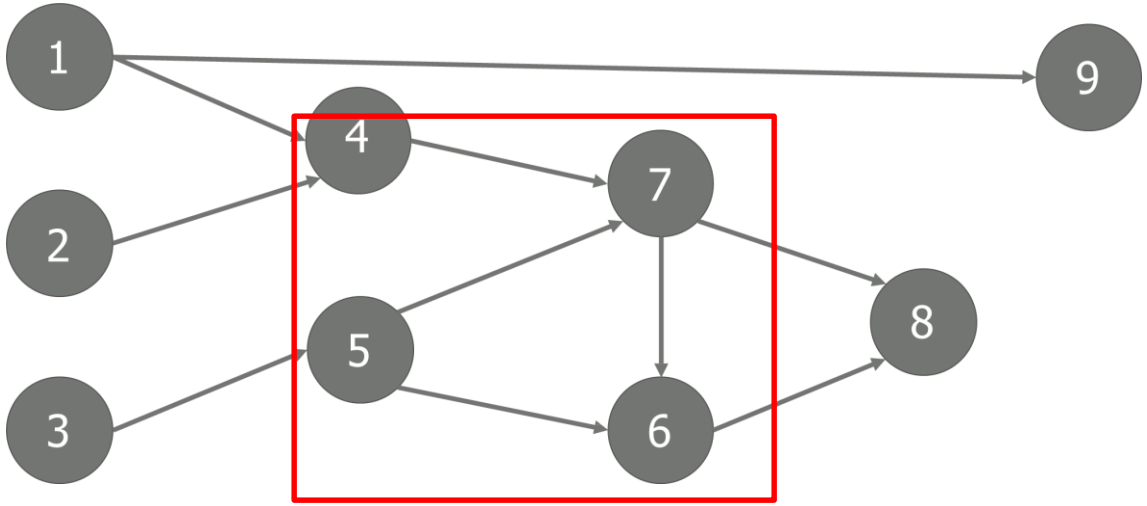
DAG – 위상 정렬

Directed Acycllic Graph

- 사이클이 없는 방향이 있는 그래프를 DAG(Directed Acyclic Graph) 라고 한다.
- DAG에서는 위상 정렬 문제를 모델링 할 수 있다.
  위상 정렬 : 어떤 일을 하는 순서를 찾는 알고리즘

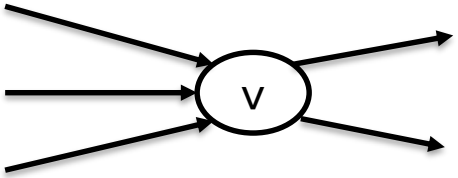


- 1,2,3,4,5,6,7,8,9 차례대로 노드를 방문하지 못한다.
  6을 방문하기 전에는 5와 7이 먼저 방문 된 후에 6이 방문 되어야 하기 때문이다.
- 1,2,3,4,5,7,6,8,9 는 위상 정렬 답 중 하나가 될 수 있다.

DAG – 위상 정렬

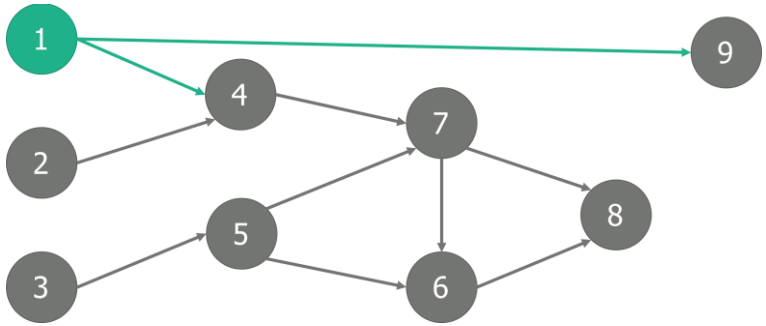
Directed Acycllic Graph

- 위상 정렬의 방문 순서를 정하기 위해서 indgree / outdegree를 따로 저장한다.

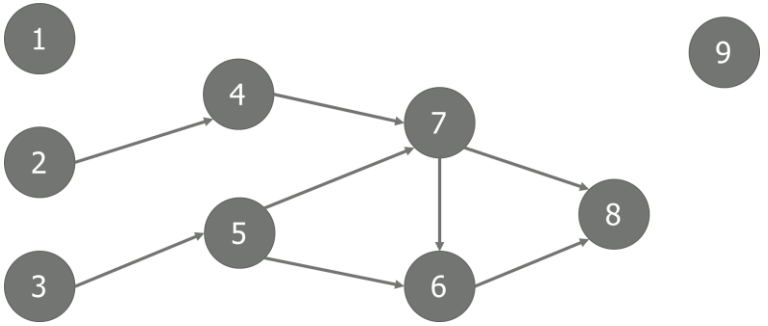


- indgree : 3 / outdegree : 2
- 위상 정렬 시 노드가 방문되기 위해서 indgree의 개수 만큼 방문 되어야 한다.
  → 방문이 되는 경우 indgree의 개수를 하나 씩 줄여 indgree가 0이되면 큐에 저장한다.

- indgree가 0인 1, 2, 3 노드를 큐에 넣는다.
- 큐 : 1, 2, 3 / 순서 :



- 큐 : 2, 3, 9 / 순서 : 1

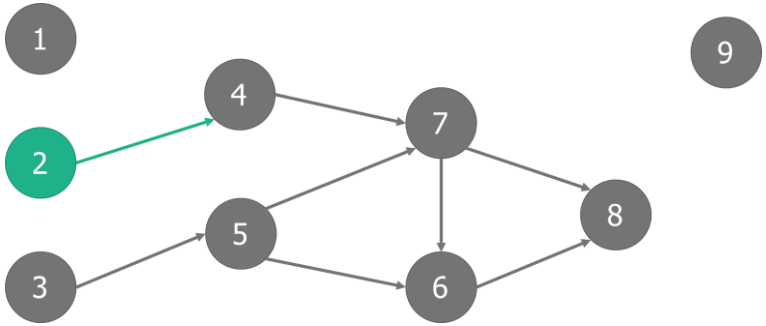


Gaussian

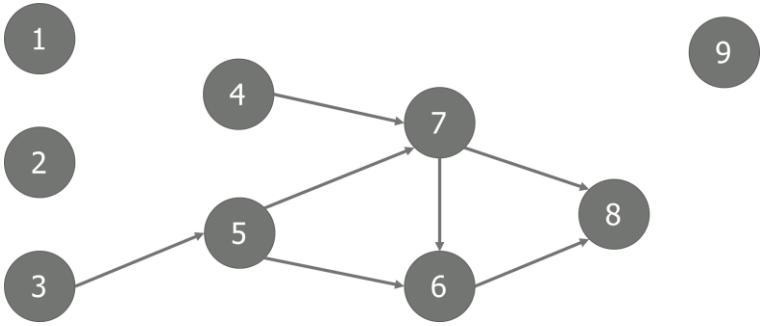
DAG – 위상 정렬

Directed Acycllic Graph

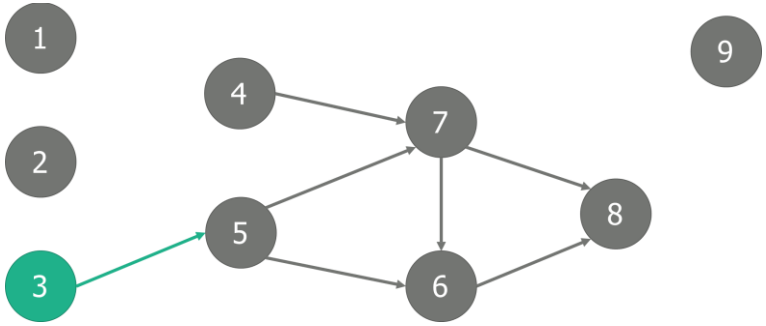
- 큐 : 2, 3, 9 / 순서 : 1



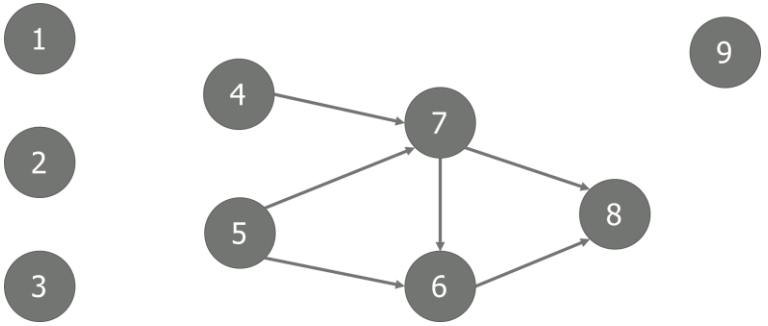
- 큐 : 3, 9, 4 / 순서 : 1, 2



- 큐 : 3, 9, 4 / 순서 : 1, 2



- 큐 : 9, 4, 5 / 순서 : 1, 2, 3

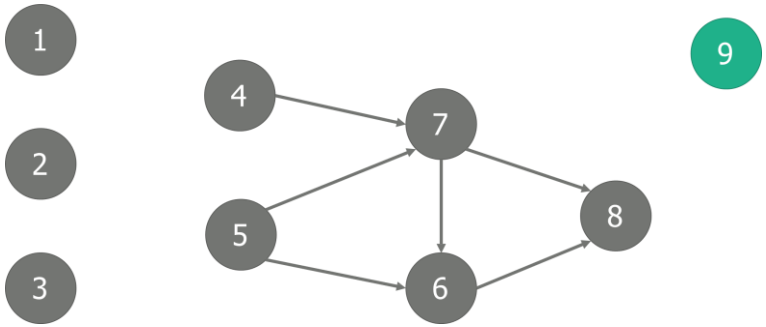


Gaussian

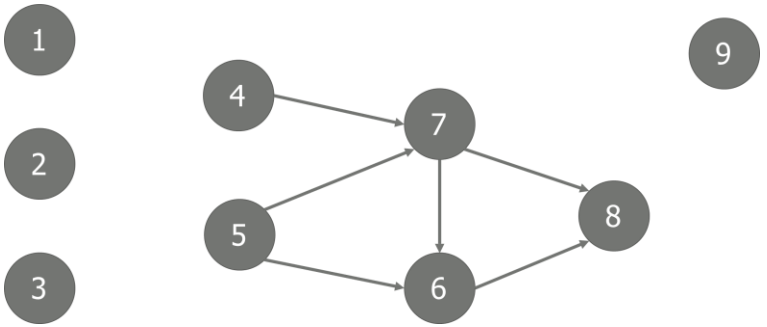
DAG – 위상 정렬

Directed Acycllic Graph

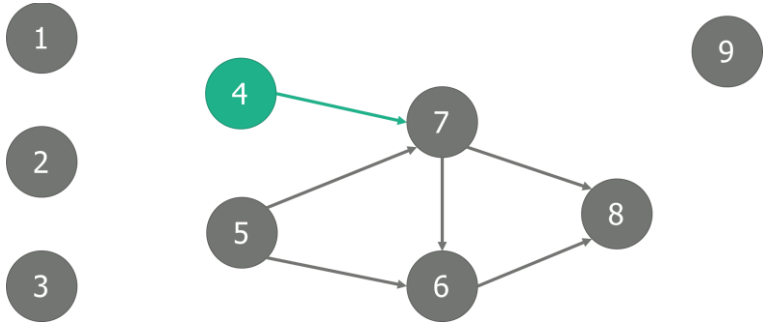
- 큐 : 9, 4, 5 / 순서 : 1, 2, 3



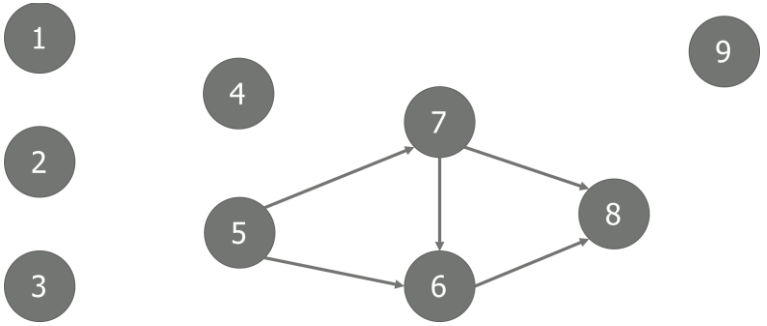
- 큐 : 4, 5 / 순서 : 1, 2, 3, 9



- 큐 : 4, 5 / 순서 : 1, 2, 3, 9



- 큐 : 5 / 순서 : 1, 2, 3, 9, 4

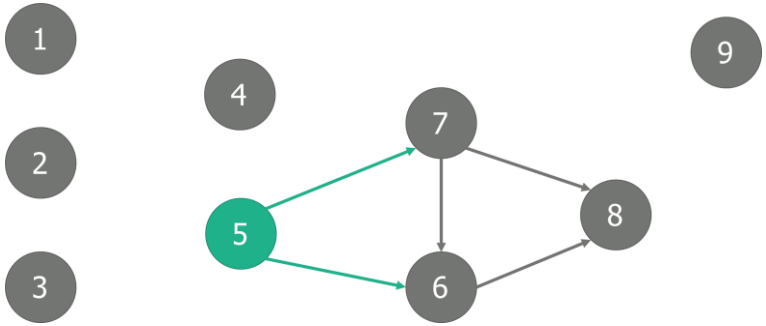


Gaussian

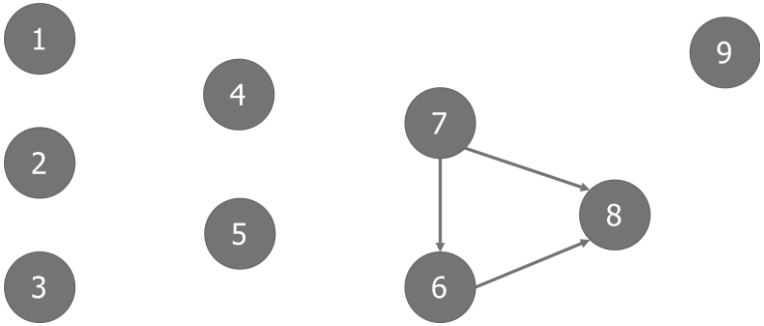
DAG – 위상 정렬

Directed Acycllic Graph

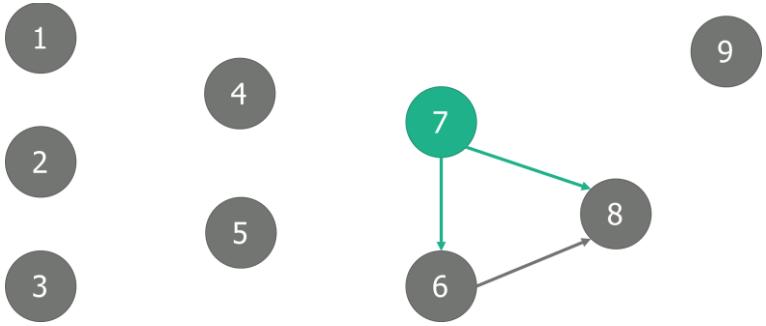
- 큐 : 5 / 순서 : 1, 2, 3, 9, 4



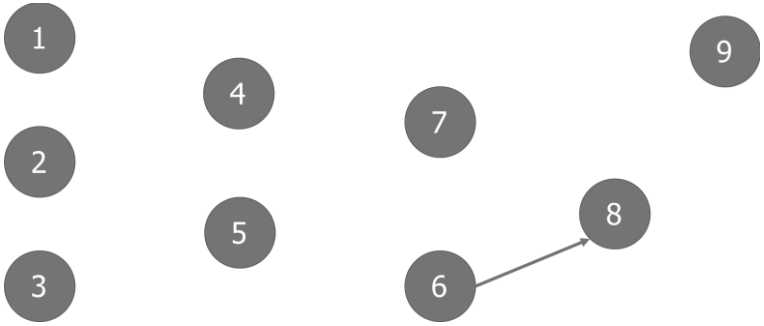
- 큐 : 7 / 순서 : 1, 2, 3, 9, 4, 5



- 큐 : 7 / 순서 : 1, 2, 3, 9, 4, 5



- 큐 : 6 / 순서 : 1, 2, 3, 9, 4, 5, 7

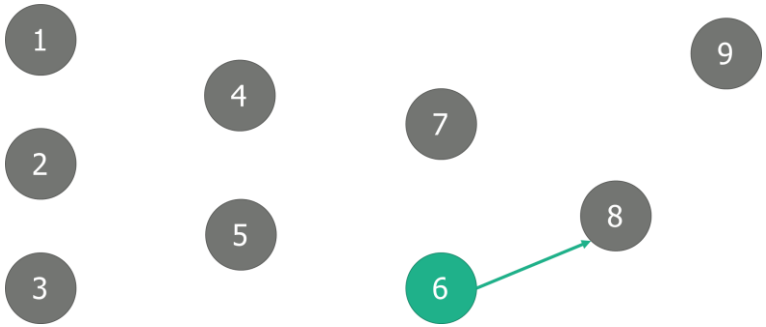


Gaussian

DAG – 위상 정렬

Directed Acycllic Graph

- 큐 : 6 / 순서 : 1, 2, 3, 9, 4, 5, 7



- 큐 : 8 / 순서 : 1, 2, 3, 9, 4, 5, 7, 6

- 큐 : 8 / 순서 : 1, 2, 3, 9, 4, 5, 7, 6

- 큐 : / 순서 : 1, 2, 3, 9, 4, 5, 7, 6, 8

Gaussian

DAG – 위상 정렬

[Directed Acycllic Graph]

```
for (int i = 0; i<M; i++){
        int u, v;
        scanf("%d %d", &u, &v);
        AdjList[u].push_back(v);
        ind[v] += 1;
}
```

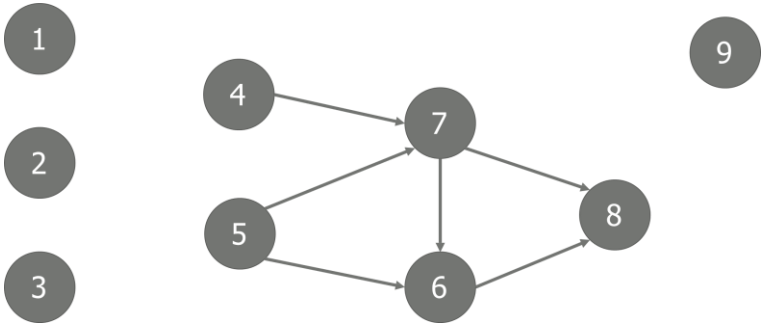
```
queue<int> q;
for (int i = 1; i <= N; ++i) {
        if (ind[i] == 0) {
                q.push(i);
        }
}

for (int j = 0; j<N; ++j) {
        int u = q.front();
        q.pop();
        printf("%d ", u);

        for (int i = 0; i<AdjList[u].size(); ++i) {
                int v = AdjList[u][i];
                ind[v] -= 1;
                if (ind[v] == 0) {
                        q.push(v);
                }
        }
}
```

DAG – 위상 정렬

Directed Acycllic Graph

- 큐 대신에 우선순위 큐를 이용하여 방문 순서의 기준을 정하면 오직 하나의 답만 나올 수 있다.

- 우선순위 큐 : 9, 4, 5 / 순서 : 1, 2, 3



- 우선순위 큐(minheap)
  : 9, 4, 5 / 순서 : 1, 2, 3