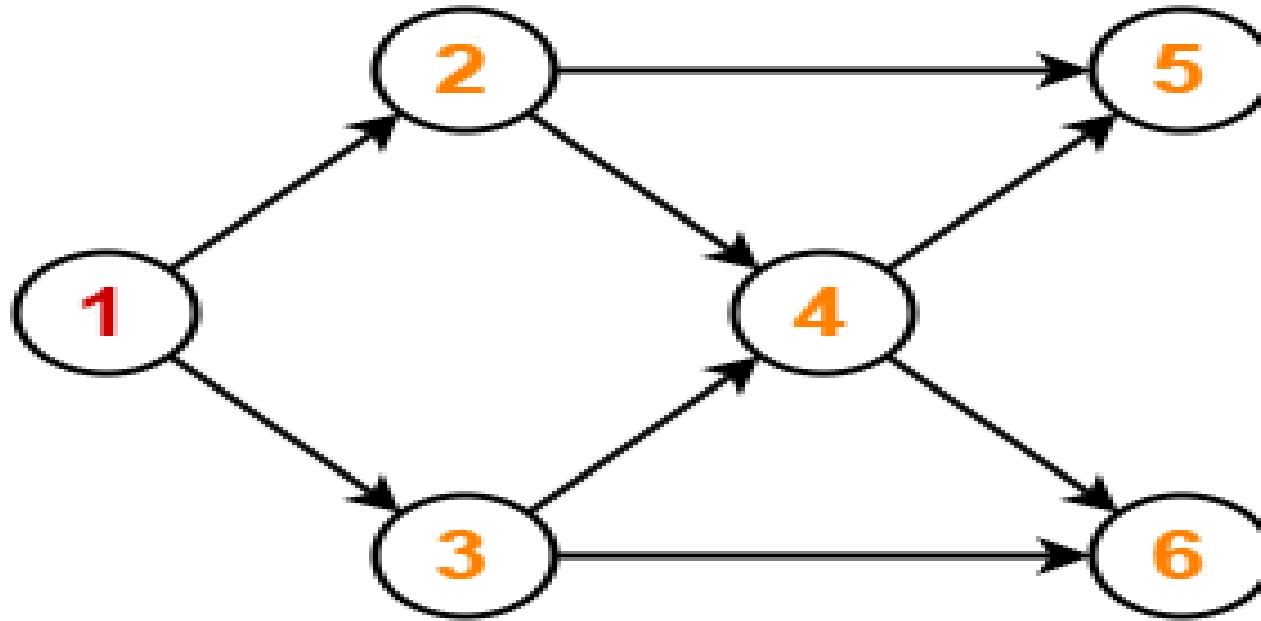# Topological Sorting

- Topological sorting for Directed Acyclic Graph (DAG) is a linear ordering of vertices such that for every directed edge (u,v), vertex u comes before v in the ordering.

- A topological sort of a graph is an ordering of its vertices along a horizontal line so that all directed edges go from left to right.

- If the graph contains a cycle, then no linear ordering is possible.

- Topological Sorting for a graph is not possible if the graph is not a DAG.
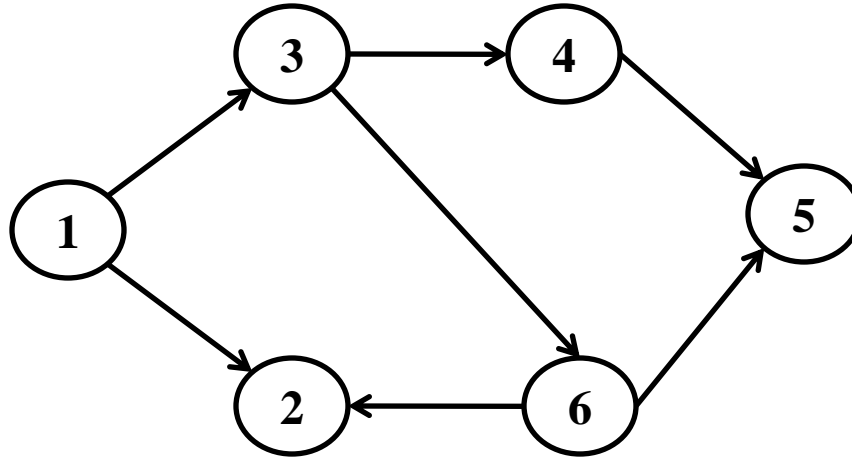
Topological Sorting

Topological Sort Example

One possible Topological Sort=[1,2,3,4,5,6]
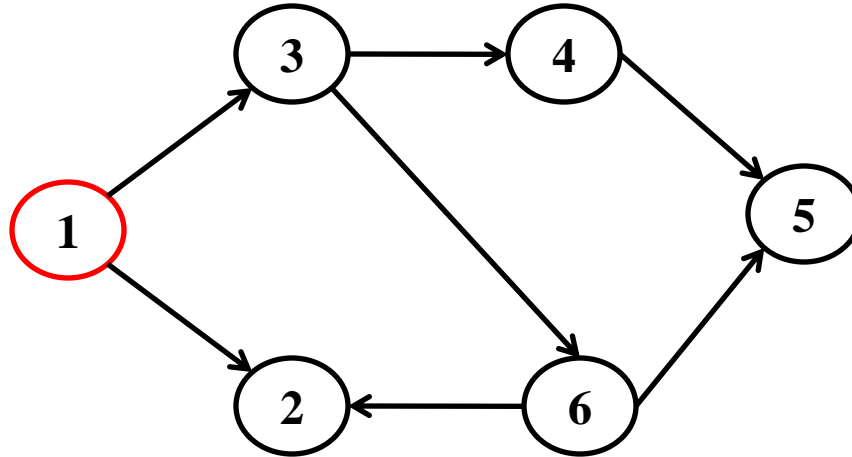
Topological Sorting Algorithm

1. Identify a node with no incoming edges(indegree=0)

2. Add this node to the ordering.

3. Remove this node and all its outgoing edges from the graph.

4. Repeat step 1 to 3 until the graph becomes empty

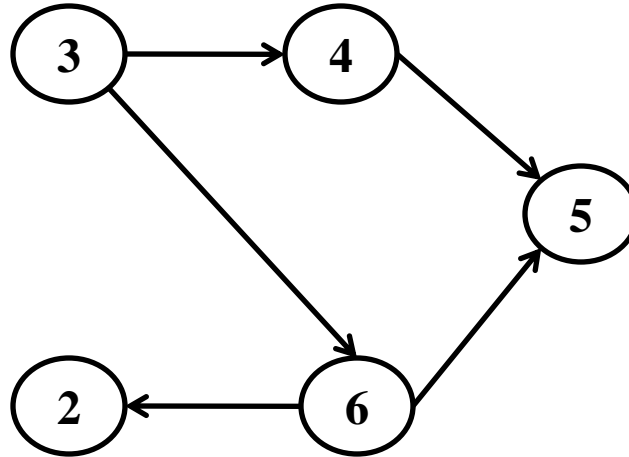# Write the topological sorting for the DAG given below

Topological Ordering:

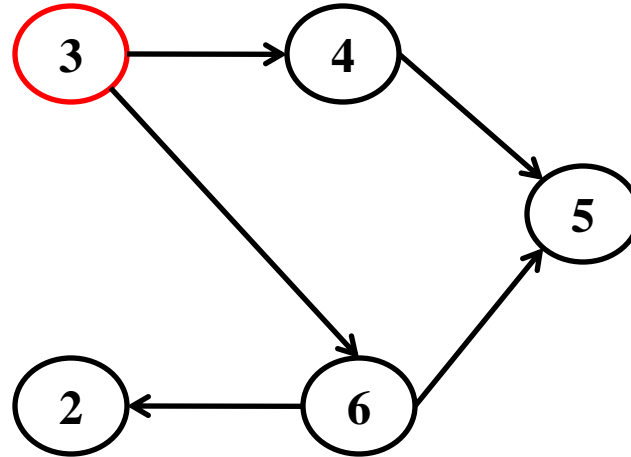# Write the topological sorting for the DAG given below

Topological Ordering:1

Write the topological sorting for the DAG given below

Topological Ordering:1

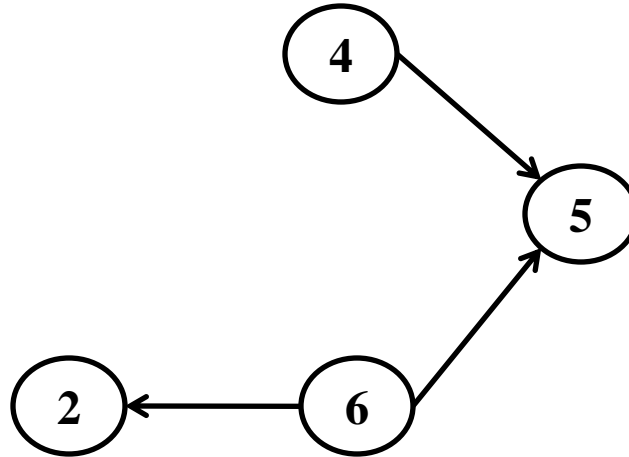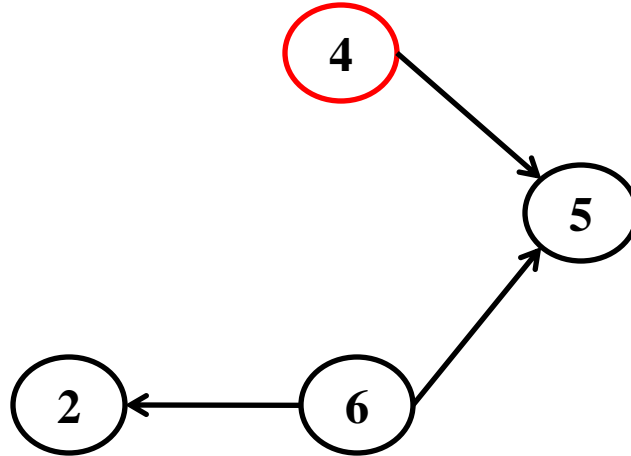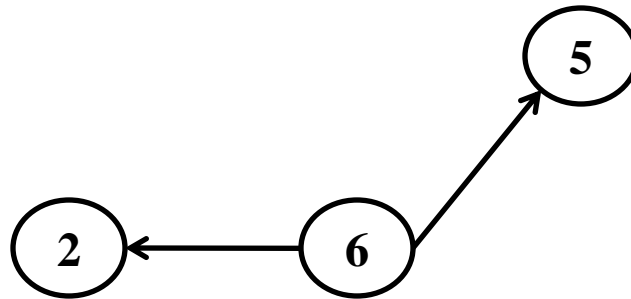**Write the topological sorting for the DAG given below**

Topological Ordering:1,3

Write the topological sorting for the DAG given below

Topological Ordering:1,3

Write the topological sorting for the DAG given below

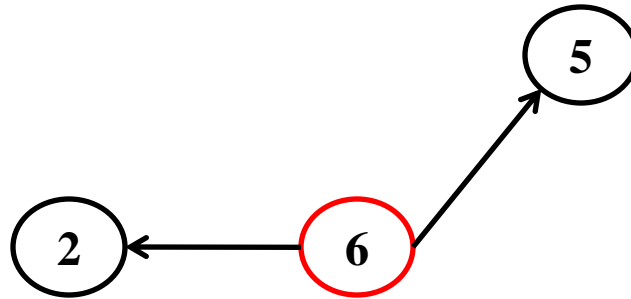Topological Ordering:1,3,4

Write the topological sorting for the DAG given below

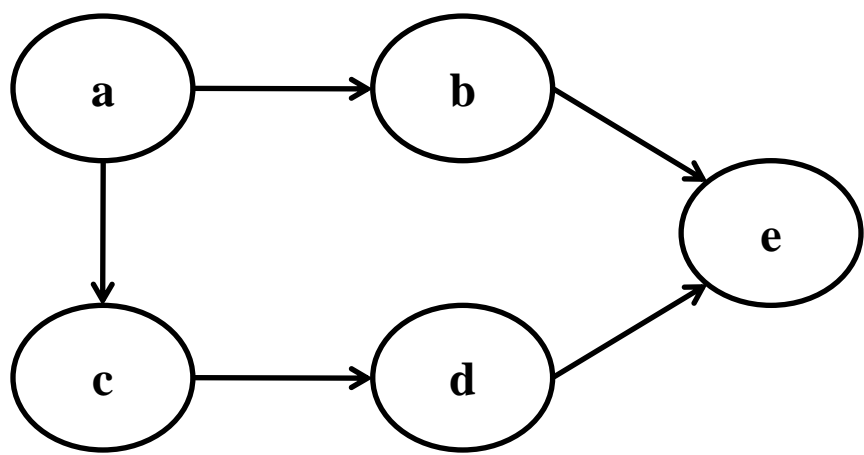Topological Ordering:1,3,4

Write the topological sorting for the DAG given below

Topological Ordering:1,3,4,6

Write the topological sorting for the DAG given below

5

2

Topological Ordering:1,3,4,6

Write the topological sorting for the DAG given below

5

2

Topological Ordering:1,3,4,6,2

Write the topological sorting for the DAG given below

5

Topological Ordering:1,3,4,6,2

Write the topological sorting for the DAG given below

5

Topological Ordering:1,3,4,6,2,5

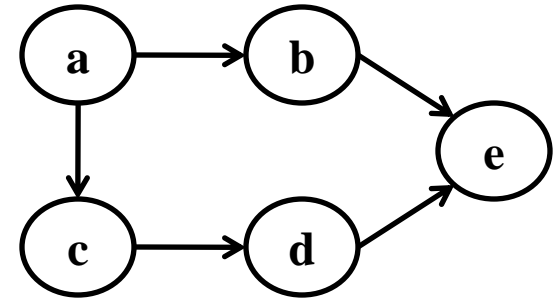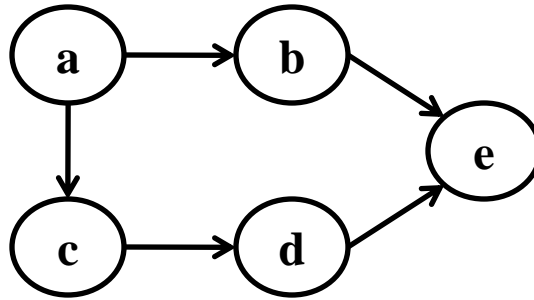**Write the topological sorting for the DAG given below**
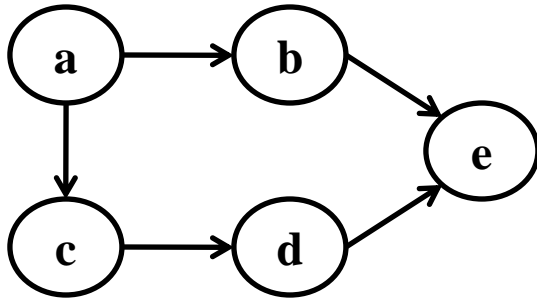
Topological Ordering:1,3,4,6,2,5

Find the possible topological orderings for the following graph

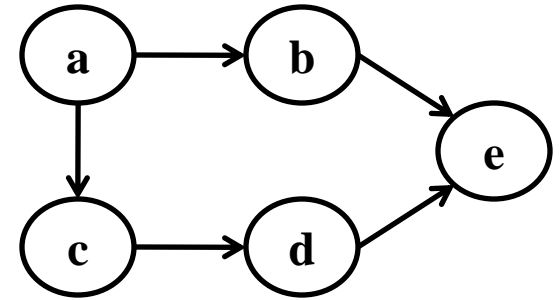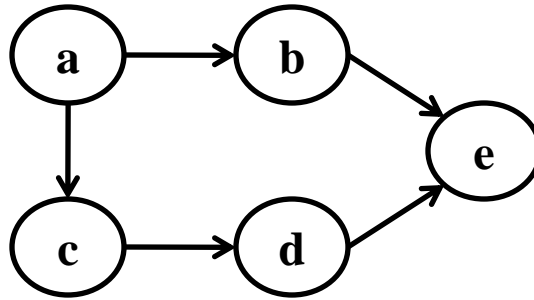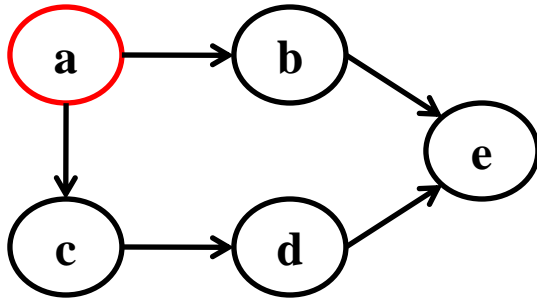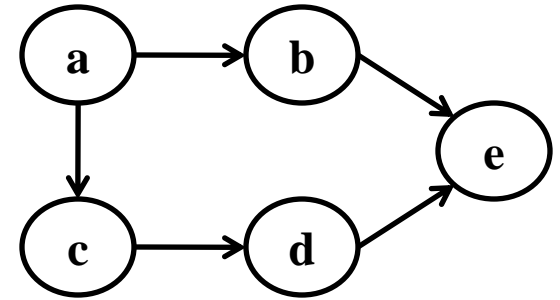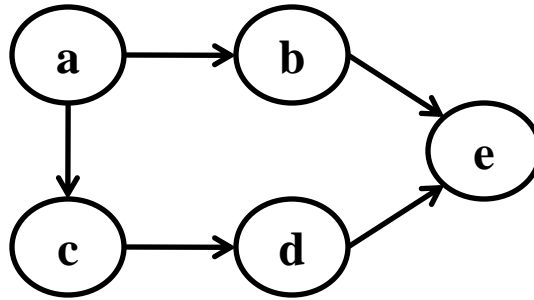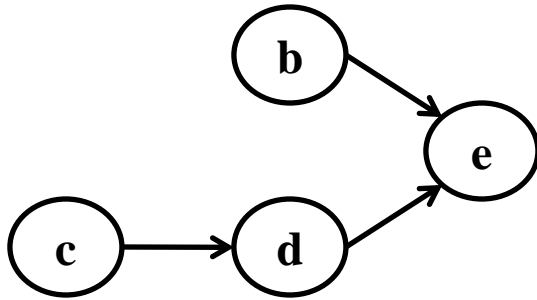# Find the possible topological orderings for the following graph

Topological Ordering-1:   Topological Ordering-2:   Topological Ordering-3:

Find the possible topological orderings for the following graph

Topological Ordering-1:
a

Topological Ordering-2:

Topological Ordering-3:

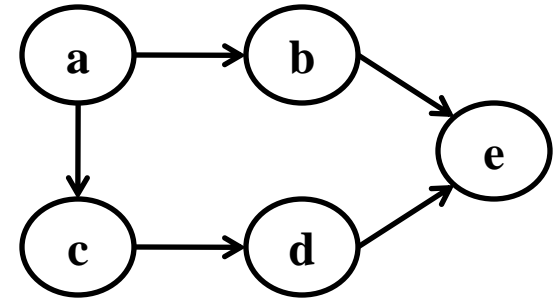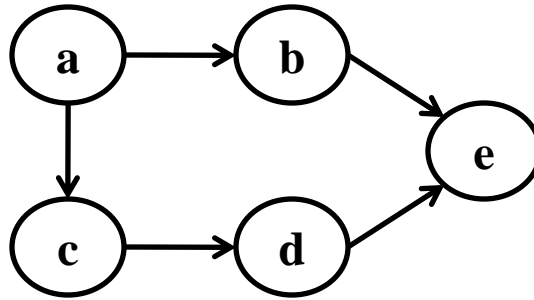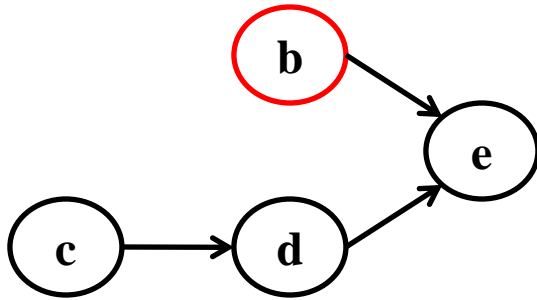# Find the possible topological orderings for the following graph

Topological Ordering-1:   Topological Ordering-2:   Topological Ordering-3:
a

Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b

Topological Ordering-2:

Topological Ordering-3:

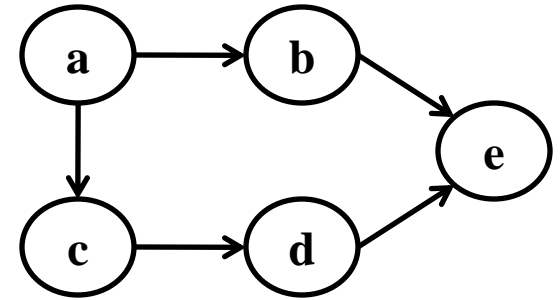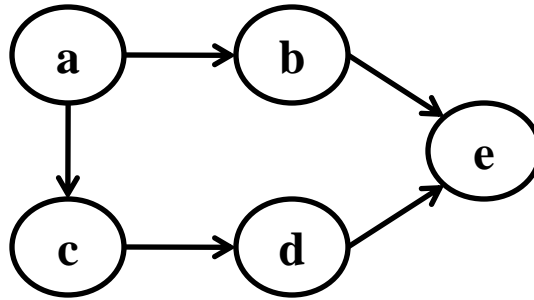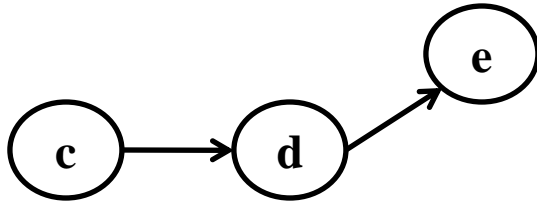# Find the possible topological orderings for the following graph

Topological Ordering-1:   Topological Ordering-2:   Topological Ordering-3:
a,b

Find the possible topological orderings for the following graph

Topological Ordering-1:   Topological Ordering-2:   Topological Ordering-3:
a,b,c

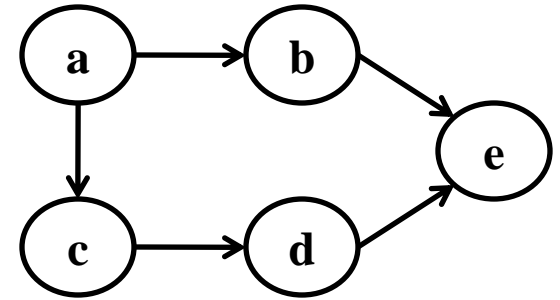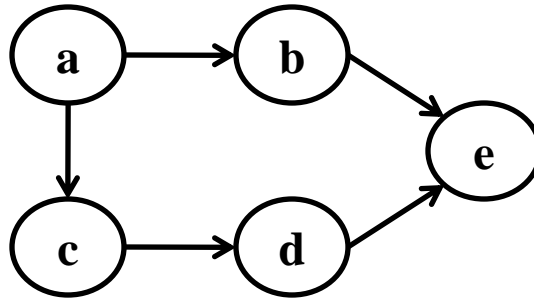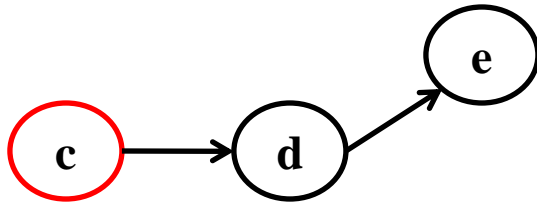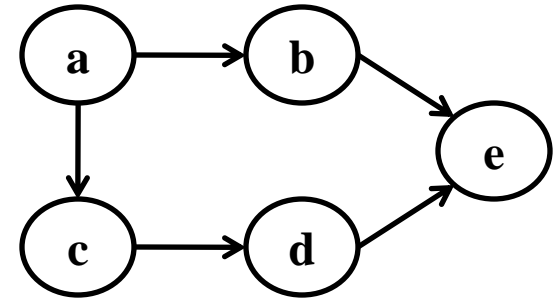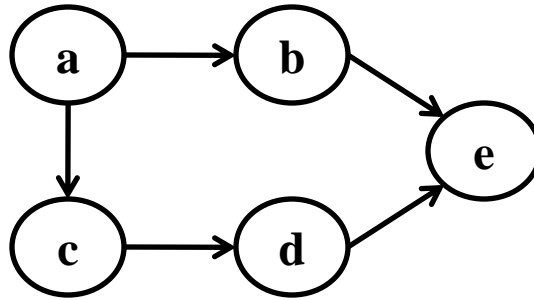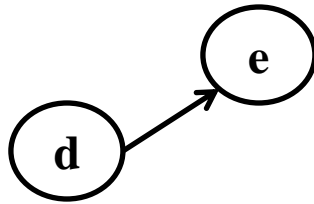# Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c

Topological Ordering-2:

Topological Ordering-3:

Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d

Topological Ordering-2:

Topological Ordering-3:

Find the possible topological orderings for the following graph

Topological Ordering-1:   Topological Ordering-2:   Topological Ordering-3:
a,b,c,d

Find the possible topological orderings for the following graph

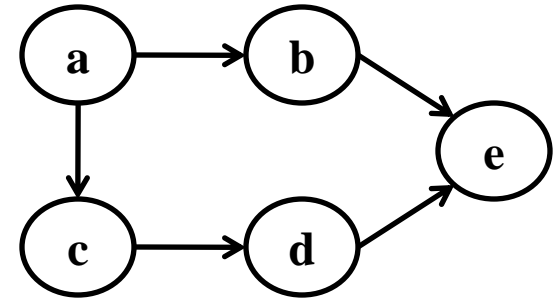Topological Ordering-1:   Topological Ordering-2:   Topological Ordering-3:
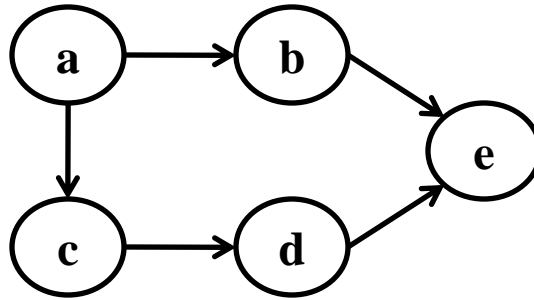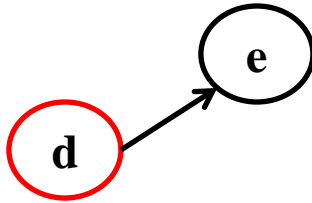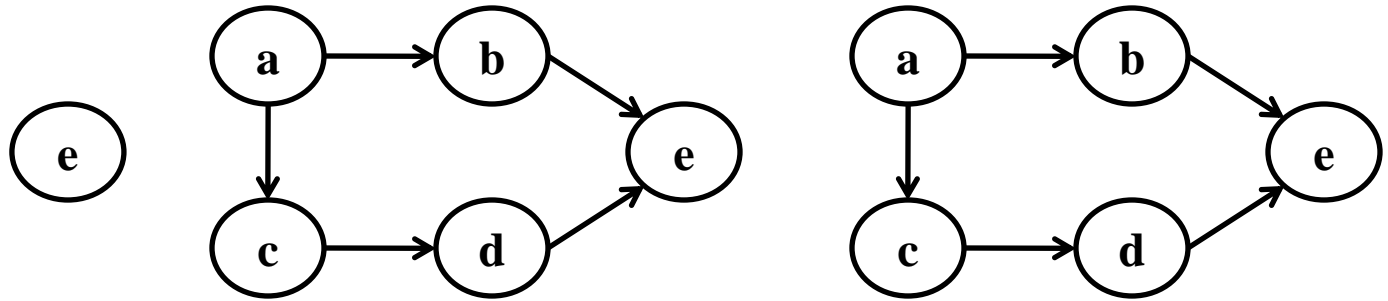a,b,c,d,e

Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:

Topological Ordering-3:

Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,

Topological Ordering-3:

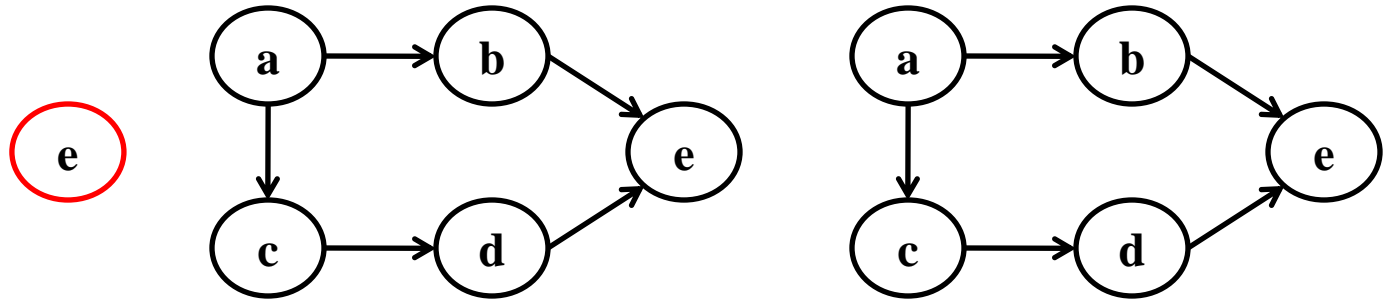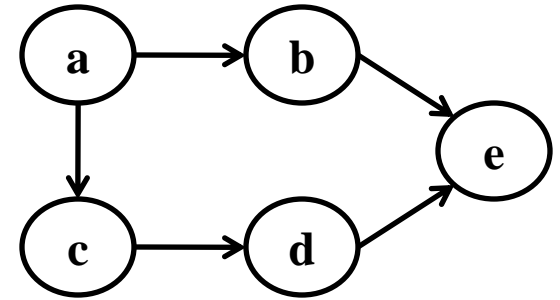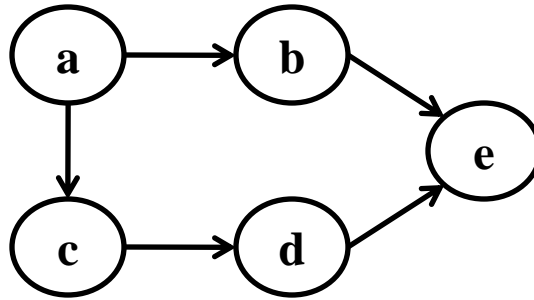# Find the possible topological orderings for the following graph

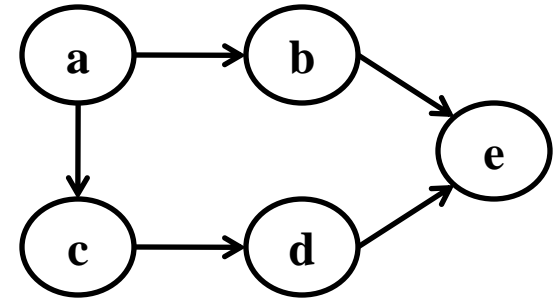Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,

Topological Ordering-3:

Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c

Topological Ordering-3:

Find the possible topological orderings for the following graph

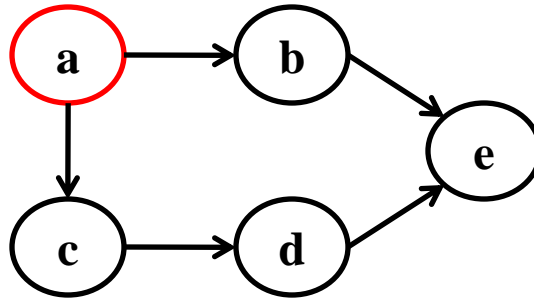

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c

Topological Ordering-3:

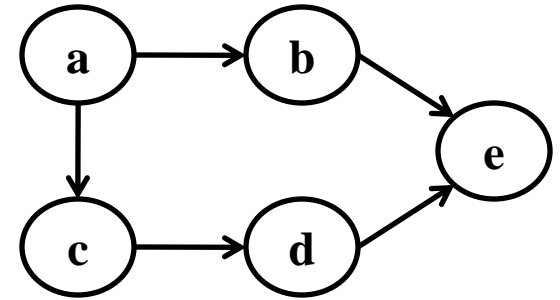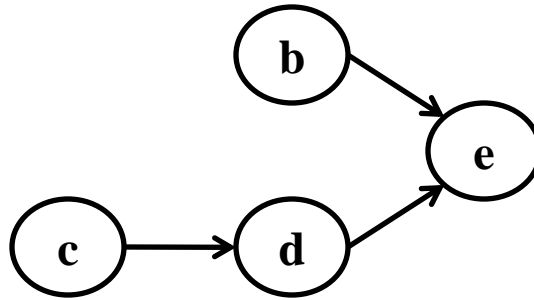# Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b

Topological Ordering-3:

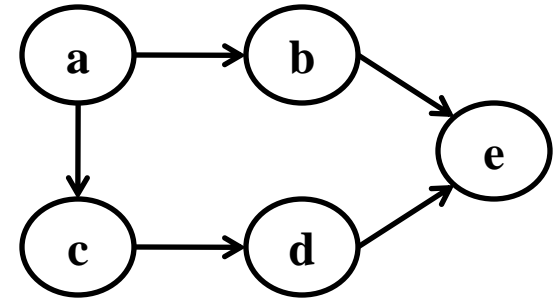# Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b

Topological Ordering-3:

Find the possible topological orderings for the following graph

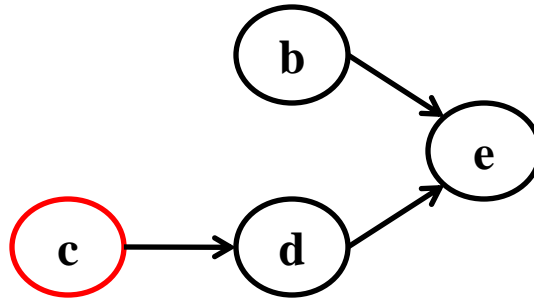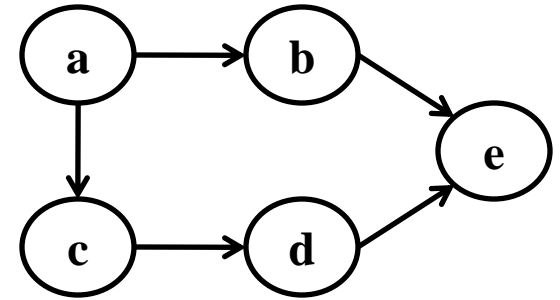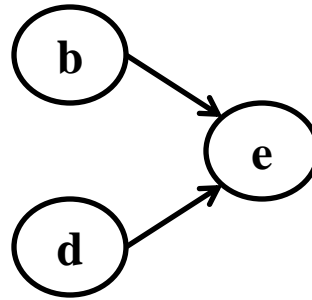Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d

Topological Ordering-3:

Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d

Topological Ordering-3:

Find the possible topological orderings for the following graph
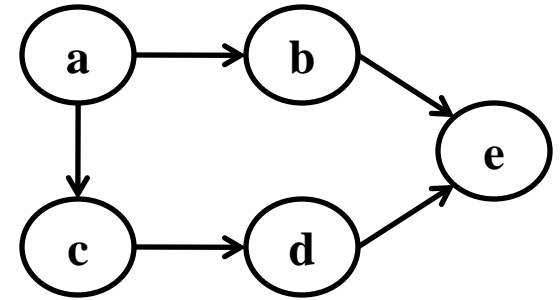
Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:

Find the possible topological orderings for the following graph
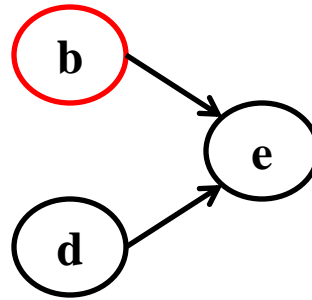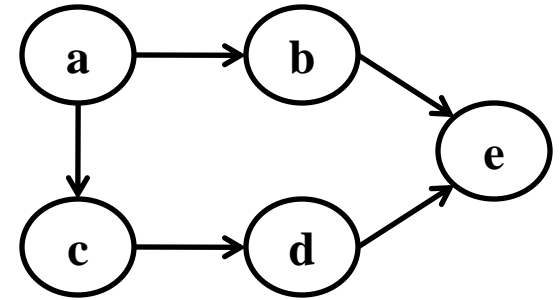

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:

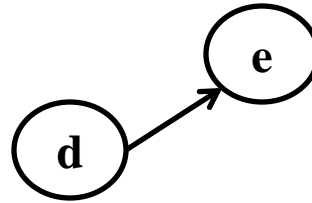# Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,

Find the possible topological orderings for the following graph
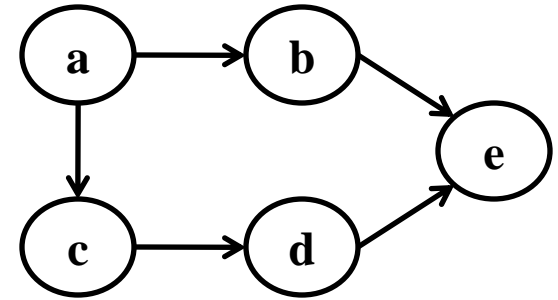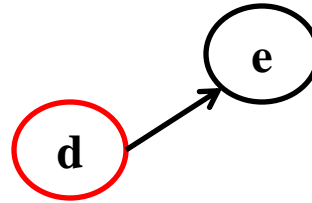

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,

Find the possible topological orderings for the following graph
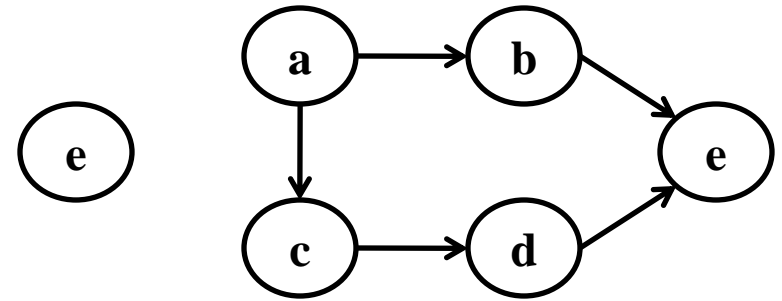

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,c

Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,c

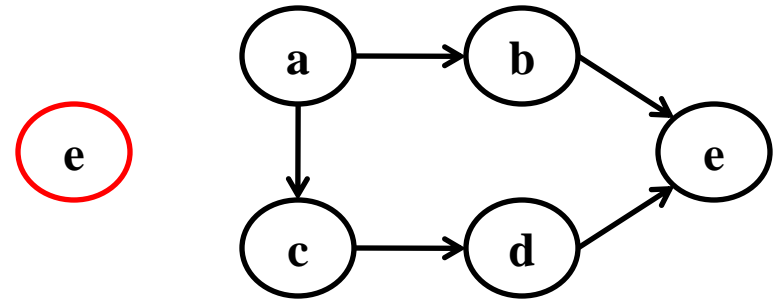# Find the possible topological orderings for the following graph
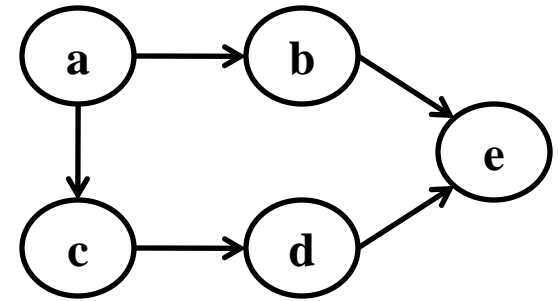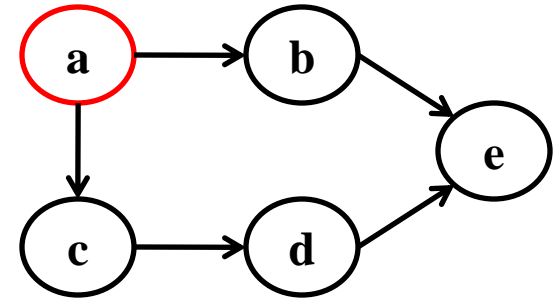

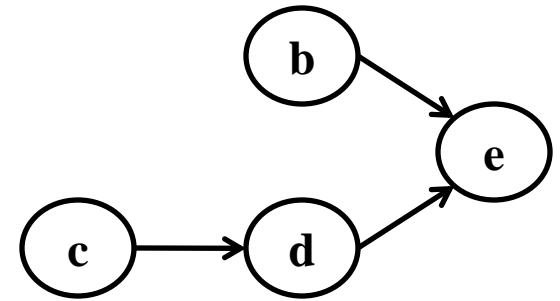Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,c,d

Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,c,d

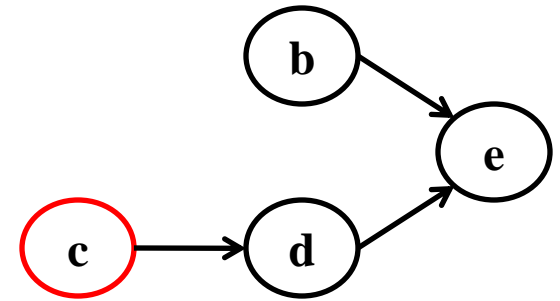# Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,c,d,b

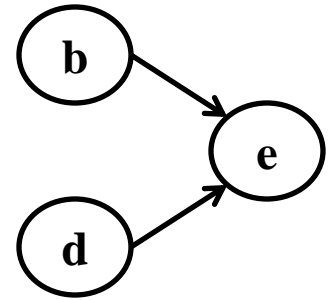# Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,c,d,b

Find the possible topological orderings for the following graph
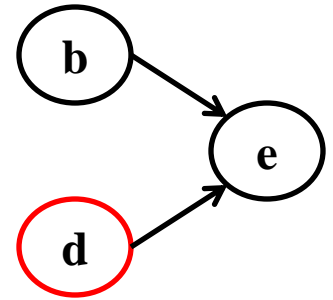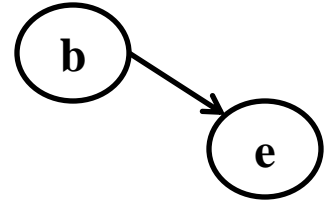
e

Topological Ordering-1:
a,b,c,d,e

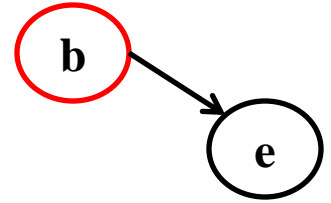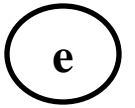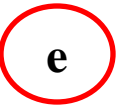Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,c,d,b,e

Find the possible topological orderings for the following graph

Topological Ordering-1:
a,b,c,d,e

Topological Ordering-2:
a,c,b,d,e

Topological Ordering-3:
a,c,d,b,e

Topological Sorting Algorithm Complexity

- Time to determine the indegree for each node = **O(E)** time. This involves looking at each directed edge in the graph once.

- Time to determine the nodes with no incoming edges = **O(V)**

- So Step 1 complexity = **O(E + V)**

- Add nodes until we run out of nodes with no incoming edges. This loop could run once for every node—**O(V)** times

- All together, the time complexity is **O(V+E)**

Topological Sorting Applications

- Scheduling jobs from the given dependencies among jobs

- Instruction Scheduling

- Determining the order of compilation tasks to perform in makefiles

- Data Serialization