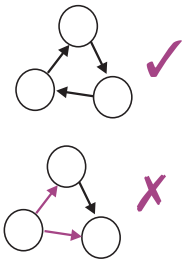
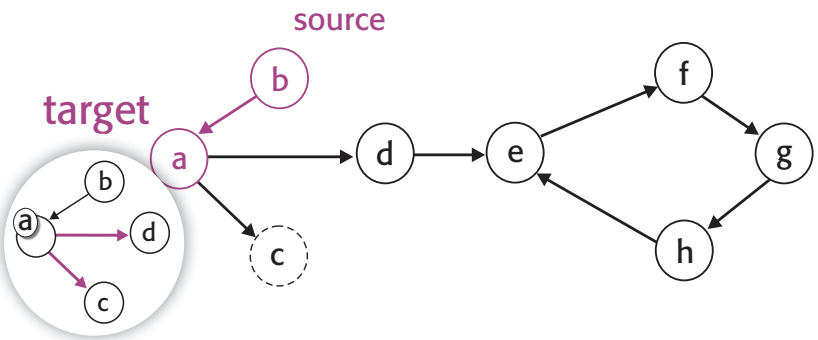
The Basics (Test 1)
Direct Graphs

- Adjacent vertices
- Connected digraph
- Weakly connected
- Directed path/cycle

Exercise
Write a formal definition of adjacent vertex for digraphs.



Exercise
Is the digraph connected? Is it weakly connected? (count connected comps.) **Hint:** use definition first, then perform a DFS to check, note how a component is connected (?).



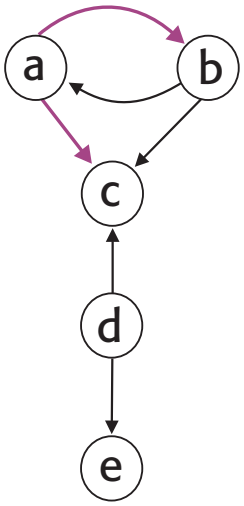
Directed Graphs (Test 1)
DFS Example

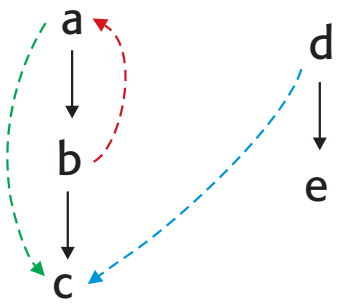
- Forward edges
- ? Strongly connected comps

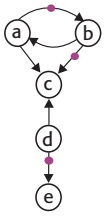
Exercise
Is the digraph connected? Is it weakly connected? (count connected comps.) **Hint:** use definition first, then perform a DFS to check, note how a component is connected (?).

Quiz
Identify each type of edge by color? Which ones seem to lead to cycles in a digraph?

Quiz
Is this digraph acyclic?



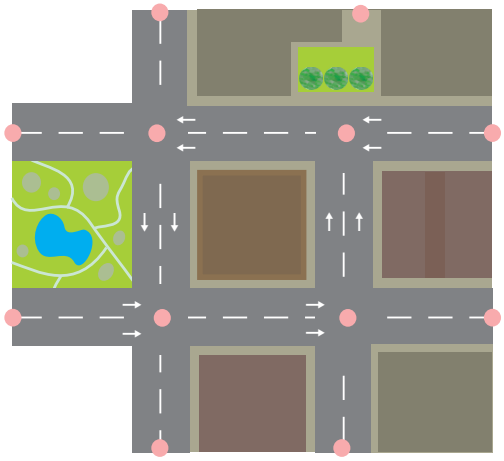


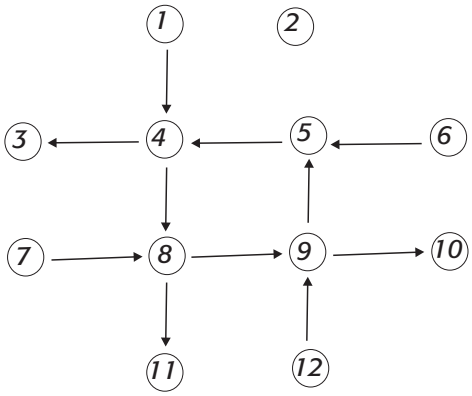


Directed Graphs (Test 1)
Exercise

➪ Weakly connected

Exercise
Perform a DFS to investigate connectivity and identify connected components (if any). Suggest changes to create the paths: 6 -> 12, 2 -> 12.





Directed Graphs
An Application

⇨ Problems

C5 may only be taken if both C3,C4 had already been taken (listed before).

- ✎ Study plan
- ✎ Project manager
- 🕮 ✎ Other examples

Course	Pre-requisites
C1,C2	: none
C3	: C1,C2
C4	: C3
C5	: C3,C4
Tasks	*Dependencies*

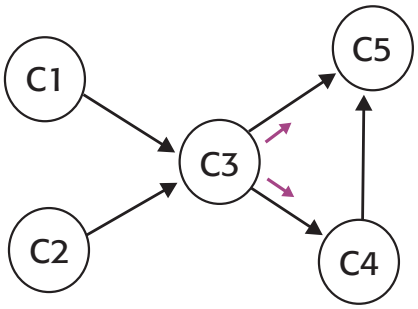
⇨ Problem question

⇨ A general <u>model</u>

Digraph Model

Exercise
Draw a digraph representing your 1st and 2nd year CS courses (draw edge from C1 to C2 if C1 is prerequisite to C2.)

Course	Pre-requisites
C1,C2	: none
C3	: C1,C2
C4	: C3
C5	: C3,C4

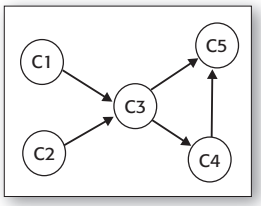


Quiz
Write the study plan problem question and the equivalent model (graph) question.

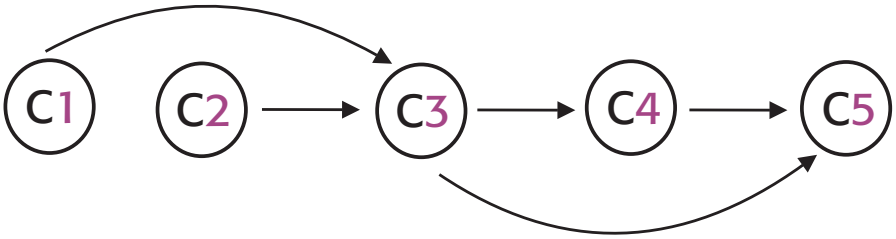
Model question

Can we order vertices such that all edges point the same way?

Topological Sorting

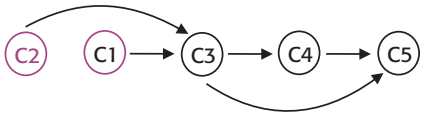


✓

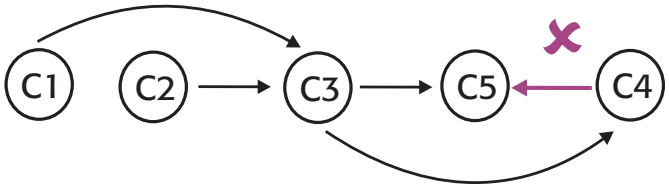


Quiz
What can be concluded about the original problem if no topological sorting can be found?

✓



Exercise
Show that vert listing 12435 is not a topological sorting for the digraph.



Topological Sorting
Solution Plan

- **Brute force approach (?)**
  - Perform DFS
  - Reverse pop-order if DAG otherwise no solution

Exercise
Which of the two possible solutions is obtained from a DFS starting at C2 and C3? (Do the DFS).

- **Another solution**
  - Source removal algorithm
  - A different approach