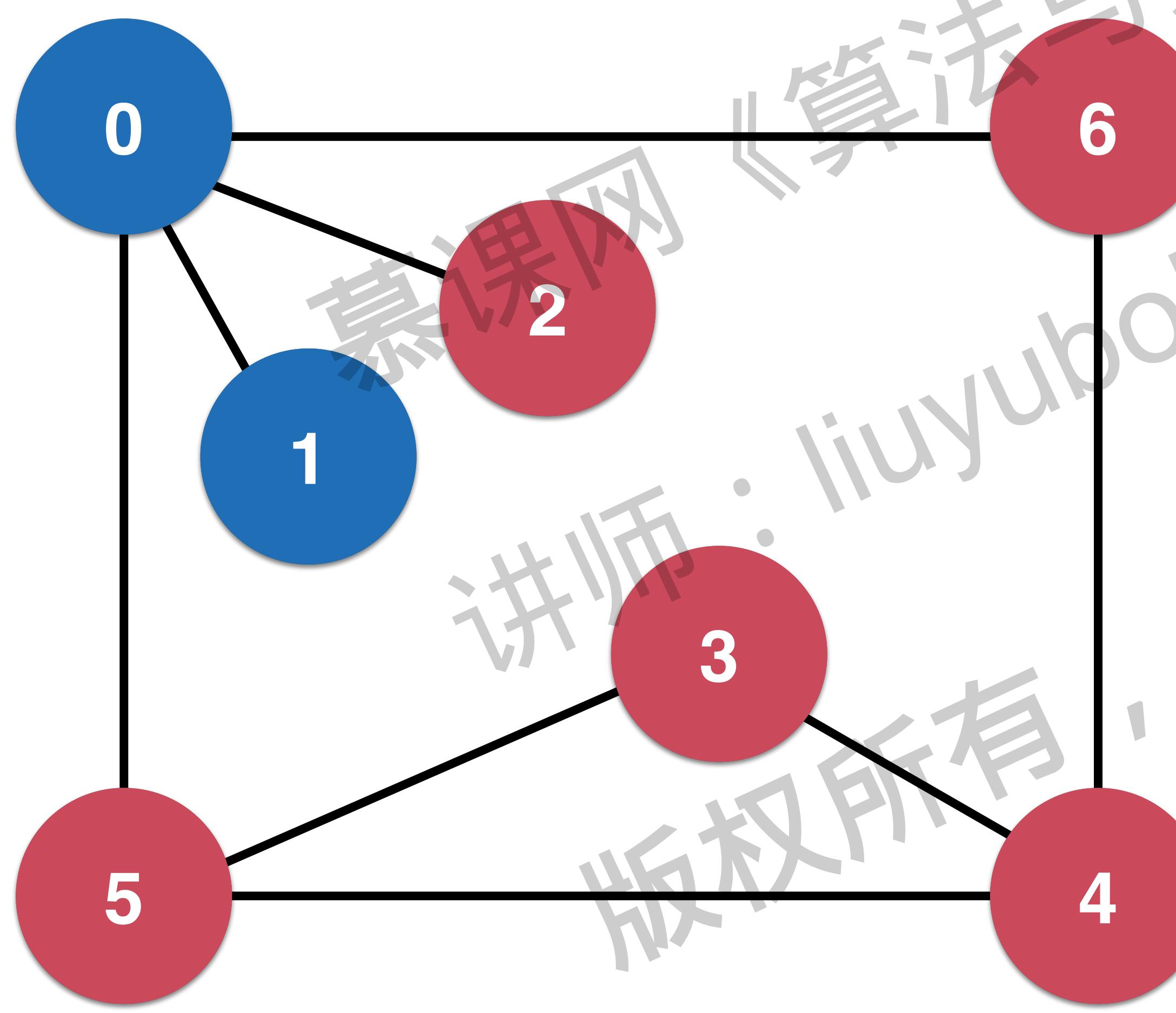
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4	3	3	3	6
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6	0	0	4	0

q 0

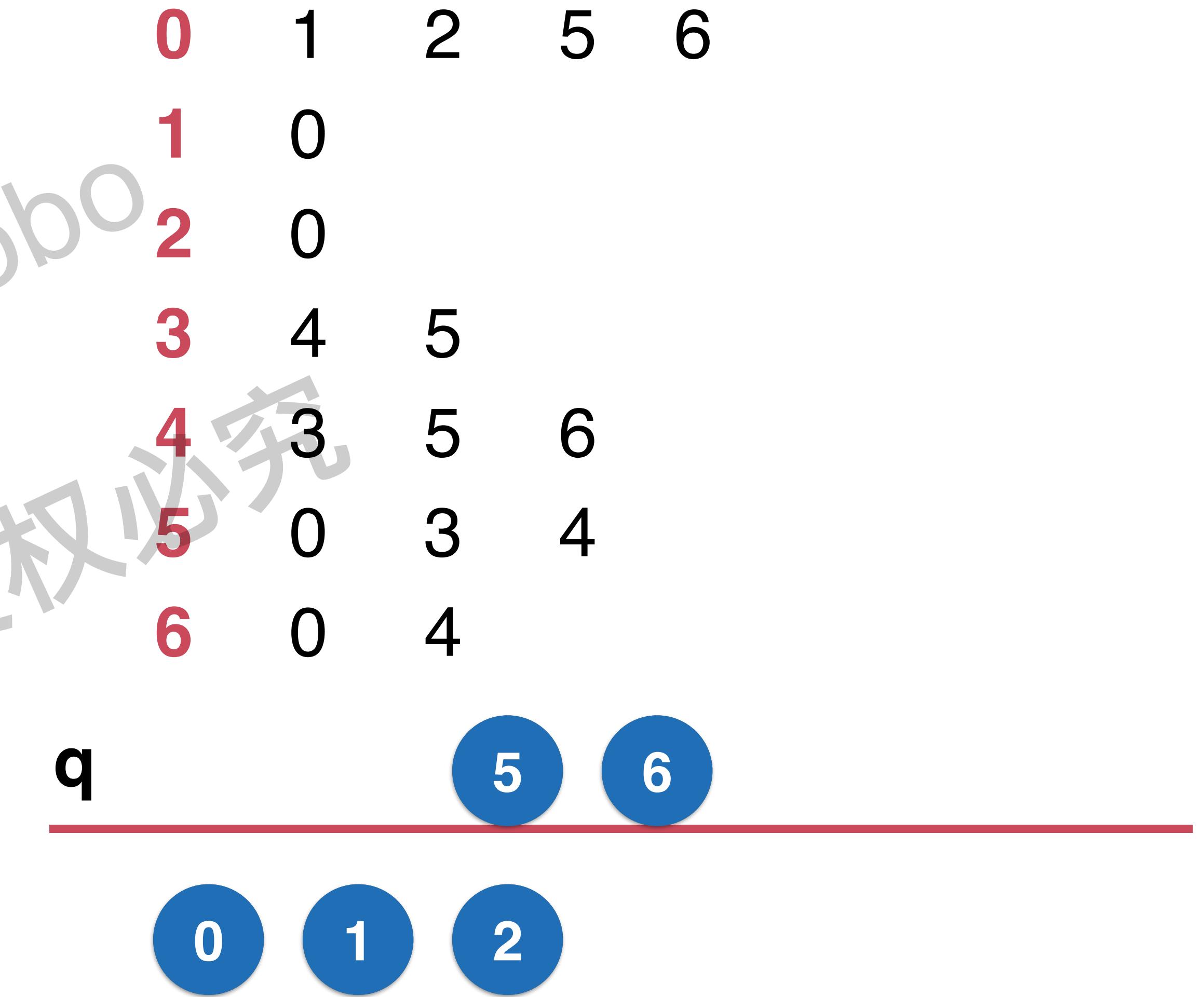
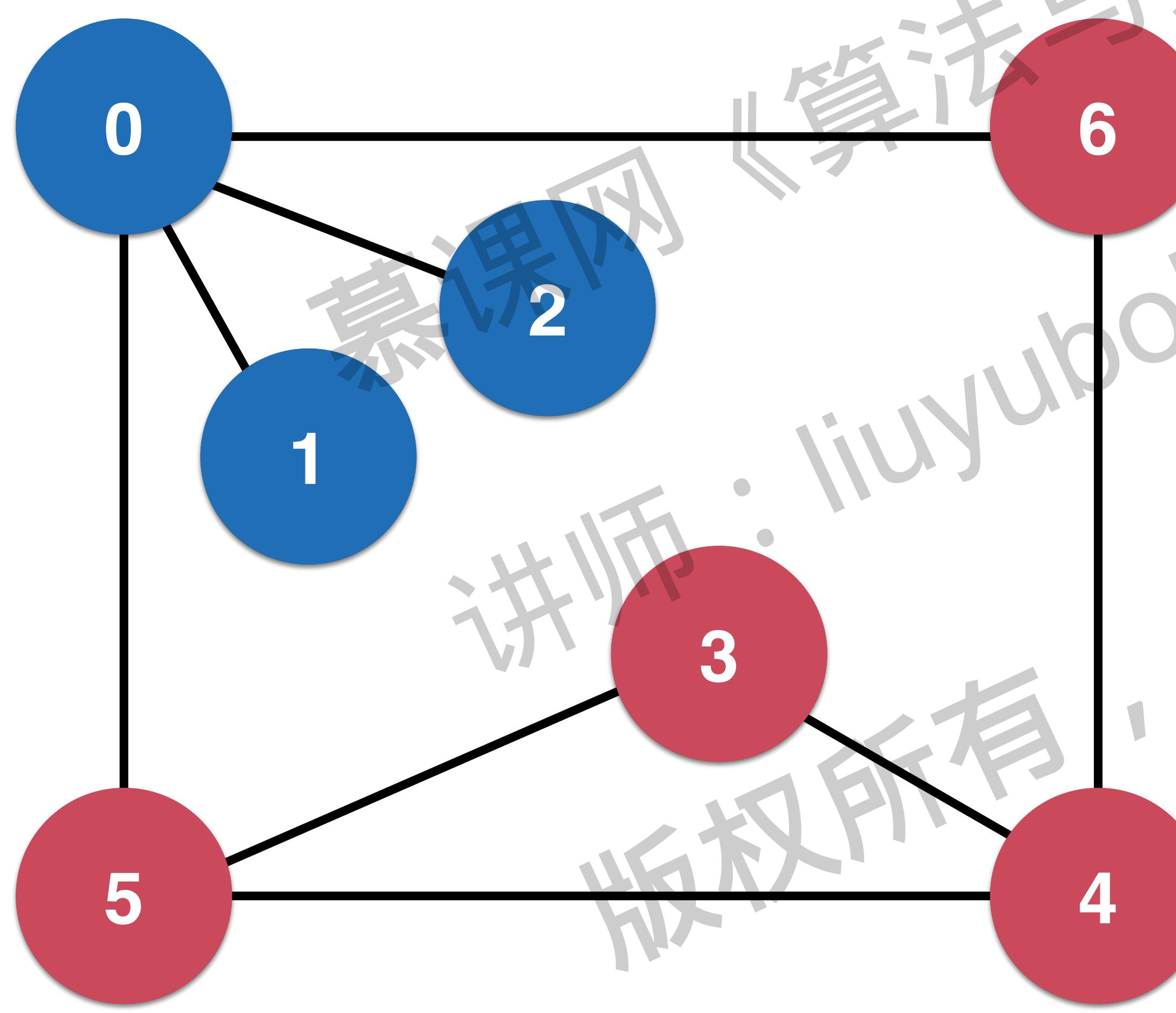
广度优先遍历



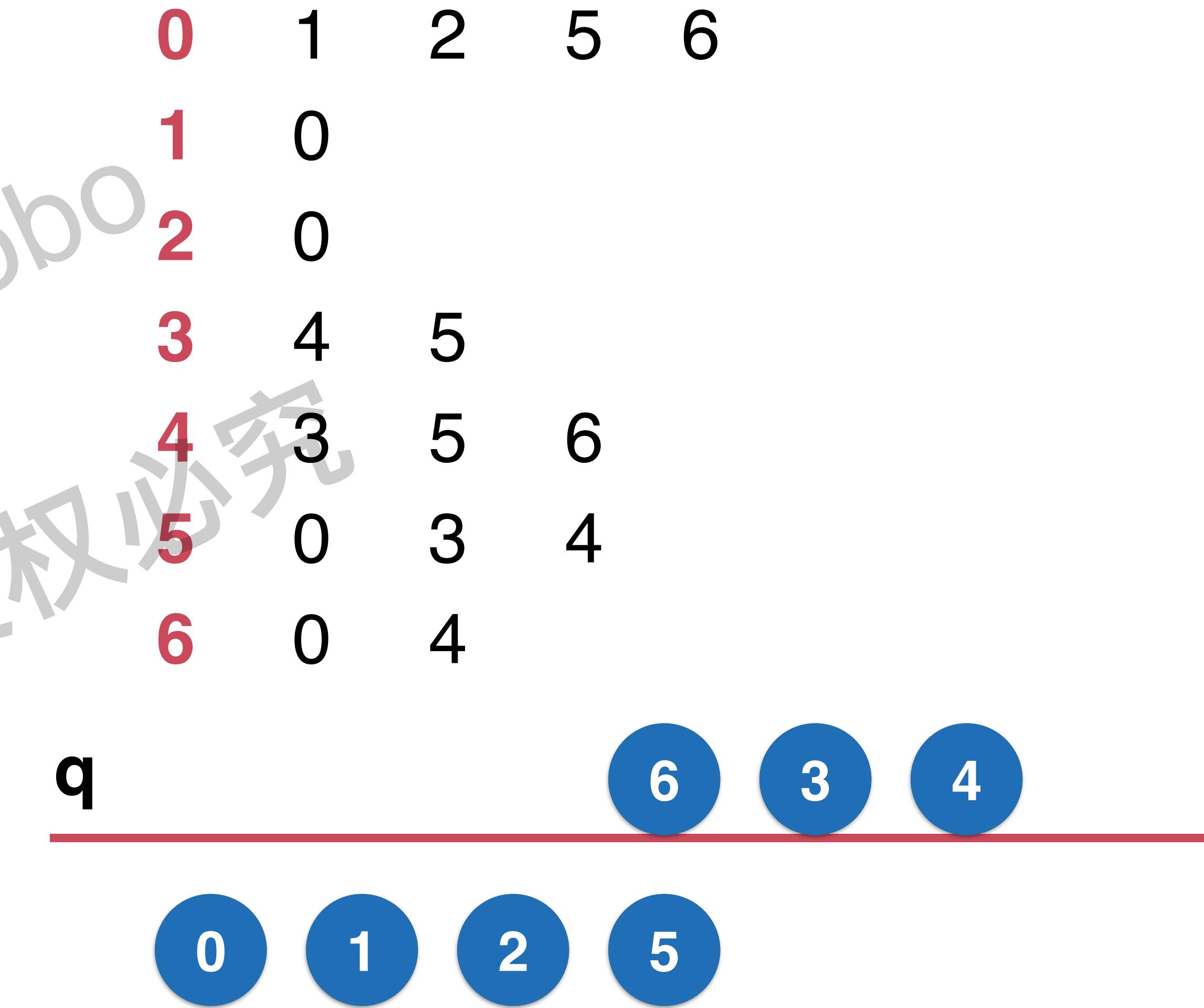
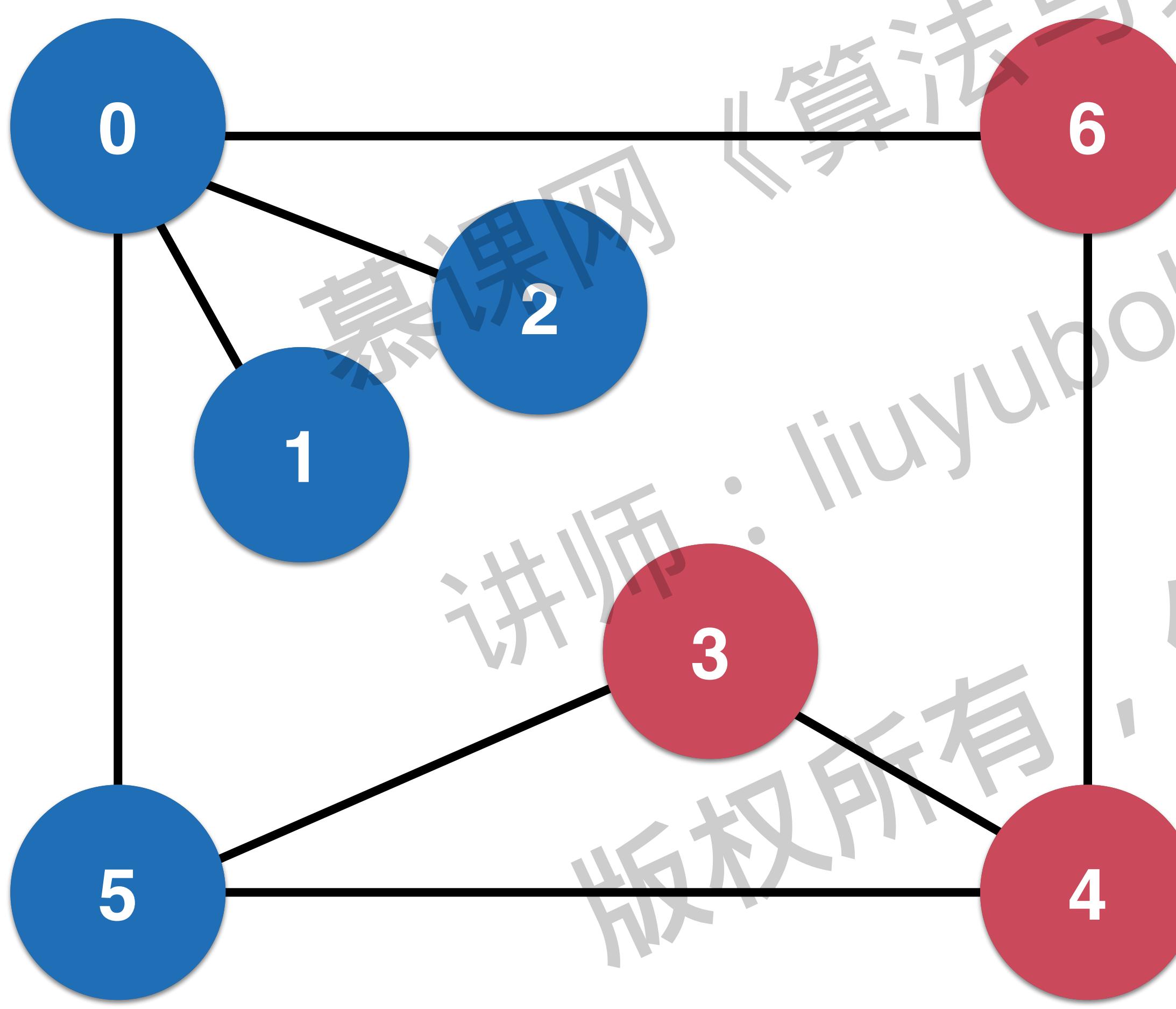
广度优先遍历



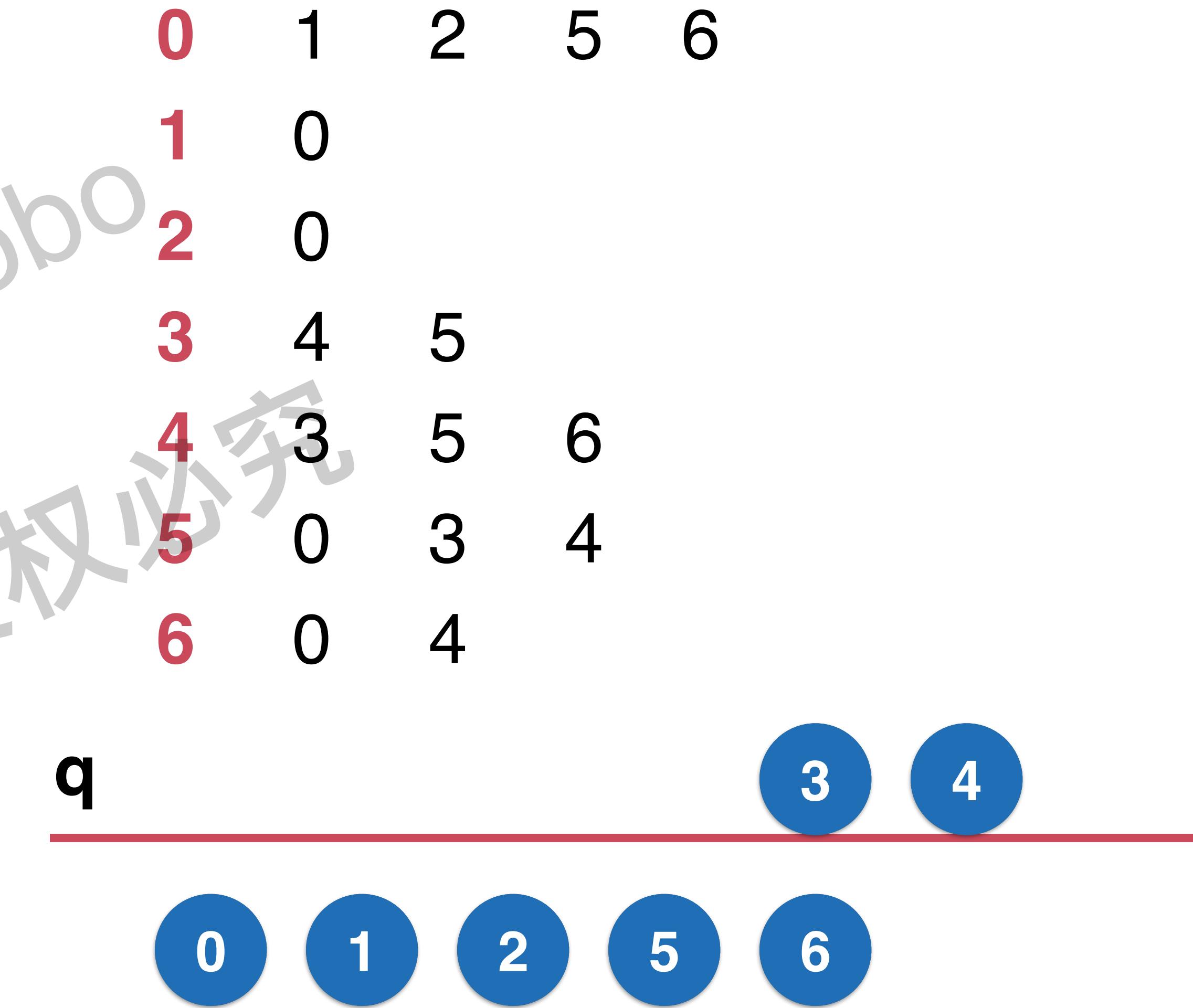
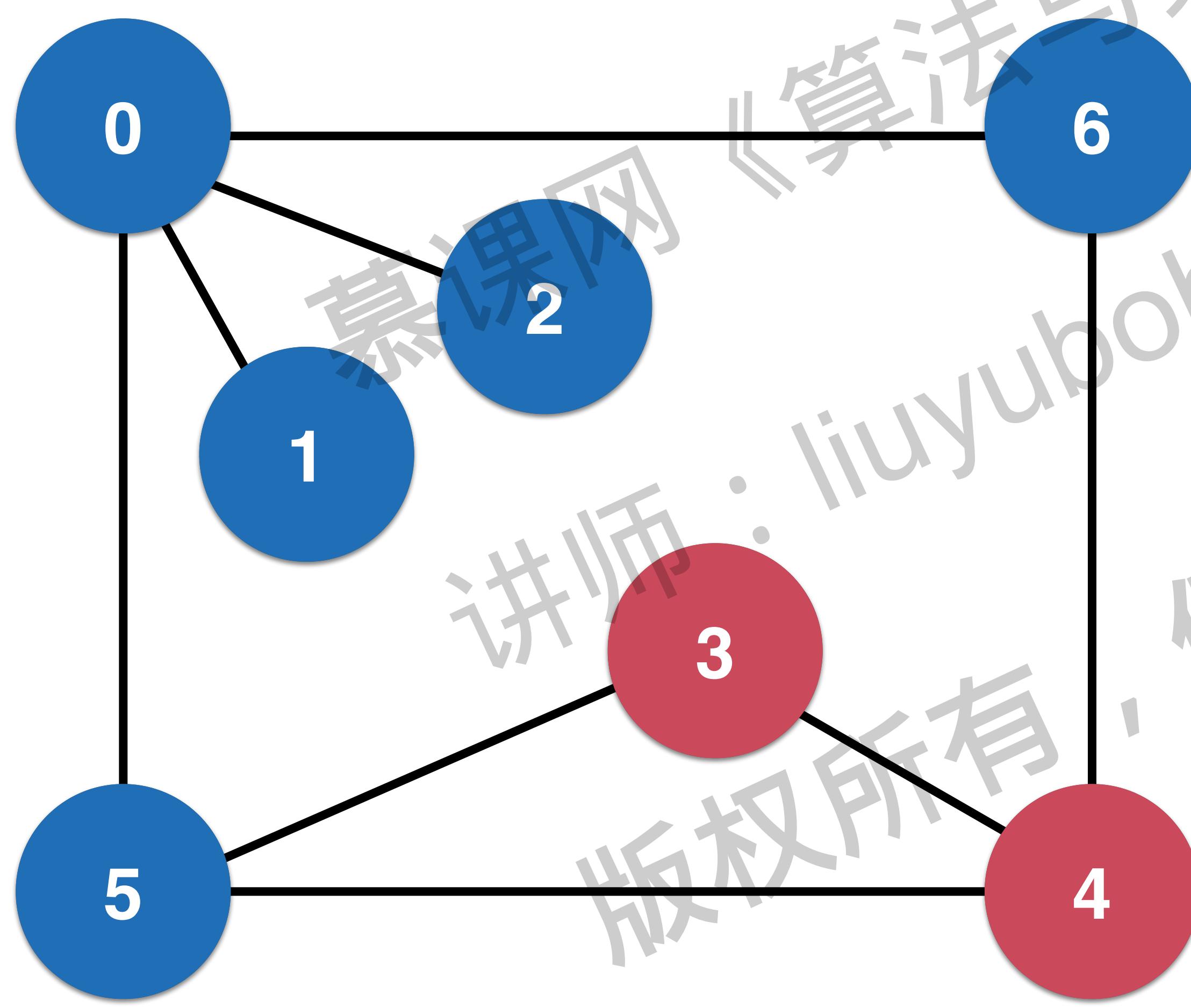
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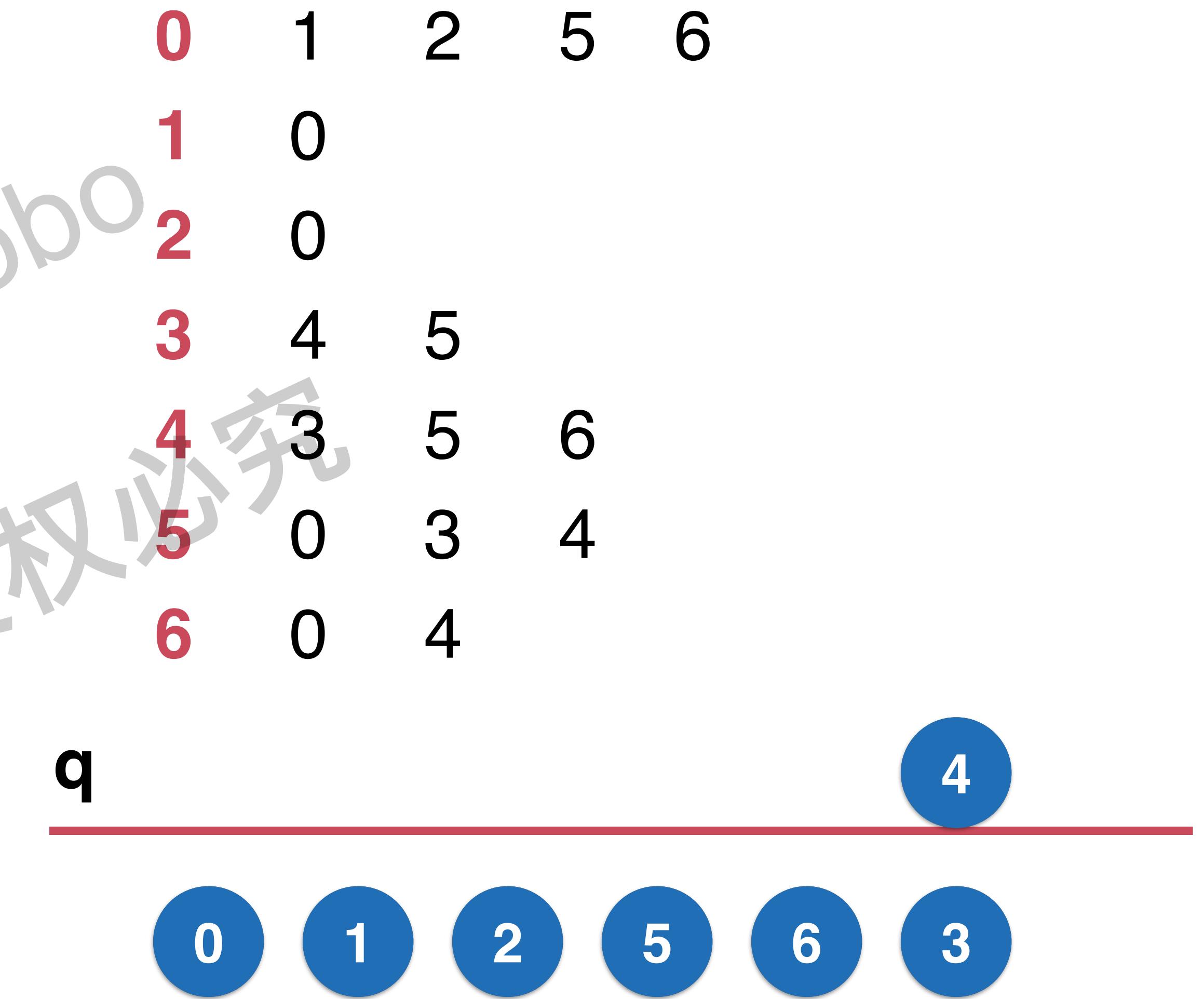
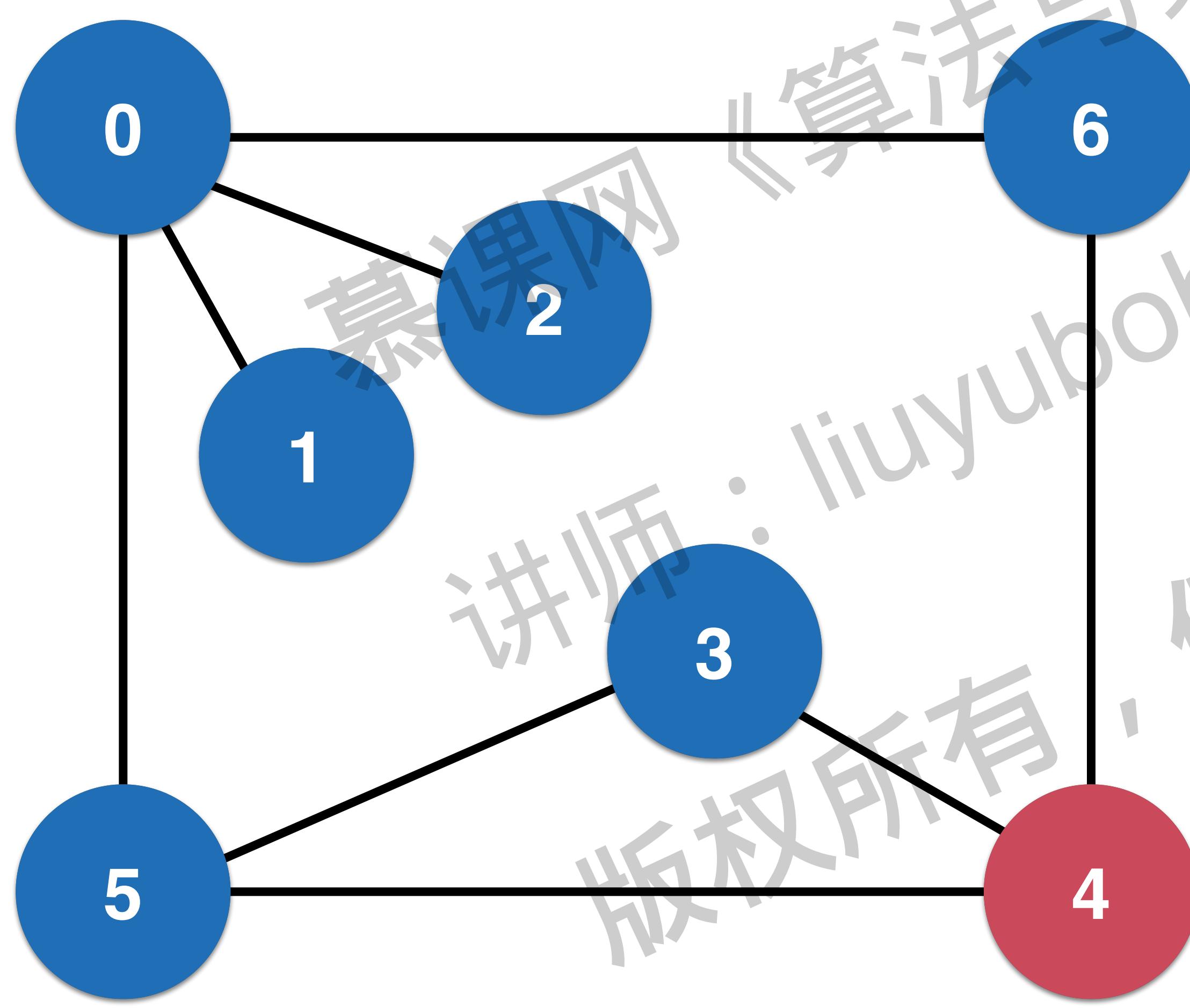
广度优先遍历



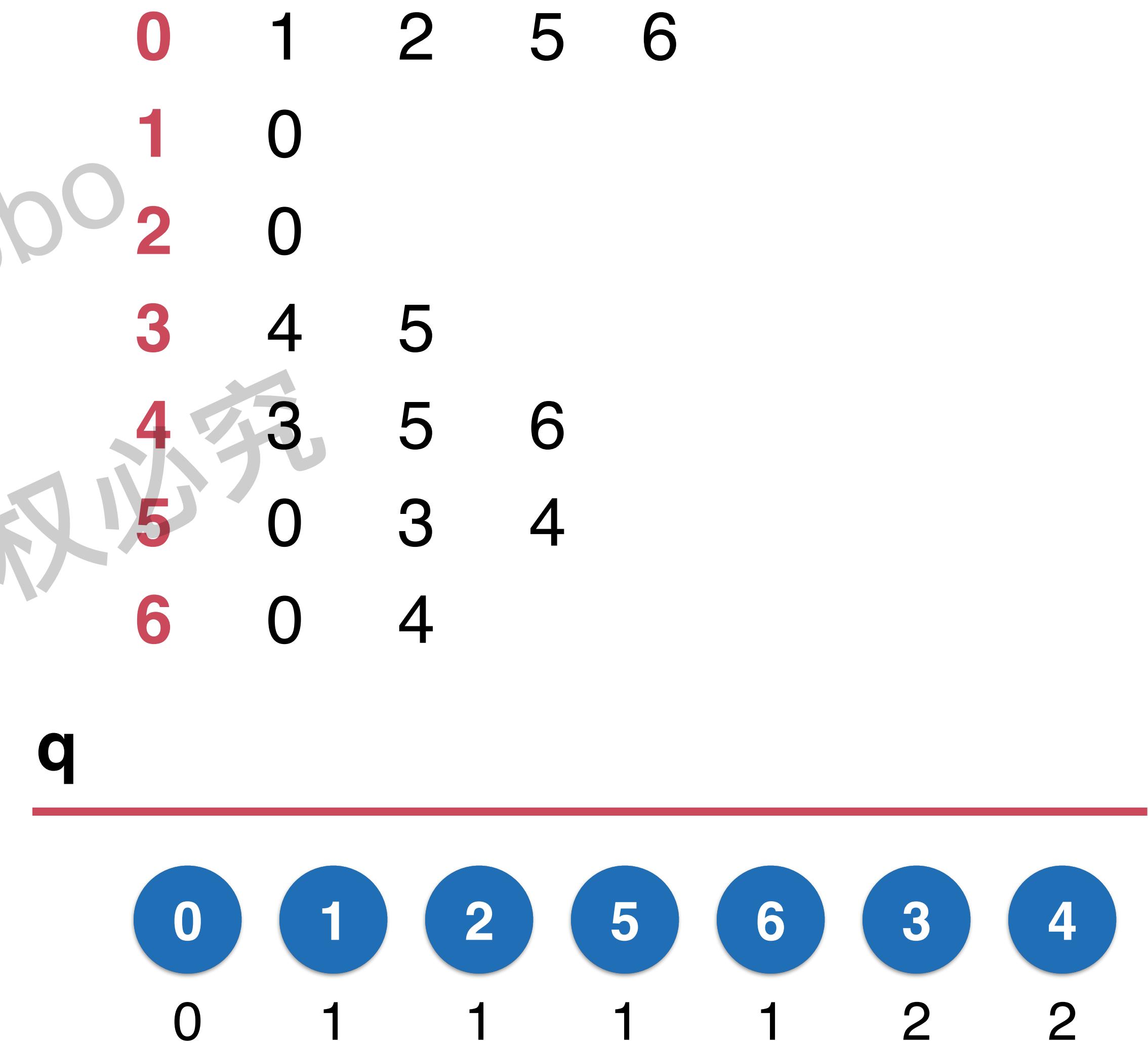
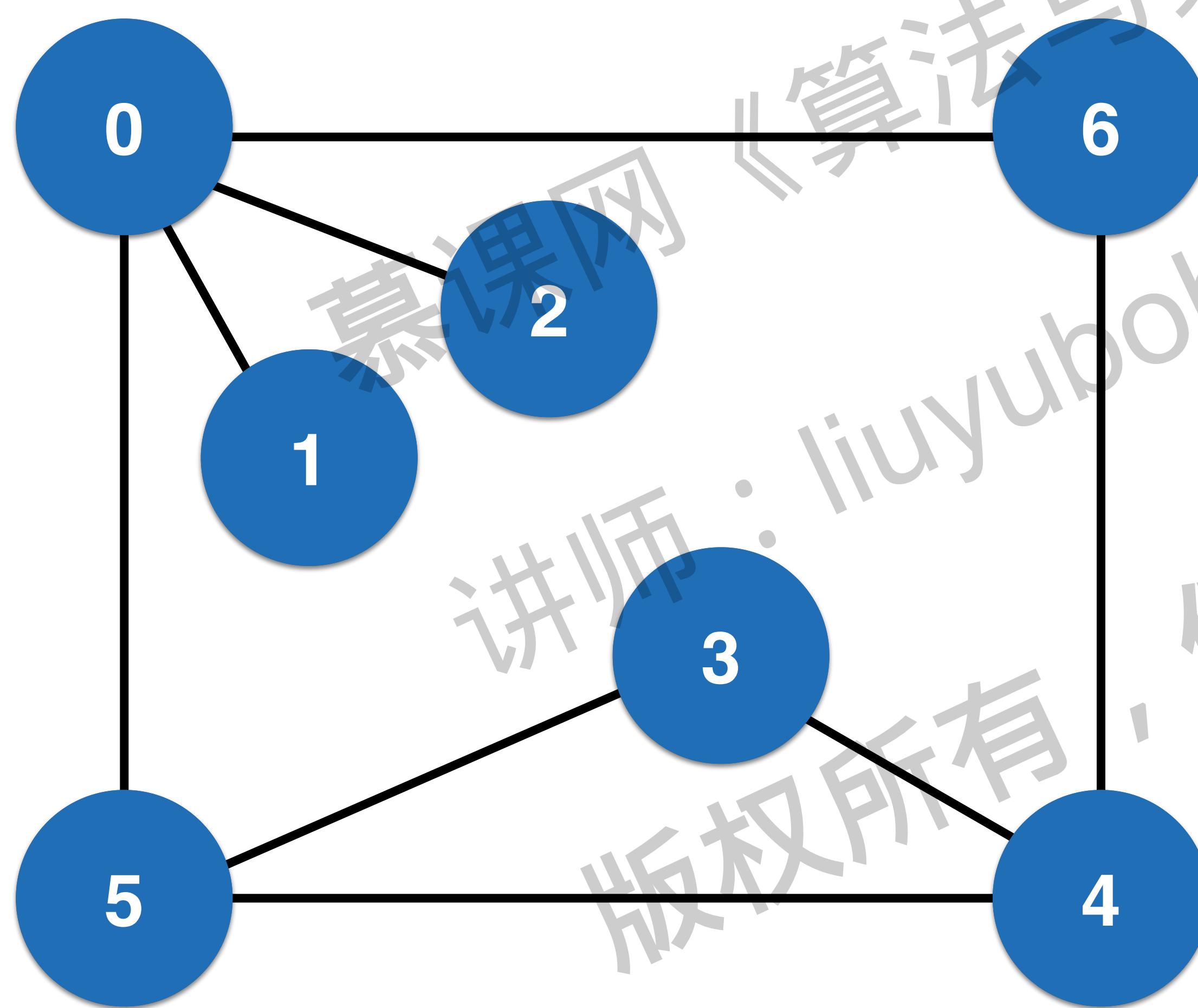
广度优先遍历



广度优先遍历



广度优先遍历



广度优先遍历求出了无权图的最短路径

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操作：广度优先遍历和无向图的最短路径

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图的广度优先遍历-复杂度

稀疏图 (邻接表) : $O(V + E)$

稠密图 (邻接矩阵) : $O(V^2)$

更多无权图算法

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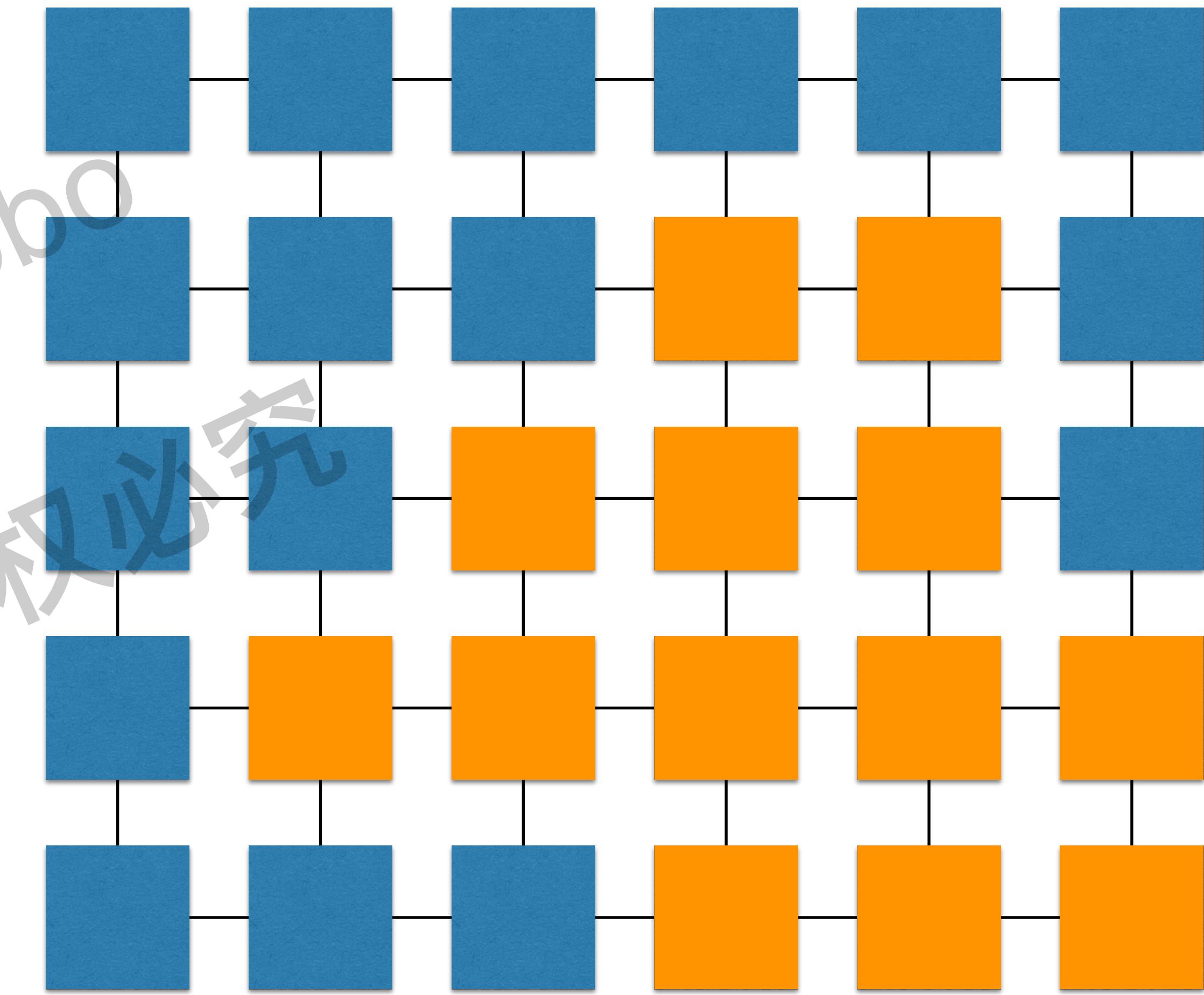
flood fill



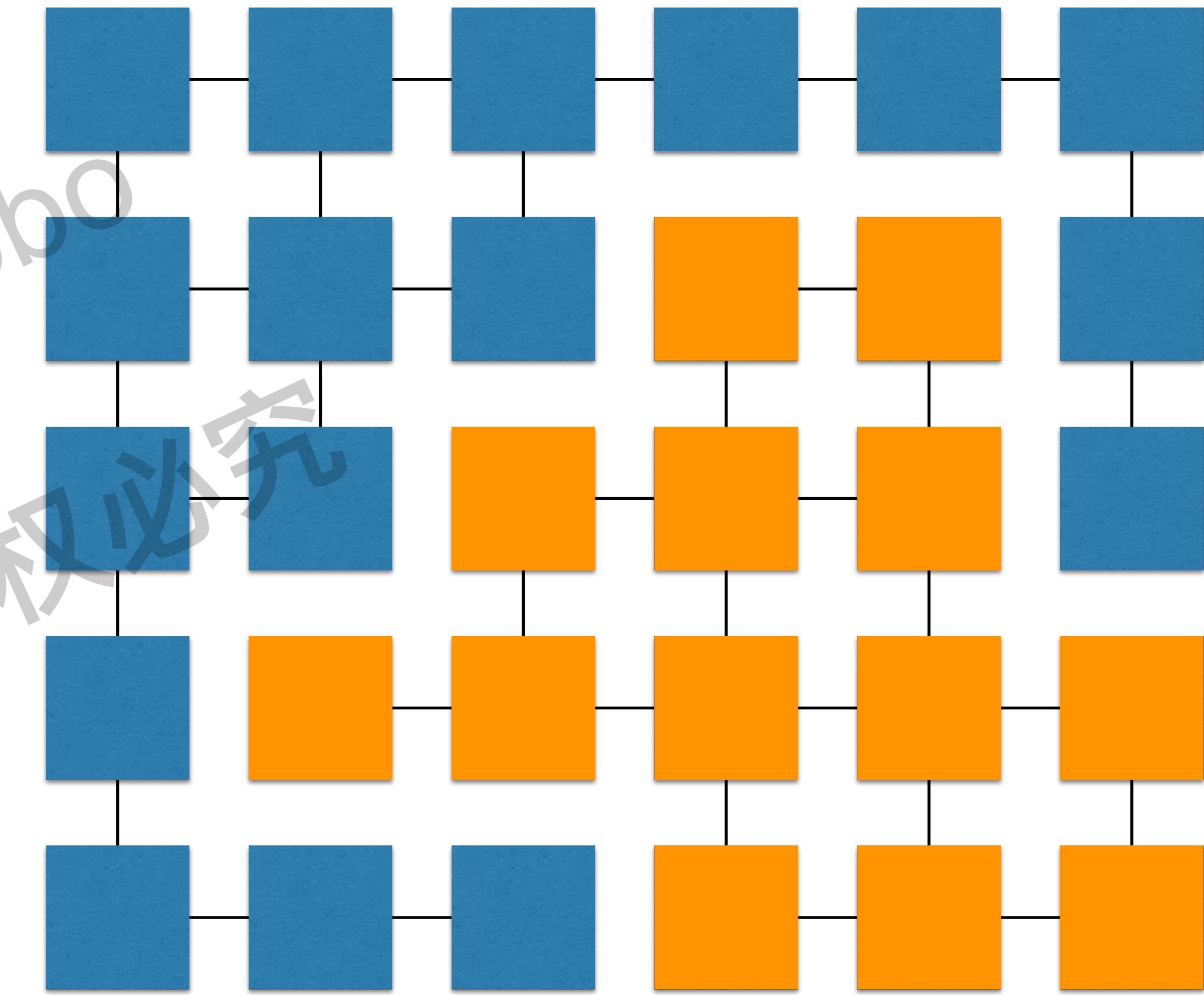
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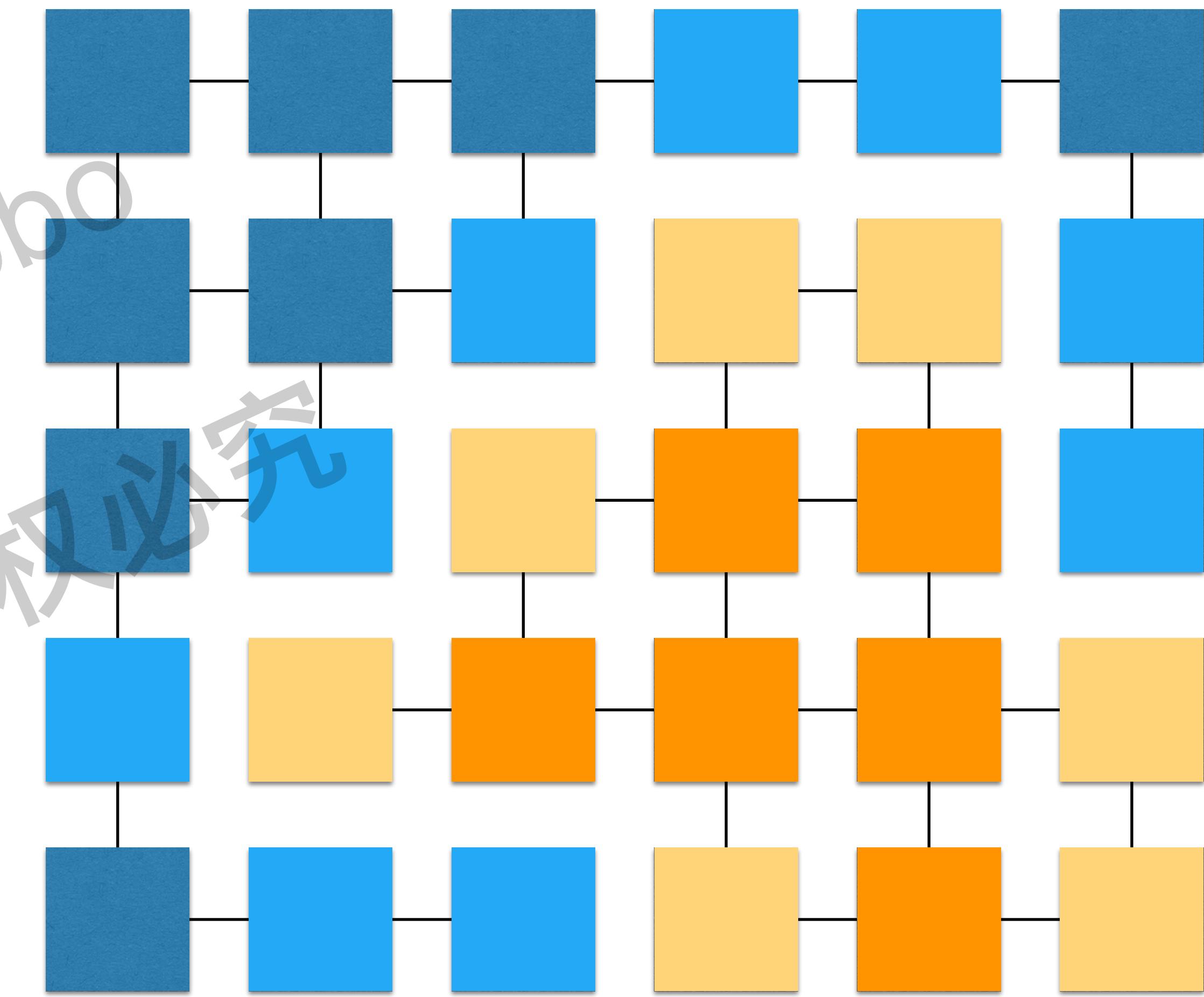
flood fill



flood fill



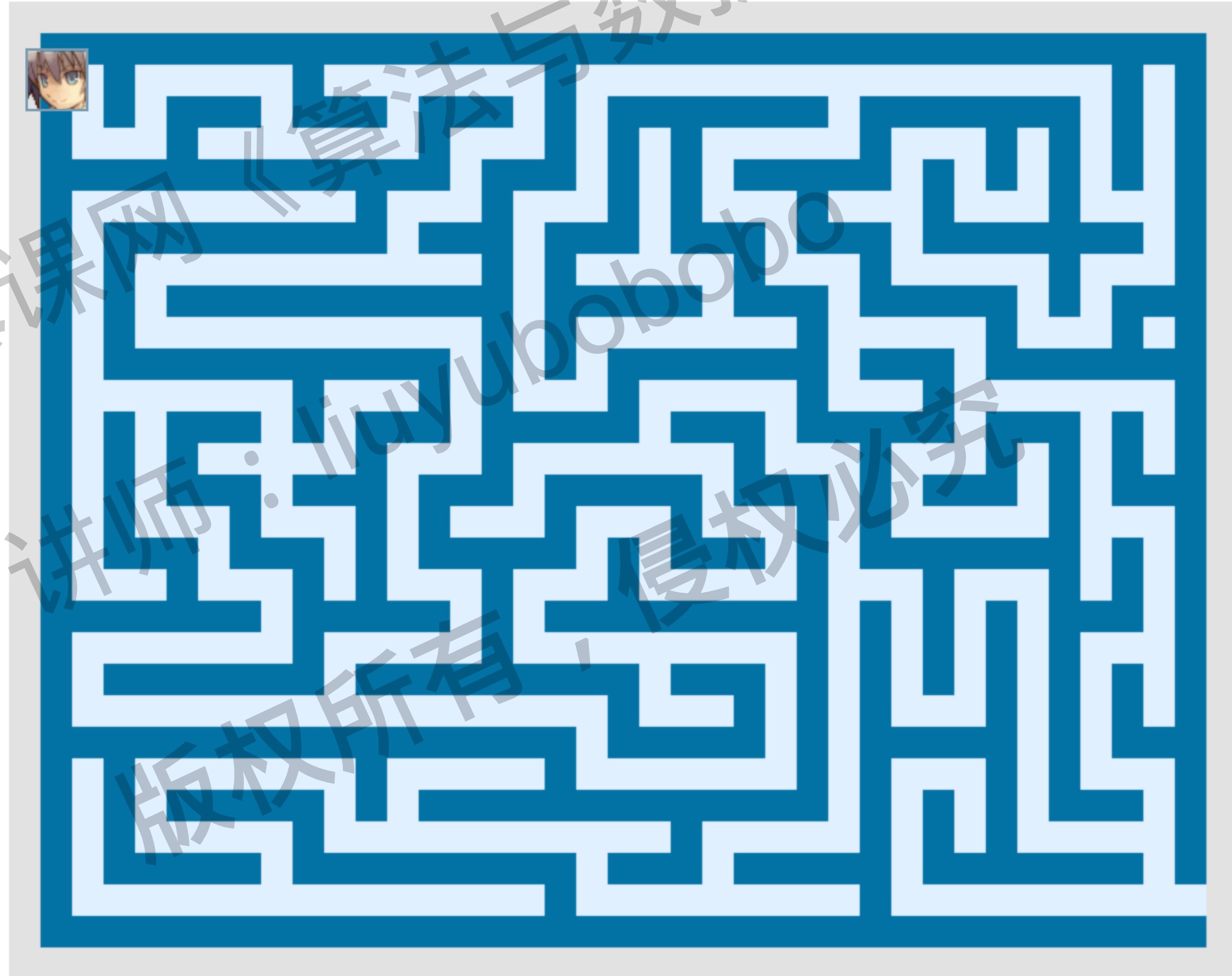
flood fill



扫雷

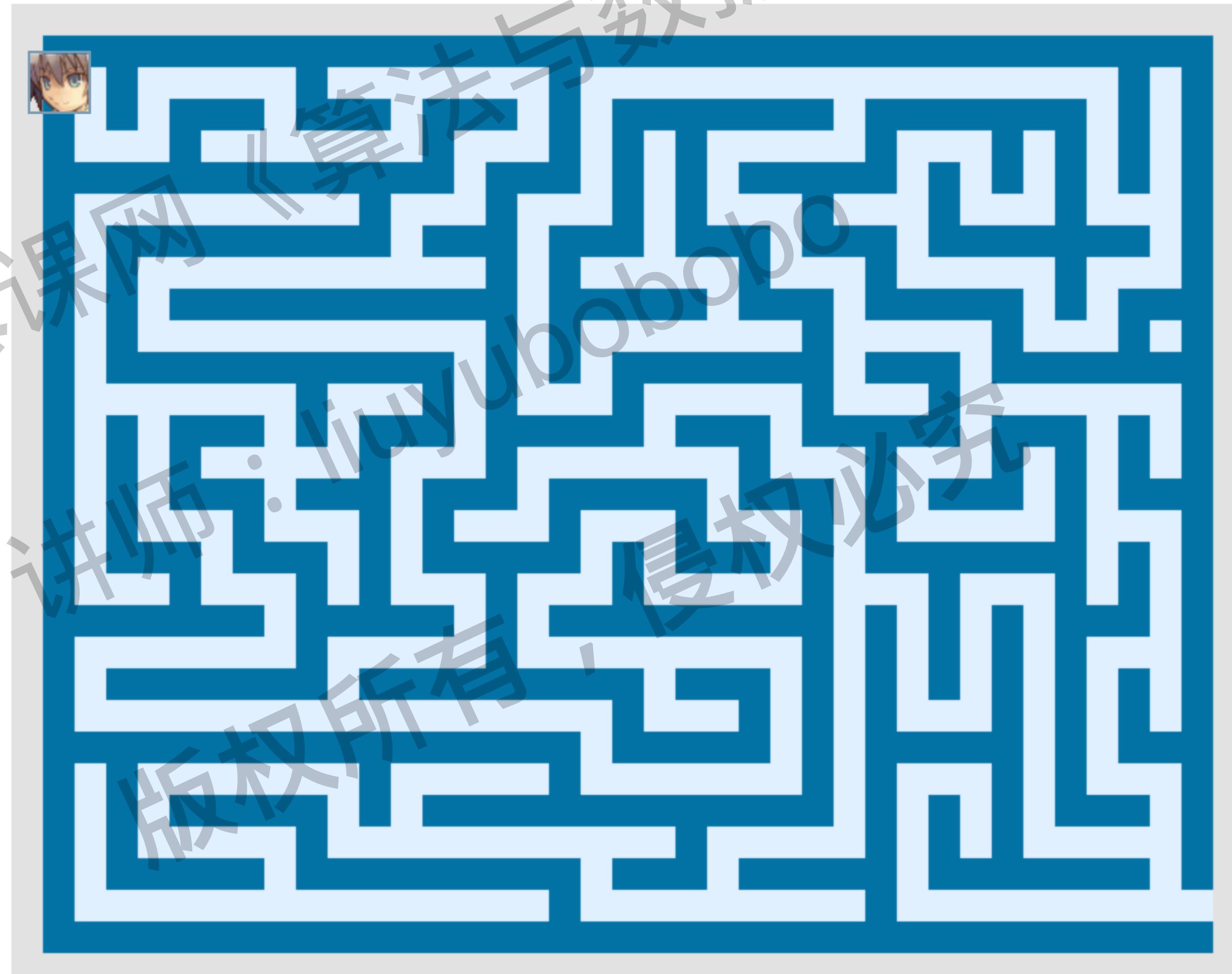


走迷宫

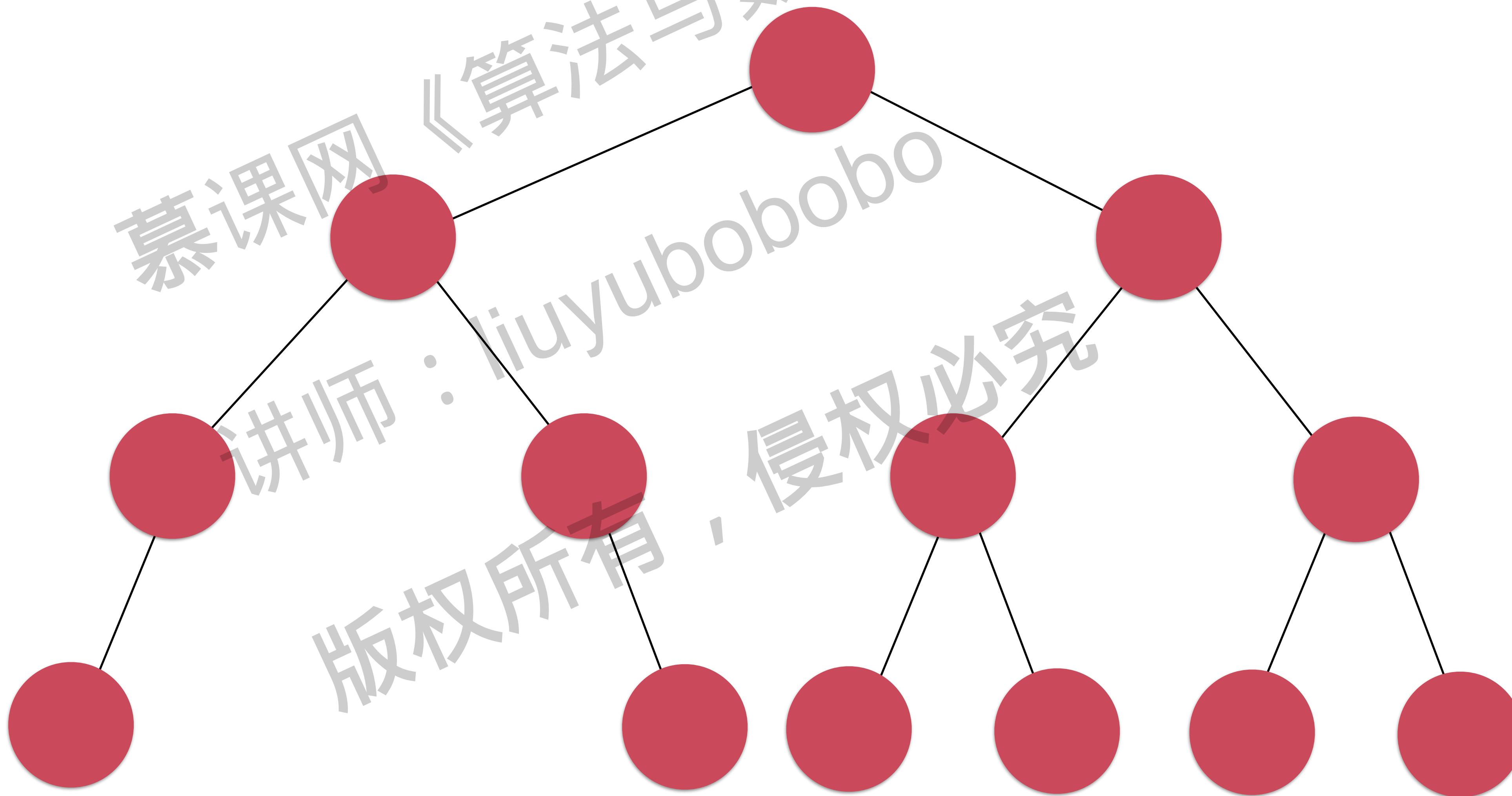


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迷宫生成



迷宫的本质是一棵树

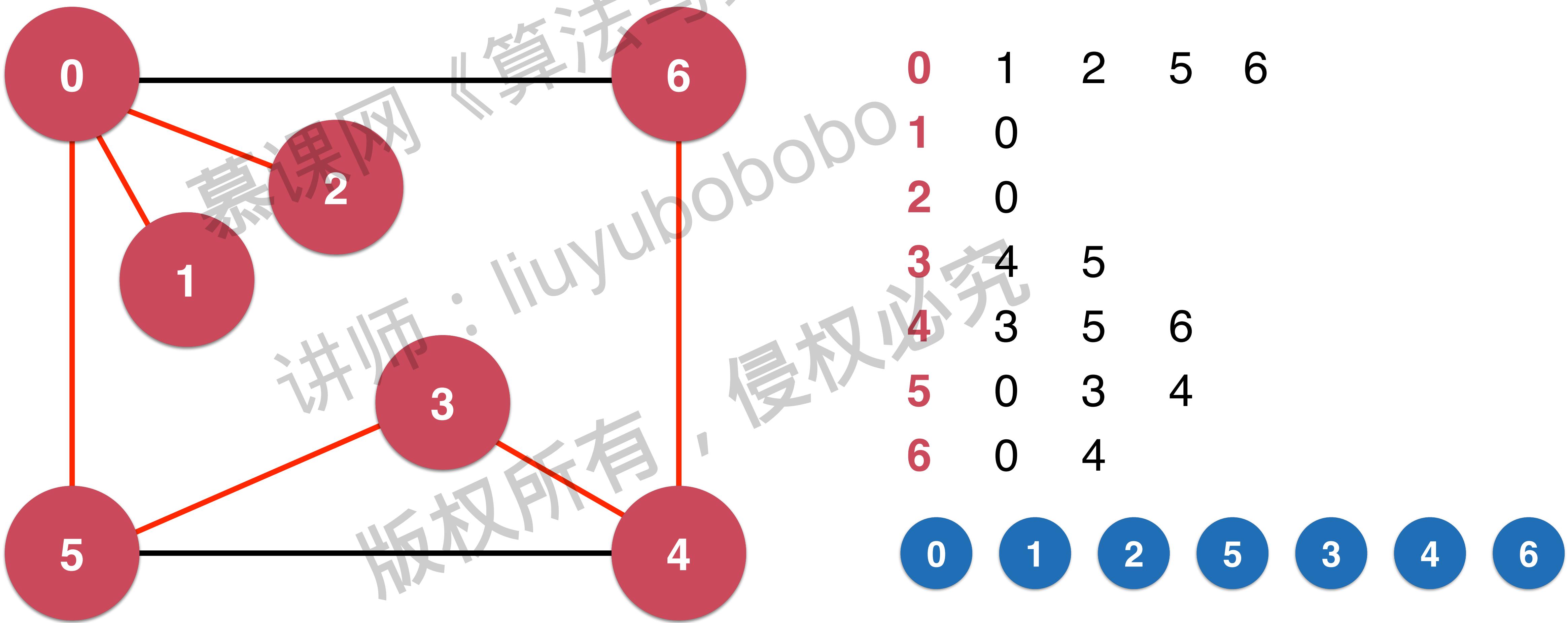


迷宫生成 是一个生成树的过程

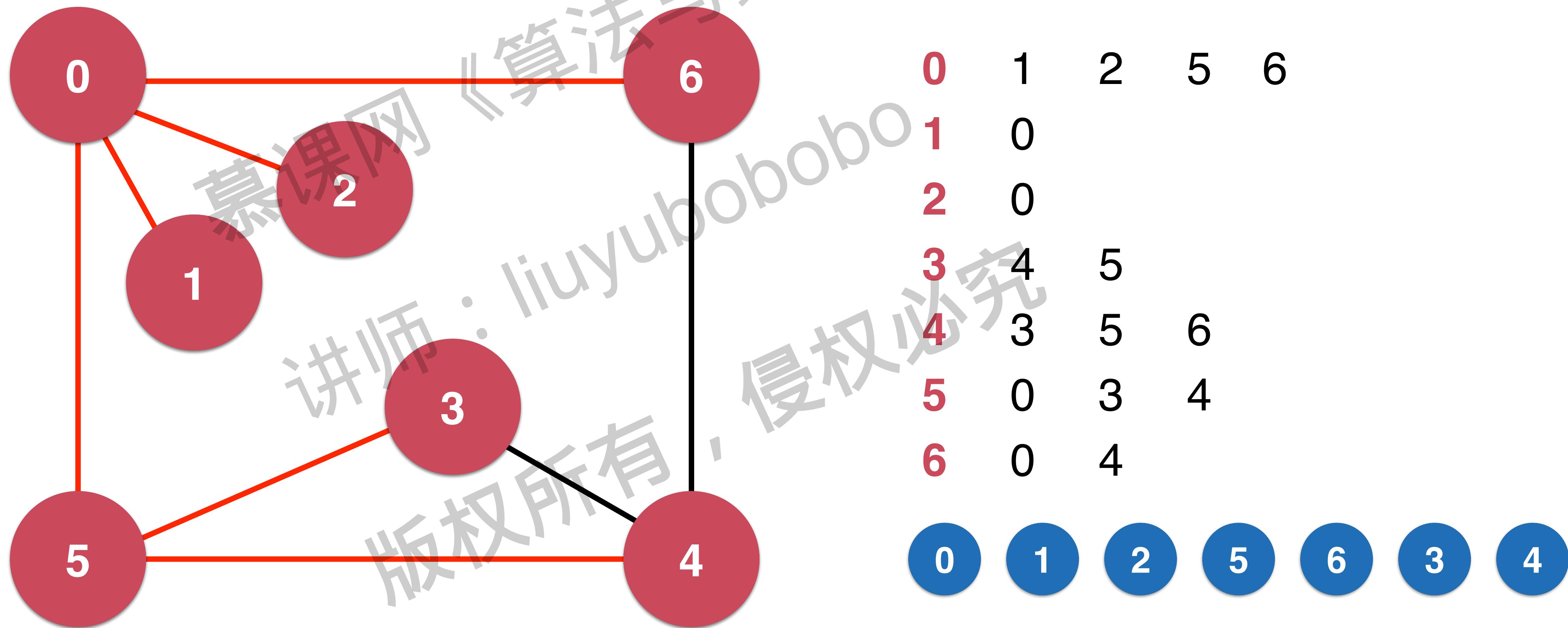
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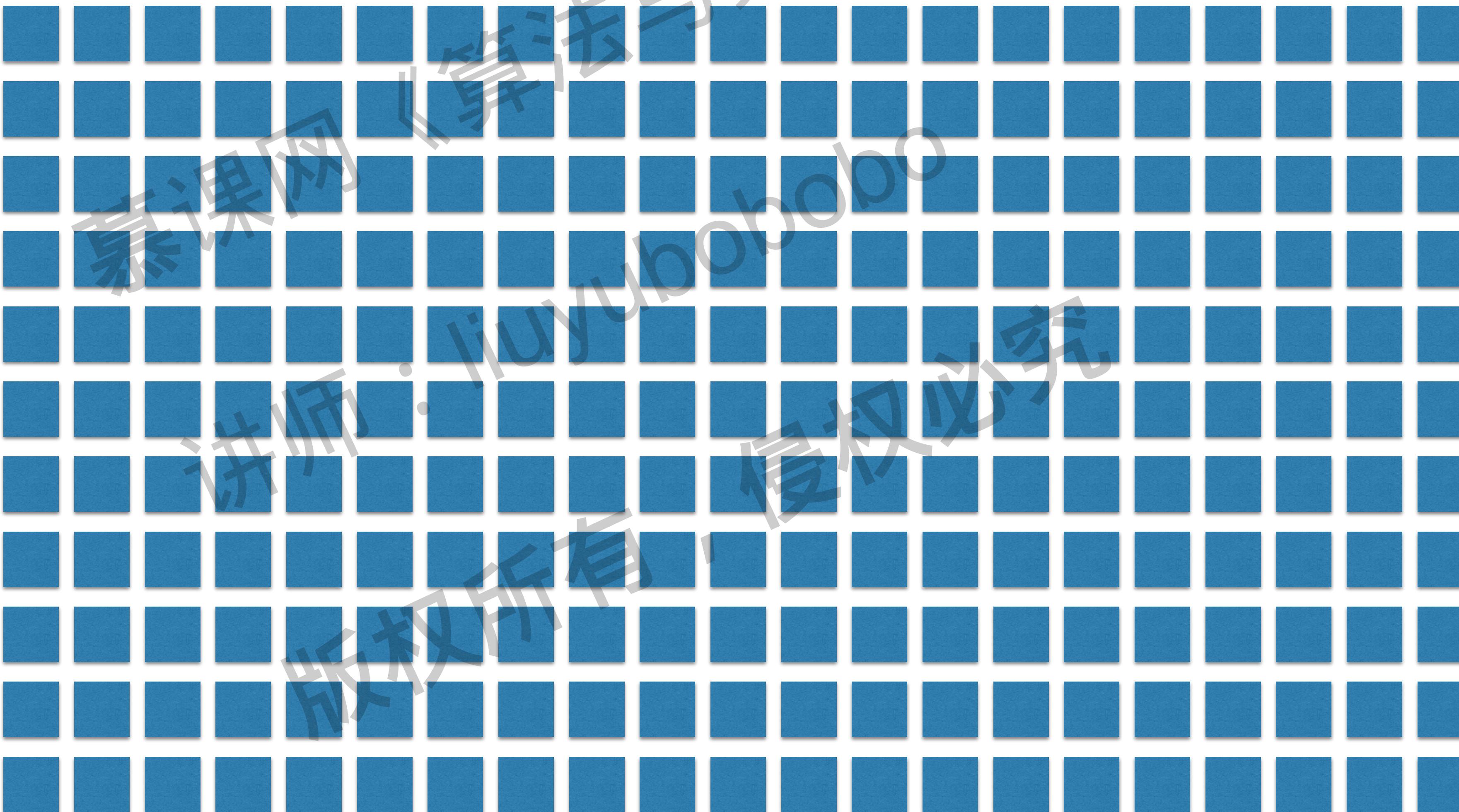
深度优先遍历



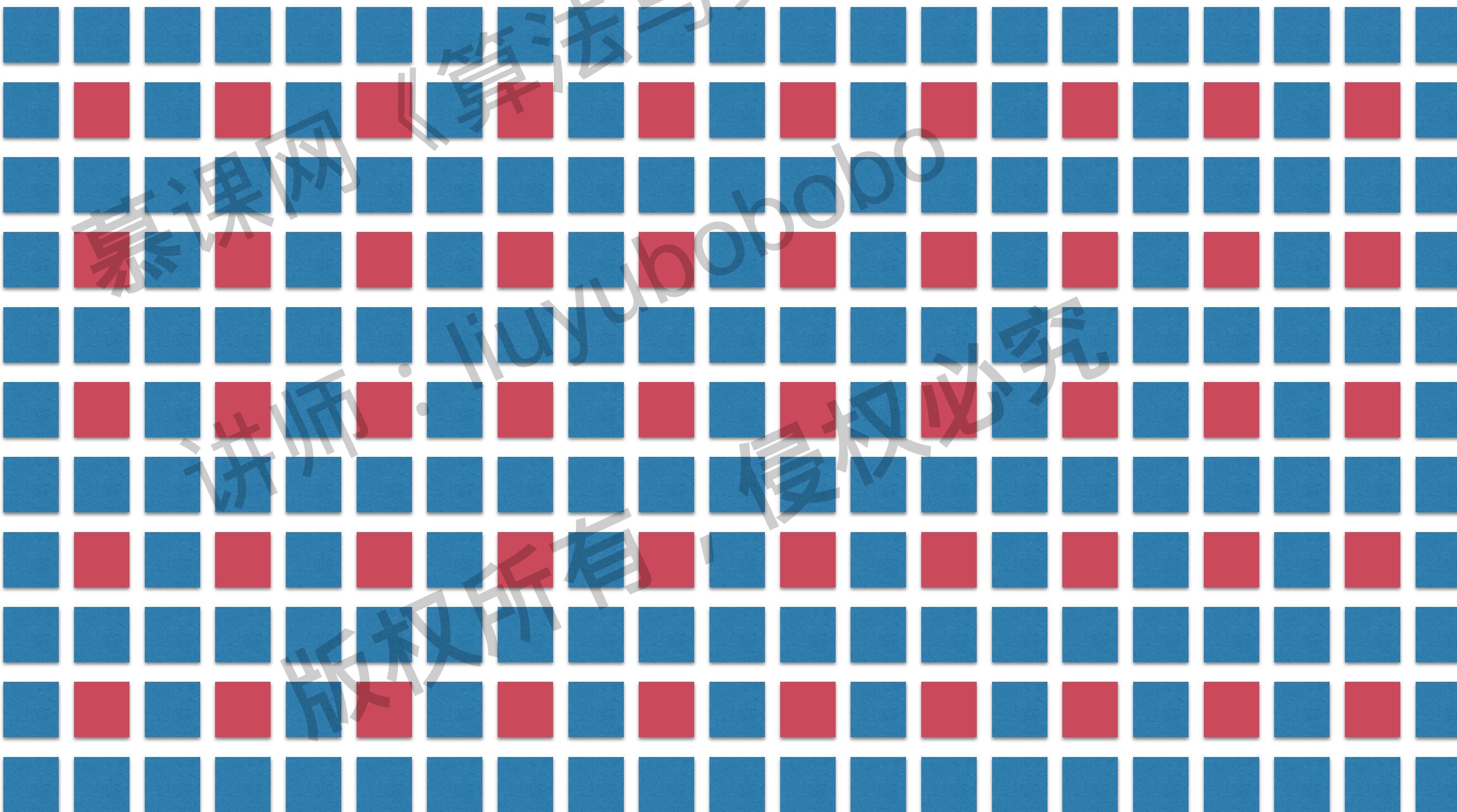
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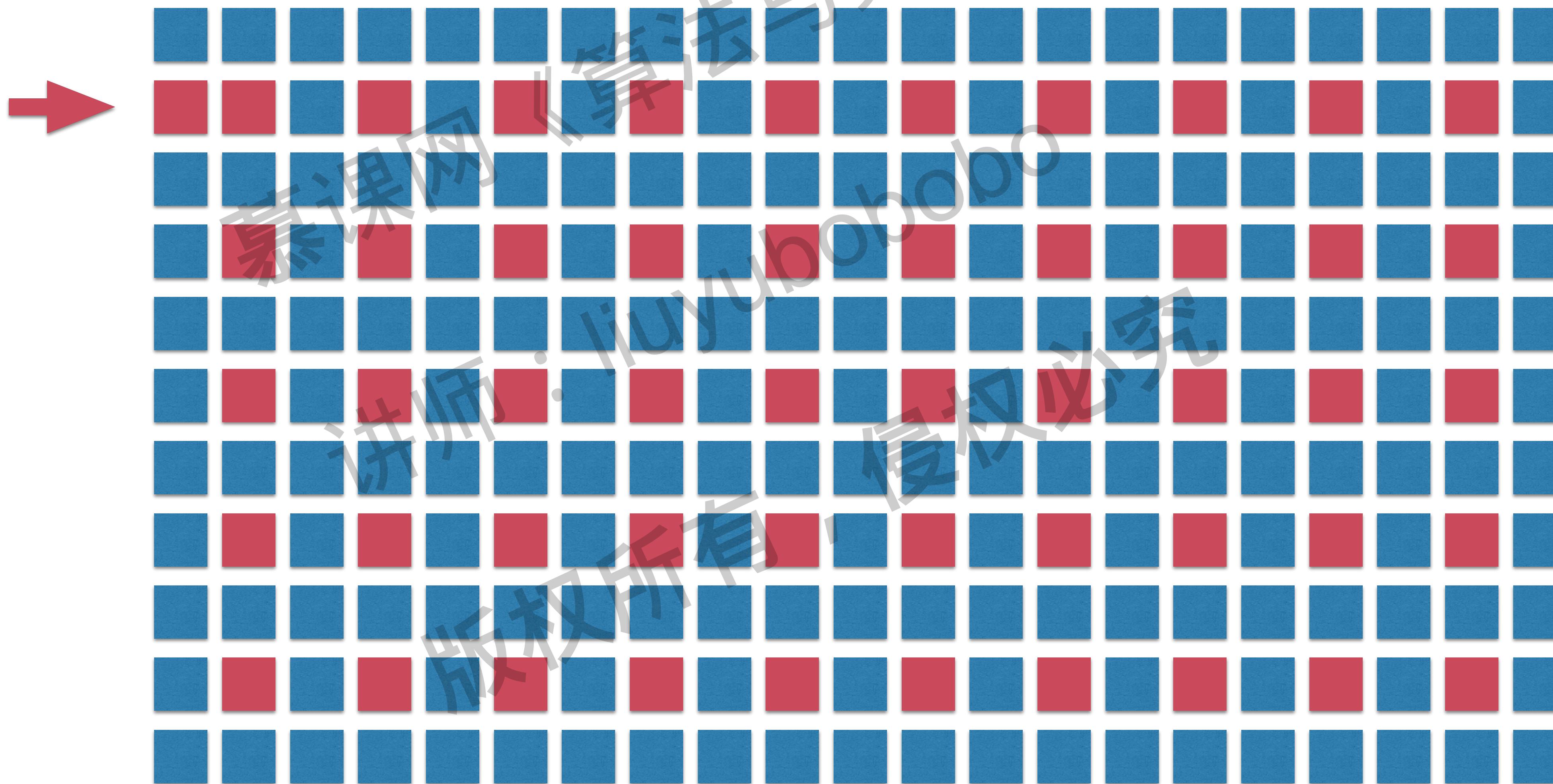
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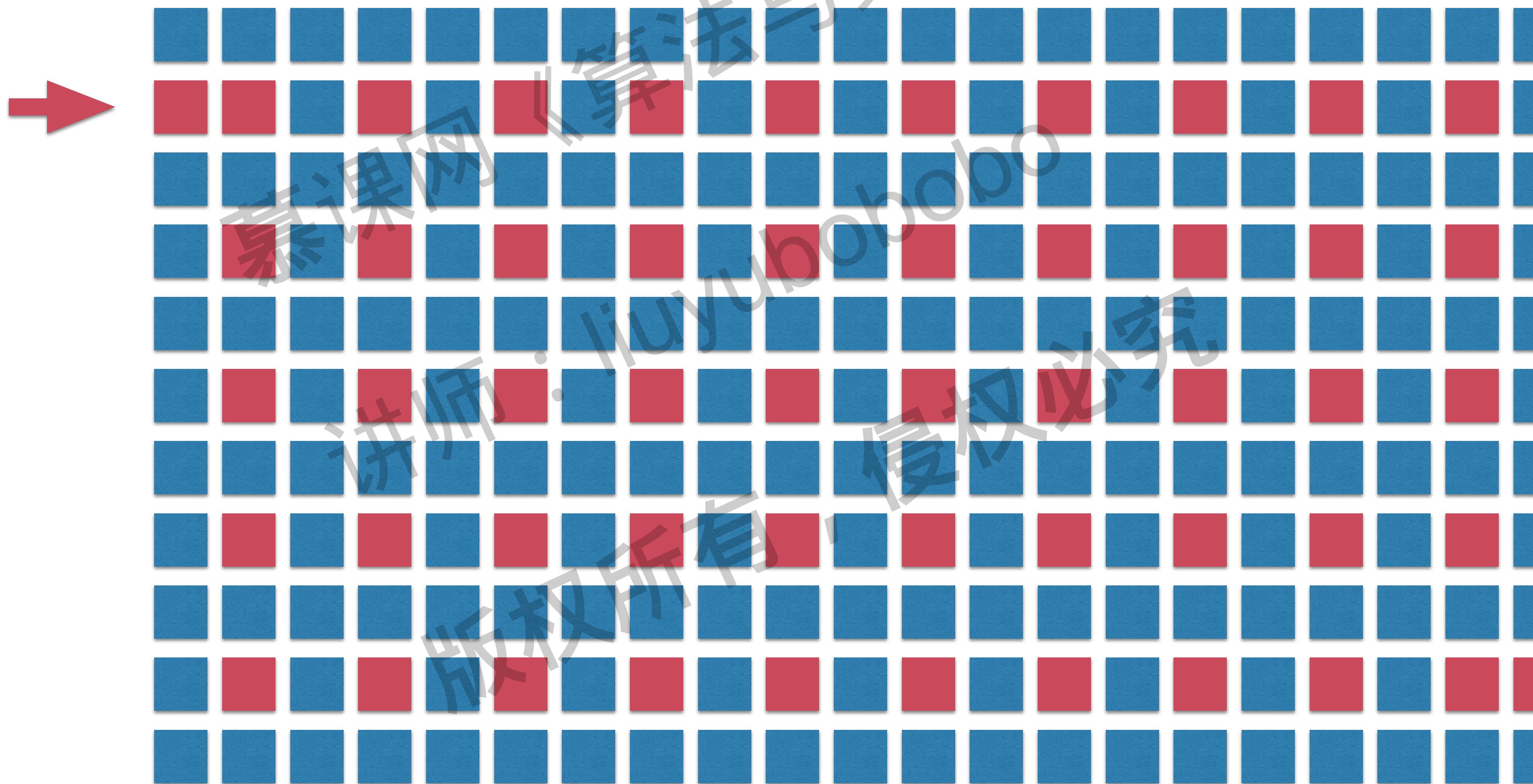
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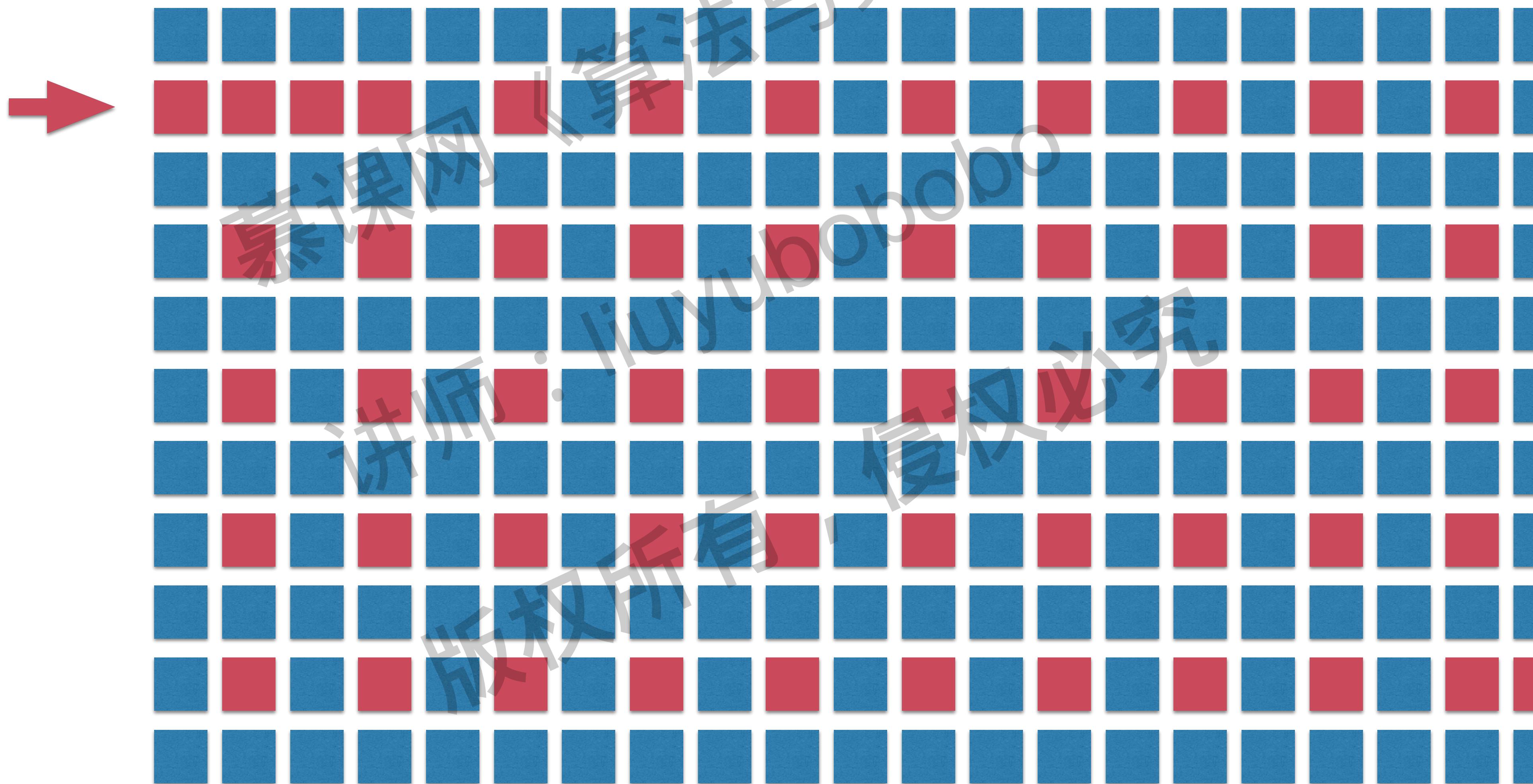
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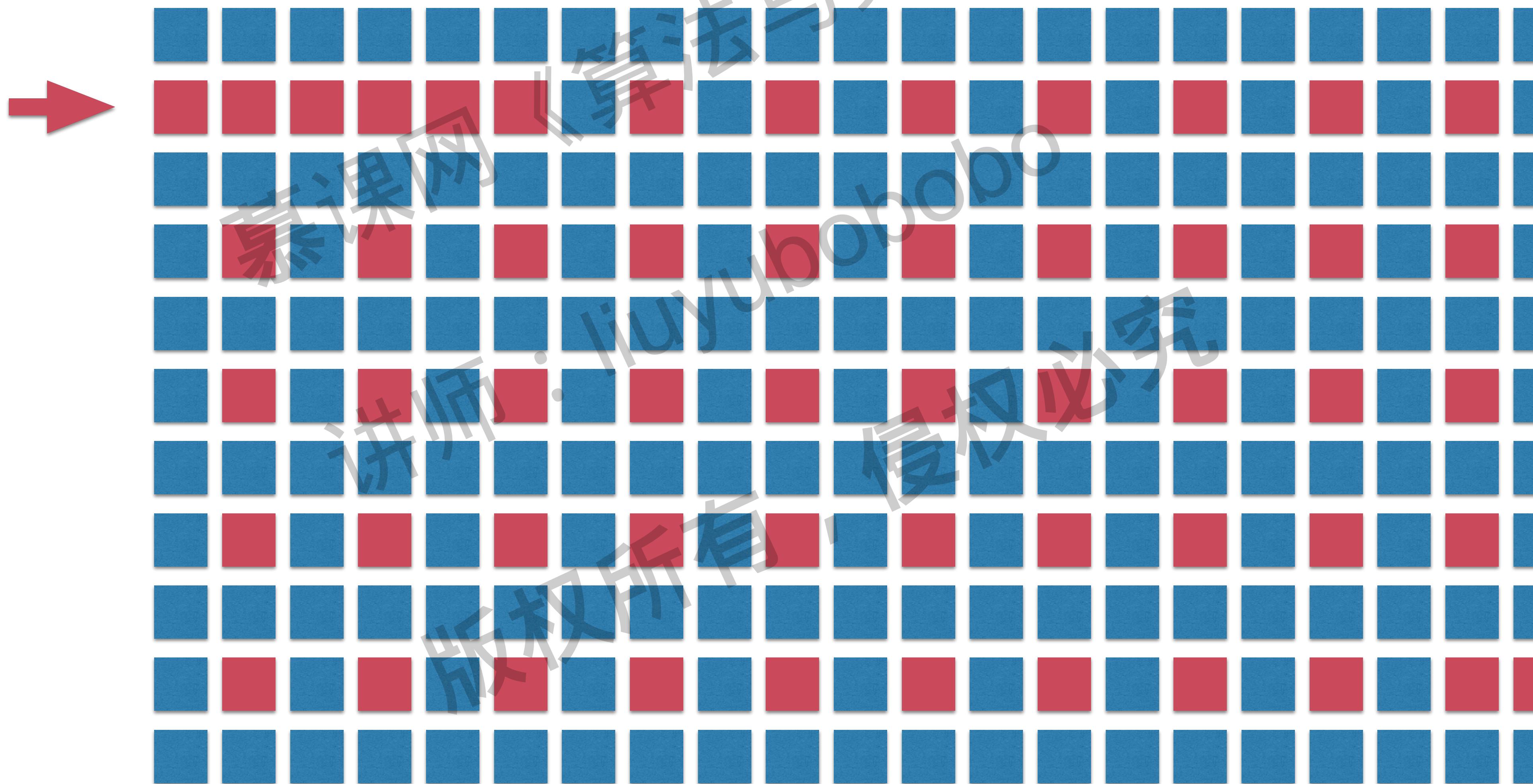
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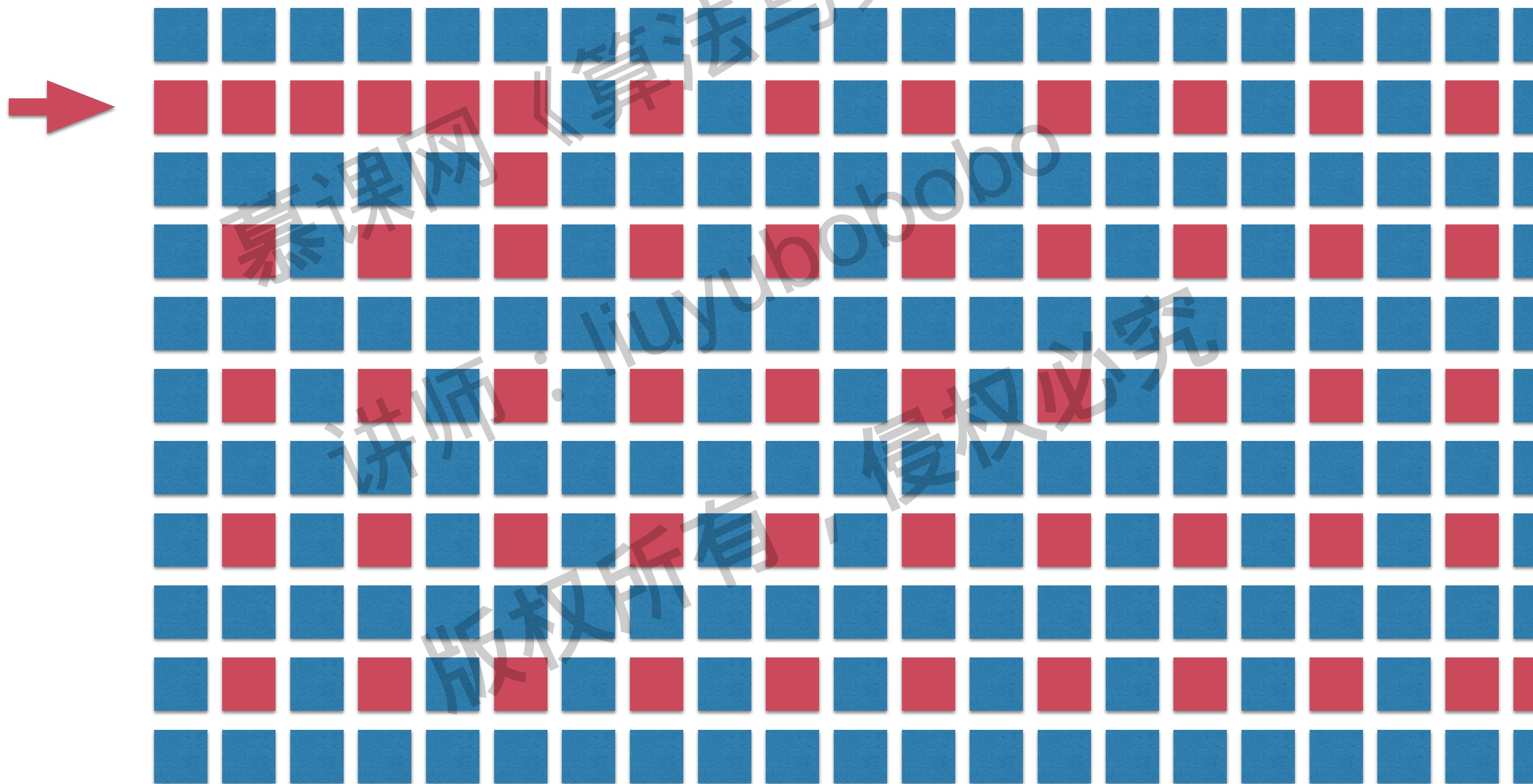
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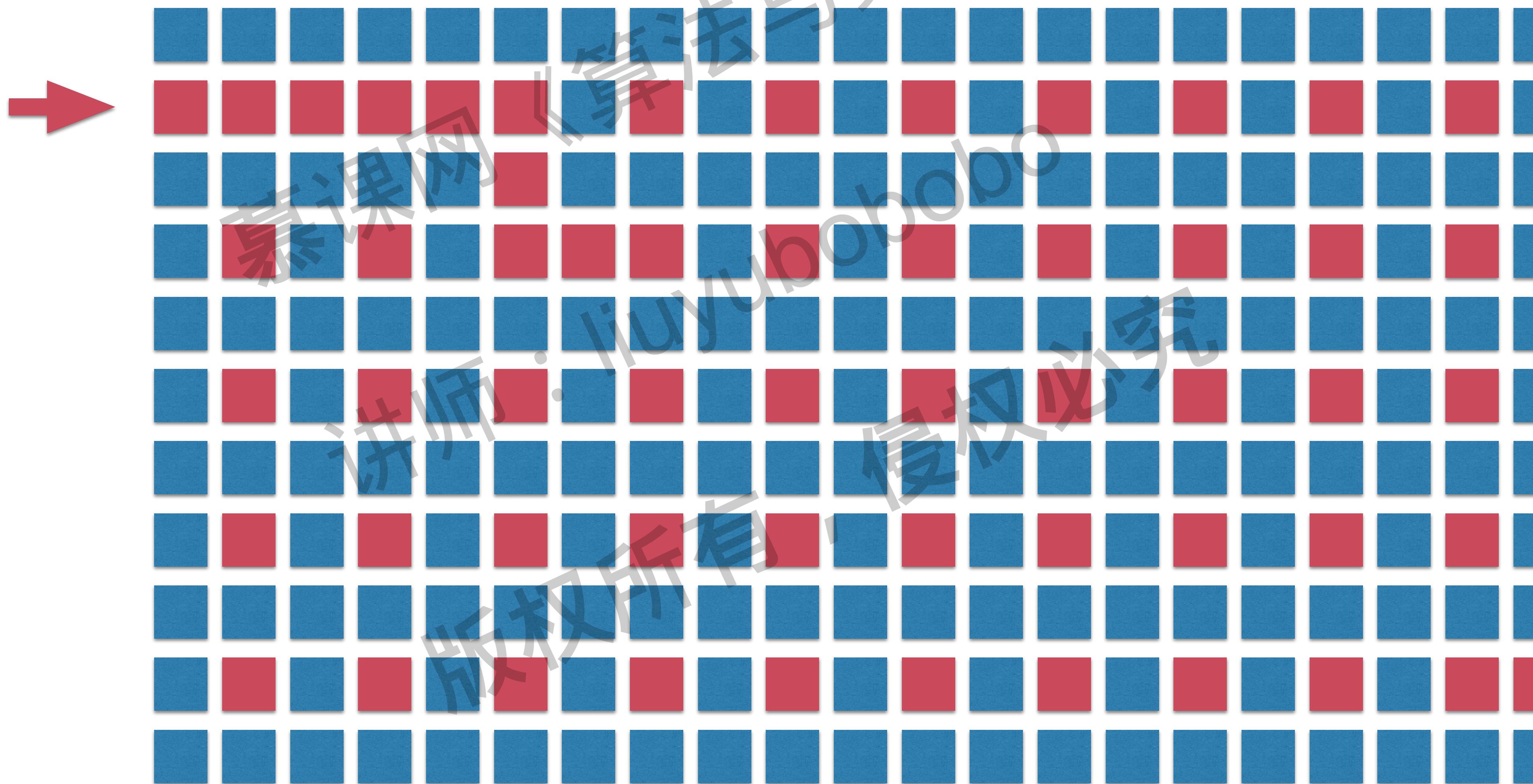
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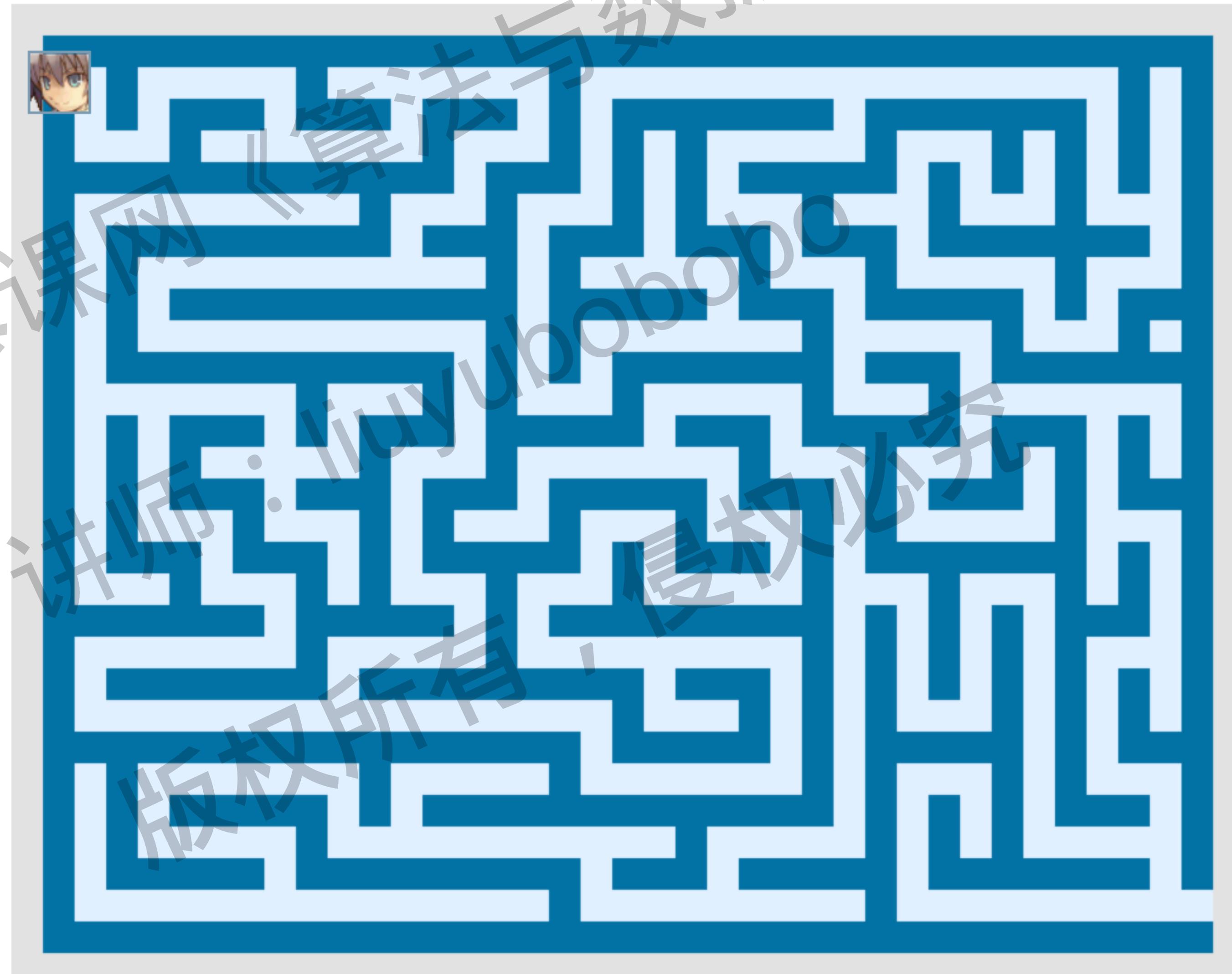
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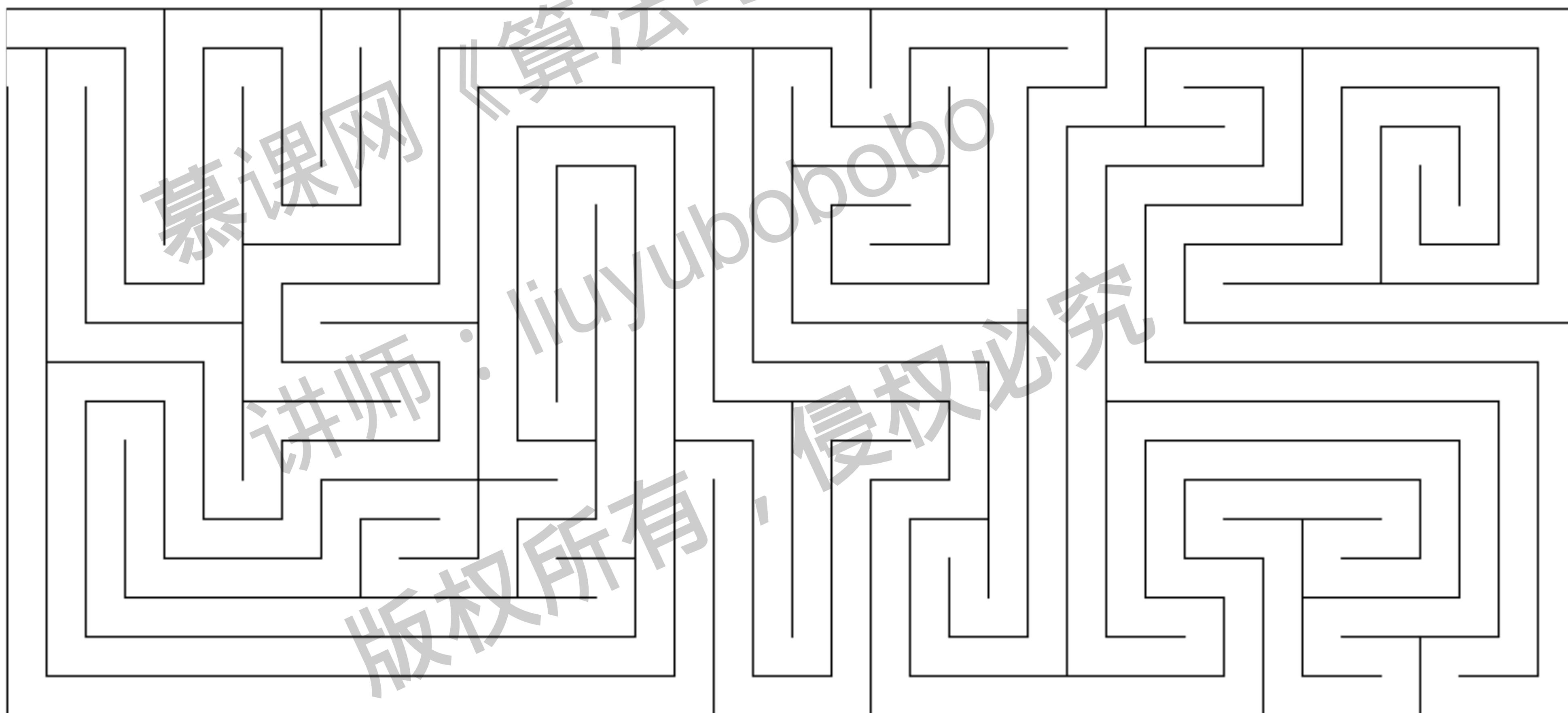
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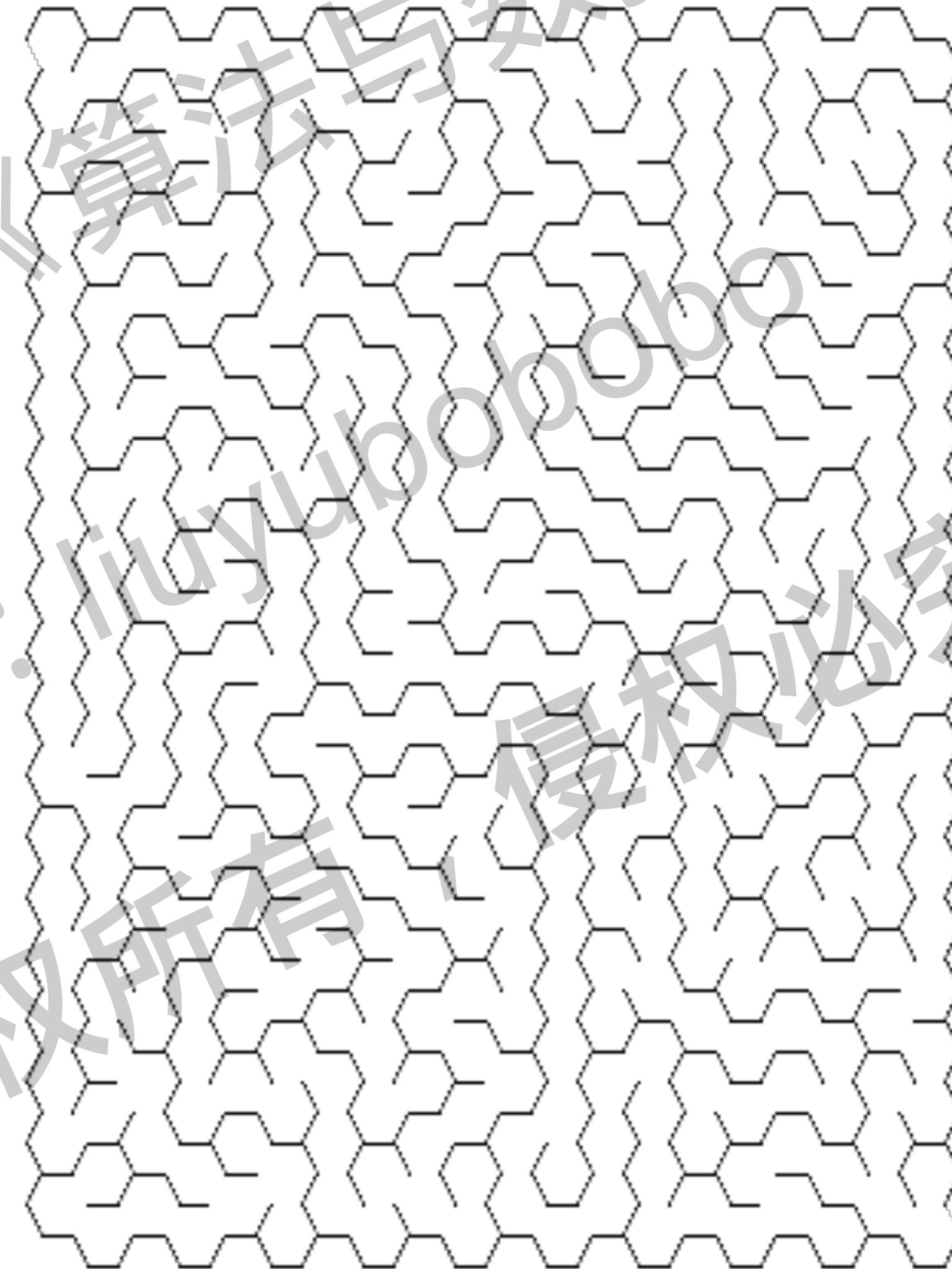
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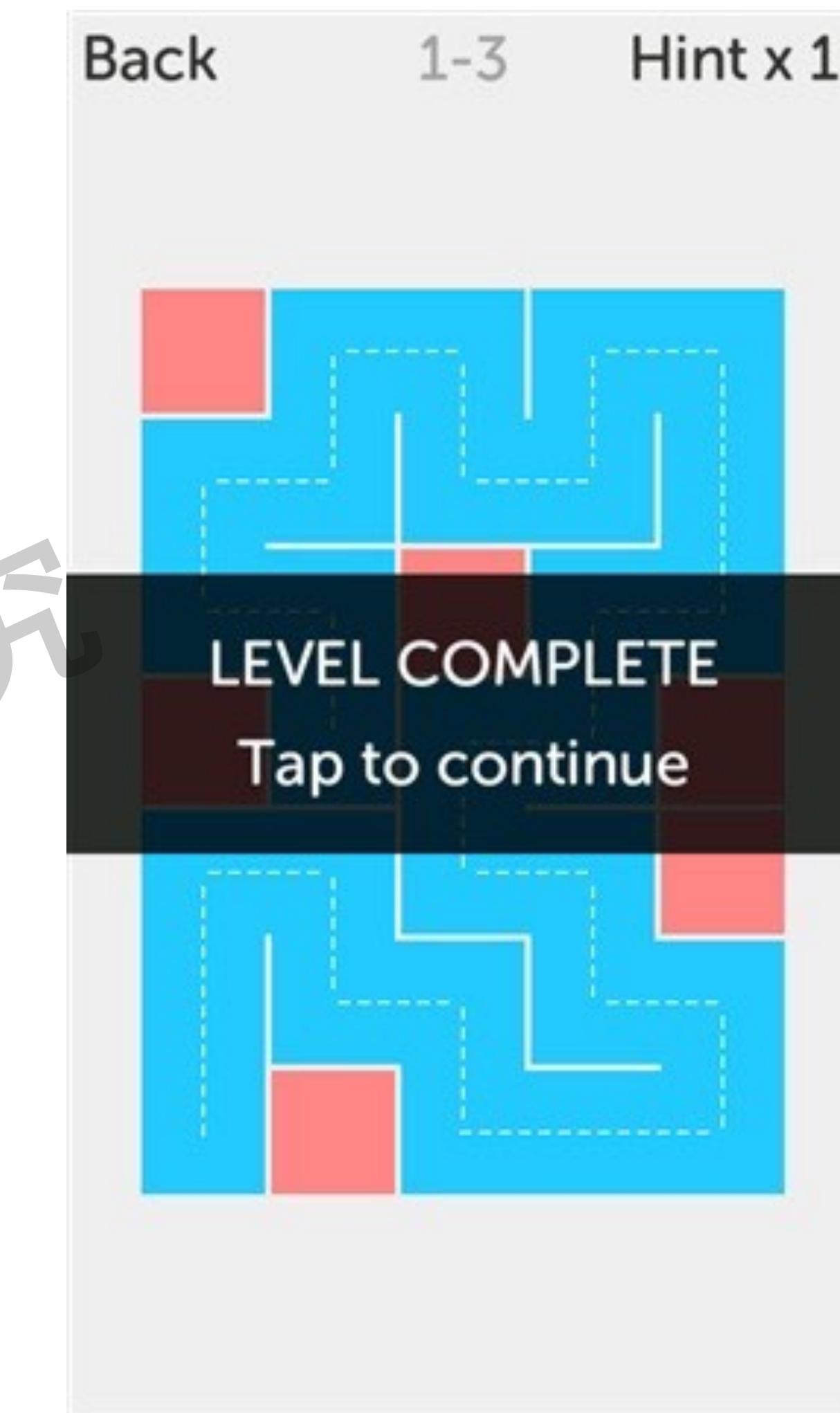
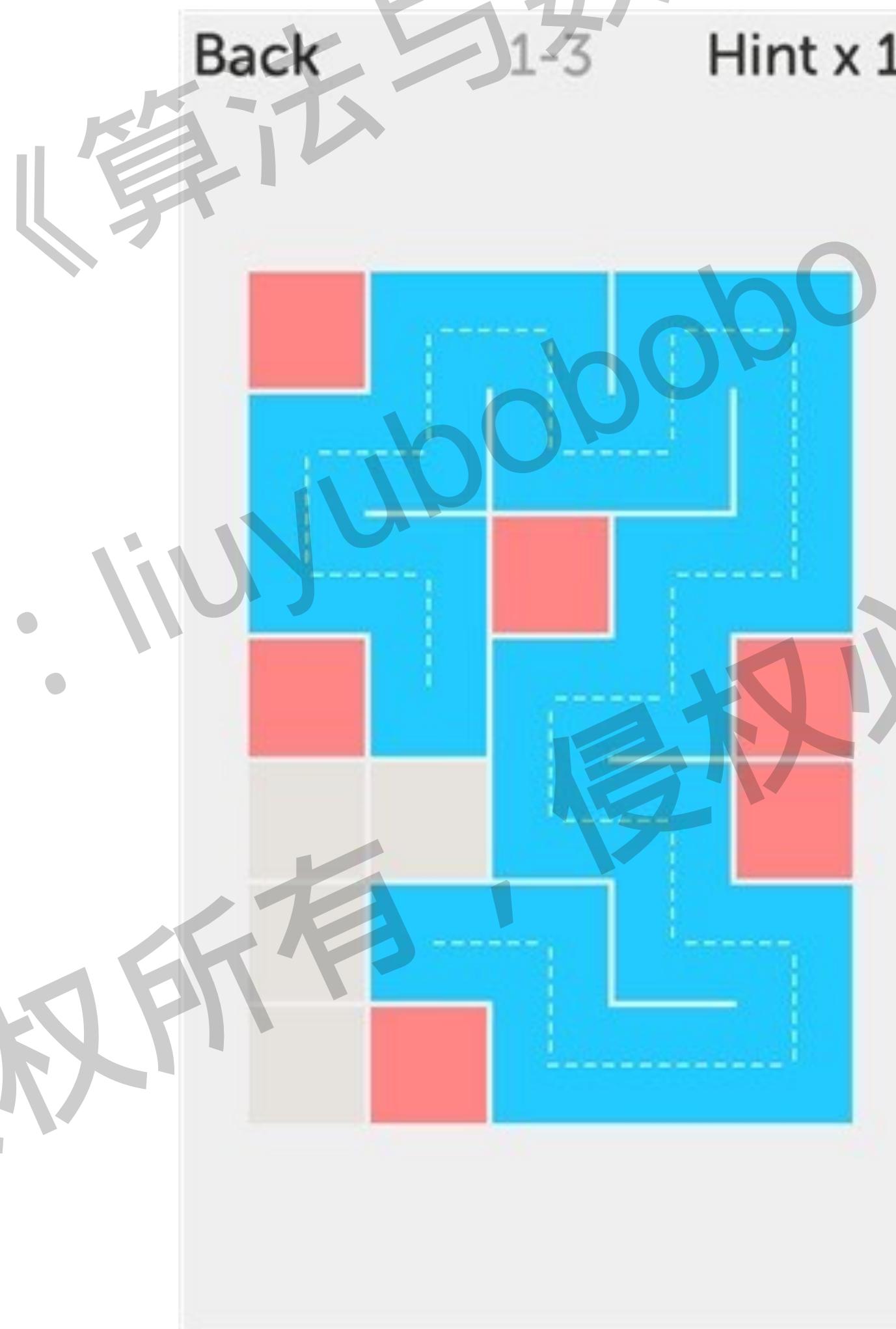
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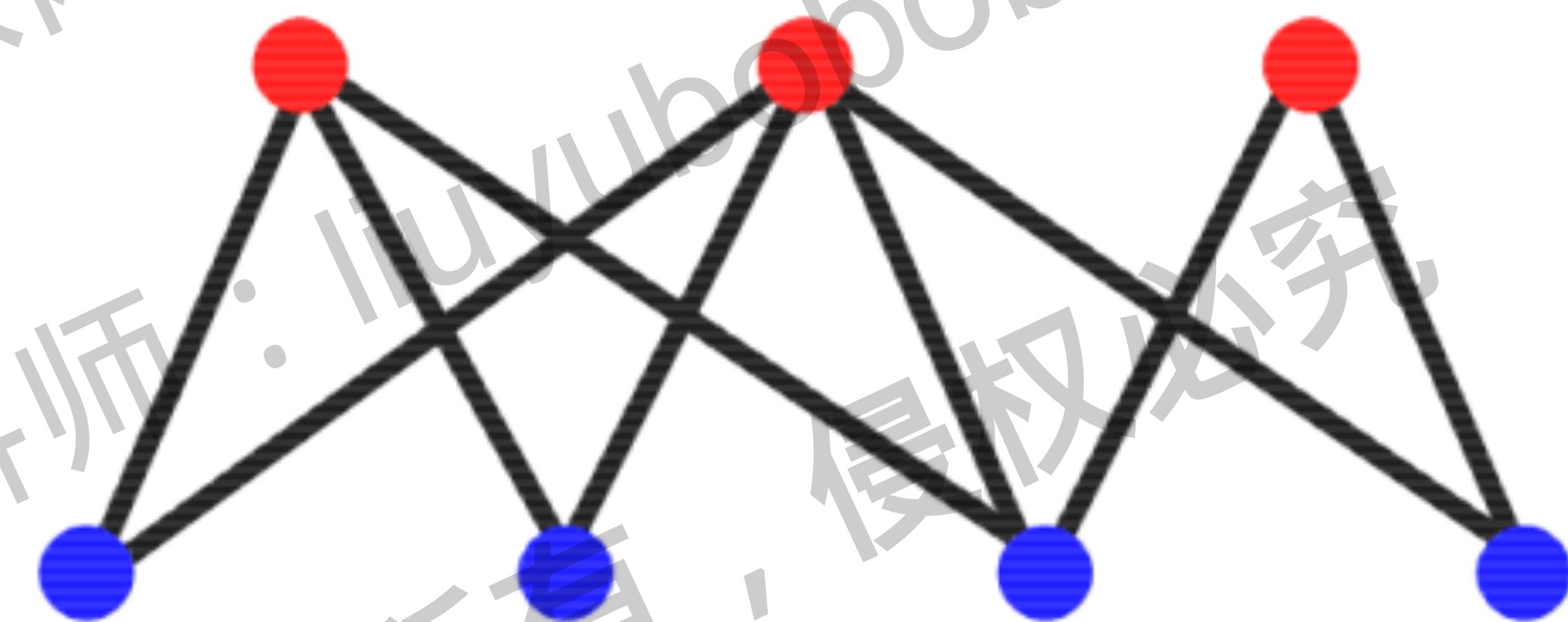
欧拉路径

哈密尔顿路径

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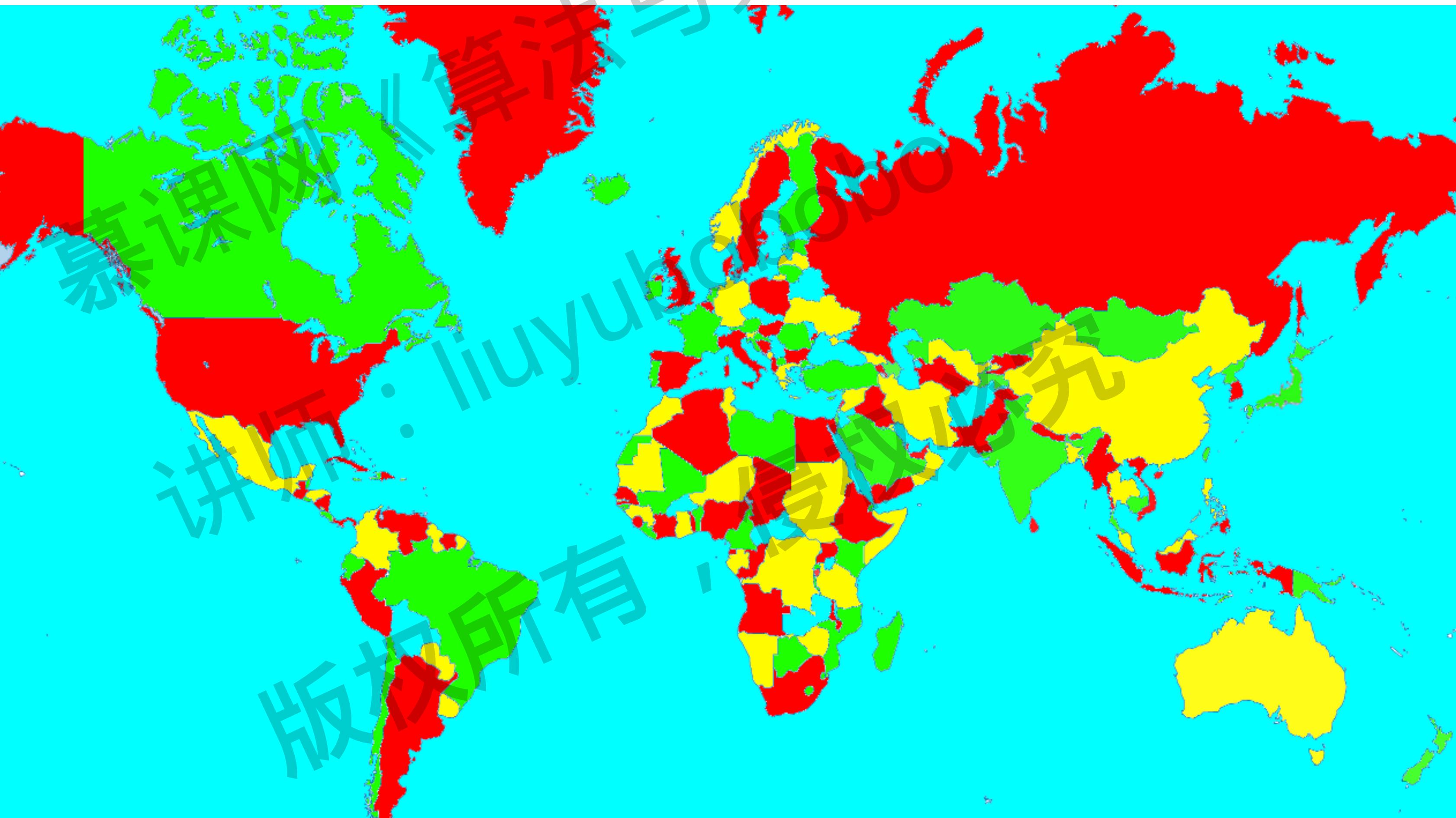


二分图



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