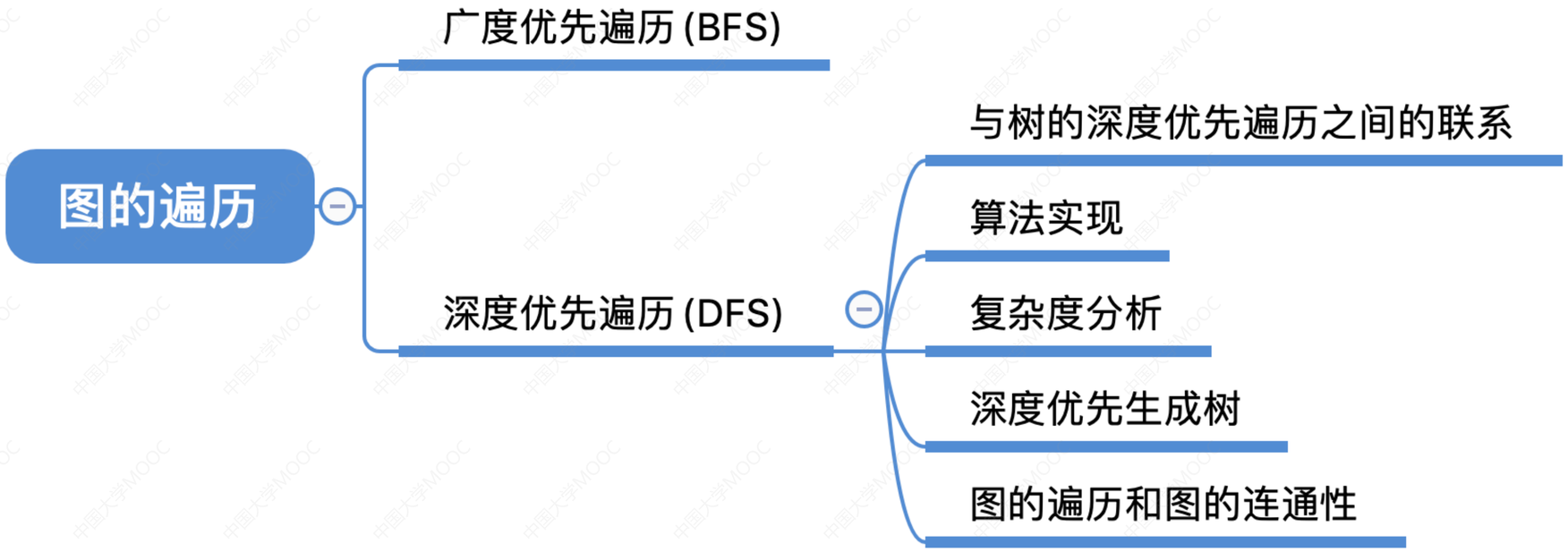
本节内容

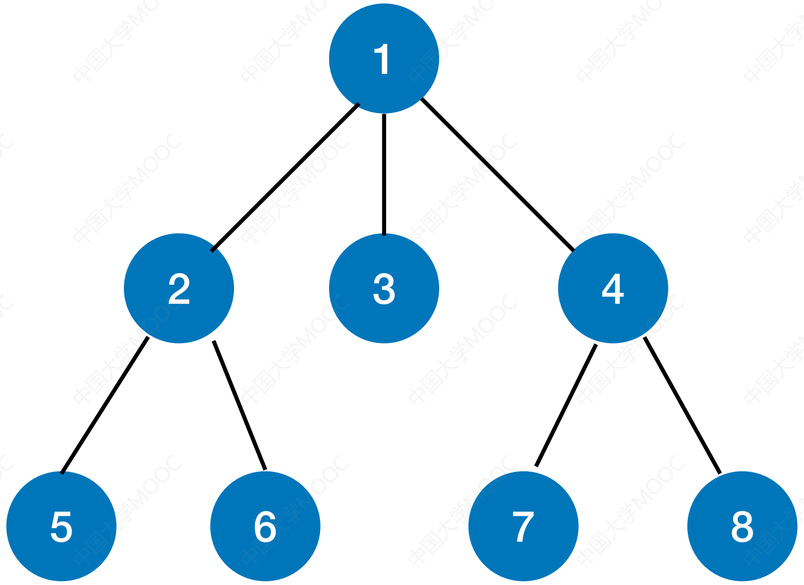
图的遍历

DFS

知识总览



树的深度优先遍历

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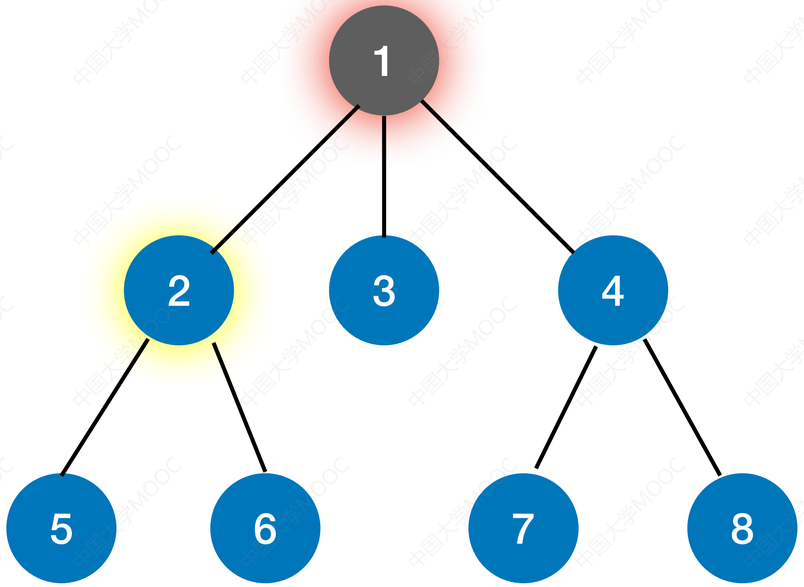


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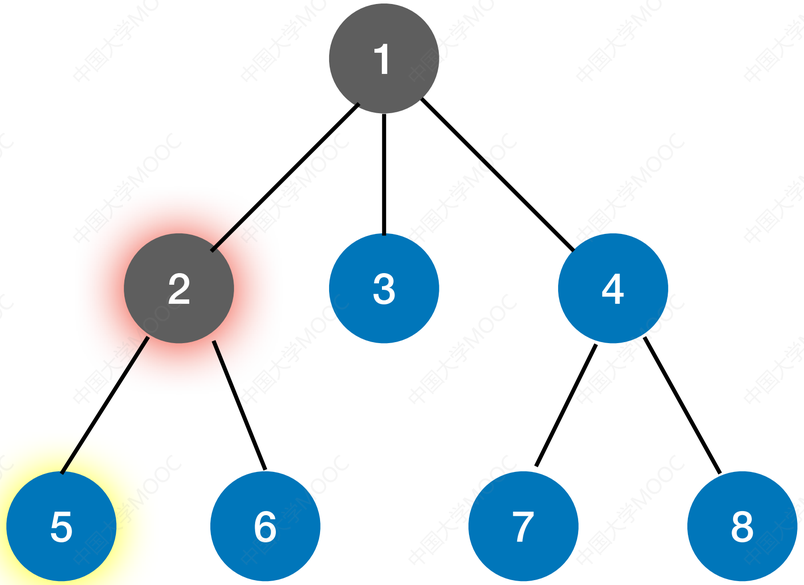


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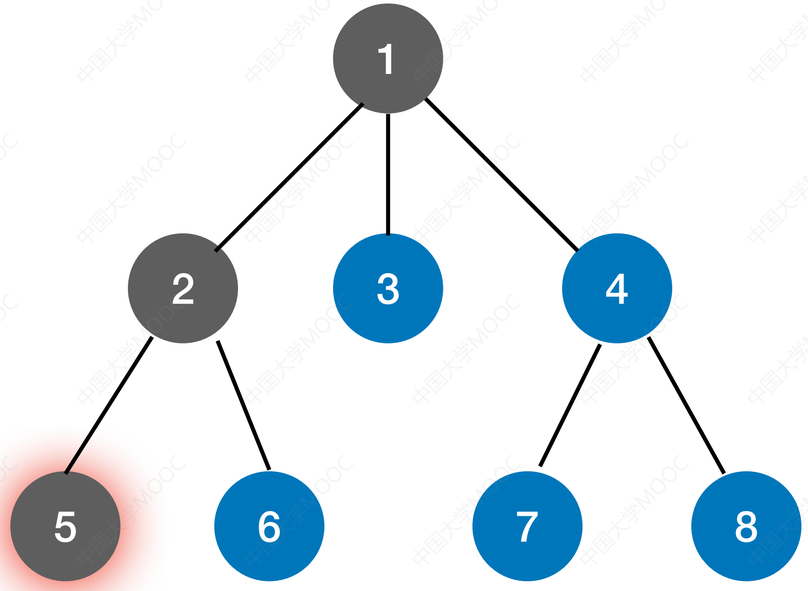


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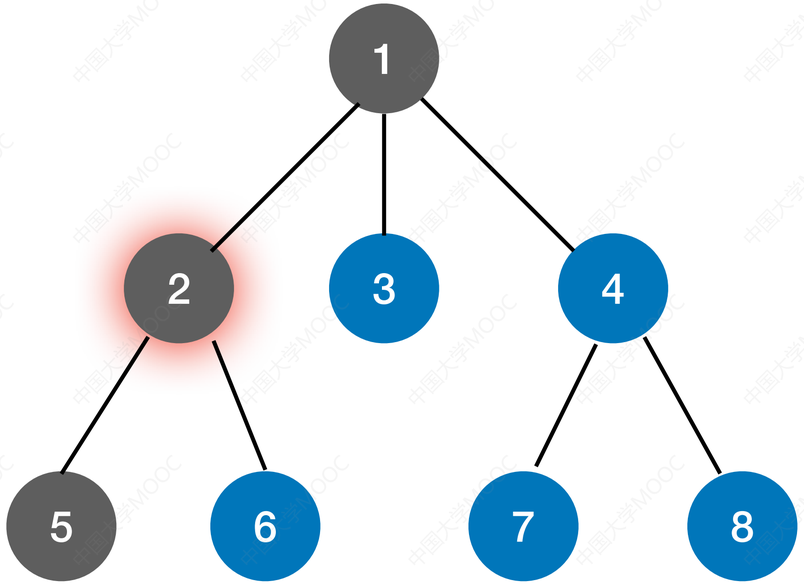


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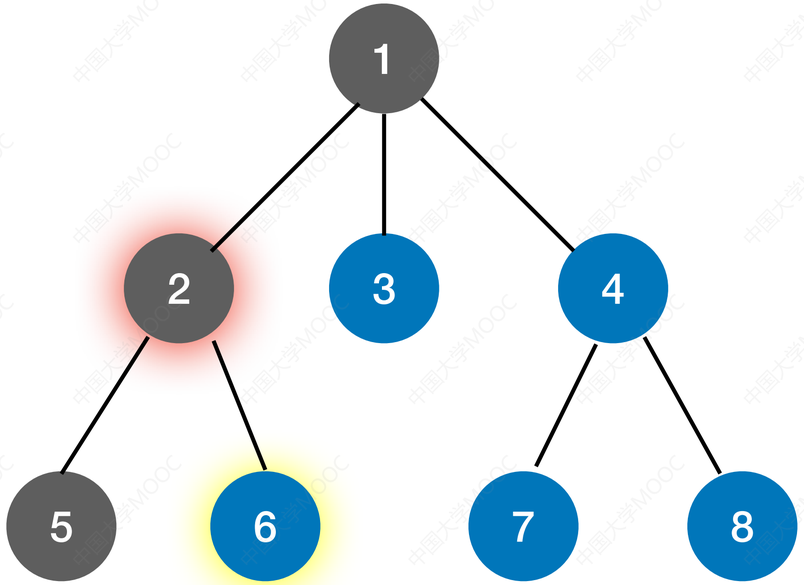


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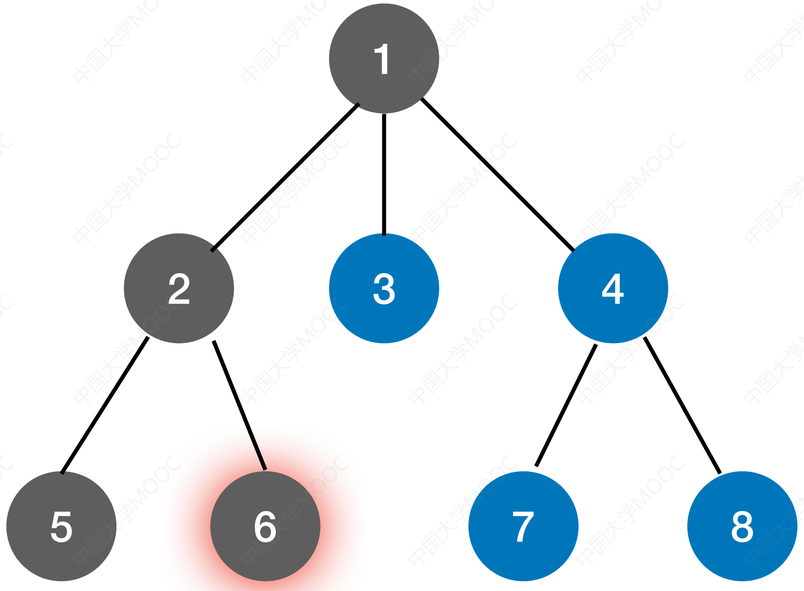


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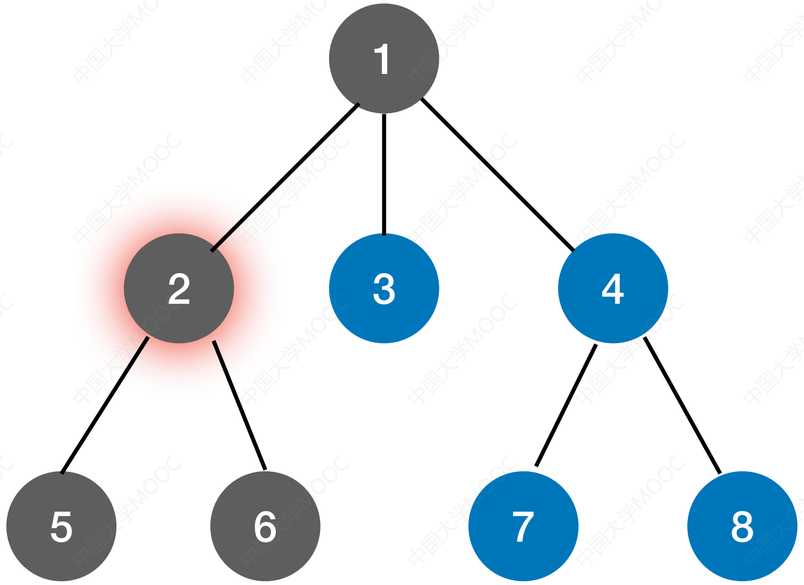


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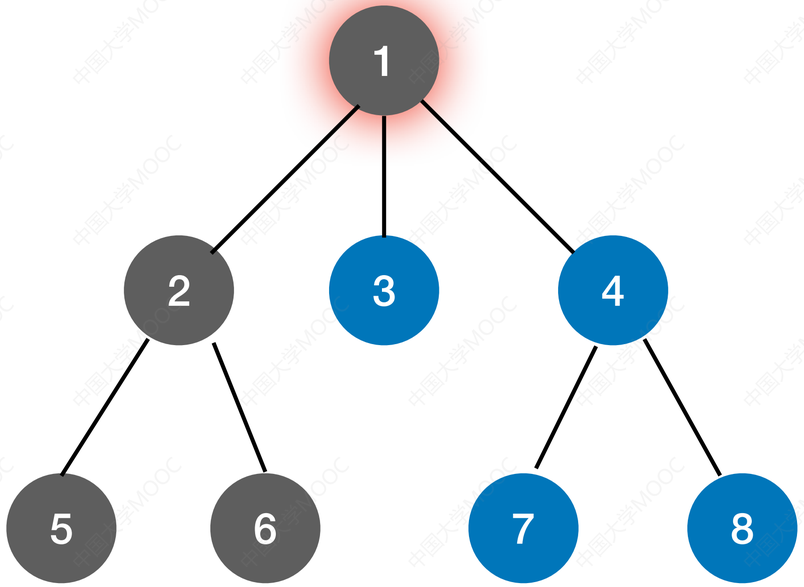


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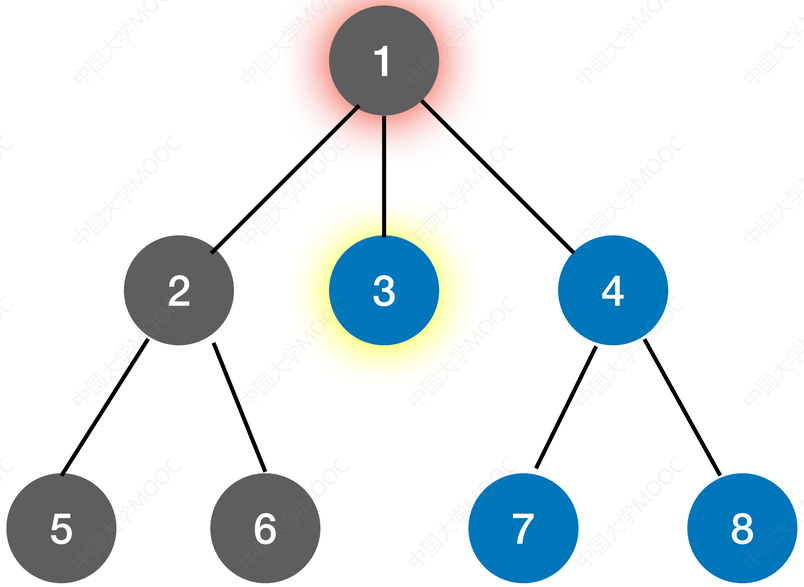


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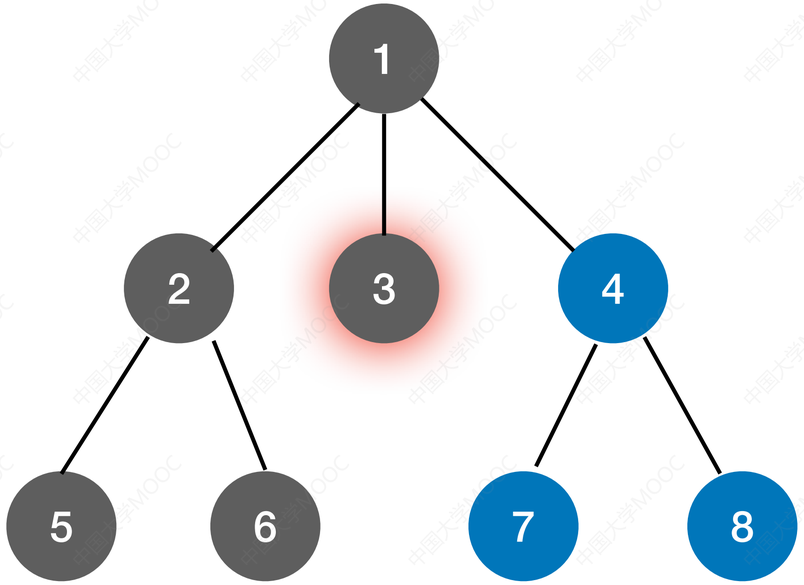


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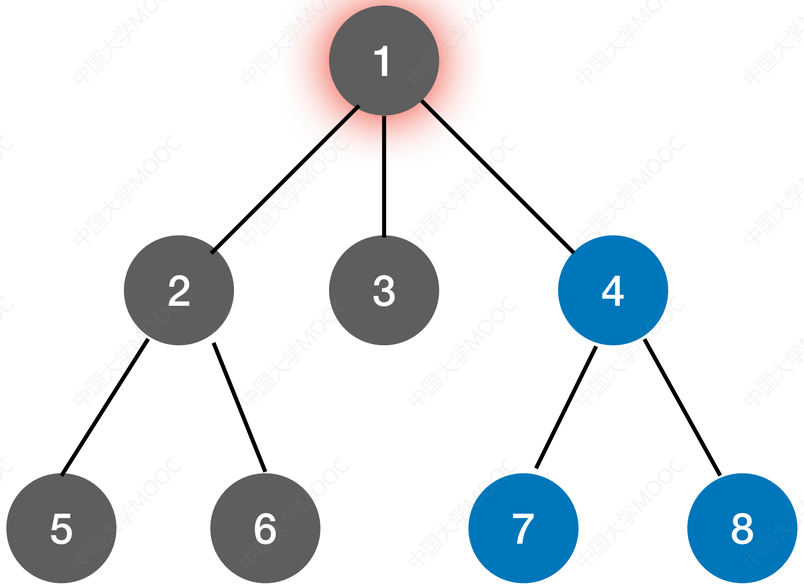


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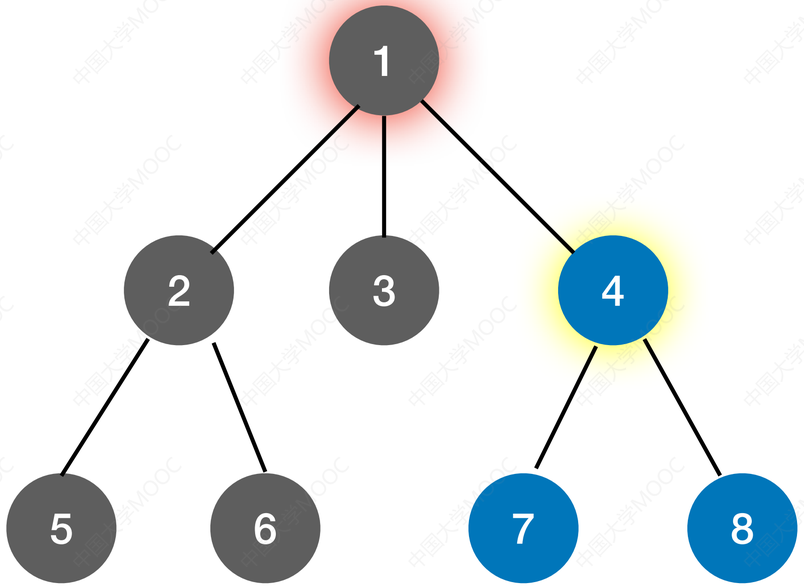


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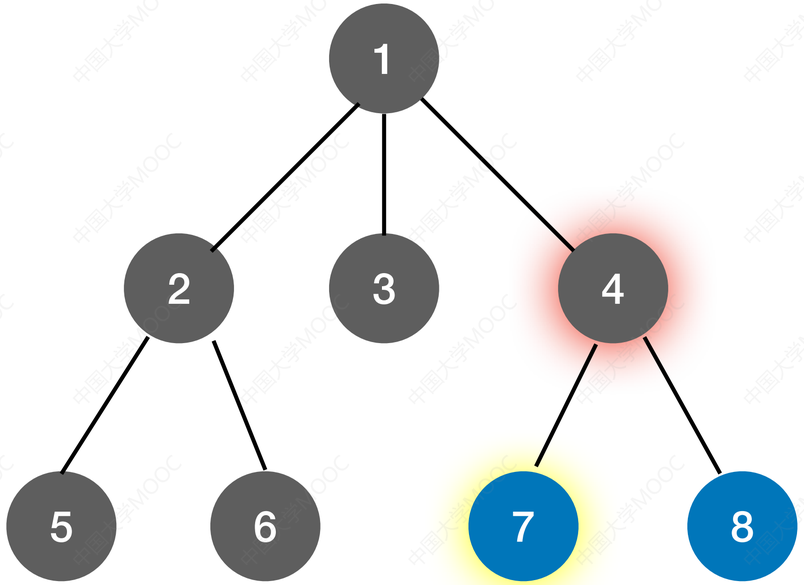


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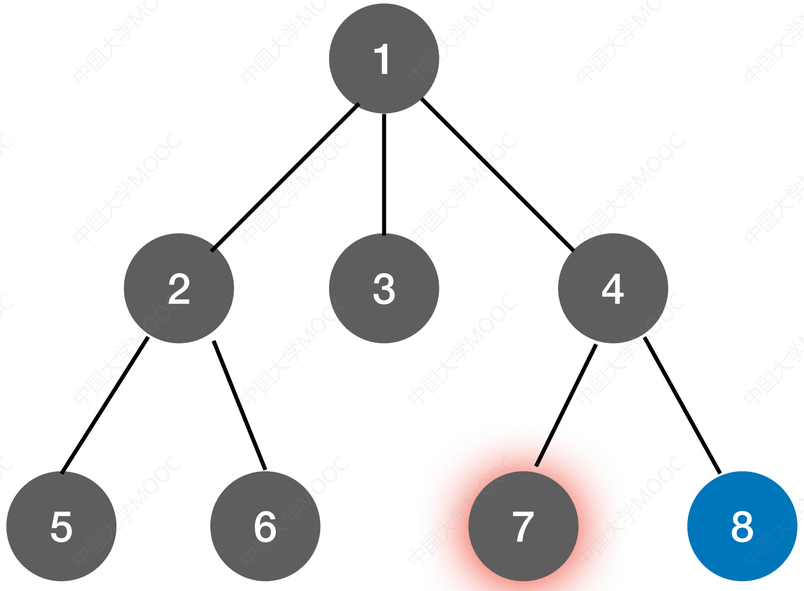


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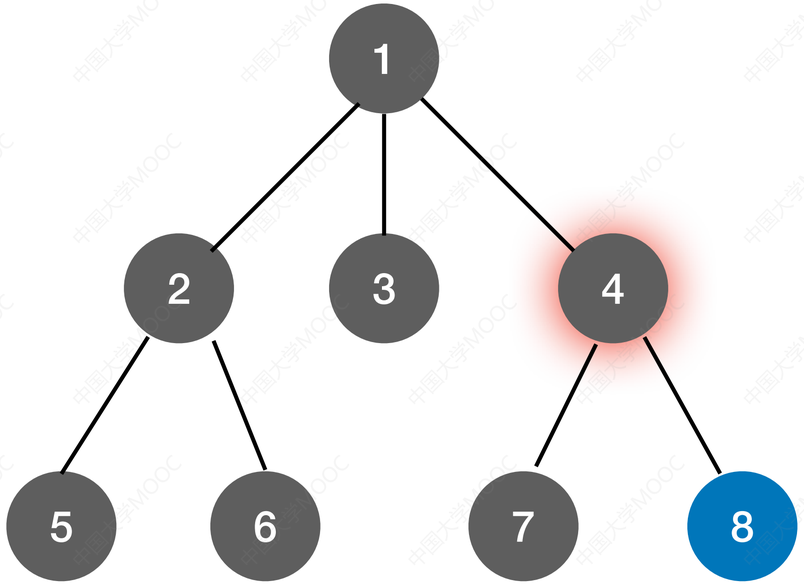


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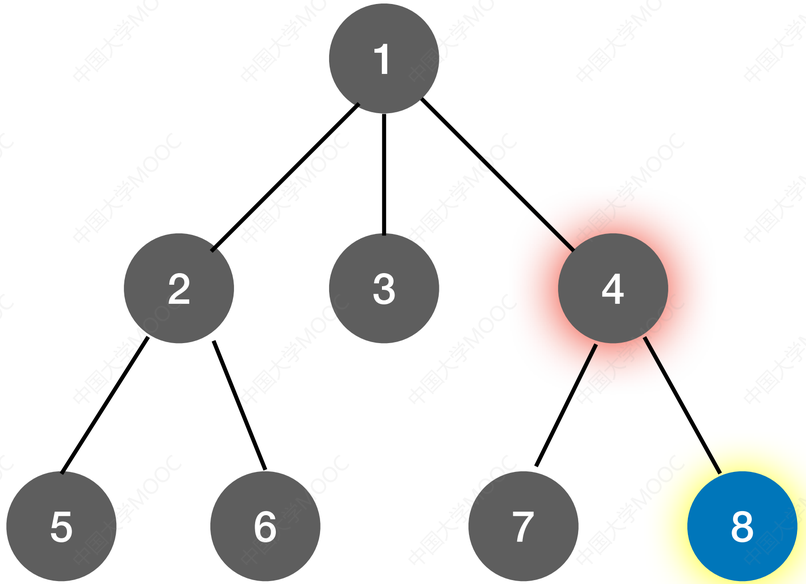


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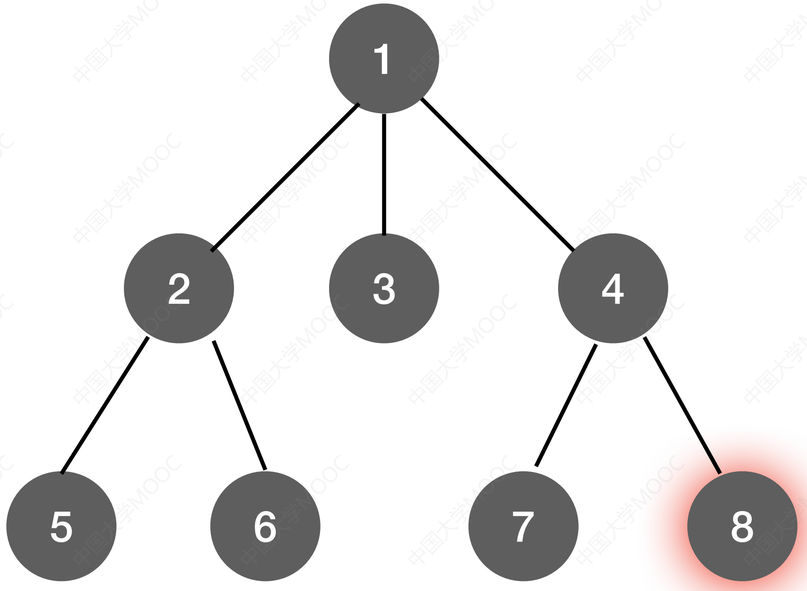


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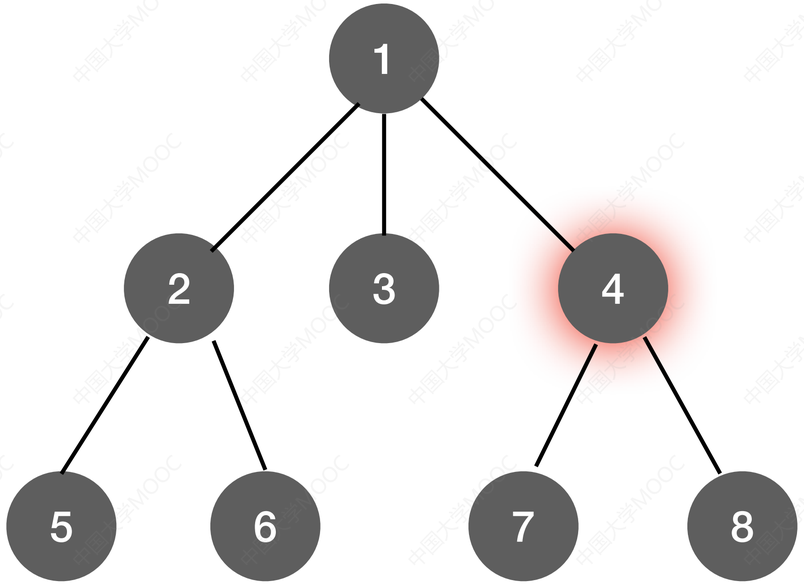


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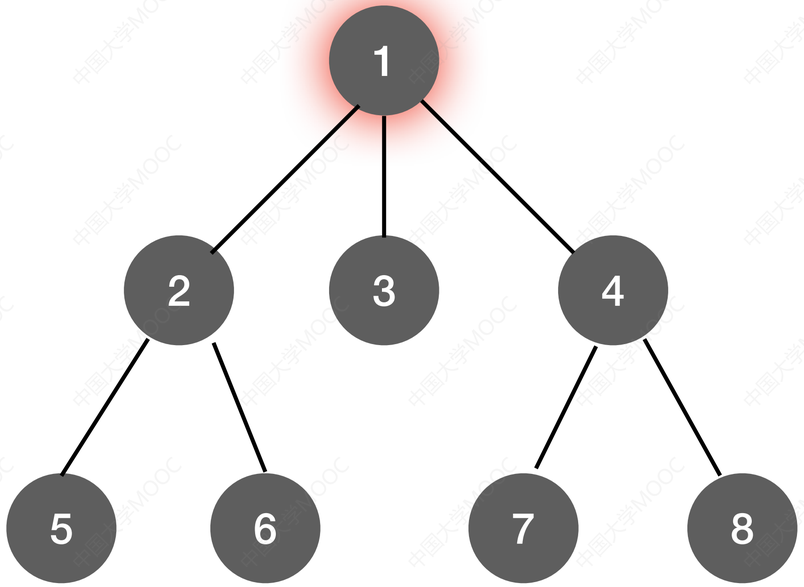


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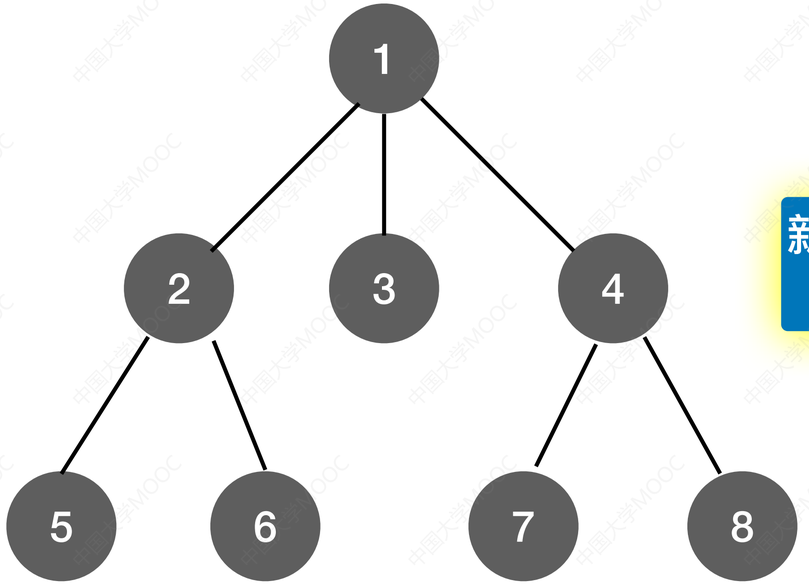

新找到的相邻结点一定是没有访问过的

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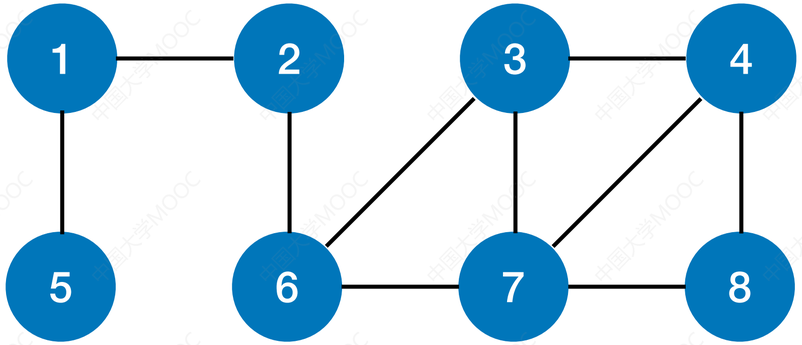
先根遍历序列：1，2，5，6，3，4，7，8

图的深度优先遍历

初始都为false

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void DFS(Graph G,int v){          //从顶点v出发，深度优先遍历图G
    visit(v);                     //访问顶点v
    visited[v]=TRUE;              //设已访问标记
    for(w=FirstNeighbor(G,v);w>=0;w=NextNeighor(G,v,w))
        if(!visited[w]){          //w为u的尚未访问的邻接顶点
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	1	2	3	4	5	6	7	8
visited	false	false	false	false	false	false	false	false

函数调用栈

图的深度优先遍历

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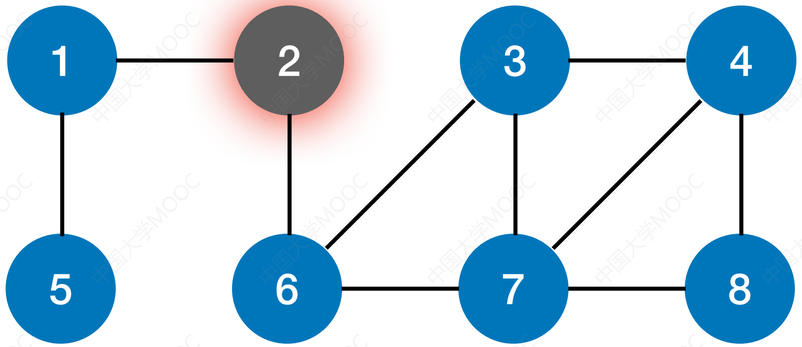


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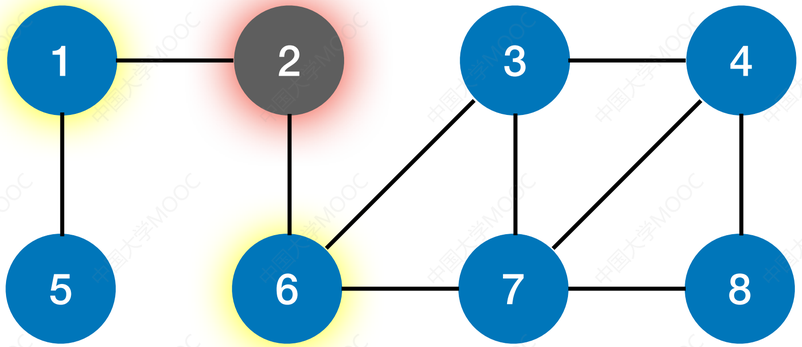


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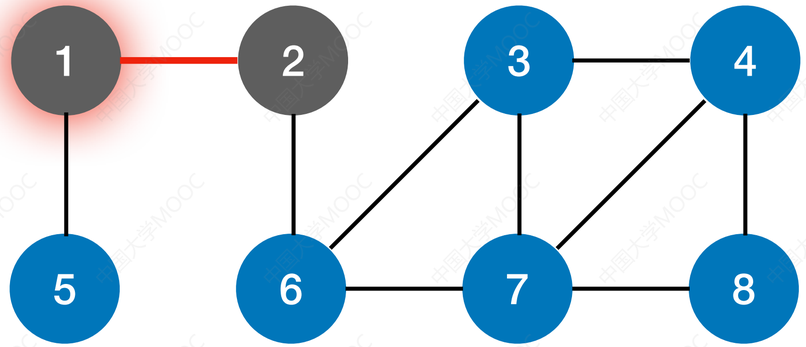


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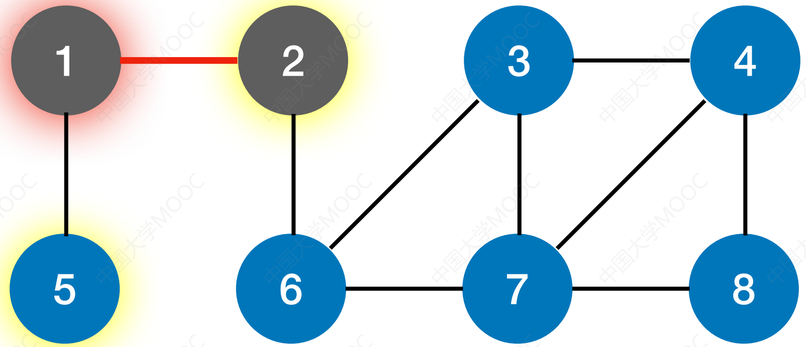


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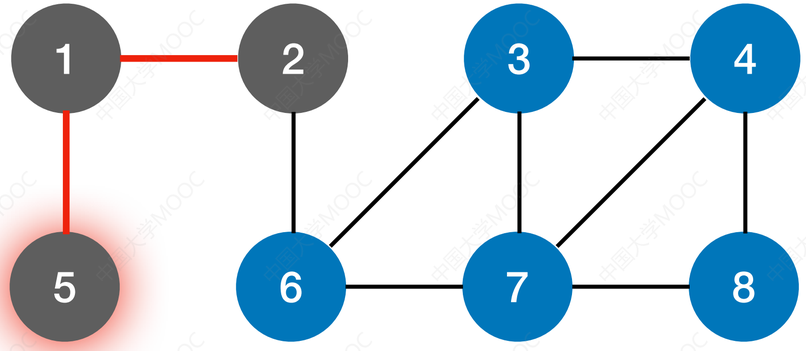


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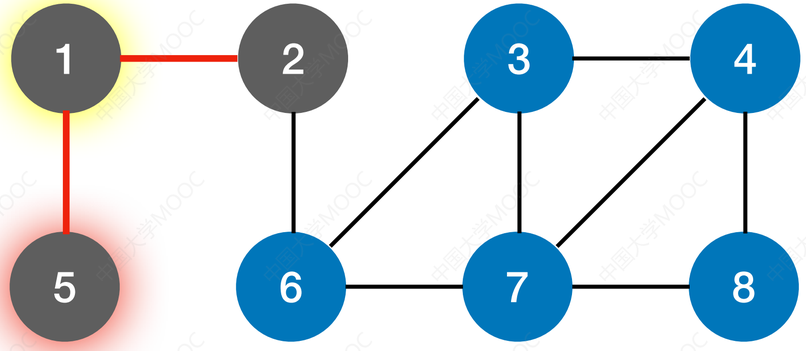


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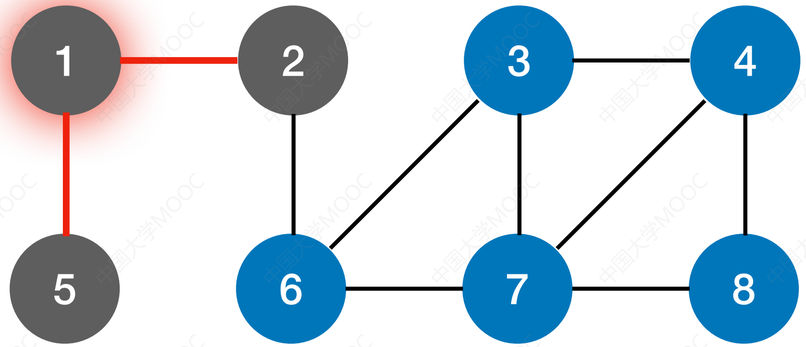


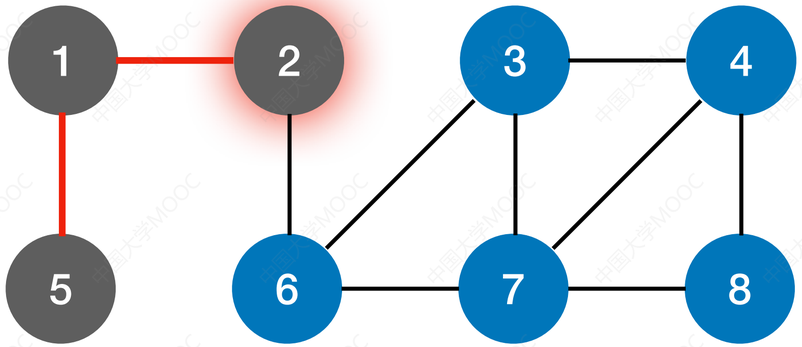

```
bool visited[MAX_VERTEX_NUM];    //访问标记数组

void DFS(Graph G,int v){          //从顶点v出发，深度优先遍历图G
    visit(v);                     //访问顶点v
    visited[v]=TRUE;              //设已访问标记
    for(w=FirstNeighbor(G,v);w>=0;w=NextNeighor(G,v,w))
        if(!visited[w]){          //w为u的尚未访问的邻接顶点
            DFS(G,w);
        }  //if
}
```

	1	2	3	4	5	6	7	8
visited	true	true	false	false	true	false	false	false

函数调用栈

图的深度优先遍历

初始都为false

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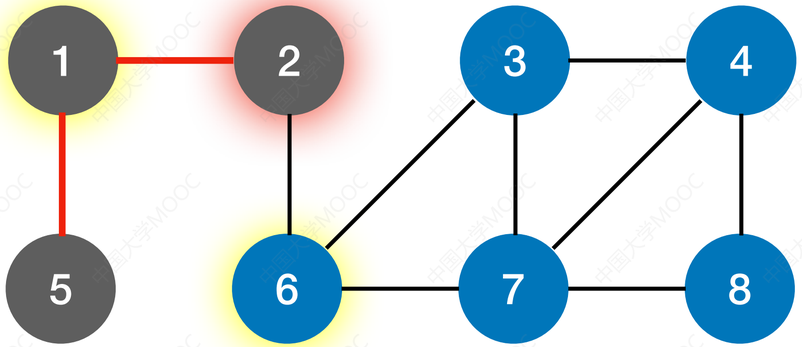
visited	true	true	false	false	true	false	false	false

函数调用栈

图的深度优先遍历

初始都为false

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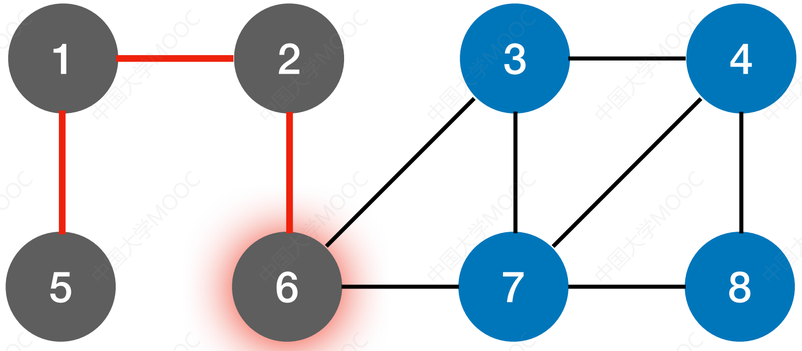
	1	2	3	4	5	6	7	8
visited	true	true	false	false	true	false	false	false

函数调用栈

图的深度优先遍历

初始都为false

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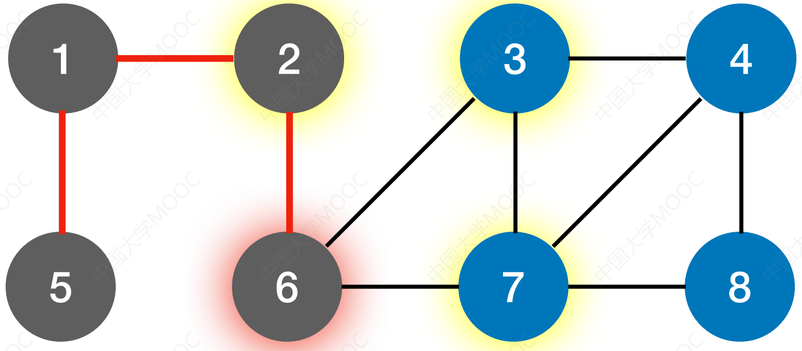
visited	true	true	false	false	true	true	false	false

函数调用栈

图的深度优先遍历

初始都为false

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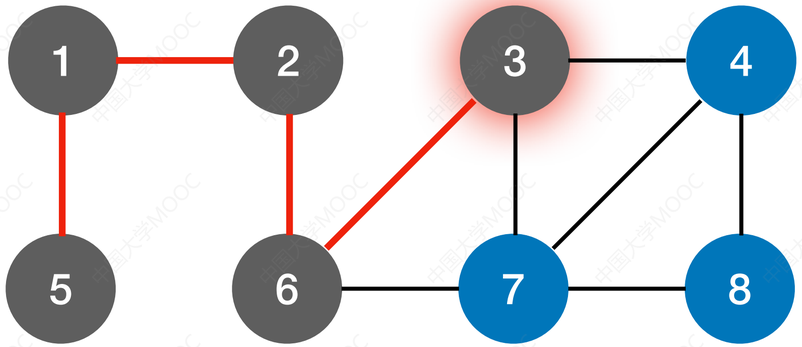
	1	2	3	4	5	6	7	8
visited	true	true	false	false	true	true	false	false

函数调用栈

图的深度优先遍历

初始都为false

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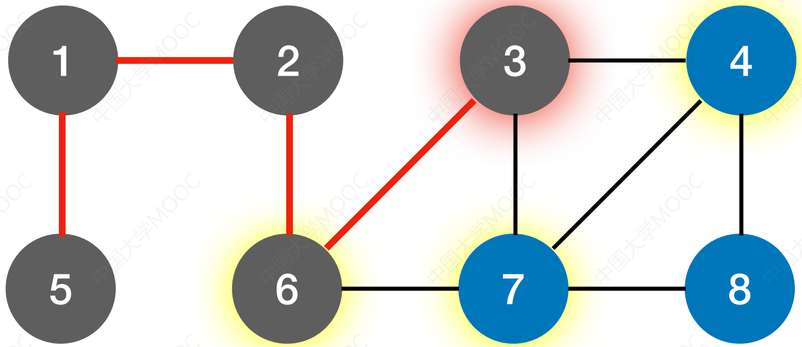
visited	true	true	true	false	true	true	false	false

函数调用栈

图的深度优先遍历

初始都为false

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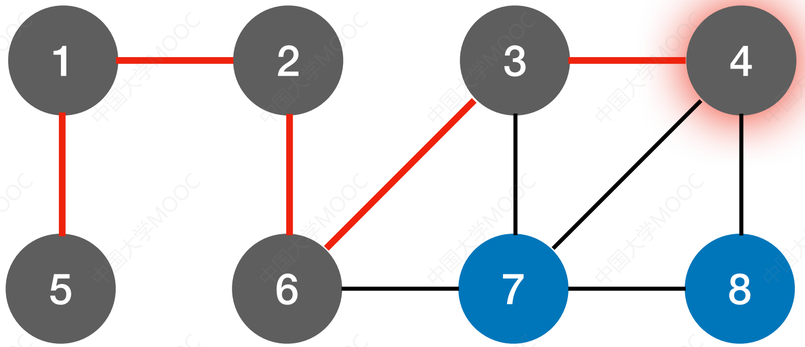
}
```

	1	2	3	4	5	6	7	8
visited	true	true	true	false	true	true	false	false

函数调用栈

图的深度优先遍历

初始都为false

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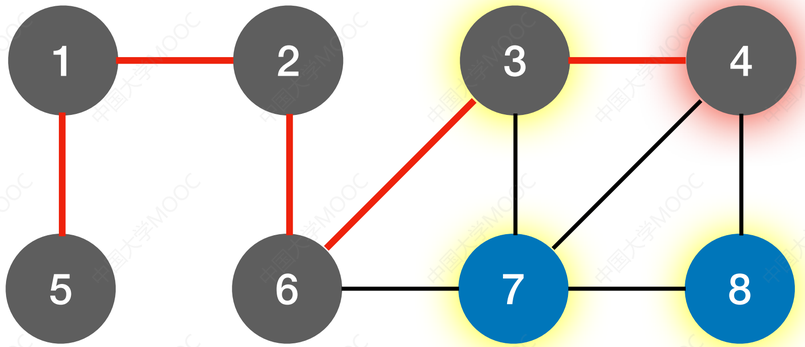
visited	true	true	true	true	true	true	false	false

函数调用栈

图的深度优先遍历

初始都为false

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函数调用栈

图的深度优先遍历

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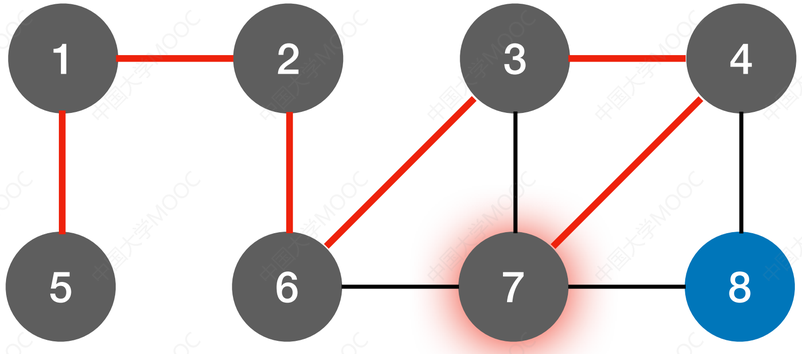


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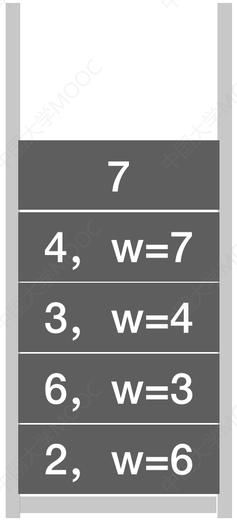
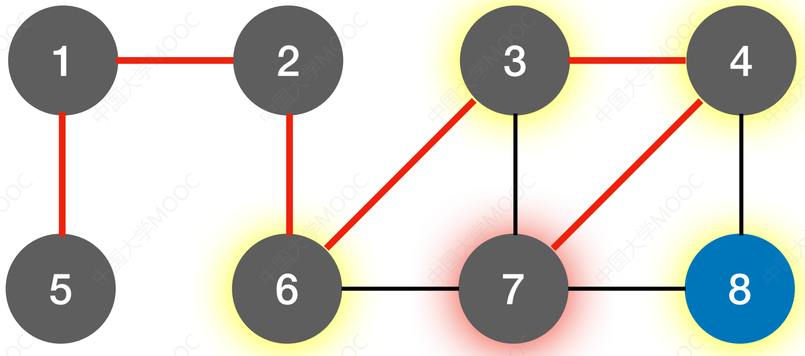


函数调用栈

	1	2	3	4	5	6	7	8
visited	true	true	true	true	true	true	true	false

图的深度优先遍历

初始都为false

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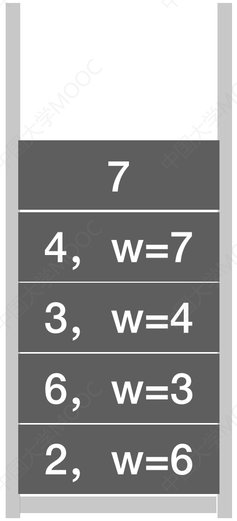

函数调用栈

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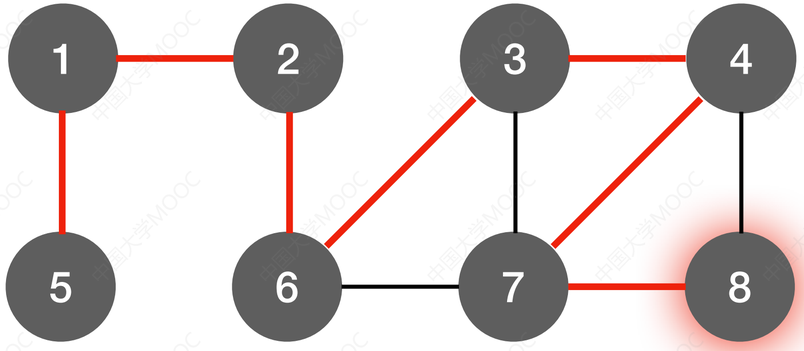
visited	true	true	true	true	true	true	true	false

图的深度优先遍历

初始都为false

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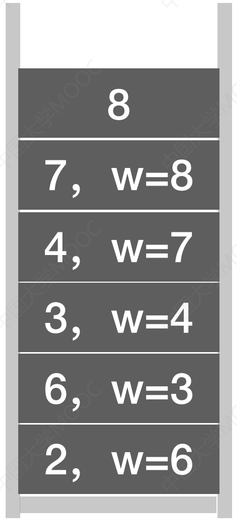
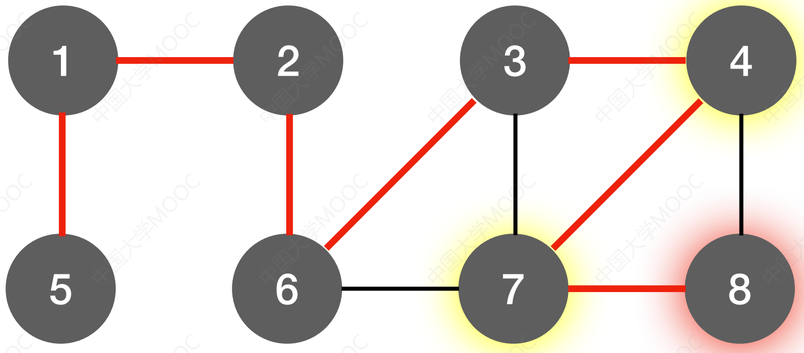


函数调用栈

	1	2	3	4	5	6	7	8
visited	true	true	true	true	true	true	true	true

图的深度优先遍历

初始都为false

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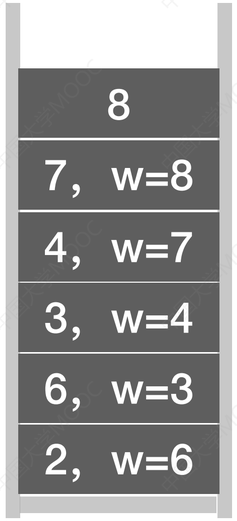

函数调用栈

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图的深度优先遍历

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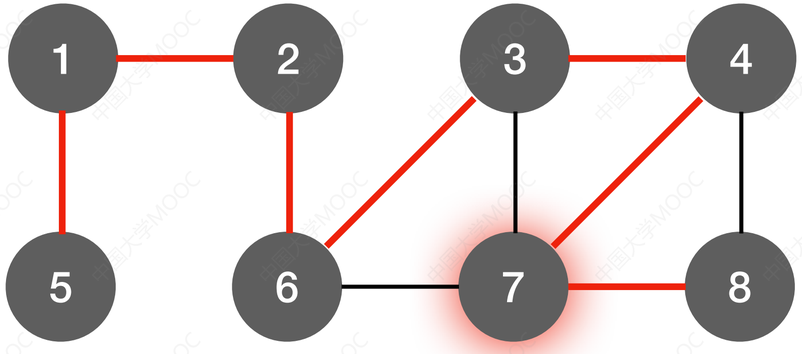


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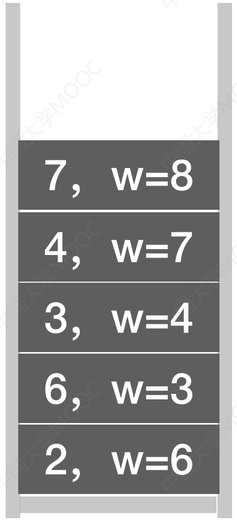

函数调用栈

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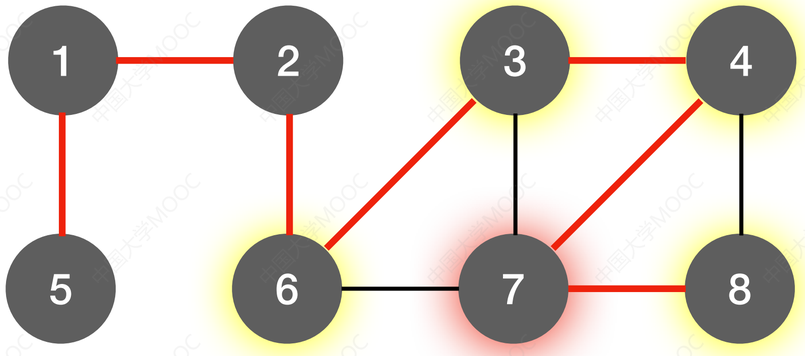
visited	true	true	true	true	true	true	true	true

图的深度优先遍历

初始都为false

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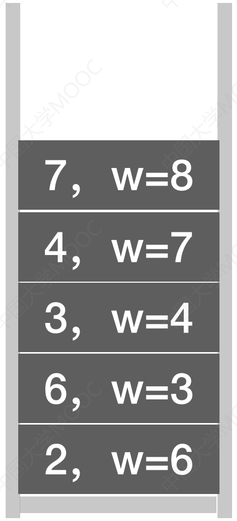

函数调用栈

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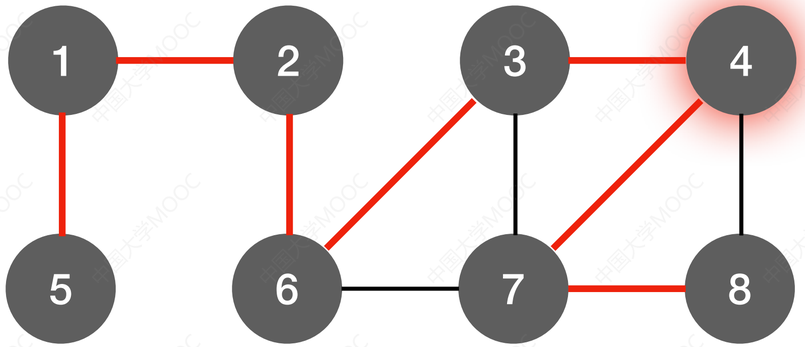
visited	true	true	true	true	true	true	true	true

图的深度优先遍历

初始都为false

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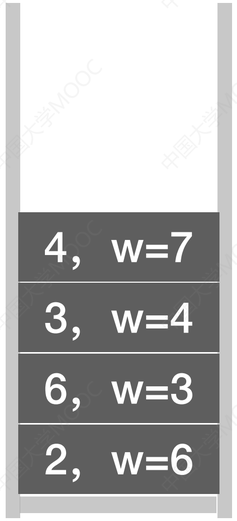
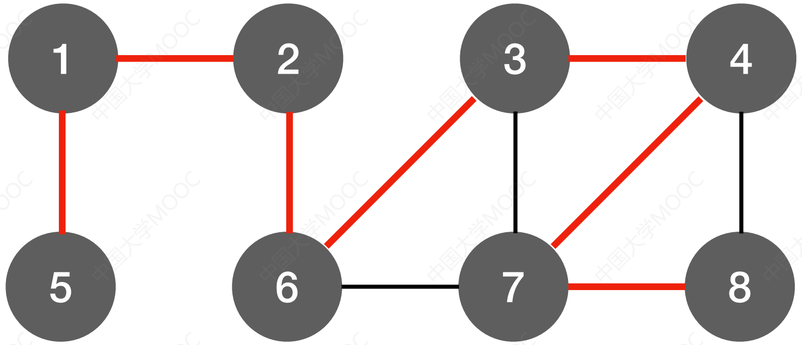
	1	2	3	4	5	6	7	8
visited	true	true	true	true	true	true	true	true



函数调用栈

图的深度优先遍历



初始都为false

```
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            DFS(G,w);
        }   //if
}
```

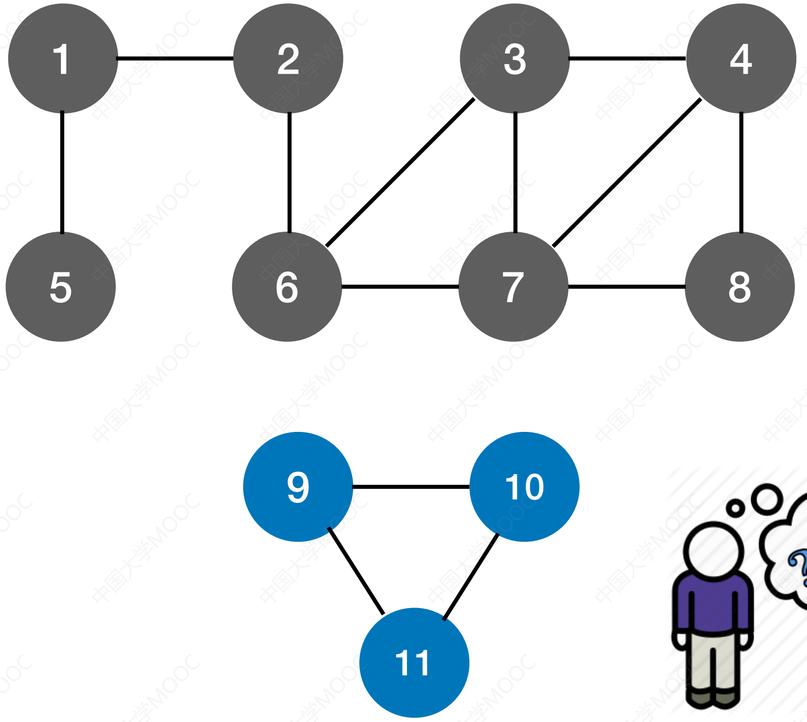
	1	2	3	4	5	6	7	8
visited	true	true	true	true	true	true	true	true

从2出发的深度遍历序列：2，1，5，6，3，4，7，8

函数调用栈

算法存在的问题

初始都为false

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        if(!visited[w]){          //w为u的尚未访问的邻接顶点
            DFS(G,w);
        }   //if
}
```
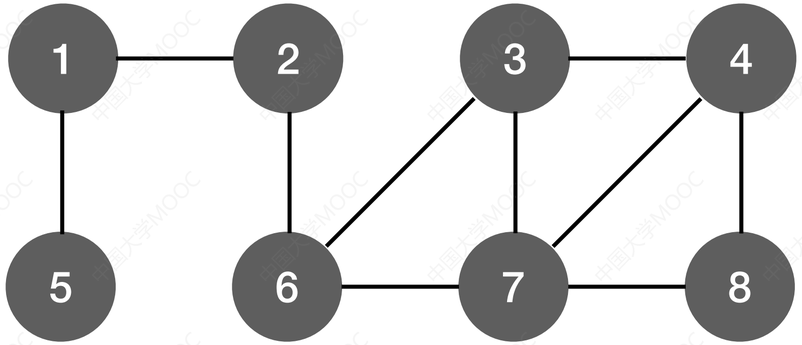
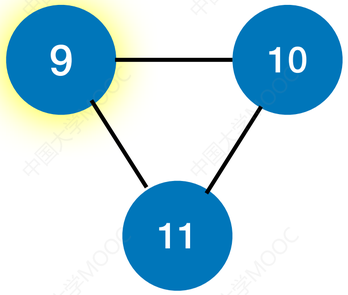


	1	2	3	4	5	6	7	8	9	10	11
visited	true	true	true	true	true	true	true	true	false	false	false

如果是非连通图，则无法遍历完所有结点

DFS算法（Final版）





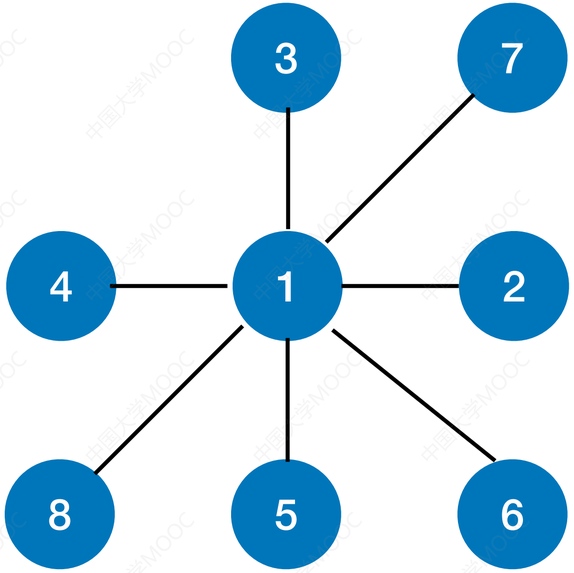
如果是非连通图，则无法遍历完所有结点

```
bool visited[MAX_VERTEX_NUM];    //访问标记数组

void DFSTraverse(Graph G){       //对图G进行深度优先遍历
    for(v=0;v<G.vexnum;++v)
        visited[v]=FALSE;        //初始化已访问标记数据
    for(v=0;v<G.vexnum;++v)      //本代码中是从v=0开始遍历
        if(!visited[v])
            DFS(G,v);
}

void DFS(Graph G,int v){         //从顶点v出发，深度优先遍历图G
    visit(v);                    //访问顶点v
    visited[v]=TRUE;             //设已访问标记
    for(w=FirstNeighbor(G,v);w>=0;w=NextNeighor(G,v,w))
        if(!visited[w]){         //w为u的尚未访问的邻接顶点
            DFS(G,w);
        }   //if
}
```

	1	2	3	4	5	6	7	8	9	10	11
visited	true	true	true	true	true	true	true	true	false	false	false

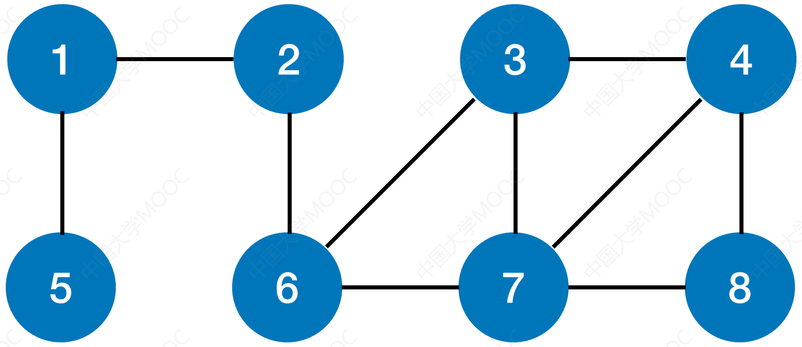
复杂度分析

空间复杂度：来自函数调用栈，最坏情况，递归深度为O(|V|)



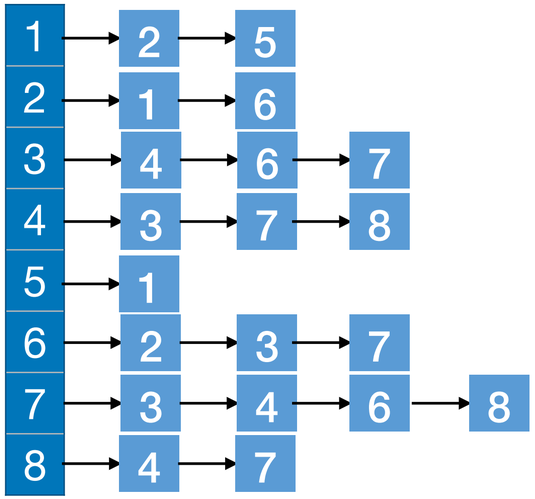
空间复杂度：最好情况，O(1)

复杂度分析



	1	2	3	4	5	6	7	8
1	0	1	0	0	1	0	0	0
2	1	0	0	0	0	1	0	0
3	0	0	0	1	0	1	1	0
4	0	0	1	0	0	0	1	1
5	1	0	0	0	0	0	0	0
6	0	1	1	0	0	0	1	0
7	0	0	1	1	0	1	0	1
8	0	0	0	1	0	0	1	0

邻接矩阵



邻接表

时间复杂度=访问各结点所需时间+探索各条边所需时间

邻接矩阵存储的图：

访问 |V| 个顶点需要O(|V|)的时间

查找每个顶点的邻接点都需要O(|V|)的时间，而总共有|V|个顶点

时间复杂度= $O(|V|^2)$

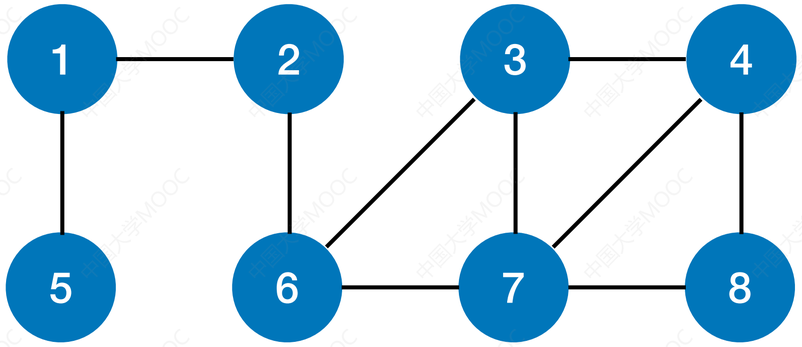
邻接表存储的图：

访问 |V| 个顶点需要O(|V|)的时间

查找各个顶点的邻接点共需要O(|E|)的时间，

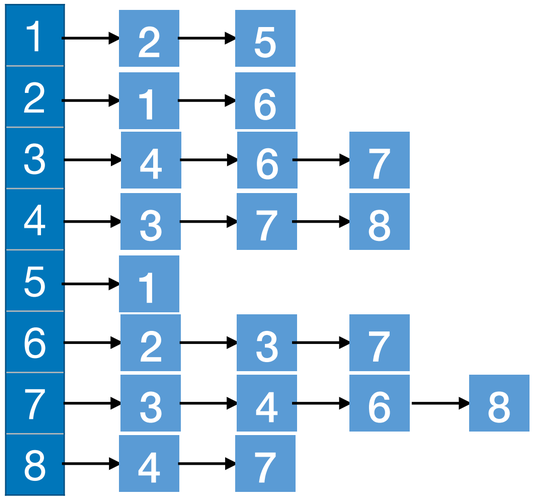
时间复杂度= O(|V|+|E|)

深度优先遍历序列



	1	2	3	4	5	6	7	8
1	0	1	0	0	1	0	0	0
2	1	0	0	0	0	1	0	0
3	0	0	0	1	0	1	1	0
4	0	0	1	0	0	0	1	1
5	1	0	0	0	0	0	0	0
6	0	1	1	0	0	0	1	0
7	0	0	1	1	0	1	0	1
8	0	0	0	1	0	0	1	0

邻接矩阵



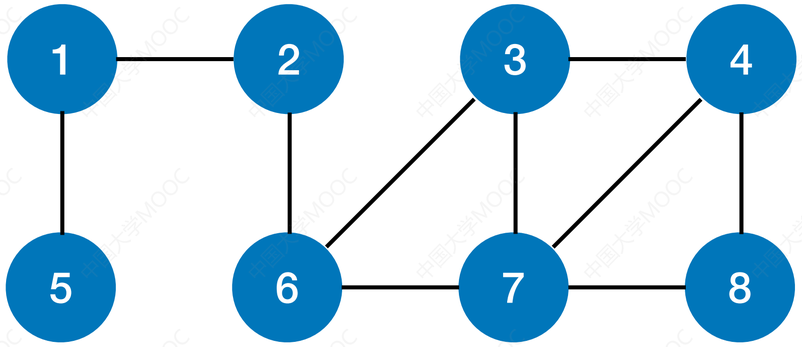
邻接表

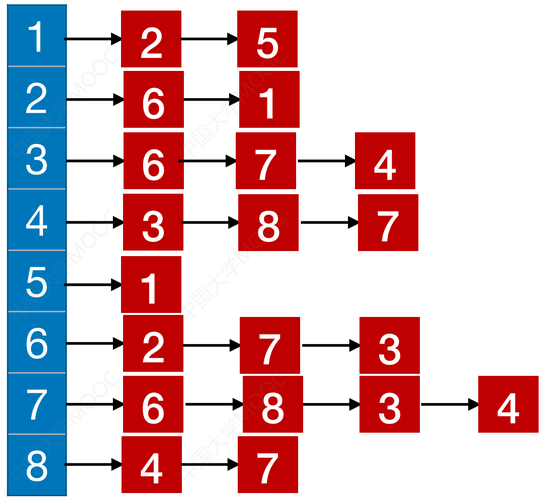
从2出发的深度优先遍历序列：2, 1, 5, 6, 3, 4, 7, 8

从3出发的深度优先遍历序列：3, 4, 7, 6, 2, 1, 5, 8

从1出发的深度优先遍历序列：1, 2, 6, 3, 4, 7, 8, 5

深度优先遍历序列





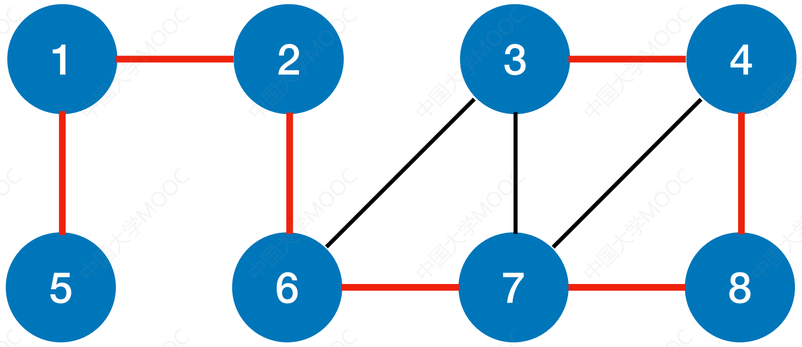
邻接表

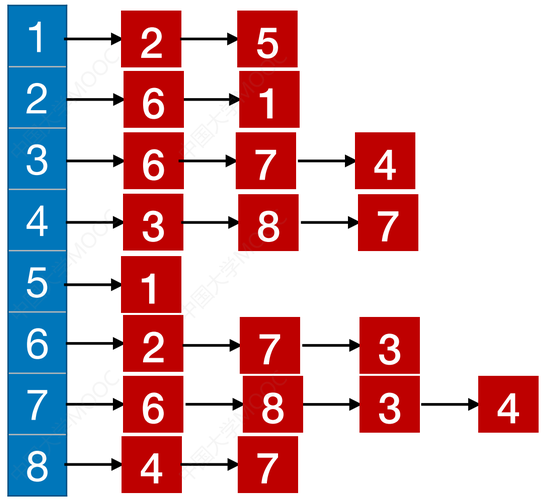
从2出发的深度优先遍历序列：2, 6, 7, 8, 4, 3, 1, 5

从3出发的深度优先遍历序列?

从1出发的深度优先遍历序列?

深度优先遍历序列





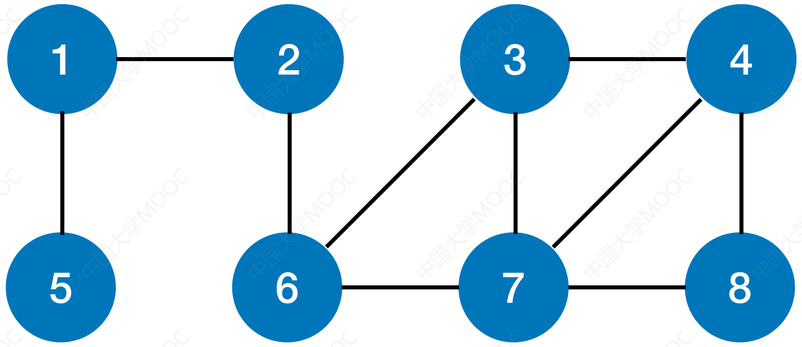
邻接表

从2出发的深度优先遍历序列：2, 6, 7, 8, 4, 3, 1, 5

从3出发的深度优先遍历序列?

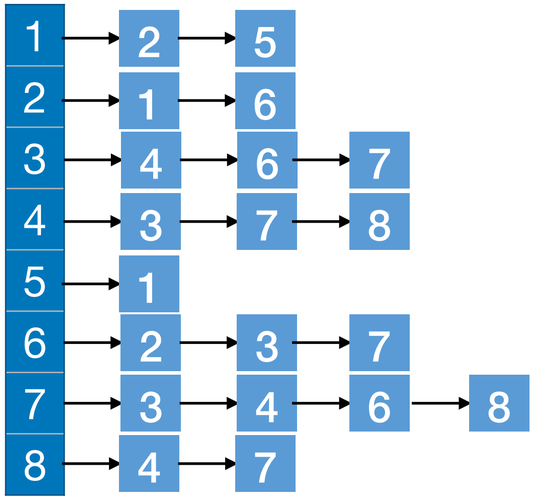
从1出发的深度优先遍历序列?

深度优先遍历序列

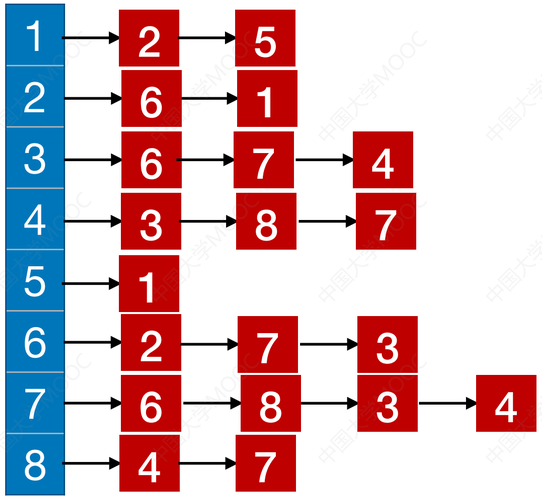


	1	2	3	4	5	6	7	8
1	0	1	0	0	1	0	0	0
2	1	0	0	0	0	1	0	0
3	0	0	0	1	0	1	1	0
4	0	0	1	0	0	0	1	1
5	1	0	0	0	0	0	0	0
6	0	1	1	0	0	0	1	0
7	0	0	1	1	0	1	0	1
8	0	0	0	1	0	0	1	0

邻接矩阵



邻接表

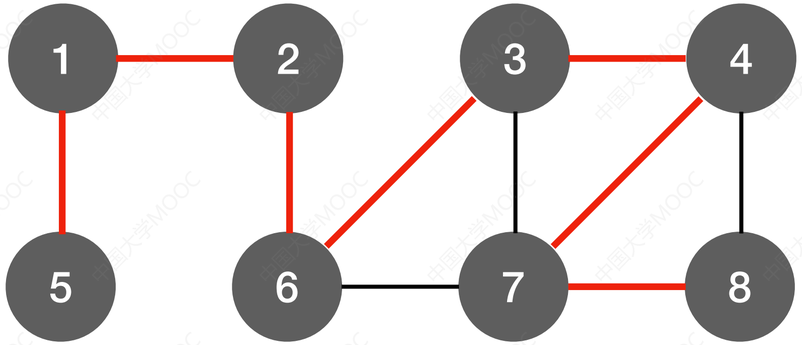


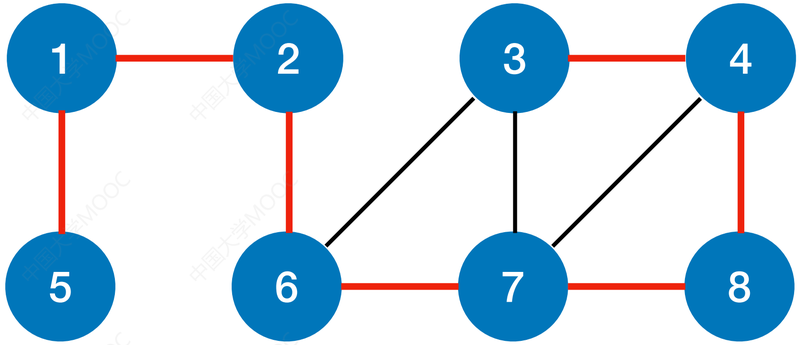
邻接表

同一个图的邻接矩阵表示方式唯一，因此深度优先遍历序列唯一

同一个图邻接表表示方式不唯一，因此深度优先遍历序列不唯一

深度优先生成树

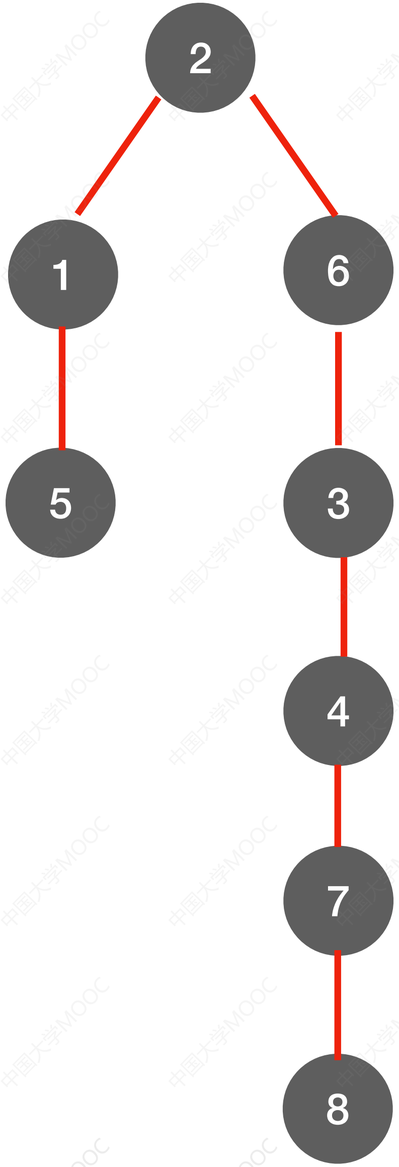


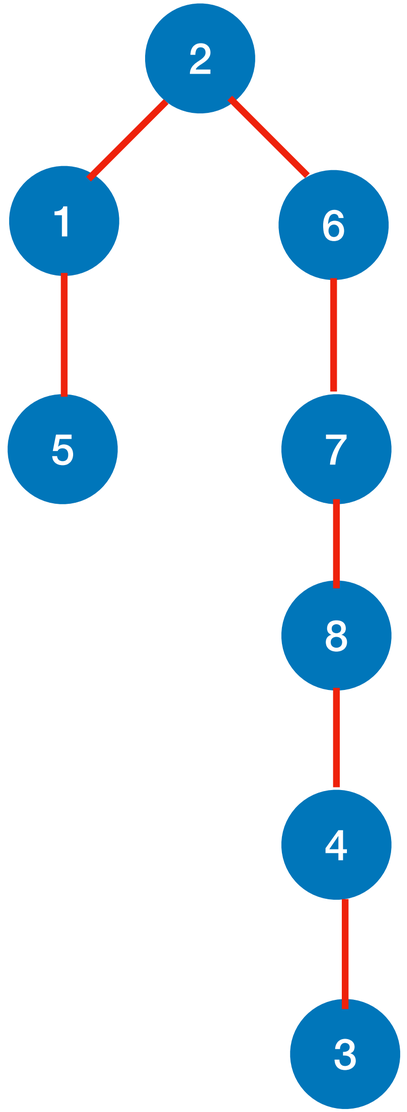


同一个图的邻接矩阵表示方式唯一，因此深度优先遍历序列唯一，深度优先生成树也唯一

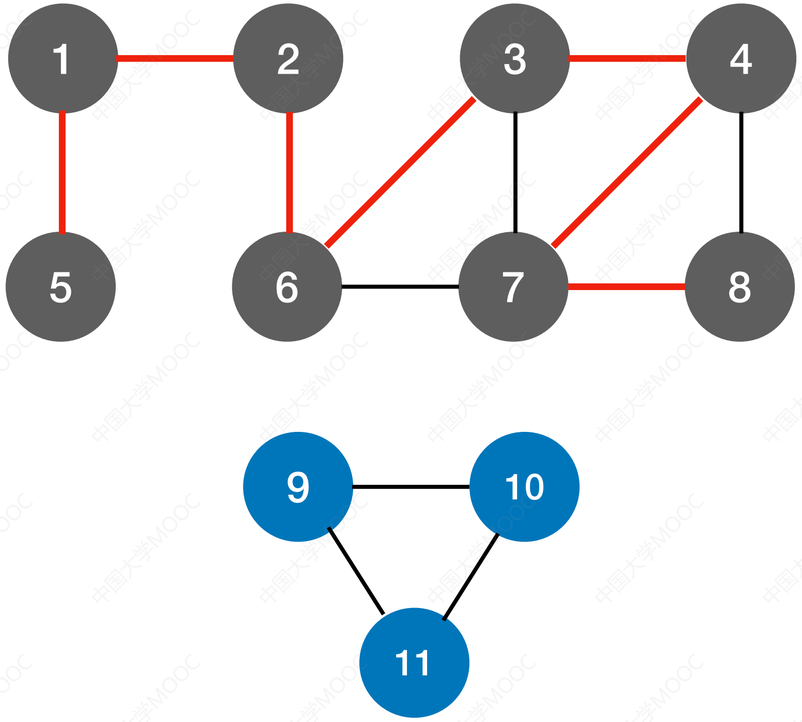
同一个图邻接表表示方式不唯一，因此深度优先遍历序列不唯一，深度优先生成树也不唯一

深度优先生成树

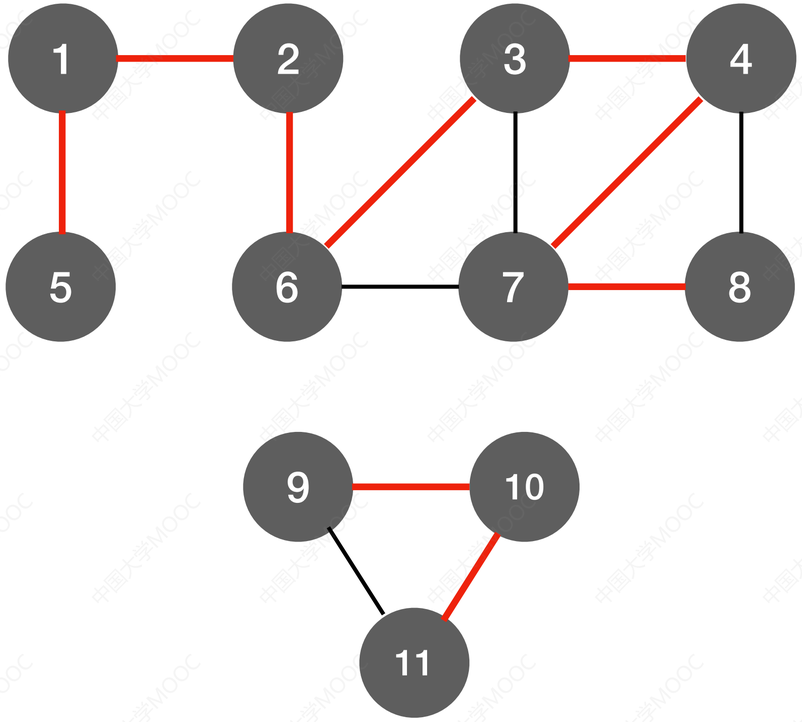




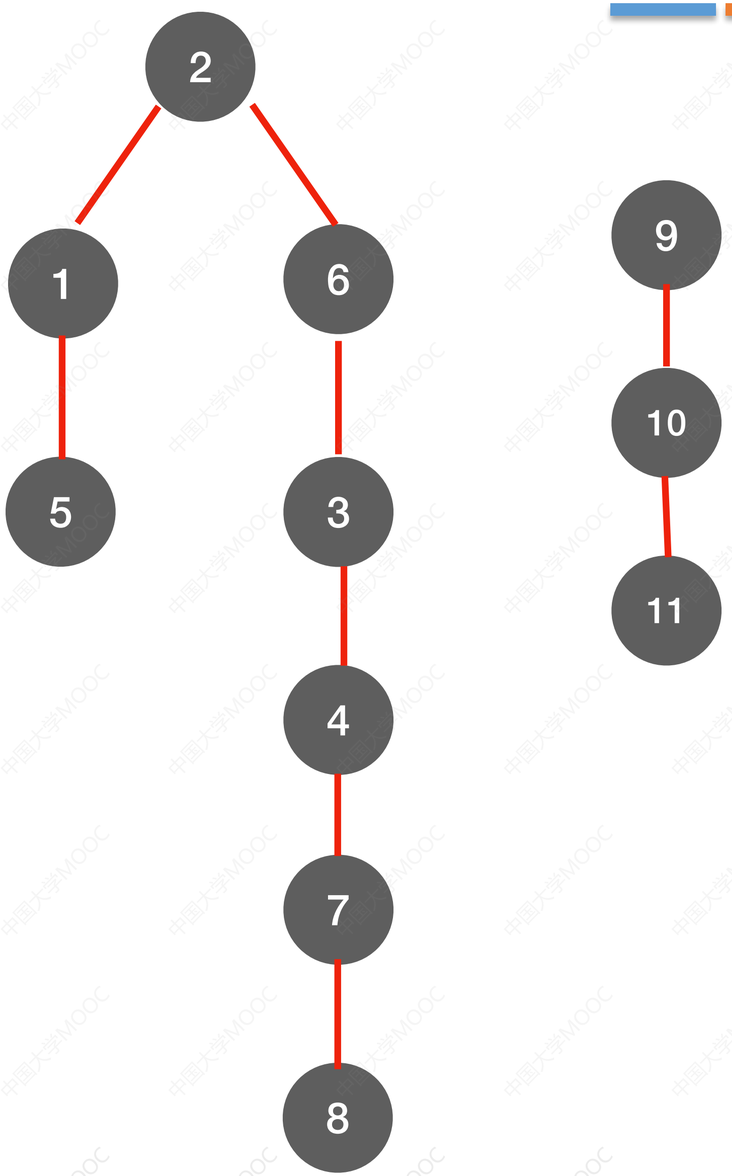
深度优先生成森林



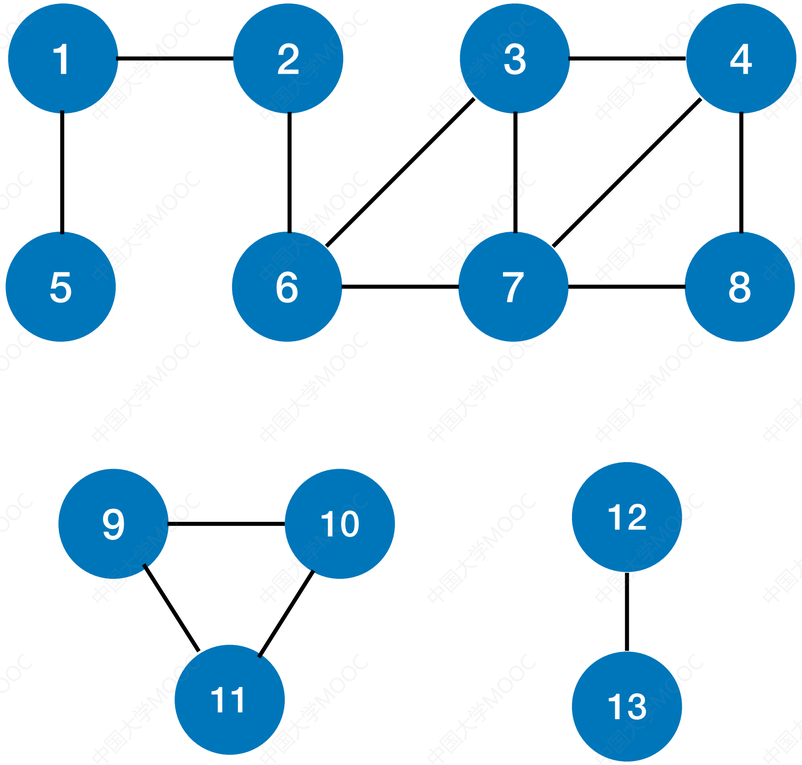
深度优先生成森林



深度优先生成森林



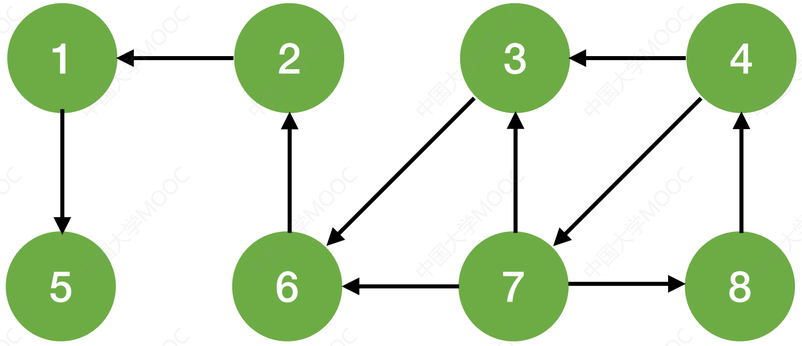
图的遍历与图的连通性



对无向图进行BFS/DFS遍历
调用BFS/DFS函数的次数=连通分量数

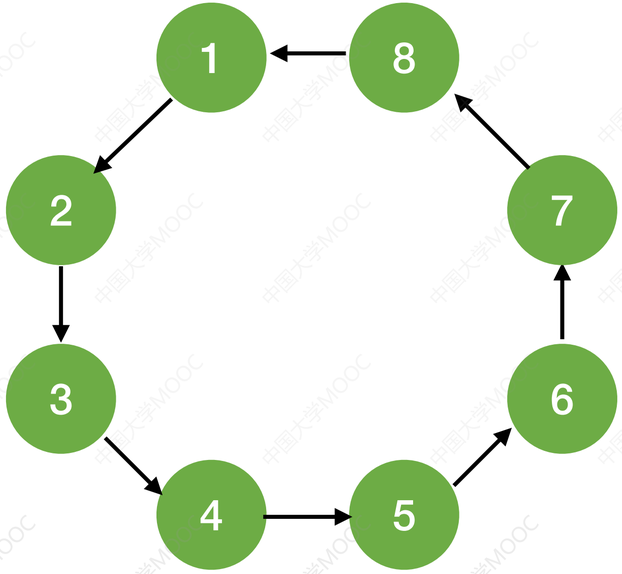
对于连通图，只需调用1次 BFS/DFS

图的遍历与图的连通性



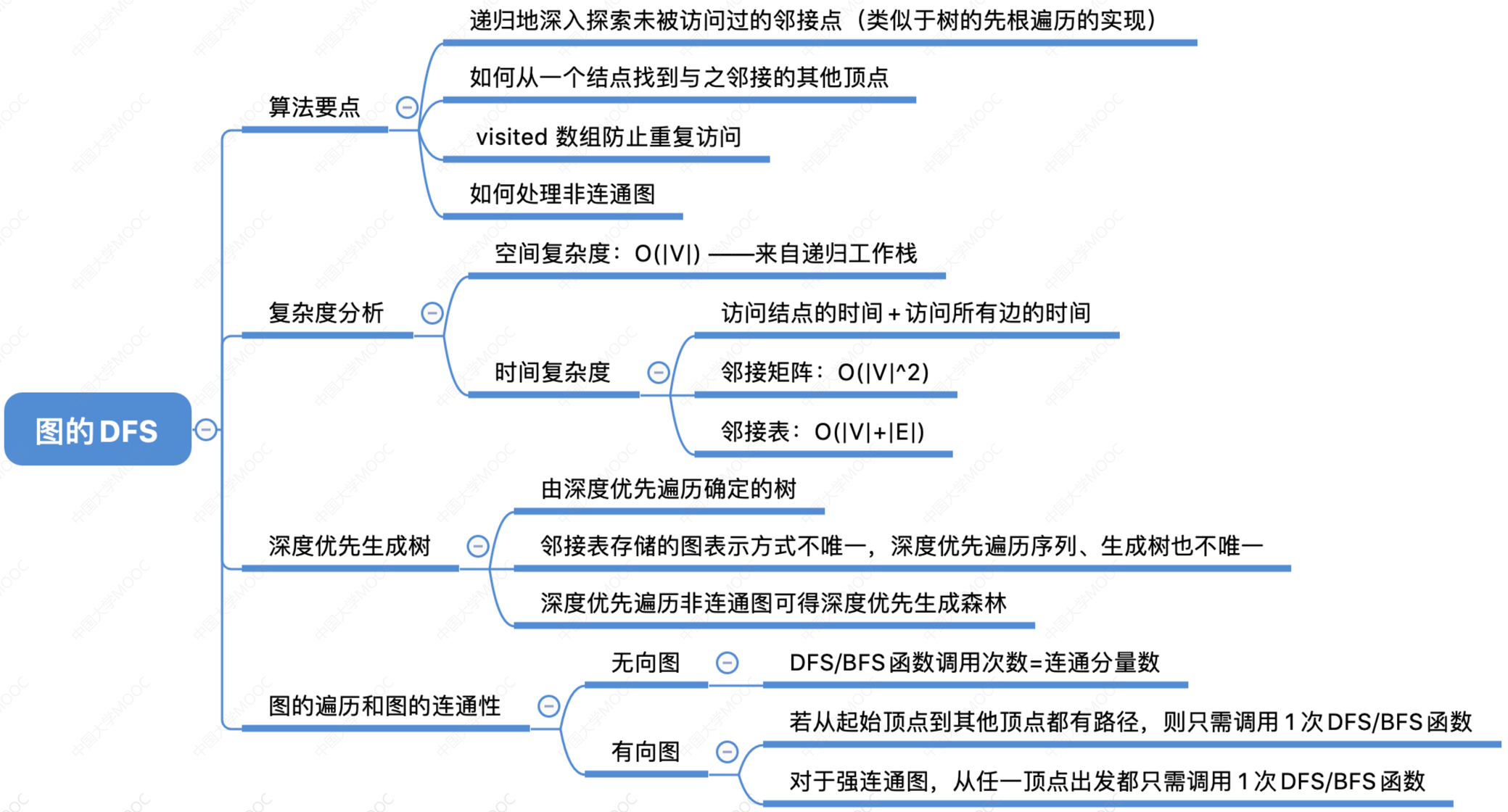
对有向图进行BFS/DFS遍历
调用BFS/DFS函数的次数要具体问题具体分析

若起始顶点到其他各顶点都有路径，则只需调用1次 BFS/DFS 函数



对于强连通图，从任一结点出发都只需调用1次 BFS/DFS

知识回顾与重要考点



欢迎大家对本节视频进行评价~

学员评分：6.3.2 图的...

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